4 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

Chapter 4 describes the potential environmental consequences of implementing each of the alternatives presented in Chapter 2. Pursuant to 40 Code of Federal Regulations (CFR) 1500.1(b) and 1500.4, this section summarizes the completed analysis and forms the scientific and analytical basis for the comparison of alternatives. The alternatives described in Chapter 2 may cause, either directly or indirectly, changes in the human and natural environment. This Environmental Impact Statement (EIS) analyzes these potential changes and discloses the effects to the decision-makers and the public. Disclosure is a fundamental goal of the National Environmental Policy Act (NEPA). In addition, cumulative effects along with applicable mitigation measures and irreversible and irretrievable effects also are discussed. Effects of each action can be neutral, beneficial, and/or adverse. Effects are quantified whenever possible, and/or are qualitatively discussed.

The individual resource discussions are generally presented by issue(s) and organized with the presentation of the effects analysis issues and indicators for the resource; a brief methodology for the analysis of impacts; an evaluation of the alternatives' impacts to the resource; a discussion of cumulative effects, irreversible and irretrievable commitments, and short-term uses versus long-term productivity; followed by a summary of impacts by issues and indicators. The final subsection provides a table summarizing and comparing quantitative and qualitative impacts to each resource by alternative.

Section 4.1, Introduction, provides a brief explanation of what each resource section will address, including a summary of incomplete and unavailable information relevant to evaluating significant adverse impacts; the presentation of past, present, and reasonably foreseeable future actions (RFFAs) used for the direct, indirect, and cumulative impact analyses; and a discussion of Forest Plan Consistency and Potential Forest Plan Amendments.

4.1.1 Effects Analysis Indicators and Methodology of Analysis

An issue is defined as a point of disagreement, debate, or dispute with a proposed activity based on some anticipated effect. Issues are described in terms of cause and effect; that is, if an action occurs, an impact could result. Issues are addressed by describing comparative factors that provide a way to define, compare, and contrast the effects of the alternatives, including No Action.

An indicator is an element or parameter used to determine change (and the intensity of change) in a resource (e.g., acres of wetlands disturbed). These issues and indicators are used to predict or detect change in a resource related to causal effects of the alternatives in Chapter 4 (i.e., environmental consequences).

In addition, the analysis procedures and assumptions used to develop the current conditions and environmental consequences are summarized in this section. Unless specifically stated otherwise, additional supporting information, including detailed analysis procedures and assumptions for each resource area, can be found in the Stibnite Gold Project (SGP) record.

The modeling, analysis, and unit amounts for indicators such as acreage and road miles are all best estimates based on the latest available information. The modeling and analysis conducted for this Draft EIS are intended to indicate relative differences among the alternatives, rather than to predict absolute amounts of activities, outputs, or effects.

4.1.2 Incomplete and Unavailable Information

The Council on Environmental Quality (CEQ) regulations in 40 CFR 1502.22 provide direction on how to address incomplete and unavailable information.

The CEQ regulations state that, “when an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency shall always make clear that such information is lacking.”

This documentation complies with 40 CFR 1502.22(b)(1-4) requirements that the agency shall develop statements for inclusion within the EIS for the following:

(1) a statement that such information is incomplete or unavailable;

(2) a statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;

(3) a summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and

(4) the agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community (e.g., assumptions).

Table 4.1-1 provides a summary of incomplete and unavailable information for areas where the incomplete or unavailable information is relevant to evaluating reasonably foreseeable significant adverse impacts on the human environment and where the information has been deemed essential to a reasoned choice among alternatives. Not all unknown data are considered incomplete or unavailable information. Note that baseline data collection and refinements to the project design and evaluation are ongoing, and that project permitting is in the early stages; therefore, the evaluation of environmental consequences continues to develop through the NEPA process, and some data gaps may be reconciled in the Final EIS.

Table 4.1-1 Incomplete and Unavailable Information (40 CFR 1502.22)

Description of the Information Incomplete or Unavailable Information (40 CFR 1502.22(b)(1))	Is the info relevant to reasonably foreseeable significant adverse impacts? (40 CFR 1502.22(b)(2))	Is the information essential to a reasoned choice among alternatives?	Evaluation/summary of existing data which is relevant to the evaluation of impacts based upon theoretical approaches or research methods generally accepted in the scientific community (40 CFR 1502.22(b)(3) and (4))
National Oceanic and Atmospheric Administration (NOAA) fisheries requires use of the Biotic Ligand Model to determine the project-specific copper criteria for fish.	Yes	Yes	The project-specific copper Biotic Ligand Model threshold will be the same for all alternatives, but without the criteria it is unknown which alternatives will or will not meet the threshold.
Lack of consideration of first flush chemistry for development rock storage facilities (DRSF) contact water Lack of consideration of mass loading inputs from some Idaho Pollutant Discharge Elimination System (IDPES) permitted discharges Lack of consideration of atmospheric mercury deposition Lack of prediction of ammonia concentrations Assumption that post-closure runoff from DRSFs will not interact with development rock	Yes	Yes	Results from the Site-Wide Water Chemistry (SWWC) Model and Hydrologic Model contain some uncertainties that, at this time, are unable to be resolved. Large modeling efforts, such as these, often require significant amounts of data, which can be difficult and expensive to obtain. When data gaps exist, assumptions based on best available science and literature searches are typically made. The SWWC modeling was provided for Alternatives 1, 2, and 3, but was assumed to apply to all alternatives because only minor changes were made to modeled features under Alternative 4.
Uncertainties exist within the modeling results.	Possibly	Yes	Results from the SWWC Model and the Hydrologic Model contain some uncertainties that, at this time, are unable to be resolved. Large modeling efforts, such as these, often require significant amounts of data, which can be difficult and expensive to obtain. When data gaps exist, assumptions based on best available science and literature searches are typically made. The uncertainties associated with modeling assumptions can be reduced by collecting more data or by performing sensitivity analyses, which involve modifying model input parameters to see how much they effect model outputs. The SGP proponent has performed sensitivity analyses to address some sources of model uncertainty. Results of the sensitivity analyses have been incorporated into the analysis for Water Quantity and Water Quality.
The Draft EIS provides a general description of SGP's water balance. A large component of the water balance includes groundwater management. No aquifer pump test results have been provided for the bedrock aquifer from which pit dewatering would occur. Rapid infiltration basin (RIB) testing results were not available for inclusion in the Draft EIS. Disposal of groundwater into RIBs also may be complicated during winter operations.	Yes	Yes	In regard to dewatering rates, the Hydrologic Model provides an estimation of the water that needs to be removed from the ground in order to maintain dry pits. The model makes assumptions (e.g. hydraulic conductivity of the bedrock) and utilizes drain cells instead of pumping wells. In regard to the discharge rate that a RIB can manage, estimates can be made if the hydraulic conductivity and RIB area are known. These estimates may contain uncertainties if hydraulic conductivities are assumed. While the Draft EIS provides a general description of the water balance, additional information will be included in the Final EIS. The methods used in the hydrologic model provide an adequate representation of the drawdown and capture zone that would be created by networks of dewatering wells; however, there is uncertainty in dewatering rates caused by these assumptions. Ultimately, operational dewatering rates may be higher or lower than currently predicted. This uncertainty can be addressed through the use of a model sensitivity analysis by varying hydraulic conductivity of the bedrock aquifer to see how these changes effect predicted dewatering rates. Estimation of manageable groundwater disposal rates through RIBs is useful when determining the water balance for proposed activities. Uncertainties associated with infiltration rates and operational functionality during winter can be reduced by testing RIB capabilities. Data acquired from RIB testing were not available for inclusion in the Draft EIS; however, this information will be included, as appropriate, in the Final EIS.
There are uncertainties regarding the hydraulic properties of pit backfill. Groundwater flow through pit backfill may vary depending on grain size distribution and effective porosity.	Possibly	Yes	A grain size distribution and effective porosity of the pit backfill material have been assumed for modeling purposes. The impact of this uncertainty is the same for Alternatives 1, 3, and 4. Impacts will be different for Alternative 2 because this alternative includes backfill of the Midnight pit and partial backfill of Hangar Flats pit at mine closure.
Information on the adequacy of the leak detection layer for Alternative 2 has not been provided. The liner/leak detection is specific to Alternative 2.	Possibly	Yes	The functionality of the MicroDrain liner/leak detection configuration proposed under Alternative 2 is relatively new technology, thus adequacy of performance over long time frames has not been fully described. Additional details on the functionality of the MicroDrain liner will be considered by Idaho Department of Environmental Quality and, if available, incorporated into the Final EIS.
Details of surface water management, discharge limits, and permitting is not yet available.	Possibly	Possibly	Surface water management is described in general in the Draft EIS. Specific details of outfall locations and discharge limits will be part of the IDPES Discharge Permit for the site.

Description of the Information Incomplete or Unavailable Information (40 CFR 1502.22(b)(1))	Is the info relevant to reasonably foreseeable significant adverse impacts? (40 CFR 1502.22(b)(2))	Is the information essential to a reasoned choice among alternatives?	Evaluation/summary of existing data which is relevant to the evaluation of impacts based upon theoretical approaches or research methods generally accepted in the scientific community (40 CFR 1502.22(b)(3) and (4))
Development Rock Management Plan	Yes	Yes	The Development Rock Management Plan will provide additional clarification on handling of development rock, particularly how potentially acid generating (PAG) rock will be handled. This could change the analysis of alternatives and the predicted water quality impacts.
Environmental Legacy Management Plan (ELMP)	Yes	Possibly	An Environmental Legacy Management Plan (ELMP) will be prepared between the Draft and Final EIS once a Preferred Alternative has been identified by the U.S. Forest Service (Forest Service). The ELMP will provide additional clarification on monitoring and mitigation for site activities.
Constructed Channels Post-closure	Possibly	Possibly	Reclaimed stream channels in general, and stream channels created on fill in particular, would have different geomorphology and would take some time for vegetation establishment. Additional analyses of the chances of successful reclamation is needed. Reconstructed channels vary among alternatives and the analysis of reclaimed channels could result in changes in the analysis between alternatives.
Incorporation of special status plant habitat information (Wetlands/Riparian Areas).	Possibly	Possibly	Special status plant habitat was modeled; however, the estimated value of wetland special status plant habitat was not included in assessment of wetland functional values in the functional assessment data. Incorporation of special status plant habitat value into Montana Wetland Assessment Method scores will need to be performed by the original assessors of this data and documented in an updated functional assessment report for inclusion in the Final EIS.
The aggregate source for Yellow Pine Route maintenance is unknown.	Possibly	Possibly	A borrow source has not yet been determined for Alternative 4. The analysis for the Draft EIS assumes that the borrow sources would cover approximately the same disturbed acreage as Alternative 1.
Stability analyses and factors of safety have not been provided for all DRSFs.	Possibly	Possibly	Due to the difference among alternatives of the placement of DRSFs, and/or the amount of material that would be in a DRSF, analysis of differing factors of safety for each DRSF may provide additional information for a reasoned choice among alternatives.
Detailed geotechnical data has not been provided for access roads.	Possibly	Possibly	Data collection along the proposed Burntlog Route is ongoing. The geotechnical considerations of the realignment between Alternatives 1 and 2, as well as, the engineering considerations could result in differences among alternatives and potentially even changes in alignments. Geotechnical information for access roads under Alternative 4 could factor into the viability of that alternative.
Detailed geotechnical data, including safety factors or assessments of the geotechnical suitability of the location for proposed upper East Fork South Fork Salmon River (EFSFSR) tailings storage facility (TSF) or DRSF.	Possibly	Yes	This information is not available for Alternative 3. This information may show a difference among alternatives, due to the different location (EFSFSR drainage) for the TSF/DRSF that is located in the Meadow Creek valley for Alternatives 1, 2, and 4.
Emissions	Possibly	Possibly	Complete information has not been developed regarding some features of action alternatives, such as vehicle travel distances and material handling rates. Emissions will vary among alternatives based on facility and operations/reclamation changes, such as moving the TSF to the EFSFSR.
The location of an access road, within an Inventoried Roadless Area (IRA), to a very-high frequency (VHF) repeater site is unknown for Alternatives 1, 2, and 3.	Possibly	Possibly	The development of an access road to construct and maintain repeater sites within an IRA will be the same under Alternatives 1, 2, and 3. Under Alternative 4, no access would be needed because the site would be constructed and maintained using a helicopter. The specific location of repeater sites has not been determined.
SGP-specific ethnographies were provided by the Nez Perce Tribe and Shoshone-Paiute Tribes (in consultation with each tribe to determine appropriate information to share). However, additional data from ethnographies prepared by the tribes with interest in the analysis area (Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes) are underway.	Possibly	Possibly	Additional data from ethnographies are not available for the Draft EIS. This data will be considered for Tribal Rights & Interests and Environmental Justice in the Record of Decision. Proprietary data will be considered but not disclosed. This information could show different impacts among alternatives to important tribal resources or areas.

Table Source: AECOM 2020

Table Notes:

1 For the purposes of this section, “reasonably foreseeable” includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.

DRSF = development rock storage facilities; EFSFSR = East Fork South Fork Salmon River; EIS = Environmental Impact Study; ELMP = Environmental Legacy Management Plan; IDPES = Idaho Pollutant Discharge Elimination System; IRA = Inventoried Roadless Area; NOAA = National Oceanic and Atmospheric Administration; PAG = potentially acid generating; RIB = rapid infiltration basin; SWWC = Site-Wide Water Chemistry; TSF = tailings storage facility; VHF = very-high frequency

4.1.3 Impact Assessment

The terms "effect" and "impact" are synonymous under NEPA. Effects may refer to physical, biological, economic, social, or health-related phenomena that may be caused by any of the alternatives. Effects may be direct, indirect, or cumulative in nature.

The word "significant" has a very particular meaning when used in a NEPA document. Significance is defined by CEQ as a measure of the intensity and context of the effects of a major federal action on, or the importance of that action to, the human environment. Significance is a function of the beneficial and adverse effects of an action on the environment.

Intensity refers to the severity or level of magnitude of impact. Public health and safety, proximity to sensitive areas, level of controversy, unique risks, or potentially precedent-setting effects are all factors to be considered in determining intensity of effect.

Context means that the effect(s) of an action must be analyzed within a framework, or within physical or conceptual limits. Resource disciplines; location, type, or size of area affected (e.g., site-specific, local, regional, national); and affected interests are all elements of context that ultimately determine significance. Both long- and short-term effects are relevant to context.

4.1.3.1 Direct and Indirect Effects

A direct effect occurs at the same time and place as the action. Indirect effects are reasonably foreseeable effects caused by an action that occur later in time or are removed in distance but are still reasonably likely. Indirect impacts may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems (40 CFR 1508.8). Direct and indirect effects are discussed in combination under each resource.

4.1.4 Mitigation for Impacts

Where applicable, mitigation measures are proposed in this document. If residual effects remain after the mitigation is applied, those effects are described within the impact analysis. Mitigation measures are a means to address environmental impacts that are applied in the impact analysis to reduce intensity or eliminate the impacts. To be adequate and effective, CEQ regulations (40 CFR 1508.20) require that mitigation measures fit into one of five categories:

(a) Avoiding the impact altogether by not taking a certain action or parts of an action;

(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation;

(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;

(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or

(e) Compensating for the impact by replacing or providing substitute resources or environments.

Mitigation measures required by the Forest Service and measures committed to by Midas Gold Idaho, Inc. (Midas Gold) as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1** Preliminary Mitigation Measures Required by the Forest Service and **Table D-2** Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The impact analyses in the following sections have taken these mitigation measures into consideration, as well as measures routinely required through federal, state or local laws, regulations, or permitting.

4.1.5 Cumulative Effects

In accordance with NEPA and the CEQ guidelines, cumulative effects are to be analyzed as a component of any project undergoing a NEPA analysis. Cumulative effects are additive or interactive effects that would result from the incremental impact of the proposed action [or alternatives] when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1508.7). Interactive effects may be either greater or less than the sum of the individual effects; thus, the action's contribution to the cumulative case could increase or decrease the net effects. It also requires a logical connection with the potential effects of the proposed action. This means that the specific past, present or RFFA must have potential interactive, additive, and/or combined effects with direct and indirect impacts on a specific resource resulting from the alternatives. This definition helps identify the projects, actions, and events that could interact or combine with the SGP to produce cumulative effects.

The analysis considers effects of past, present, and RFFAs that are determined to be relevant because the effects of these actions could increase or change in combination with the direct and indirect effects of the proposal action or its alternatives. Relevant cumulative effects typically result from human activities, climate change, and natural trends which produce effects that accumulate within the temporal and geographic boundaries of the effects of the proposed project. The purpose of cumulative effects analysis is to document the consideration of the context and intensity of the effects of a proposed project, particularly whether the action is related to other actions with individually insignificant but potentially cumulatively significant impacts (40 CFR 1508.27(b)(7)).

Therefore, cumulative impacts are assessed by combining the potential environmental impacts of the alternatives with the impacts of other actions that have occurred in the past, are currently occurring, or are proposed in the future in the vicinity of the project area. The actions considered in the cumulative impact analysis may vary from those of the proposed project in nature, magnitude, and duration. These actions are considered based on their likelihood of occurrence, and only projects with either ongoing or reasonably foreseeable impacts are identified. In summary, cumulative impacts are past and present actions (baseline conditions) impacts plus reasonably foreseeable actions impacts plus SGP impacts.

If SGP impacts to a resource are identified as minor or not significant, it is unlikely that the SGP impacts would contribute to cumulative effects. Also, any positive or beneficial effects that would reduce impacts from past projects (e.g., reclaiming fish habitat, water quality improvement) are identified as beneficial cumulative impacts. Note that if the SGP may contribute to an impact to a resource some distance from the SGP area but could not be reasonably measured at that distance, those projects, actions, or events would not be considered in this analysis.

Past, present, and RFFAs considered in the cumulative effects analysis are discussed below. Cumulative effects are described in a separate subsection in each resource section for the alternatives, based on applicable RFFAs discussed in Section 4.1.5.2, Reasonably Foreseeable Future Actions and evaluated as being “reasonably foreseeable.”

4.1.5.1 Past and Present Actions

Past actions include activities that may have been initiated in the past but also could involve present operations such as mineral exploration, infrastructure development, and non-mining related actions. They may have lingering effects in degrading the environment or may influence trends in the physical, biological, or social environment.

Present actions include mining projects and their related activities that may have just come online or are currently underway and are causing impacts. They also may include other non-mining related projects currently in progress, such as timber sales or vegetation treatment; recreation; other utility lines (e.g., powerlines) and roads; maintenance and use of the existing transportation network; urban development in Valley County; private land development and uses; and sand and gravel extraction.

Past and present actions that have an interactive, synergistic, and/or additive effect (per 40 CFR 1508.7) with a specific resource (such as lingering effects or influencing trends) in the SGP area are described below:

<u>Mineral Exploration and Mining Activities</u> – Past and present mineral exploration and mining have occurred in the vicinity of the mine site, including prospecting, exploration, underground mining, and open pit mining. To support past mining, other related activities occurred in the vicinity, including: ore milling and processing, tailings disposal, smelting, heap leaching of ore, spent heap leach ore disposal, development rock disposal, hydropower generation, water retention dam construction, saw mill operations, electric power transmission line construction, and occupancy by thousands of people in housing camps and later in the town of Stibnite.

Two major periods of mineral exploration, development, and operations have occurred in the past century, and have left behind substantial environmental impacts. Between the mid-1920s and the 1950s, the area was mined for gold, silver, antimony, and tungsten mineralized materials by both underground and, later, open pit mining methods. The second period of major activity started with exploration activities in 1974 and was followed by open pit mining and seasonal on-off heap leaching and one-time heap leaching from 1982 to 1997, with ore provided by multiple operators from several locations, and processed in adjacent heap leaching facilities (Forest Service 2015).

The mining, milling and processing activities created numerous legacy impacts including underground mine workings, multiple open pits, development rock dumps, tailings deposits, heap leach pads, spent heap leach ore piles, a mill and smelter site, three town sites, camp sites, a ruptured water dam (with its associated erosion and downstream sedimentation), haul roads, an abandoned water diversion tunnel, and an airstrip.

Other past and/or present mining projects considered in the cumulative effects analysis include:

- **Fourth of July Mine** – Located in Government Creek on National Forest System (NFS) land, Fourth of July Mine has been inactive (Forest Service 2012).
- **Camp Bird Mine** – Located in Logan Creek on private land, Camp Bird Mine has been inactive for more than 30 years (Forest Service 2012).
- **Valley County Quarry Development** – Development and operation of an aggregate source to support the road maintenance activities on McCall-Stibnite Road (County Road [CR] 50-412), Johnson Creek Road (CR 10-413), and other backcountry roads as determined by Valley County (Forest Service 2017).
- **Walker Millsite** – Located in Logan Creek on private land, the plan of operations approved in 1990 included a 50 ton per day ball mill and gravity milling process with the following components: a 50-foot by 100-foot by 8-foot-deep tailings impoundment, 1,000 feet of access road, a water transmission line, and explosives magazine. The millsite on NFS land has been reclaimed (Forest Service 2012).
- **Golden Hand No. 1 and No. 2 Lode Mining Claims** – Located in the Big Creek drainage on 1,309 acres of NFS land, approximately 19 miles north of Yellow Pine, the plan of operations included drilling operations, trenching and sampling, and reopening the caved Ella Mine adit. The project also would include the collection of subsurface geological information to prepare for a new mineral examination. The claims encompass approximately 20 acres each and are adjacent to Coin Creek (Forest Service 2012).
- **Cinnabar Mine** – Located 15 miles east of Yellow Pine and approximately 50 acres in extent, most of the mining occurred during the 1950s. No reclamation has been performed at the site and contaminants of concern include mercury, methylmercury, and arsenic (EPA 2020).

Exploration activities for potential future mining development have been occurring for the last decade and are ongoing at or within the vicinity of the SGP. Affiliates of Midas Gold initiated mineral exploration activities in 2009 as part of the Golden Meadows Exploration Project to better define the mineral deposit potential for the area. Activities associated with the Golden Meadows Exploration Project included the use of the existing road network, and construction of several temporary roads to access drill sites, drill pad construction, drilling on both NFS and private lands, and reclamation (Forest Service 2015). The following is a brief summary of the activities:

- **Midas Gold Exploratory Drilling (2009-2012)** –Exploratory drilling consisting of approximately 6 to 122 drill pads mostly occurred on private land. Crews were housed on private property in Yellow Pine. All equipment was staged on private property and drilling activities generally occurred 24 hours per day. Water withdrawal sites included existing sediment retention ponds and streams. Private and Forest Service temporary roads were used and/or authorized to access drill pads located on NFS lands. Road maintenance was needed to open the existing roads. For winter activities, chained rubber-tired vehicle, helicopter, snowcat, or snowmobile provided access. Where drill pads were located next to roads, some snow plowing occurred at select locations. During snow-free periods, access occurred by helicopter, and where there was authorized access on NFS land or on private land, rubber-tired vehicles also were used for access. Midas Gold also drilled 16 new groundwater alluvial and bedrock monitoring wells on 8 pads in 2012 (Forest Service 2015).

- **Monitoring Wells for the Golden Meadows Project (2013)** – Midas Gold drilled four new groundwater alluvial and bedrock monitoring wells on two pads in 2013. Exploration drilling was conducted in 26 drill areas within NFS land. Twenty-four of the drill areas were accessed by helicopter (i.e., for transport of equipment and crew) and contained temporary helicopter-supported drill pads. No temporary roads were needed for these 24 drill areas (Forest Service 2015).
- **Midas Gold Baseline Studies (2013-2017)** – Baseline data collection studies including water quality, fishery surveys, wildlife surveys, and vegetation mapping were conducted (Forest Service 2015).
- **Winter Geotechnical Study (2017)** – Exploration drilling was conducted in 26 drill areas within NFS land. Twenty-four of the drill areas were accessed by helicopter (i.e., for transport of equipment and crew) and contain temporary helicopter-supported drill pads. No temporary roads were needed for these 24 drill areas (Forest Service 2015).
- **Geotechnical Studies along Meadow Creek (2017)** – Geotechnical study field work program was conducted in support of feasibility level engineering work on the proposed tailings impoundment and impoundment dam foundation conditions. Midas Gold utilized a track mounted Cone-Penetrometer Test rig to access eight locations along Meadow Creek in September/October 2017 (Forest Service 2015).
- **Operations Exploratory Drilling (2016-2019)** – In addition to exploratory drilling for the winter geotechnical study in 2017, expansion of an existing borrow source on NFS land just east of the camp and shop area also occurred. The borrow material supplied approximately 7,000 cubic yards of crushed rock to support the exploration program, including road maintenance and site reclamation activities and also was used by previous operators and the Forest Service. Approximately 141,000 gallons of fuel (diesel, gasoline, and jet fuel) per calendar year was transported on existing Valley County roads to the fuel storage facility (located on private land) (Forest Service 2015).
- **Exploration and Geotechnical Drilling (2018)** – Midas Gold drilled 62 exploration and geotechnical drilling pads within the project area. Fifty-six of the pads are track-supported and the remaining six are helicopter-supported. None of the pads are steep slope drill pads. The 62 proposed pads are located in the vicinities of the following water

bodies: Upper East Fork South Fork Salmon River, Meadow Creek, Middle East Fork South Fork Salmon River, Lower East Fork South Fork Salmon River, Upper Meadow Creek, and West End Creek (HDR 2017).

- **On-going Monitoring for Golden Meadows Project** – Monitoring for weeds, water quality, minerals and geology, access and haul route water quality monitoring, monitoring of water quality best management practices and project standard operating procedures associated with haul and access road use, wildlife and rare plants continue to be conducted (Forest Service 2015).
- **Burntlog Route Geophysical Investigation Field Work (2020-2021)** – Midas Gold collected geophysical data at proposed rock quarries, bridge abutments, cut slopes, and soil nail/mechanically stabilized earth wall locations using four methods including a Dynamic Cone Penetrometer Test, a track mounted excavator, a truck/track mounted hollow stem auger/core rig, and a helicopter assisted casing advancer/core drill rig. Midas Gold is investigating 24 locations by drilling or excavating 40 borings/test pits along the proposed Burntlog Route. The geophysical investigation field work will last approximately 40 days. Nearly half of the locations are situated along the existing Burntlog Road and the remaining sites are located along the proposed new alignment of the Burntlog Route between Trapper Creek and Stibnite (Midas Gold 2019). (Refer to **Table 4.1-2** in Section 4.1.5.2, Reasonably Foreseeable Future Actions for additional detail.)

Transportation Projects – Road maintenance, improvement projects, airstrip operations and maintenance, and culvert and bridge replacements have occurred in the past and are expected to continue in the future. Installation or improvement of culverts and bridges may impact aquatic habitat due to construction-related effects and erosion. Maintenance of existing roadways, culverts, and bridges will likely be short-term, while new roadways, culverts, and bridges would have a larger effect. More information regarding current and future road maintenance and airstrip operations are provided below:

- **Road Maintenance of NFS Roads** – Thunder Mountain Road (National Forest System Road 50375) and Meadow Creek Lookout Road (National Forest System Road 51290) are both NFS maintenance level 2 roads that received maintenance in 2014 and are on a regular maintenance schedule. Road maintenance activities include blading, slough removal, and culvert cleaning. It is assumed that private landowners on private lands keep roads open and maintained to meet their needs.
- **Road Maintenance of County Roads** –Warren Profile Gap Road (CR 50-340) and the road to the Big Creek Trailhead are currently maintained by Valley County under a cooperative agreement; both roads are on an annual or biannual maintenance schedule. Road maintenance activities include blading, slough removal, and culvert cleaning. Smith Creek and Pueblo Summit Roads have not received any maintenance for years (Forest Service 2016).
    - McCall-Stibnite Road (CR 50-412) is currently maintained by Valley County under a cooperative agreement, on a regular maintenance schedule. There is an agreement

between Valley County and Midas Gold to allow Midas Gold to provide maintenance along the road from Yellow Pine to Midas Gold's property, “the road will be continuously maintained during the open period. Maintenance will, in all respect, be subject to review and approval by the Valley County Road Superintendent. The Owner/Contractor will abide by the Schedule 8: Payette National Forest; Road Maintenance Best Management Practices. During winter operations the Owner/Contractor will maintain a vehicle and trailer parking and turn around area at Profile Creek and Stibnite. The Owner/Contractor will place a temporary Valley County owned and signed gate above the Profile Creek Road during the Spring Breakup to prohibit any full-size vehicles from entering the Yellow Pine-Stibnite Road, unless otherwise authorized. All-terrain vehicles (ATV), utility-terrain vehicles and snow mobile access on the Yellow Pine-Stibnite Road will still be permitted for the public at large during this temporary travel restriction.”

- The Idaho Transportation Department (ITD), Division of Aeronautics maintains and operates the Johnson Creek, Warm Springs, and Bruce Meadows airstrips which are located on NFS land.

Mine Closure and Reclamation – Closure and reclamation of Hecla and SMI mining and processing facilities located in the headwaters of EFSFSR and Sugar Creek occurred between 1993 and 2000. Several Comprehensive Environmental Response, Compensation, and Liability Act Removal Actions also were conducted in the same area by the Forest Service, Environmental Protection Agency, and Exxon-Mobil Corporation to minimize risks to human health and the environment from legacy mining and processing activities during the 1930s, 40s, and 50s.

Recreation and Tourism – Past and present recreation and tourism activities include sport hunting, fishing, trapping, boating and river recreation, camping, hiking, backpacking, outfitter/guide operations, tourist services – Big Creek Lodge, Elk Springs Outfitters, and Juniper Mountain Outfitters. These activities take place primarily from late spring to late fall, and there may be small plane, helicopter, and vehicle traffic associated with access.

Infrastructure Development – Past and present community infrastructure projects include the transmission line upgrades in the West Central Mountain Electric Plan 2014, which follows the general location of the SGP upgraded transmission line route (Idaho Power Company [IPCo] 2014).

Water Diversions and Hydro Power Projects – There are eight water diversions on federal and private lands in vicinity of the SGP area. There also are three residential, small-scale hydroelectric operations (0.4 to 0.9 cubic feet per second permitted), and one hydroelectric operation at Big Creek Lodge.

Wildland Fire, Noxious Weed Control, and Firewood Harvest – There have been numerous wildland fires in vicinity of the SGP area and it is likely more will occur in the future. Past fires within the headwaters of the EFSFSR and Sugar Creek include: Indian Creek Point (12,204 acres); Tamarack (2,348 acres); Bishop Creek (2,610 acres); Cascade Complex (299,930 acres); Thunder City (13,263 acres). Removal of firewood for non-commercial use has occurred in the past and is expected to continue in the future on NFS land, in compliance with general permit requirements for the Payette National Forest. Several noxious weed species have been identified in the vicinity of the SGP including spotted knapweed, Canada thistle, yellow toadflax, and rush skeletonweed. Treatment of noxious weeds occurs regularly throughout the area. Treatments include chemical spraying and pulling. Main areas of treatment for noxious weeds include Chamberlain area, Beaver Creek, and Big Creek trails, and along road access areas.

Forest Management - These activities include easements and other management actions. There are several easements in the SGP area and vicinity that are granted and maintained by the Forest Service including: Road Right-of-Way, Forest Road and Trail Act (FRTA) on McCall-Stibnite Road (CR 50-412), Road Right-of-Way and Linear Utility easement to the IPCo. The Yellow Pine Blowdown Project near Yellow Pine was conducted to remove down material from camping and recreating areas, reduce the risk of insect outbreak, and to reduce the fuel loading to help to ensure the safety of the Yellow Pine community.

Commercial and Subsistence Harvest of Fish and Wildlife – Past and present harvest of fish and wildlife for recreational and subsistence purposes puts some degree of pressure on those resources. Legal hunting, fishing, and trapping has occurred and is currently occurring in the SGP area and vicinity. Fish and wildlife resources are managed by the Idaho Department of Fish and Game and federal agencies to maintain sustainable populations. Managers use management tools such as harvest limits and areas open and closed to sport and commercial harvest of fish and wildlife to maintain sustainable resources and allocate harvest. Section 4.12, Fish Resources and Fish Habitat and Section 4.13, Wildlife and Wildlife Habitat describe historic trends for area wildlife and fish populations.

4.1.5.2 Reasonably Foreseeable Future Actions

For the EIS analysis, determination of RFFAs involved the identification of permit applications for the Forest Service and Valley County, existing plans, and scoping comments to assess which potential projects or activities are reasonably likely to occur in the SGP area that would result in overlapping effects, both spatially and temporally, with the alternatives. The evaluation of RFFAs also considers the likelihood of the action moving forward.

NEPA requires analysis of “reasonably foreseeable” future actions and does not require speculation about unknown future events. Therefore, the cumulative effects analysis is generally limited to projects with known locations and descriptions, usually those for which a permit application has been filed or other public announcement made with enough detail to allow for comparison provided. Projects with known locations and descriptions that have been considered as “reasonably foreseeable” include the continuation of present actions such as recreation activities, mine exploration activities, private land development and uses, and timber sales.

Table 4.1-2 provides a detailed list of the RFFAs considered in the cumulative analysis and **Figure 4.1-1** shows the location of these RFFAs. **Figure 4.1-1** also shows relevant RFFAs and historic fire boundaries that might be reasonably expected to contribute measurably to cumulative effects from the SGP for one or more resources (e.g., watersheds, transportation routes). Individual resource sections discuss a cumulative analysis area specific to that resource and, therefore, may not consider all of the RFFAs shown in **Figure 4.1-1**, or in certain cases may consider an area larger than shown (e.g., airsheds).

This page intentionally left blank

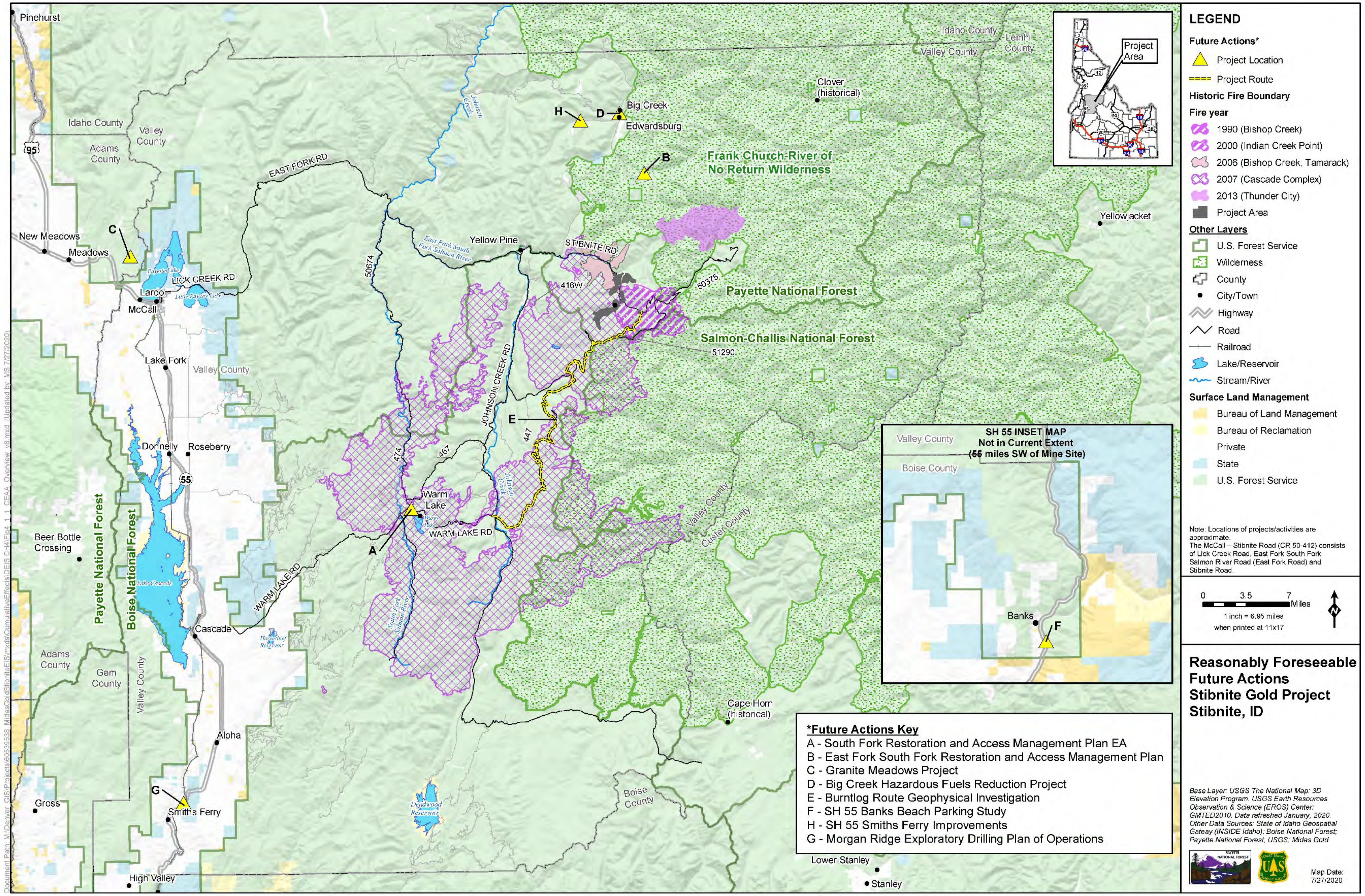


Figure Source: AECOM 2020

Figure 4.1-1 Reasonably Foreseeable Future Actions

This page intentionally left blank

Table 4.1-2 Reasonably Foreseeable Future Actions in the Vicinity of the SGP Area

Project or Activity Name	Forest Service Document/ District	Brief Description	Approximate Construction/ Operation Dates
South Fork Restoration and Access Management Plan (RAMP)	EA (PNF SOPA, BNF SOPA)	- Recreation management - Watershed management - Road management This project will address both restoration and public and private access needs to determine the minimum road system, improve watershed condition, provide ATV and motorcycle trail opportunities, and provide dispersed camping and parking opportunities. The project includes numerous actions relating to watershed restoration, motorized and non-motorized access, and improvements of recreation facilities within the South Fork Salmon River (SFSR) watershed within a 329,000-acre project area. http://www.fs.usda.gov/project/?project=51257	In Progress: Objection Period Legal Notice: 12/18/2019 Expected Decision: 11/2020 Expected Implementation: 12/2020
East Fork Salmon River Restoration and Access Management Plan (RAMP)	(PNF)	Scoping for the East Fork Salmon River (EFSR) RAMP is on hold until late 2020/early 2021. The spatial extent of the EFSR RAMP could include Yellow Pine, Big Creek, and Thunder Mountain within the PNF. The purpose of the EFSR RAMP is travel management. The Forest Service would conduct travel planning to identify a Minimum Road System (MRS) (36 CFR 212 Subpart A) and the routes open for public use (36 CFR 212 Subpart B).	Expected scoping: spring 2021
Granite Meadows	EIS (PNF SOPA)	- Recreation management - Wildlife, fish, rare plants - Forest products - Vegetation management (other than forest products) - Fuels management - Watershed management - Road management This is the fifth project within the PNF's Collaborative Forest Landscape Restoration Program. Proposed treatments include timber harvest, thinning, prescribed fire, road treatments and road decommissioning, watershed improvement and restoration treatments, and recreation improvements. Coordination with existing permittees on grazing schedules also would be included to meet the purpose and need related to fuels reduction.	In Progress: Estimated DEIS NOA in Federal Register 12/2020 Expected Decision: 9/2021 Expected Implementation: 10/2021

Project or Activity Name	Forest Service Document/ District	Brief Description	Approximate Construction/ Operation Dates
		The Granite Meadows Project area totals approximately 83,000 acres and includes approximately 70,000 acres of NFS lands within the New Meadows and McCall Ranger Districts on the PNF. Additionally, the project area includes approximately 7,000 acres of state land and 6,000 acres of private land. The project is located in the Hard Creek, Hartsell Creek-North Fork Payette River, Elk Creek-Little Salmon River, Lower Meadows Valley-Little Salmon River, Round Valley Creek-Little Salmon River, Sixmile Creek-Little Salmon River, Box Creek-North Fork Payette River, Fisher Creek, and Payette Lake subwatersheds with the Little Salmon and North Fork of the Payette subbasins. http://www.fs.usda.gov/project/?project=54029	
Big Creek Hazardous Fuel Reduction	EA (Big Creek Road Plan of Operations EA; PNF SOPA)	- Fuels management Community protection for Edwardsburg/Big Creek area using commercial and noncommercial treatments and prescription fire to reduce hazardous fuels. Treatments are on Forest Service lands along public roads and adjacent to private property, outside of wilderness. The project would create an area of reduced wildfire risk and fire severity/intensity on NFS lands around Big Creek and Edwardsburg and private property using commercial timber harvest, understory treatment, and prescribed burning. Approximately 10,600 acres would be treated with this project in one of the following manners: • Approximately 2,250 acres of mechanical treatments consisting of commercial and noncommercial thinning, using tractor, jammer or skyline systems, or mastication. • Approximately 550 acres of non-commercial thinning within Riparian Conservation Areas using hand treatments and pile burning. • Approximately 7,800 acres of natural fuel prescribed fire burn blocks. Less than 1 mile of temporary road could be constructed to facilitate equipment access and product removal and would be reclaimed after vegetation management treatments were completed. http://www.fs.usda.gov/project/?project=54260	In Progress: Objection Period Legal Notice: 04/17/2020 Expected Decision: 10/2020 Expected Implementation: 11/2020
Burntlog Route Geophysical Investigation	CE (BNF SOPA)	- Minerals and geology The purpose of the investigation is to collect crucial geophysical data along the existing Burnt Log Road and proposed new alignment between Trapper Creek and Stibnite.	In Progress: Scoping Start: 02/10/2020 Expected Decision: 09/2020 Expected Implementation: 05/2021

Project or Activity Name	Forest Service Document/ District	Brief Description	Approximate Construction/ Operation Dates
SH 55 Banks Beach Parking Study	ITD and FHWA-WFLHD	Safety and operational improvement at the Banks Beach picnic area, located at milepost 77.9 on the west side of SH 55 (approximately 1 mile south of the intersection of SH 55 and Banks-Lowman Road).	Alternatives Analysis, Public Notification, and Design: 2020
SH 55 Smiths Ferry Improvements	ITD	Safety improvement on SH 55 from Smiths Ferry to Round Valley. The project is expected to take 2 to 2.5 years to construct (four or five spring and fall blasting periods).	Construction to begin: Fall 2020
Morgan Ridge Exploratory Drilling Plan of Operations	EA (PNF SOPA)	A plan of operations is being considered to conduct exploratory drilling for locatable minerals from four drill pads, including six 1,500-foot core holes and the use/repair of 3.1 miles of existing routes as temporary road for motorized vehicle access. http://www.fs.fed.us/nepa/nepa_project_exp.php?project=49889	On hold
Wildlife Conservation Strategy	EIS (Forest Plan Amendment) 101 (PNF SOPA)	- Land management planning - Wildlife, Fish, Rare plants Short- and long-term management strategies and priorities for maintaining and restoring habitats associated with terrestrial wildlife species. http://www.fs.usda.gov/project/?project=28633	On hold

Table Source: FHWA 2020, Forest Service 2018, 2020a and 2020b, ITD 2020

Table Notes:

ATV = all-terrain vehicle; BNF = Boise National Forest; CE = Categorical Exemption; EA = Environmental Assessment; EFSR = East Fork Salmon River; EIS = Environmental Impact Statement; FHWA-WFLHD = Federal Highway Administration, Western Federal Lands Highway Division; IPCo = Idaho Power Company; ITD = Idaho Transportation Department; NFS = National Forest System; NOA = Notice of Availability; PNF = Payette National Forest; RAMP = Restoration and Access Management Plan; SFSR = South Fork Salmon River; SOPA = Schedule of Proposed Actions

4.1.6 Irreversible and Irretrievable Commitments of Public Resources

The CEQ regulations require an evaluation of "any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented" (40 CFR 1502.16).

A commitment of resources is irreversible when the impacts of the SGP would limit the future options for use of the resource. This applies primarily to non-renewable resources or to processes or resources that are renewable over long periods of time.

A commitment of resources is irretrievable when the impacts of the SGP would result in a loss of production or use of renewable resources. These opportunities are foregone for the period of the SGP, during which the resource cannot be used. These decisions are reversible, but the utilization opportunities foregone are irretrievable***.***

4.1.7 Short-term Uses versus Long-term Productivity

The CEQ regulations require an evaluation of environmental sustainability considering the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity (40 CFR 1502.16). Each resource section provides a brief discussion of the short-term effects of the SGP versus the maintenance and enhancement of potential long-term productivity of each resource in its analysis area.

4.1.8 Forest Plan Consistency and Potential Amendments

The 2003 Payette National Forest Land and Resource Management Plan (Payette Forest Plan) and 2010 Boise National Forest Land and Resource Management Plan (Boise Forest Plan) provide guidance for the management of lands and activities within each respective National Forest. The Forest Plans accomplish this by establishing desired conditions, goals, objectives, standards, and guidelines. Desired conditions, goals, and objectives are applicable on a forest-wide basis. Standards and guidelines are either applicable on a forest-wide basis or by specific management areas.

A review of all standards in the Forest Plans within forest-wide and specific management areas was conducted to identify aspects of the Forest Plans where the proposed activities of the SGP were found to be inconsistent with relevant standards and for which amendments are proposed. The purpose of the amendments is to ensure consistency between the SGP and the Forest Plans. A total of 5 Payette Forest Plan and 9 Boise Forest Plan standards were identified where a project-specific amendment would be required. For additional details on the project-specific amendments and their specific rationale, see **Appendix A** Forest Plan Consistency and Land and Resource Management Plan Amendments.

4.2 Geologic Resources and Geotechnical Hazards

4.2.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to geologic resources and geotechnical hazards includes the following issues and indicators:

Issue: The minerals present at the site are economically valuable, and may contribute to the national goal of being economically independent in strategic metals, such as antimony.

***Indicators**:*

- Amount and value of ore extracted
- Depletion of mineral resources

Issue: Mining activities could change the existing topography and leave physical hazards if not properly designed and managed.

***Indicators**:*

- Alteration of natural topography
- Unstable slopes

Issue: Geological and geotechnical stability of the Stibnite Gold Project (SGP) facilities, including the tailings storage facility (TSF) and other mine components.

Indicators:

- Geological/Geotechnical suitability of the selected locations for the mining and facilities to be constructed.
- Long-term geologic/geotechnical stability of the proposed structures.

Geologic resources and geotechnical hazards were analyzed using data generated by Midas Gold Idaho, Inc. (Midas Gold) as part of the SGP development and other sources of information such as SRK Consulting (2012); STRATA, Inc. (STRATA) (2014a, 2016); Tierra Group 2018; M3 Engineering and Technology (2019); and Gillerman et al. 2019, as well as Geographic Information System spatial analyses, and review of additional scientific literature and applicable regulations.

4.2.2 Direct and Indirect Effects

The following analysis of effects associated with geologic resources and geotechnical hazards is considered within the overall context of the local and regional geology. Elements of this context include:

- A majority of the analysis area is on National Forest System lands within the Salmon River Mountains, a high-relief mountainous physiographic province of central Idaho with the presence of steep slopes that are subject to landslides and avalanches.
- The analysis area is comprised of relatively common types of rocks to the region (see Chapter 3.2) and common landforms (e.g., glacial and fluvial geomorphic features, asymmetric hillslopes).
- The area lacks protected or managed geologic resources, such as cave and karst formations, and contains rock units that generally preclude preservation of fossils.
- The analysis area is within the seismically active Centennial Tectonic Belt and it is anticipated to be subjected to earthquake ground shaking (URS Corporation 2013).
- The mine site includes disturbed areas as a result of previous mining activities, resulting in the presence of legacy mine features with associated slope stability and seismic stability considerations.
- The ore of interest (i.e., gold-, silver-, and antimony-bearing material) is economically valuable and/or of strategic importance.

4.2.2.1 Alternative 1

4.2.2.1.1 MINE SITE

Mining methods would include open pit mining and recovery and re-processing legacy tailings. In addition, the SGP includes limited underground exploration and sampling to be accessed via the Scout exploration decline (see Chapter 3.2, Affected Environment, and Chapter 2, Alternatives). The legacy tailings are in the Meadow Creek valley. Open pit mining methods would be implemented for three known mineral deposits: Yellow Pine, Hangar Flats, and West End. Reprocessing of the legacy tailings would be conducted early during SGP operations to mitigate discharge of legacy-tailings-derived sediment and heavy metal-containing leachates into Meadow Creek.

The legacy tailings, which were deposited in the Meadow Creek valley bottom without a liner system, are currently under the spent heap leach ore disposal area but within the planned footprint of the proposed Hangar Flats development rock storage facility (DRSF). The spent heap leach ore would be removed and reused for construction purposes as appropriate. The legacy tailings would then be removed and reprocessed.

Although there would be temporal overlap in the mine development and operations, the general sequence of mining would be the Yellow Pine deposit first, Hangar Flats deposit second, and the West End deposit third. This mining sequence is guided by the reclamation aspects of the SGP, which include backfilling the Yellow Pine pit with West End development rock to reclaim the approximate original gradient of the East Fork South Fork Salmon River (EFSFSR), to provide permanent fish passage, and facilitate aquatic habitat enhancement.

Mining of the three mineral deposits would be conducted using conventional open pit surface mining techniques with a series of benches from which development rock and ore would be extracted using standard mining equipment including blast-hole drills, shovels, loaders, and off-highway trucks.

4.2.2.1.1.1 Bedrock Geology and Mineral Resources

Approximately 168 million tons of ore and development rock would be mined from the Yellow Pine pit. Approximately 102 million tons of ore and development rock would be mined from the Hangar Flats pit. Approximately 166 million tons of ore and development rock would be mined from the West End pit.

Within the context of operations at mine pits, there would be direct impacts to bedrock during mining. The geologic resources impacted by the SGP mine pits would consist of relatively common types of rocks and the ore of interest. Depletion of the ore bodies would occur within the mine pits. Impacts to bedrock geology would be permanent from ground disturbances and reshaping of landforms by excavation and direct removal of materials.

4.2.2.1.1.2 Surficial Geology and Topography

Within the context of the mining area, there would be direct impacts to landforms, including hills, ridges, and valleys. Workings, tailings, and storage areas would be excavated and modified for reclamation, material re-use, or reprocessing. The effects would be localized and limited to discrete portions of the analysis area. After closure, the areas impacted by operations would be contoured and graded to blend into the surrounding landscape and the Yellow Pine pit would be backfilled. Some pit highwalls would remain post-closure.

4.2.2.1.1.3 Seismic Hazards

Seismic hazards, such as earthquakes, are a common geologic phenomenon in central Idaho and design and construction of dams, bridges, pipelines, within a mining area, is governed by regulation. In the event of a major earthquake near the mine site, impacts to mine site structures would range from low intensity, meaning no noticeable damage to structures, to moderate intensity, in which facility design is adequate to withstand earthquakes. Overall impacts resulting from earthquakes would be expected to cause minor to moderate damage, with a low probability of higher-intensity events that could cause greater damage. Impacts from earthquakes could be minimized with mitigative measures such as incorporation of existing geotechnical design standards and building code standards, as well as construction quality control, operations and maintenance, and surveillance.

Temporary effects from seismic hazards include minor damage that is easily reparable to permanent effects such as failure of a pit wall. Geographic extent of effects would be mostly localized, within the immediate vicinity of the various structure footprints. There would be a low probability of high-intensity effects at certain structures and SGP phases, such as pit walls in post-closure. These effects would be reduced to moderate severity through incorporation of standard geotechnical design criteria for pit walls, coffer dam, impoundment, slope, bench, and foundation design. Use of development rock to provide overlapping buttress support for the TSF would improve the geotechnical stability provided by the standard TSF embankments (see Geotechnical Stability Impacts, below, for more information).

4.2.2.1.1.4 Mass Wasting Hazards

Several landslides have been identified within the footprints of the proposed Hangar Flats and Yellow Pine pits, as shown on **Figure 3.2-5** (STRATA 2014a). The pits would be excavated as part of overall mining operations and hazards associated with these features within the footprint of the open pit would be removed.

Known landslides and rockfalls outside of the pits are not anticipated to cause adverse effects on mine operations (STRATA 2014a). The geographic extent of effects would be localized, within the immediate vicinity of these rockfall and landslide features. Effects would be temporary including minor damage that is easily reparable. It is possible that a rockfall or landslide could occur from a seismic event and cause greater effects on operations (URS Corporation 2013). Such high-intensity effects from mass wasting would be reduced to moderate-intensity effects through incorporation of existing geotechnical design standards and building code standards, as well as construction quality control, operations and maintenance, and surveillance.

Several areas of the mine site are within avalanche hazard zones described in 2019 by Midas Gold based on information from Midas Gold, Boise National Forest, and Payette National Forest (**Figure 3.2-5**) (Midas Gold 2019). Avalanche hazards are already present in the analysis area, and would not be substantially exacerbated by the SGP. Avalanche occurrence is largely a result of a combination of three factors: weather, snowpack, and terrain. The SGP would not substantially alter these factors. Blasting associated with mining operations could trigger avalanches; however, this would likely cause more frequent but less severe avalanches than would naturally occur without blasting. Presence of personnel at the mine site and increased value of facilities and structures as a result of Alternative 1 could increase the magnitude of impact through property damage and personal injury or loss of life from avalanches.

4.2.2.1.2 Geotechnical Stability of Proposed Mine Site Structures

4.2.2.1.2.1 TSF Dam and Hangar Flats DRSF

Excavation and processing of mineral resources proposed under Alternative 1 would produce fine-grained tailings with high water content to form a slurry. The tailings would be thickened, and process water recovered (tailings would be approximately 55 percent solids), neutralized, and pumped to the TSF (see Chapter 2, Alternatives, and Midas Gold 2016).

A slope stability analysis of the TSF dam design including the buttressing effect on the TSF dam by the Hangar Flats DRSF was performed by Tierra Group (2017). Slope stability analyses were performed for static or normal conditions and for a facility under earthquake event loading conditions, representing pseudo-static conditions. The TSF and Hangar Flats DRSF were analyzed to determine factors of safety[1] for two potential failure surfaces: 1) full height failure of the Hangar Flats DRSF; and 2) TSF dam failure resulting in loss of tailings containment.

Factors affecting slope stability include the height and the angle of the slope, soil properties, pore pressure within the slope, and external forces such as seismic ground acceleration. The term “factor of safety” is used to express how much stronger a feature is (e.g., tailings dam) to withstand the calculated load imposed on the structure. Factors of safety were calculated based on the currently proposed design of the Hangar Flats DRSF and the TSF dam (**Table 4.2-1**). At a factor of safety of 1.0 the two forces (design dam strength and load) are in balance – meaning the feature is not designed with any additional safety margin to withstand the intended load. The required regulatory ratio per Idaho Administrative Procedures Act (IDAPA) 37.03.05 for tailings dams under static (normal) conditions is 1.50 and under pseudo-static (earthquake) conditions is 1.0.

Table 4.2-1 Calculated Factors of Safety for Hangar Flats DRSF and TSF Dam

Case	Static Factor of Safety	Pseudo-Static (Operations) Factor of Safety	Pseudo-Static (Closure) Factor of Safety
Hangar Flats DRSF	2.58	2.20	1.46
TSF Dam	4.09	3.17	1.81

Table Source: Tierra Group 2017

Table Notes:

Minimum factor of safety for static load is 1.50; minimum factor of safety for earthquake load (pseudo-static) is 1.0 (IDAPA 37.03.05).

These static factor of safety levels for the Hangar Flats DRSF and the TSF would likely result in an annual probability of failure <10^{-7} or 1:10,000,000 in any individual year (Herza et al. 2018), assuming design, construction, maintenance, and oversite of the structure is performed at the highest levels of industry standard. Such a frequency of failure is considered to be extremely low.

Results of the Tierra Group (2017) study indicate the TSF dam and Hangar Flats DRSF would be stable under pseudo-static conditions. Pseudo-static conditions refer to additional load

[1] Factor of safety describes the safety margin and is calculated by the strength of the resisting forces divided by the strength of the stress imparted to the feature/structure (in this case, the TSF dam).

potential placed on the structure due to external forces, in this case an earthquake (Tierra Group 2017).

Earthquakes considered as part of the slope stability analysis by Tierra Group (2017) are:

- During operations with a 475-year return period[2] earthquake
- During post-closure with the maximum credible earthquake (MCE)[3].

The factor of safety of the design of the Hangar Flats DRSF and the TSF are within the levels required by regulation for maintaining geotechnical stability under normal, and earthquake conditions, provided they are designed, constructed and monitored in accordance with standard engineering practices.

4.2.2.1.2.2 Fiddle DRSF and West End DRSF

The Fiddle DRSF and West End DRSF would be constructed at a 2.5 (horizontal) to 1 (vertical) slope (2.5H:1V) (Midas Gold 2016) These two facilities would be regraded at closure to an overall slope of 3.5H:1V for the Fiddle DRSF and 3.2H:1V for the West End DRSF. In general, a 3:1 slope design is considered to be protective against a slope failure under most conditions. It is approximately the same as the slope of many of the surrounding natural areas, including the hillsides both north and south of Fiddle Creek.

As part of closure and final reclamation, the top of the Fiddle DRSF would be graded to promote positive drainage and prevent ponding of water on top of the development rock. The lower portion, or “toe,” of the DRSFs would be graded and seeded to promote facility stabilization and to mitigate sediment generation and migration. Fiddle Creek would be reestablished in a surface channel routed over the reclaimed Fiddle DRSF (see Chapter 2, Alternatives). Riparian plantings of grasses and shrubs, particularly willows, would provide cover to the reconstructed channel to provide riparian habitat, keep water shaded and cool, and stabilize the landform. The DRSF grading and contouring would produce a final topography that would conform to and blend with the surrounding landscape, as well as to produce a permanent and stable landform.

The waste rock would be extracted by the same means as ore rock via blasting and is anticipated to consist of angular-shaped and competent (i.e., strong and resistant to breaking, high compressive strength) granitic rocks (e.g., granodiorite), quartzite, and marble. Based on the size and type of the materials placed in the DRSFs, and the slope of the DRSF, the design would appear to be effective and would likely result in long term geotechnical stability of the features.

---

[2] Return period (or recurrence interval) is the estimated average time between earthquake events.

[3] Maximum credible earthquake (MCE) is the largest earthquake that reasonably appears capable of occurring under the conditions of the presently known geological environment (IDAPA 36.03.06). The MCE represents the most severe ground shaking that could be expected at the site (return period from 2,500 years up to that of the MCE) for which structures must be designed to resist collapse and uncontrolled release.

4.2.2.1.2.3 Pit Slopes

A probabilistic geotechnical analysis was used to evaluate overall pit slope stability and compute Probability of Instability (POI) along specific cross-sectional transects within each of the pits (STRATA 2014b). The slope stability analyses rely on measured density and shear strength of the geologic units. POI was used to calculate appropriate bench widths. A bench is a ledge formed by excavating into the side of the pit, like a step, during mining. The slope stability information and POI is used to help determine the optimal bench width during mining – to be most efficient in rock extraction and yet maintain stability of the bench. Typically, in mining applications the acceptable POI value is in the range of 0.03 to 0.15, depending on potential impacts of slope movement. The higher the POI number, the less stable the bench or slope. Temporary slopes, such as the pit walls, often have recommended POI values near the upper end of this range, while long-term slopes have values near the lower end of the range. For a three-meter-wide bench, the POI for each pit area is as follows:

- Yellow Pine pit – POI 0.005 to 0.091
- West End pit – POI 0.001 to 0.007
- Hangar Flats pit – POI 0.001 to 0.012.

During the STRATA study (2014b) there was one area in the West End pit (on the north and west wall) with a computed POI for an assumed three-meter bench of 0.274 to 0.332 – higher than the acceptable POI range described above. Therefore, the bench width in this area would need to be designed wider than three meters.

The design of the pits includes the appropriate setback and benching in accordance with standard engineering principles and practices. Based on the design, and the strength of the underlying bedrock, failure of the pit walls during the scope of the SGP and beyond is considered to be unlikely.

4.2.2.1.3 Geotechnical Suitability of Mine Structure Location

4.2.2.1.3.1 TSF Dam and Hangar Flats DRSF

Regarding geotechnical suitability of the proposed locations of the TSF and Hangar Flat DRSF, elements of design and construction that were used in screening alternative locations include requirement for site conditions that must be amenable for: meeting design criteria and considerations for tailing storage; a TSF with low-permeability liner; tailings dewatering methodology and construction of TSF underdrain system; containment capacity; avoidance of side-hill locations and steep topography; avoidance of excessive embankment (i.e., dam) heights; avoidance of areas that would preclude using placement of DRSF as buttress material; and downstream embankment construction (Midas Gold 2016, Appendix G). Midas Gold (2016) describes the evaluation of alternative sites for the TSF. The Meadow Creek valley site is surrounded by mountain topography that would be above the dam crest at peak processing. There are identified rockfalls above the Meadow Creek valley site (STRATA 2014a) that could impact the integrity of the liner during initial construction, but these risks can be mitigated with engineering controls (e.g., berms, rock nets, rock-fall berms).

The underlying materials and slope stability have been characterized by numerous investigations as described in Chapter 3.2, Affected Environment, and have been determined to be suitable for the proposed structures based on geotechnical investigations. The TSF and DRSF area include a discontinuous 5-foot thick layer of peat which would be removed along with topsoil and other potentially compressible/weak silt and clay soils encountered) during construction. The underlying bedrock is more than sufficiently competent to support the proposed structures because the rock types consist of quartz monzonite, diorite, granite and rhyolite (Tierra Group 2018). These engineering properties of these rock types includes high compressive strength (the resistance of a material to breaking under compression).

4.2.2.1.3.2 Fiddle DRSF and West End DRSF

The load imposed from waste rock placed in the Fiddle and West End DRSFs would be much less than the Hangar Flats DRSF and the TSF structures. The Fiddle and West End DRSF structures are large, but have a low slope, and would be placed on competent underlying bedrock with the soil removed. As such, based on currently available design and site information, both locations are suitable for the structures proposed with adherence to standard construction protocols for the placement and construction of this type of facility.

4.2.2.1.3.3 Pit Slope Design

The location of the pits is determined by the location of the ore rock to be extracted and cannot be altered or moved. The locations appear to be suitable for the proposed mining methods, with appropriate engineering setbacks and bench design.

4.2.2.1.4 POTENTIAL FAILURE SCENARIOS

4.2.2.1.4.1 TSF Dam and Hangar Flats DRSF

Based on the slope stability analysis of the proposed design of the TSF dam (Tierra Group 2017), failure of the TSF dam from a seismic event is considered to have extremely low probability. Therefore, analysis of failure-related effects is not included in this NEPA analysis. Design and construction of the TSF dam would be required to comply with regulations at IDAPA Section 37.03.05, Mine Tailings Impoundment Structure Rules. The pseudo-static (i.e., earthquake load) Factor of Safety for the TSF dam with the downstream design and buttressing from DRSF, has been calculated for the design earthquake events: once in 475-year event for operations phase; and the MCE event for post-closure phase. At TSF complete build-out, the operations-phase pseudo-static Factor of Safety would be 3.17, more than three times the minimum earthquake load Factor of Safety 1.00, per IDAPA Section 37.03.0. The post-closure phase Factor of Safety would be 1.81. The MCE event used for post-closure stability analysis is a much longer return period, meaning there is a lower probability of occurrence than the 475-year return period earthquake, but results in higher peak ground acceleration (see Section 3.2, Affected Environment, for information on peak ground acceleration). Additionally, at complete build-out of the TSF, the static load Factor of Safety would be 4.09, which is well above the minimum required static Factor of Safety of 1.50 per regulations at IDAPA Section 37.03.05.

Mears and Wilber Engineering (2013) evaluated the avalanche hazard around the TSF and the Hangar Flats DRSF. The assessment identified areas of high, moderate, and low risk of avalanche activity. The assessment indicates that both the TSF and Hangar Flats DRSF have a risk of being impacted by avalanches. Associated impacts from avalanches would be expected to be contained within the TSF or DRSF and are not expected to cause additional impacts.

4.2.2.1.4.2 Fiddle DRSF and West End DRSF

Based on the slope and design of the DRSFs and nature of the angular and competent rock placed in the DRSF, failure appears unlikely. Because of the attributes of the angular competent rock, a failure of these DRSF structures would result in only small slides at the toe of the DRSF. Impacts would be limited to the area immediately downgradient of the DRSF, and would consist of localized impacts to soil and vegetation. There would be no expected impacts to surface water bodies. See Chapter 2, Alternatives, for more description about routing of Fiddle and West End creeks around these DRSF facilities.

4.2.2.1.4.3 Pit Slope Design

Overall it is unlikely that failure of the pit slope, before or after mining, would result in significant environmental impacts to the SGP. This conclusion is based on the rock types (granite, marble, etc.), but also the edges and benches of the existing Yellow Pine, Midnight, and West End pits, which are still well defined since historic mining ceased. However, such a failure could result in socioeconomic impacts to the area, shutting down the mine for some period of time. A pit slope failure could impact health and safety of mine workers. Slumps or collapse post-mining into the resulting pit lakes at Hangar Flats and West End pits could result in water overtopping the rim of the pit lake, sending water downstream. West End pit water levels, water management, and water quality are described Section 4.9, Surface Water and Groundwater Quality.

4.2.2.1.5 MINE SITE SUPPORT FACILITIES AND INFRASTRUCTURE

Mine site support facilities and infrastructure that would potentially impact geology or be affected by geologic or geotechnical hazards include at the mine administration office, maintenance yards, haul roads, ore processing plant, Scout underground exploration portal and decline (located south of the planned ore processing plant (see Chapter 2, **Figure 2.3-2**), and storage facilities. New infrastructure would be located in areas that best facilitate operations without inhibiting access to mineral deposits or negatively impacting habitat. To the extent possible, new infrastructure would be placed within or near historically used areas.

Impacts would be minor provided mine support facilities and infrastructure would be designed in accordance with applicable building codes and in accordance with recommendations of site-specific geotechnical design reports.

4.2.2.1.5.1 Bedrock and Surficial Geology and Topography

Within the context of a legacy mining area, there would be direct impacts to bedrock during construction of new support facilities and infrastructure (e.g., ore processing facilities and new DRSFs and TSF). There also would be direct impacts to landforms including hills, ridges, and valleys. The effects would be localized, as they would be limited to discrete portions of the mine site in the immediate vicinity of proposed new facilities. The geologic resources impacted by construction of mine site support facilities under Alternative 1 would consist of relatively common types of rocks and the ore of interest.

4.2.2.1.5.2 Seismic Hazards

Earthquakes are a common geologic phenomenon in central Idaho and development of certain structures (e.g., dams, bridges, pipelines) is governed by regulation. In the event of an earthquake near the analysis area, effects to mine site support facilities and associated infrastructure are expected to range from low intensity effects (e.g., ground shaking) that may or may not be noticeable, to moderate intensity (e.g., design is adequate to withstand earthquakes), with a low probability of high-intensity effects at certain structures. Effects would range from temporary (e.g., minor damage that is easily reparable) to permanent (e.g., lateral displacement at fault crossings). The geographic extent of effects would be mostly localized, within the immediate vicinity of the various facility footprints. Impacts would be reduced to moderate intensity effects through incorporation of existing geotechnical design standards and building code standards, as well as construction quality control, operations and maintenance, and surveillance.

4.2.2.1.5.3 Mass Wasting Hazards

Although several mass wasting features have been identified in the vicinity of proposed mine support facilities and infrastructure (**Figure 3.2-5**), the proposed facilities' sites are not within the area to the south of the confluence of EFSFSR and Meadow Creek, which is reported to include soils conditions that are unsuitable as a foundation material (STRATA 2014a).

There is an ancient (glacial-age) landslide upslope of the proposed worker housing facility, about 1.3 miles upstream from the EFSFSR confluence with Meadow Creek (see Chapter 3.2, under "Southeast Area") (**Figure 3.2-5**). These glacial-age landslides are associated with groundwater seeps on steep slopes and may experience creep during wet periods (STRATA 2014a). Construction of the worker housing facility is not expected to exacerbate existing landslide hazards, provided the toe of the existing landslide is not disturbed during construction.

The geographic extent of effects would be mostly localized, within the immediate vicinity of the existing rockfall and landslide features. Effects would mostly be temporary (e.g., minor damage that is easily reparable), although there is a low probability of high-intensity effects from a major rockfall or landslide event, that would be reduced to moderate through incorporation of existing geotechnical design standards and recommendations of the geologic hazard assessment for additional geotechnical investigation at any proposed processing, crusher, or other infrastructure sites (STRATA 2014a).

Avalanche hazard areas also are present in proximity to the proposed mine support facilities and infrastructure (**Figure 3.2-5**). These existing avalanche hazards would not be exacerbated by the construction or operation of proposed facilities at the mine site, as such activities would not alter the three key factors of avalanche formation (weather, snowpack, and terrain). The increased number of personnel present at mine facilities, and increased value of facilities and structures at the mine as a result of Alternative 1 would increase the risk of damage, injury, and loss of life from the existing hazards.

4.2.2.1.6 Access Roads

Materials required for the proposed road upgrades/realignment would be obtained from local borrow sites that are being considered, as described above. In addition, spent heap leach ore from historical mining operations may be reused for road construction purposes.

Detailed geotechnical data has not been generated for the access roads. However, it is expected that geotechnical issues arising from these components would generally be minor compared to those described for the mine site and construction of access road would be required to follow standard engineering practices to address and prevent geotechnical failures.

4.2.2.1.6.1 Bedrock and Surficial Geology and Topography

Widening of access roads is anticipated during construction and would increase the size of existing cut-slopes, exposing bedrock upslope of road corridors. Exposed bedrock would become more susceptible to mechanical weathering such as ice heave and wedging, which could dislodge large blocks of bedrock into road corridors. Application of appropriate engineering design features would be incorporated into all road construction and foundation planning for the SGP, which could minimize the effects of frost heave and wedging. Although impacts to bedrock for the purposes of construction would be permanent and high in intensity, impacts would be much smaller in scale compared to other components of the SGP, such as mining operations. Impacts would be localized to areas where new and upgraded roads are needed.

Surficial geology and landforms would be directly impacted during construction activities, which would require construction and grading. Impacts would be localized to areas where new and upgraded roads are needed.

4.2.2.1.6.2 Seismic Hazards

Low to moderate intensity earthquakes are likely to occur during the SGP with a lower probability of a large event. Facilities would be designed to withstand moderate intensity seismic events. Therefore, impacts from seismic events are expected to be low. In the unlikely event that a large earthquake occurs in the vicinity of the Burntlog Route, moderate to high impacts should be anticipated. Effects would range from temporary (e.g., minor damage that is easily reparable) to permanent (e.g., lateral displacement of roads at a fault crossing and rockfall)

4.2.2.1.6.3 Mass Wasting Hazards

Slope stability effects would be low in intensity in low to moderate relief areas. The majority of the Burntlog Route alignment would not be impacted by significant mass wasting hazards; however, there is potential for slumping or rockfall in several sections which could impact road construction (STRATA 2016). **Figure 3.2-6** shows an overview of geohazards for the Burntlog and Yellow Pine Routes. Figures showing landslide hazards along the Burntlog Route are included as **Appendix E-1**. **Appendix E-2** is a desktop study of geohazards along both the Burntlog and Yellow Pine access routes. Application of appropriate siting, engineering design, construction, and maintenance protocols would be incorporated into all roads for the SGP, which could prevent or minimize potential for mass wasting thereby minimizing impacts.

A road segment in proximity to an avalanche runout zone and presence of workers or construction of facilities could increase the magnitude of impact from avalanche through damage to equipment, damage to structure, or personal injury or loss of life.

Existing avalanche hazards on the Yellow Pine Route would continue to exist and could impact travel during the construction period. Along the Burntlog Route, the potential impacts resulting from existing avalanche hazards would increase due to increased vehicular traffic during mine operations and reclamation/closure activities.

The Burntlog Route is generally viewed as having less susceptibility to avalanche hazards than the Yellow Pine Route (see Section 3.2, Affected Environment), as the proposed Burntlog Route generally runs higher up on the ridgelines; therefore, not crossing through potential avalanche paths (Midas Gold 2019).

4.2.2.1.7 UTILITIES

4.2.2.1.7.1 Bedrock and Surficial Geology and Topography

A new transmission line from the new Johnson Creek substation to the mine site, partially within a previously used transmission line right-of-way, would be constructed to supply electric service to the mine site. The right-of-way for the new transmission line would be approximately 100 feet wide. Upgrades to existing transmission lines also would be performed (within an expanded right-of-way (from 50 to 100 feet) as well as upgrades and new construction to electric infrastructure (e.g., substations, switching station, etc.). Additionally, there would be upgrades to existing communication towers as well as new communication sites. Impacts to bedrock for the purposes of utilities would be localized and permanent. Impacts would be limited to areas where new utility infrastructure, or upgrades to existing equipment is needed.

Surficial deposits would be affected in localized areas the expanded utility easements for pole replacement, trenching, or footings as needed. Surficial deposits would be affected in localized areas within these new communication sites.

Similarly, surficial geology and landforms would be directly impacted during utility upgrades. Impacts would be localized to areas where new utility infrastructure (or upgrades) is needed.

4.2.2.1.7.2 Seismic Hazards

As noted above, low to moderate intensity earthquakes are likely to occur during the SGP lifecycle with a lower probability of a larger event. Employment of current geotechnical and structural design standards during utility upgrades would allow facilities to withstand moderate intensity seismic events. Therefore, impacts from anticipated seismic events are expected to be low. However, in the unlikely event that a large earthquake occurs in the vicinity of the mine site, moderate to high impacts should be anticipated. Effects would range from temporary (e.g., minor damage that is easily reparable) to permanent (e.g., lateral displacement of utilities at a fault crossing).

4.2.2.1.7.3 Mass Wasting Hazards and Geotechnical Stability

Detailed geotechnical data or assessment of existing mass wasting hazards has not been generated for utility components. However, it is expected that geotechnical issues arising from these components would generally be minor compared to the mine site and their construction would follow standard engineering practices that address and prevent geotechnical failures.

Slope stability effects would mostly range from low in intensity (e.g., minor slumps or rockfall in low to moderate relief areas) to moderate intensity (e.g., design of tower adequate to meet static stability criteria).

4.2.2.1.8 Off-Site Facilities

Off-site facilities associated with Alternative 1 include the Stibnite Gold Logistics Facility on Warm Lake Road (County Road [CR] 10-579) and the Landmark Maintenance Facility near the intersection of Warm Lake Road and Johnson Creek Road (CR 10-413).

The Stibnite Gold Logistics Facility and Landmark Maintenance Facility would be sited in discrete, localized areas and, similar to the mine support facilities and infrastructure buildings, would incorporate existing geotechnical design standards.

4.2.2.1.8.1 Bedrock and Surficial Geology and Topography

Impacts to bedrock for the purposes of off-site facilities would be localized and permanent and would be limited to areas where facilities are needed.

Surficial geology and landforms would be directly impacted during facility construction. Impacts would be localized and long-term to permanent. The Stibnite Gold Logistics Facility has a post-mining land use designation of light industry, where it would remain un-reclaimed after mining operations and transferred to a third-party for light industrial uses, whereas the Landmark Maintenance Facility would be reclaimed as part of closure and reclamation.

4.2.2.1.8.2 Seismic Hazards

Low to moderate intensity earthquakes are likely to occur during the SGP lifecycle with a lower probability of a larger event. Facilities are anticipated to be designed to withstand moderate intensity seismic events. Therefore, impacts from anticipated seismic events are anticipated to be low. However, in the unlikely event that a large earthquake occurs in the vicinity of an off-site facility, moderate to high impacts should be anticipated. Effects would be temporary (e.g., minor to moderate damage that is easily reparable).

4.2.2.1.8.3 Mass Wasting Hazards and Geotechnical Stability

Detailed geotechnical data or assessment of existing mass wasting hazards has not been generated for off-site facility components of the SGP. However, it is expected that geotechnical issues arising from these components would generally be minor compared to the mine site and their construction would follow standard engineering practices that address and prevent geotechnical failures. Slope stability effects would mostly range from low in intensity (e.g., minor sloughing in low to moderate relief areas) to moderate intensity (e.g., design of buildings to meet static stability criteria).

4.2.2.2 Alternative 2

Impacts associated with geologic resources and geotechnical hazards under Alternative 2 would be the same as for Alternative 1, except as described below.

4.2.2.2.1 Mine Site

Bedrock Geology and Amount of Ore Extracted – same as for Alternative 1.

Surficial Geology and Topography – same as for Alternative 1, except that the West End DRSF would not be developed; therefore, surficial geology in that area would not be impacted.

Seismic and Mass Wasting Hazards – same as for Alternative 1.

Geotechnical Stability – same as for Alternative 1, except that the West End development rock would be backfilled directly into the Midnight pit (within the West End pit) and partially backfilled the Hangar Flats pit. The backfilled development rock would not be compacted, except as it nears the final reclaimed surface of the backfilled area, although some compaction would naturally occur during placement, truck and dozer traffic over the top of the dumped rock, burial, and consolidation.

4.2.2.2.2 Mine Support Facilities and Infrastructure

Bedrock and Surficial Geology and Topography – same as for Alternative 1.

Seismic and Mass Wasting Hazards – same as for Alternative 1, except that the construction of additional facilities such as the limestone crushing plant and lime generation equipment in the ore processing plant area would further increase the risk of damage to such facility during avalanche or other mass wasting hazards.

Geotechnical Stability – same as for Alternative 1.

4.2.2.2.3 ACCESS ROADS

Bedrock and Surficial Geology and Topography – Same as for Alternative 1, except the Riordan Creek segment of the Burntlog Route would reduce disturbance and also would reduce the area of surficial geology disturbed by construction of such facilities.

Seismic and Mass Wasting Hazards and Geotechnical Stability – Same as for Alternative 1, except that:

- On-site lime generation would decrease haul truck trips and therefore decrease risks from existing avalanche or landslide hazards along the access roads. On the other hand, inclusion of a public access road through the mine site (Option 1 or Option 2) would increase vehicular traffic in the area and therefore subject additional drivers to avalanche risk within the mine site.

4.2.2.2.4 UTILITIES

Bedrock and Surficial Geology and Topography – The upgraded utility corridor would be realigned in two locations under Alternative 2 but overall the impacts would be the same as for Alternative 1.

Seismic and Mass Wasting Hazards and Geotechnical Stability – Same as for Alternative 1.

4.2.2.2.5 OFF-SITE FACILITIES

Bedrock and Surficial Geology and Topography – Same as for Alternative 1, except that impacts associated with the off-site maintenance facility would occur in a different location to Alternative 1.

Seismic and Mass Wasting Hazards and Geotechnical Stability – Same as for Alternative 1.

4.2.2.3 Alternative 3

4.2.2.3.1 MINE SITE

Bedrock Geology and Amount of Ore Extracted – same as for Alternative 1, except there would be no reprocessing of legacy tailings in the Meadow Creek drainage.

Surficial Geology and Topography – same as for Alternative 1, except that impacts associated with the TSF would occur within the EFSFSR valley, rather than Meadow Creek. There is currently no specific geotechnical data available for the TSF under Alternative 3. This area is undisturbed by previous mining activities as compared to the TSF location for Alternative 1. The geologic hazards assessment identified landslide areas within and above the EFSFSR TSF location under Alternative 3 (STRATA 2014a, Detail D, feature LS-12). After closure, the area of the EFSFSR valley impacted by the TSF would be contoured and graded to blend into surrounding locations.

Seismic and Mass Wasting Hazards – same as for Alternative 1, except that the TSF and DSRF would overlap a large existing landslide on the south bank of the EFSFSR. As discussed below under geotechnical stability, detailed geotechnical analysis, including an assessment of the geotechnical suitability of the selected location to support the TSF and DSRF has not been undertaken.

Geotechnical Stability – same as for Alternative 1, except that TSF and DRSF would be in the EFSFSR valley rather than at Hangar Flats in Meadow Creek valley. Like Alternative 1, the DRSF would buttress the downstream slope of the TSF. The DRSF buttress for the TSF would be constructed in the same manner as described for Alternative 1 and would have constructed cut slopes of 2.5H:1V until regraded for reclamation.

Detailed geotechnical data, including Factors of Safety or assessment of the geotechnical suitability of the selected locations to support the EFSFSR TSF or DRSF, have not been generated. However, given that the design of the structures is proposed in a similar manner to Alternative 1, it is assumed that Factors of Safety also would be similar, and would therefore be more than adequate to maintain geotechnical stability under normal, and even earthquake, conditions, provided they are constructed to, and monitored, in accordance with standard engineering practices.

4.2.2.3.2 Mine Support Facilities and Infrastructure

Bedrock and Surficial Geology – same as for Alternative 1, except that areas of surficial geology disturbed from construction of the worker housing facility would be relocated to the Blowout Creek drainage.

Seismic and Mass Wasting Hazards – same as for Alternative 1, except that the worker housing facility would not be located adjacent to an existing landslide deposit.

Geotechnical Stability – same as for Alternative 1.

4.2.2.3.3 Access Roads

Bedrock and Surficial Geology – Similar to Alternative 1, except the Burntlog Route in the vicinity of the EFSFSR TSF would be rerouted further west, on a new road segment around the TSF, entering the mine site on a new road adjacent to Blowout Creek during operations.

Seismic and Mass Wasting Hazards and Geotechnical Stability – Same as for Alternative 1, except the rerouted segment of Burntlog Route closest to the mine site would avoid potential impacts related to a large landslide south of the EFSFSR and several smaller geohazard areas that occur along the Alternative 1 access road route.

4.2.2.3.4 Utilities

Bedrock and Surficial Geology – Same as for Alternative 1, except that approximately 2.5 miles of the new transmission line from the Johnson Creek substation to the mine site would be realigned.

Seismic and Mass Wasting Hazards and Geotechnical Stability – Same as for Alternative 1.

4.2.2.3.5 Off-Site Facilities

Bedrock and Surficial Geology – Same as for Alternative 1.

Seismic and Mass Wasting Hazards and Geotechnical Stability – Same as for Alternative 1.

4.2.2.4 Alternative 4

4.2.2.4.1 Mine Site

Amount and Value of Ore Extracted – same as for Alternative 1.

Bedrock and Surficial Geology – same as for Alternative 1.

Seismic and Mass Wasting Hazards – same as for Alternative 1.

Geotechnical Stability – same as for Alternative 1.

4.2.2.4.2 Mine Support Facilities and Infrastructure

Bedrock and Surficial Geology – same as for Alternative 1.

Seismic and Mass Wasting Hazards – same as for Alternative 1.

Geotechnical Stability – same as for Alternative 1.

4.2.2.4.3 Access Roads

Bedrock and Surficial Geology – Impacts associated with construction of the Burntlog Route would not occur under Alternative 4; however, impacts from the proposed upgrade of the Yellow Pine Route (road widening and curve straightening along the Stibnite Road portion of McCall – Stibnite Road (CR 50-412) and construction of public access road through the mine site would require blasting, road cuts and retaining walls. Potential impacts along Stibnite Road (CR 50-412) and public access roads would be similar to those described for Alternative 1, in that newly exposed bedrock would become more susceptible to ice heave and wedging, which could dislodge large blocks of bedrock into road corridors. Application of appropriate engineering design features would be incorporated into all road construction and foundation planning for the SGP, which would minimize the effects of heave. Impacts associated with Stibnite Road upgrades would be permanent.

Seismic and Mass Wasting Hazards and Geotechnical Stability – Impacts associated with construction of the Burntlog Route would not occur under Alternative 4; however, the risk of damage, injury, or loss of life from mass wasting events along the Yellow Pine Route would be increased due to its location, particularly Stibnite Road (CR 50-412), because the route is within the runout zone for avalanches. Twelve avalanche paths were identified along Stibnite Road. Additionally, future avalanches along the Yellow Pine Route could result in road closures similar to those that occurred in March 2014 and April 2019. There are more areas of landslides and rockfalls along the Yellow Pine Route than there are along the Burntlog Route (45 landslide/ rockfall areas on Yellow Pine Route compared to 26 along Burntlog Route). See **Appendix E-2** for more information about geohazards along both the Burntlog and Yellow Pine routes. Construction of the road would require geotechnical design considerations related to widening of the existing road from the current width to up to 21 feet along with required rock blasting for bedrock cut slopes to achieve this width. It is noted that under Alternative 4, no secondary access for mine or public traffic would be provided.

4.2.2.4.4 UTILITIES

Bedrock and Surficial Geology – Same as for Alternative 1, except that the proposed helicopter access for construction and maintenance of very high frequency radio repeater and cell tower sites within inventoried roadless areas would reduce the area of surficial geology disturbed by construction of access to such facilities.

Seismic and Mass Wasting Hazards and Geotechnical Stability – Same as for Alternative 1.

4.2.2.4.5 OFF-SITE FACILITIES

Bedrock and Surficial Geology – Same as for Alternative 1, except that impacts associated with the Landmark Maintenance Facility would occur in a different location to Alternative 1.

Seismic and Mass Wasting Hazards and Geotechnical Stability – Same as for Alternative 1.

4.2.2.5 Alternative 5

Under Alternative 5, no action alternative would be approved and there would be no open-pit mining or ore processing at the mine site, or other supporting infrastructure corridors and facilities. Because there would be no new construction or new mining operations, Alternative 5 would not have any new direct or indirect effects on geology and geotechnical hazards.

Alternative 5 would not restore legacy mining impacts, such as the reclamation of physiography associated with underground mine workings, multiple open pits, development rock dumps, tailings deposits, heap leach pads, and spent heap leach ore piles in addition to legacy infrastructure.

Under Alternative 5, legacy geotechnical impacts would remain as they are today. These legacy conditions have been compounded by extensive forest fires over the past several decades, which have caused severe damage from soil erosion, landslides, and debris flows, and resultant sediment transport into local waterways.

Previous structures at the mine site were constructed with little, if any, geotechnical planning and oversight, and numerous failures already have occurred because of poor planning and design. For example, the erosion of the East Fork of Meadow Creek (Blowout Creek) is from the failure of a dam at that location. This has resulted in ongoing upstream erosion of the valley and deposition of the resulting sediments downstream. Previous pits (i.e., Yellow Pine pit, West End pit) were not necessarily designed to be stable during long- term exposure to the elements.

Various development rock piles and tailings piles are not necessarily properly graded or abandoned and may not be geotechnically stable; resulting in possible failure in the future. The design, construction, and reclamation of the subject waste rock dumps complied with federal and state standards at the time (1980s and 1990s) and these standards have not substantively changed since 1998. The waste rock piles were faced with coarse resistant rock and are not exhibiting signs of mass wasting.

4.2.3 Mitigation Measures

Mitigation measures required by the U.S. Forest Service (Forest Service) and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.2.4 Cumulative Effects

The cumulative effects analysis area for geologic resources and geotechnical hazards that could be directly or indirectly affected by the SGP is the same as defined in Section 3.2 for the direct and indirect impact analysis, which is the entire footprint of disturbance of all SGP components.

Cumulative effects associated with the SGP consider the range of existing and foreseeable activities and their potential effects with respect to geologic resources and geotechnical hazards. Past and present actions that have, or are currently, affecting geologic resources and geotechnical hazards include mineral exploration and mining activities, infrastructure and road development and previous road construction or upgrades within the cumulative effects analysis area.

4.2.4.1 Common to All Action Alternatives

4.2.4.1.1 Depletion of Mineral Resources

Alternative 1 through Alternative 4 would have a permanent impact on ore reserves in the cumulative effects analysis area, which would combine with the impacts of past mining activities such as from Valley County Quarry Development, Fourth of July Mine, Camp Bird Mine, etc., that also have depleted ore reserves in this part of Idaho, as well as combine with any future mining operations in the region which would further deplete ore reserves. The contribution of the action alternatives to this cumulative impact would deplete an additional approximately 100 million tons of ore, the volume of ore proposed to be extracted under Alternatives 1 through 4.

4.2.4.1.2 Seismic and Mass Wasting Hazards

Alternative 1 through Alternative 4 would increase risks from seismic and mass wasting hazards by introducing additional personnel and equipment into existing hazard areas. Geohazards and seismic conditions are site-specific, as individual project sites would be geologically removed from one another. A few of the reasonably foreseeable future actions (RFFAs) (e.g., mineral exploration and mining associated with Golden Hand No. 3, 4, and 8, Big Creek Fuels Reduction Project, Morgan Ridge Exploration Project, and Dewey Mine Sediment Stabilization Project) have the potential to add some additional traffic on Stibnite Road (CR 50-412) to access their respective project sites. Although Stibnite Road has an existing avalanche hazard (i.e., is located at the bottom of an avalanche runout zone) that could impact travel along the road, use of this road by the SGP and by RFFAs would not exacerbate the existing hazard, but it would add additional personnel on this road, which would increase the risk of damage, injury, or loss of life from the hazard.

4.2.4.1.3 Geotechnical Hazards

Some of the past mining activities at the mine site were conducted with little, if any, geotechnical planning and oversite. Various development rock piles and tailings piles may not be properly graded or abandoned and may not be geotechnically stable. Alternatives 1 through 4 would substantially reduce geotechnical risks associated with legacy mining operations through proposed reclamation activities. Comprehensive, designed and engineered solutions would be required to restore legacy mining features (Midas Gold 2016). New geotechnical risks would be associated with the proposed TSF and DRSF structures, but these risks would be prevented or minimized through incorporation of standard geotechnical design standards, as well as construction quality control, operations and maintenance, and surveillance.

Geohazards and seismic conditions are site-specific, as individual project sites would be geologically removed from one another. As such, the RFFAs would not increase risks associated with geotechnical hazards.

4.2.4.2 Alternative 5

Under Alternative 5, no action alternative would be approved and there would be no open-pit mining or ore processing at the mine site, or other supporting infrastructure corridors and facilities. The effects of past mining activities and their current geological/geotechnical conditions (e.g., alteration of topography/ridgelines, the presence of the Yellow Pine pit and current condition of the adjacent highwall slopes, reclaimed areas, etc.) would remain. Although none of the RFFAs identified in **Table 4.1-2** would physically overlap with action alternative disturbance footprints, forest management, motorized use of road systems, fire suppression, prescribed fire and wildfire, dispersed camping, fishing, and hunting activities would continue in the cumulative effects area and vicinity, which would be subject to existing geotechnical hazards, including seismic and mass wasting hazards. Under Alternative 5, Midas Gold would continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and Environmental Assessment (Forest Service 2015), which include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices; however, as described in the Golden Meadows Environmental Assessment, the exploration and subsequent reclamation activities would have an insignificant direct effect to geology/soils and therefore an insignificant cumulative contribution.

4.2.5 Irreversible and Irretrievable Commitments of Public Resources

4.2.5.1 Common to All Action Alternatives

Implementation of Alternative 1 would result in the commitment of natural and man-made resources for new infrastructure, mine operations, remediation and habitat restoration, and post-mining reclamation. The predominant commitment of resources would be from the mining, which would deplete the valuable mineral assets in the targeted ore bodies. Gold, silver, and antimony are non-renewable resource that would be removed and then used, constituting an irreversible commitment.

Substantial labor and materials needs are anticipated throughout the life of the SGP. Utility upgrades and new infrastructure are required to facilitate mine operations and reclamation of historically damaged areas. Legacy mined waste rock would be incorporated into new construction to the extent feasible. Contaminated areas would be remediated during new construction as required.

Implementation of the SGP would remove the land from other uses while it is in operation, but the use would be converted back to habitat for native species and recreational uses through reclamation. The temporal loss of the land for some uses would be irretrievable. However, due to the current geotechnical condition of the land, some uses are not currently possible. Geotechnical stability would reclaim the possibility for some of these uses in the future.

From a geotechnical standpoint, SGP would add a small, incremental level of risk for long-term TSF, DRSF, or pit wall failure. Although this risk of failure likely would be very low, it would be unlikely to ever be eliminated completely.

4.2.6 Short-term Uses versus Long-term Productivity

4.2.6.1 Common to All Action Alternatives

Development of the SGP would result in short-term and long-term impacts to geology in the area. Surficial deposits and topography would undergo changes throughout the life cycle of the mine. Bedrock would primarily be impacted by depletion of the targeted ore bodies in the three pits. Short-term uses of the mineral resources would represent a beneficial use of these resources.

Consolidation and reprocessing of existing mined material at the mine site would result in improvements to geotechnical stability of site features. Post-mining reclamation is anticipated to provide an overall long-term geotechnical improvement at the mine site, facilitating the long-term productivity of the mine site.

4.2.7 Summary

Implementation of the SGP under all action alternatives would result in impacts to geologic resources. Under all action alternatives the same amount of minerals would be extracted, and these resources would be permanently depleted. Past-mining impacts have resulted in long-term impacts to the natural topography and the SGP activities could result in removal and/or stabilization of these past-mining impacts. Under all action alternatives the natural topography would be permanently altered through mining and placement of development rock and tailings. Highwalls would remain within all of the mine pits.

Past mining activities in the area were conducted with little, if any, geotechnical planning and oversite. Various development rock piles and tailings piles are not necessarily properly graded or abandoned and may not be geotechnically stable. Proposed features under all alternatives, including the TSF and DRSFs, would be designed for short- and long-term conditions under both static and earthquake conditions. Under Alternative 3 the area of the EFSFSR TSF and associated DRSF has not had detailed geotechnical analysis. The TSF location also would be placed in part on a large ancient landslide (STRATA 2014a, Detail D; see Chapter 3.2 for description of glacial-age landslides). Additional geotechnical studies would be needed to inform a TSF/DRSF design in this location.

Under all alternatives the Yellow Pine Route would be used for mine deliveries. Under Alternative 1, 2, and 3, the Yellow Pine Route would be used short-term for 1 to 2 years while the Burntlog Route is being constructed. Under Alternative 4, the Yellow Pine Route would be used from construction through operations and closure and the Burntlog Route would not be constructed. The Yellow Pine Route has more geotechnical hazards associated with landslides, and rockfalls (45 total) compared to the Burntlog Route (26 total) There are two avalanche paths mapped for the Burntlog Route versus 12 mapped avalanche paths for the Yellow Pine Route (**Appendix E-2**).

Table 4.2-2 provides a summary comparison of impacts associated with geologic resources and geotechnical hazards by issues and indicators for each alternative.

Table 4.2-2 Comparison of Geological Resources and Geotechnical Hazards Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The minerals present at the site are economically valuable, and they contribute to the national goal of being economically independent in strategic metals such as antimony.	Amount and value of ore extracted	Past mining projects are estimated to have extracted approximately 15 million tons of ore from the Hangar Flats, Yellow Pine, and West End areas	A total of 426 million tons of ore and development rock would be mined from the three open pits.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as baseline conditions.
	Depletion of mineral resources	Past mining projects have resulted in depletion of mineral resources.	Mineral resources would be permanently depleted within the pit areas.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as baseline conditions.
Mining of minerals present at the site could result in changes to the existing topography and the addition of physical hazards.	Alteration of natural topography	Past mining projects have resulted in long-term impacts to natural topography. Approximately 1,967 acres of existing disturbance lie within the SGP area.	A total of approximately 3,532 acres of land would be disturbed by proposed mining and related activities.	A total of approximately 3,423 acres of land would be disturbed by proposed mining and related activities. Same as Alternative 1.	A total of approximately 3,610, acres of land would be disturbed by proposed mining and related activities.	A total of approximately 3,218 acres of land would be disturbed by proposed mining and related activities.	Same as baseline conditions.
	Unreclaimed steep slopes	Past mining activities in the area were conducted with little, if any, reclamation. Various mine pit highwalls, development rock piles and tailings piles are not necessarily properly graded or abandoned and may over-steepened slopes.	Most SGP facilities would be reclaimed to blend with the surround topography. Some pit highwalls would remain in each of the mine pit areas.	Most SGP facilities would be reclaimed to blend with the surround topography. Some pit highwalls would remain in each of the mine pit areas.	Most SGP facilities would be reclaimed to blend with the surround topography. Some pit highwalls would remain in each of the mine pit areas.	Most SGP facilities would be reclaimed to blend with the surround topography. Some pit highwalls would remain in each of the mine pit areas.	No changes to existing conditions.
Geological and geotechnical stability of the SGP facilities, including the TSF and other mine components.	Geological/Geotechnical suitability of the selected locations for the structures to be constructed.	Past mining activities in the area were conducted with little, if any, geotechnical planning and oversite. Various development rock piles and tailings piles are not necessarily properly graded or abandoned and may not be geotechnically stable; resulting in risk of possible failure in the future.	Underlying materials have been tested and are suitable for proposed key facility locations.	Same as Alternative 1	Same as Alternative 1 for most facilities. The area of the EFSFSR TSF and associated DRSF has not had detailed geotechnical analysis. The TSF location also would be placed in part on a large existing landslide.	Same as Alternative 1	No changes to existing conditions.
	Long-term geologic/geotechnical stability of the proposed structures	Past mining activities in the area were conducted with little, if any, geotechnical planning and oversite. Various development rock piles and tailings piles are not necessarily properly graded or abandoned and may not be geotechnically stable; resulting in risk of possible failure in the future.	New structures have been designed with geotechnical stability for long-term stability.	Same as Alternative 1.	Same as Alternative 1 for most facilities. The area of the EFSFSR TSF and associated DRSF has not had detailed geotechnical analysis. The TSF location also would be placed in part on a large existing landslide.	Same as Alternative 1.	No changes to existing conditions.

This page intentionally left blank

4.3 AIR QUALITY

4.3.1 Effects Analysis Indicators and Methodology of Analysis

The indicators for the air quality resource reflect four components of air quality impact: magnitude or intensity, duration, geographic extent, and context. The issue and indicators analyzed for air quality are as follows:

Issue: The Stibnite Gold Project (SGP) may affect air quality characteristics and resources that are affected by air pollutants.

Indicators:

- Geographical extent of pollutant concentrations and deposition.
- Type and volume of air pollutants emitted, including haze precursors, airborne dust, and hazardous air pollutants (HAP).
- Criteria air pollutant ambient air concentrations outside the Operations Area Boundary anywhere the public is allowed unrestricted access.
- Comparison of predicted ambient concentrations to Class I and Class II increments and Significant Impact Levels.
- HAPs (including mercury [Hg]) emissions and Hg deposition.
- Deposition of nitrogen and sulfur compounds in Class I and specified Class II areas.
- Near-field plume blight and far-field regional haze in protected areas.

Environmental consequences related to air quality are evaluated by comparing to objective, usually numerical, standards. In this case, the assessment of potential air quality impacts relies on a quantification of the emissions from the construction and operations phase of the action alternatives. It is typical practice for analysis of air quality effects to evaluate the period during which emissions are predicted to be highest. If the resulting indicators for that period are below the appropriate standards, then impacts for other periods can be reasonably concluded to be of lower magnitude and extent. Estimated construction, mining, and processing emissions for Alternatives 1 and 2 are presented in **Appendices F-1** and **F-2**, reproduced from the report entitled Air Quality Analysis, prepared for Midas Gold Idaho, Inc. (Midas Gold) (Air Sciences 2018b) and from an updated modeling analysis submitted to support the air quality permitting process (Air Sciences 2020). Impact analysis for Alternatives 1 and 2 are presented in Sections 4.3.2.1 and 4.3.2.2 respectively; with the relative effects of Alternatives 3 and 4 on air emissions discussed in Sections 4.3.2.3 and 4.3.2.4, respectively.

The assessment of potential effect regarding the air quality issue and indicators is analyzed for each action alternative in its entirety (i.e., the combined emissions of all mine site transmission line construction/operation, and access road activities). The methodology for analysis of air quality-related effects is detailed in the following 4.3.1 sections. The subsequent sections (4.3.2) present the results of the quantitative assessment of the impacts of emissions from the action alternatives, including fugitive emissions from surface mining activities, roadway dust, and tailpipe exhaust. For the air quality impacts analysis, the basis for emissions of pollutants, including criteria and HAPs, sulfuric acid mist, Hg, and hydrogen cyanide, was the year of mine operations with the highest level of overall emissions.

4.3.1.1 Air Quality Analysis Area

An air quality analysis usually relies on defined geographic regions that represent the areas for which different types of modeling would be conducted. First, a "near field" was examined using appropriate models to quantify the effects of action alternative sources. The near-field modeling domain for the ambient air quality analysis, which extends 10 kilometers (km)[1] from the mine site, is depicted in **Figure 3.3-2**. Other aspects of the near-field modeling used a domain of 50 km from the mine site. Federal modeling rules (40 Code of Federal Regulations [CFR] 51, Appendix W) stipulate that near-field models may be applied for distances of 50 km or less from the emission sources. For the SGP, preliminary modeling confirmed that the 10-km domain size was adequate to characterize worst-case near-field air quality impacts. Air quality effects would decrease at distances beyond the modeled 10 km range.

The refined model uses a "grid" of defined receptor points at which air pollutant concentrations are predicted by the model calculations. Receptor tiers were used starting at 25 meters (m)[2] along the operations boundary and transitioning to 1 km spacing out to the 10-km extent of the modeled domain to follow accepted regulatory modeling practice. Tighter spaced receptors were used closer to the Operations Area Boundary to allow the model to map in more detail the predicted close-in concentrations that are generally the highest.

Second, a much larger "far-field" region was defined within an area up to 300 km-radius from the mine site that encompassed more-distant Class I areas, wilderness areas, and Tribal lands that were considered in the analysis. For the locale of the mine site, this region is shown in **Figure 3.3-1**, with the Class I areas identified. As described in the following sections, specialized air quality modeling in the far-field region examined SGP source contributions to regional haze, nitrogen deposition, and sulfur deposition.

As described in Section 3.3.1, Scope of Analysis, a key concept in air quality analysis is the definition of "ambient air" as a defined area in which air pollutant effects to ambient air are to be compared to the national and state ambient air quality standards, because that area is accessible to the general public (U.S. Environmental Protection Agency [EPA] 2019a). For purposes of the SGP, the inner boundary of the area defined as ambient air for modeling

[1] Metric units, including kilometers (km), are used predominantly in this section because of permit and measuring requirements. 1 km = 0.6mi; 1 mi =1.6 km

[2] 1 meter (m) = 3.3 feet; 1 foot = 0.3 meter.

analyses is the Operations Area Boundary. This area is illustrated in **Figure 3.3-2** and is understood to be the limit of the area that is closed to unrestricted public access. In this area, public access would be prohibited, or restricted through such measures that are accepted as means to control public access (EPA 2019a) as Midas Gold security checkpoints, physical barriers at points of potential access road and trail entry, and security surveillance patrols.

For the far-field air quality impact analysis, a suitable far-field modeling domain was defined as an area 420 km by 420 km in extent, centered on the mine site, as shown in **Figure 3.3-3**. This area encompasses the closest Class I areas and Class II wilderness areas that are most likely to have impacts. The four Class I areas for which far-field modeling results were reported are Sawtooth Wilderness (SAWT), Selway-Bitterroot Wilderness (SELW), Hells Canyon Wilderness (HECA), and Craters of the Moon National Monument (CRMO).

There are additional Class I areas within a 300-km radius; however, these are further from the mine site, and in the same general cardinal directions as the four closer Class I areas. A tiered approach was adopted to analyze the closer Class I areas that would have greater potential for air quality or visibility impacts. If the impacts predicted at the four closer Class I areas indicated potential for impacts at greater distances, then additional analyses would have been conducted for the more-distant Class I areas.

Four Class II wilderness areas, also shown in **Figure 3.3-3**, were selected by the U.S. Forest Service (Forest Service) for far-field evaluation: Frank Church-River of No Return Wilderness (FCRNRW), Gospel-Hump (GOSPEL), Hemingway-Boulders (HEMBLD), and Cecil D. Andrus - White Clouds (WHTCLD). Also, at the request of the Nez Perce Tribe, a fifth far-field region was included: the Nez Perce Requested Analysis Area.

The FCRNRW area is a large wilderness adjacent to the SGP Operations Area Boundary and extends more than 50 km from that boundary. For purposes of far-field analysis, only the portion of the FCRNRW that lies beyond 50 km from the Operations Area Boundary was considered. The regions of the FCRNRW that are within 50 km of the mine site were included in the near-field analysis area, which allows the impacts to be evaluated using dispersion models that are suitable for such distances.

4.3.1.2 Air Emissions Inventory Methodology

Because the direct and indirect air quality effects related to concurrent construction and operations are not distinguishable, a complete air emission inventory is to consider mining operations, ore processing (including refining), ongoing development of the mine site, support facilities, access roads, utilities (transmission line construction), and off-site facilities. For purposes of environmental impact assessment (EIS) analyses and Idaho Department of Environmental Quality (IDEQ) permitting, separate air pollutant emission inventories have been assembled for:

- Criteria air pollutants addressed by National Ambient Air Quality Standards (NAAQS): carbon monoxide (CO), nitrogen dioxide (NO_2), fine particulate matter less than

2.5 microns in diameter ($PM_{2.5}$), particulate matter (PM) less than 10 microns in diameter (PM_{10}), sulfur dioxide (SO_2), ozone (O_3), and ozone precursors (e.g., nitrogen oxides [NO_X] and volatile organic compounds [VOCs]);

- HAPs, including Hg and hydrogen cyanide (HCN);
- Non-criteria pollutants: total PM sulfuric acid mist (H_2SO_4), hydrogen sulfide; and
- Greenhouse gases.

The detailed emission inventories in **Appendices F-1** and **F-2** provide the source and selection rationale for the various factors that were used. Additional evaluation regarding the selection of emission factors for the specific sources included in the SGP is provided in **Appendix F-3**. This methodology applies to criteria, non-criteria, and HAP emissions estimates. These factors and estimation techniques are provided in regulatory and industry technical documents, including, but not limited to:

- EPA Document AP-42: “Compilation of Air Pollutant Emission Factors” and associated background documents (EPA 1995);
- Published emission estimation reports, including reports from the EPA and other environmental experts (EPA 1994; Schmidt and Card 2010; Eckley et al. 2010);
- EPA emission estimation models, such as MOVES (Motor Vehicle Emission Simulator) (EPA 2015a), and TANKS for hydrocarbon storage tanks (EPA 1999);
- Applicable regulatory emission requirements from Title 40 of the CFR (CFR 2011a, 2011b, 2016a, 2016b);
- EPA reference method performance test data or permit limits from similar gold ore processing operations (Nevada Division of Environmental Protection 2006, 2015, 2016; Schmidt and Card 2010);
- Manufacturer emissions certification data (Caterpillar 2019); and
- Other technical documents (Air Sciences 2018a, 2018c; EPA 2003, 2012; Nevada Division of Environmental Protection 2017).

The air emissions inventory for an action alternative is based on calculations for each emission source, for each life-of-mine (LOM) year. Midas Gold timelines in the Plan of Restoration and Operations (Midas Gold 2016) and supporting documents, including the Air Quality Analysis (Air Sciences 2018b), are based on a timeline that starts with construction years listed as negative years to Year 1 which is the first mine operational year. This EIS assumes Year 1 is the first year of any type of disturbance associated with the SGP, including construction and does not use negative years in discussing mine timelines[3]. Timelines in the air quality discussion are

[3] Note that Midas Gold’s Plan of Restoration and Operations (Midas Gold 2016) includes a schedule that reports SGP construction as negative years (-3, -2, and -1) counting down to when operations begin at the mine site in year 1. This differs from the timeline presented in Chapter 2 of this EIS (**Figure 2.3-3**), which begins at year 1 aligning with the first year of SGP construction-related activity.

based on the EIS timelines but some figures may be taken from reports using the Midas Gold timelines; in these cases, explanatory notes are added.

4.3.1.2.1 CRITERIA POLLUTANT INVENTORY METHODS

Mining operations involve numerous emission source categories characterized by the type of process, material processed, and equipment used. Most of the methods used to estimate emissions follow the accepted technique that is described in EPA Document AP-42, Compilation of Air Pollutant Emission Factors (EPA 1995). This compilation is the largest single reference used to develop air emission estimations and is maintained as an EPA website resource. It provides methodologies, emission model equations, and emission factors for a broad range of process equipment and industrial sources. An emission factor is usually a well-supported, representative value that reasonably relates the quantity of a pollutant released from some activity or process to a quantitative measure of the intensity or rate of the activity. Examples of the measure of activity rate are acres disturbed, tons processed, gallons of fuel combusted, or thermal content of fuel used. An evaluation of the selected emission factors for the SGP sources is provided in **Appendix F-3.**

In general, Document AP-42 emission factors represent a broad average of emissions data available for a specific source type. A single tabulated emission factor usually encompasses data from several actual operations and a relatively large range of actual emission rates per unit of activity. Therefore, the Document AP-42 emission factors should be considered as representing an average of the range of measured or calculated emission rates. When the individual factors are applied to a specific operating unit, the resulting emissions estimate is therefore subject to some level of uncertainty. In EPA Document AP-42, the level of uncertainty in each factor is indicated by an “emission factor rating” with values ranging from “A” for best accuracy, and “E” for greater uncertainty.

To illustrate the level of confidence in judging emission estimates, it can be noted that nearly all the emission factor values in Section 11.19.2 of Document AP-42, which is relied on for many Midas Gold sources, have emission factor ratings of “D” or “E.” To compensate for this uncertainty, the accepted practice applied in this analysis is to over-estimate the activity rates for a given operation. This tends to avoid under-reporting the final estimates used for air quality analyses (Air Sciences 2018b).

As described in Section 4.3.1.2.3, inventories were developed for two different mine operating scenarios. One inventory was applied to support the range of non-regulatory analyses presented in this EIS (Alternative 1 EIS inventory), and a second inventory applied to the NAAQS analysis by IDEQ that supported the Permit to Construct (PTC) for SGP (Alternative 2 New Source Review [NSR] inventory). For each inventory, activity-specific (e.g., drilling, blasting, material crushing and conveying, refining, and other ancillary sources) emissions were estimated based on the maximum activity rates for mining and production sources, coupled with applicable emission estimation techniques. Emissions were calculated on a short-term (hourly) and a long-term (annual) basis for ore processing, mining operations, and construction activities.

During full production, the daily ore-milling and processing rate would range from 20,000 to 25,000 tons per day (tpd). To ensure a conservative analysis, maximum daily ore processing emissions for the two inventories were based on the maximum design rate of 25,000 tpd, and this rate was assumed to be maintained for each annual operating scenario. Maximum annual emissions for the processing sources were based on the maximum daily emissions and multiplied by 365 days per year.

4.3.1.2.2 NON-CRITERIA AND HAP INVENTORY METHODS

Most of the non-criteria and HAP emissions from operations come from the combustion of fossil fuels, processing of gold-bearing ore, and fugitive dust containing trace metals. For the SGP, emission estimates from these sources include:

- Organic and inorganic HAP from combustion of propane and diesel fuel in stationary sources, non-road engines, and vehicles
- Hg from gold ore refining sources (e.g., autoclave, carbon kiln, retort and induction furnaces);
- Hg from exposed surfaces (stockpiles, development rock, tailings, and pits);
- Fugitive dust containing Hg released from mining and ore processing activities;
- HCN volatilization from the dilute cyanide solution in leach tanks, carbon-in-pulp tanks, and HCN detoxification tanks; and
- Release of trace amounts of residual hydrogen cyanide (HCN) contained in tailings storage facility (TSF) impoundment of process tailings.

Combustion of propane and diesel fuels in stationary and mobile sources comprise a substantial source of HAP emissions for the SGP. For each category of fuel combustion equipment, published emission factors were used to relate the short term and annual emission rates of HAPs to the rate of fuel consumption. As discussed in Section 4.3.1.2.3, different categories of fuel combustion sources were included in the two inventories compiled for air quality assessments. Most notably, in line with permitting procedures, the mobile engine tailpipe emissions were not considered in the IDEQ new source review inventory. The non-regulatory inventory for EIS analyses did include these mobile source tailpipe criteria and HAP emissions.

Emissions of Hg result from mining operations due to the natural Hg content in mined materials and from several steps in the refining of extracted gold (e.g., retort, carbon regeneration kiln, induction furnaces). Estimates of these emissions for the action alternatives were based on regulatory compliance emission test results available for several gold mines in Nevada that use the same type of extraction process (Nevada Division of Environmental Protection 2006, 2015, 2016).

Evaluation of potential Hg emission impacts was conducted, in part, to verify that emissions would comply with the EPA Hg emission standards provided in 40 CFR 63, Subpart EEEEEEE, for gold ore processing and production facilities. The SGP would be subject to these federal standards through the use of a carbon-in-pulp process for capturing gold that has been extracted from the crushed ore using dilute HCN solutions and the use of a retort for purifying the gold-laden precipitate from electrowinning.

Sources of HCN emissions include volatilized HCN from several types of tanks used to extract gold from crushed ore (leach tanks, carbon-in-pulp tanks, HCN detoxification tanks). Process tailings that contain trace amounts of residual HCN impounded in the TSF are the largest source of volatized HCN. These emissions were estimated using published EPA field test data derived from HCN flux measurements at active gold processing facilities in Nevada and estimated physical properties specific to the SGP gold-refining processes (i.e., area, temperature, pH, HCN concentration) (Schmidt and Card 2010).

4.3.1.2.3 Comparison of Alternative 1 EIS and Alternative 2 New Source Review Inventories

As described in Section 4.3.2.1.1 for Alternative 1, and Section 4.3.2.2.1 for Alternative 2, different mine operational scenarios were used to develop separate emission inventories for this EIS, and for the modeling that supported the PTC application to IDEQ.

The Alternative 1 EIS inventory examined projected levels of mine development and operation for each LOM year. Emissions from mining operations (drilling, blasting, material extraction and movement, mobile machinery use, and other ancillary sources) vary significantly year to year. Therefore, annual emissions were calculated based on the maximum annual activity/production rates for each LOM year. The year with the highest level of overall pollutant emissions, LOM Year 7, has been used for the non-regulatory analyses presented in this EIS for Alternatives 1 and 2, namely, near-field plume blight, increment comparison and deposition analyses, and for the far-field air analyses, as discussed in Section 4.3.2.1.

Recently, IDEQ, as the regulatory authority for the NAAQS compliance analysis, has approved an alternative emissions inventory to support the NSR process. This inventory, referred to here as the Alternative 2 NSR inventory, included the Lime Kiln and related processes. The Alternative 2 NSR inventory also was based on LOM Year 7 and a hypothetical operating scenario that was found to result in the highest potential ambient air concentrations of pollutants near the mine site. This scenario assumed the maximum level of daily mine output would occur in one of the mine pits, and rock disposal would occur in only one of the disposal facilities. Such a condition, while not likely to be representative of actual mine operations, would tend to focus the potential impacts in a smaller area and provide a conservative worst case used by IDEQ for the NSR evaluation of compliance with the NAAQS, as discussed in Section 4.3.2.2.

The full inventories of emissions for Alternatives 1 and 2 for the EIS and for the hypothetical operating scenario comprising the approved Alternative 2 NSR inventory are provided in **Appendices F-1** and **F-2,** respectively. There are a number of differences to note between the emissions inventories. The inventories used for non-regulatory analyses presented in this EIS for Alternatives 1 and 2 include fugitive dust emissions from the Burntlog Route, as well as mobile tailpipe emissions from on-site mobile equipment. These sources were not included in the Alternative 2 NSR inventory because state regulations do not require mobile sources to be covered by the PTC. Other emission levels have been revised in the Alternative 2 NSR emissions inventory in accordance with IDEQ's engineering review specific operating condition assumptions. Further, the NSR inventory assumed a specific hypothetical operating scenario that assumed the highest maximum daily mine activity would occur in just a single pit, and that all development rock disposal would use a single Development Rock Storage Facility (DRSF). This resulted in an inventory with generally larger emission rates for the SGP than those reflected in the Alternative 1 and Alternative 2 EIS inventories, which provided a more conservative regulatory assessment of NAAQS compliance (Air Sciences 2020). **Table 4.3-1** summarizes the different source categories and action alternatives that were considered in each of the emission inventories.

The Alternative 1 and Alternative 2 EIS inventories include both dust and tailpipe emissions from vehicle travel on Burntlog Route from the mine site to Landmark for mine construction and operation periods. The traffic emissions included projected workforce, supply, and haulage vehicles (buses, light and heavy trucks) and road maintenance equipment (graders and dozers). Emissions from construction activities during LOM years 1 to 3 (site preparation, temporary power generation to support construction, mobile machinery use, transportation, etc.) vary within each year of the construction period. The maximum overall operations phase emissions from this source would occur during the peak in mine throughput in LOM Year 7. While the Alternative 1 and Alternative 2 EIS inventories include mobile source emissions along the Burntlog Route, these were considered to be outside the mine site, and not included as sources in the EIS modeling.

Table 4.3-1 Comparison of EIS Inventories and New Source Review Inventory

Emission Inventory	Used for Non-Regulatory EIS Analyses	Used for IDEQ NAAQS Analysis	Action Alternative Basis	Mobile Source Tailpipe Emissions	Burntlog Route Fugitive Dust
Alternative 1 EIS [2]	Yes	No	Alternative 1	Included	Included
Alternative 2 NSR [1]	No	Yes	Alternative 2	Not Included	Not Included
Alternative 2 EIS [2]	Yes	No	Alternative 2	Included	Included

Table Sources: 1 - From Midas Gold PTC application (Air Sciences 2020) 2 - Air Sciences 2018b

Table Notes:

NAAQS - National Ambient Air Quality Standards.

IDEQ = Idaho Department of Environmental Quality.

NSR = New Source Review.

4.3.1.3 Near Field Air Quality Analyses

This section provides an overview of the air dispersion modeling methods, procedures, and datasets used for the near-field assessment. Additional details are provided in the Air Quality Analysis (Air Sciences 2018b). **Figure 3.3-2** illustrates the extent of the near-field modeling domain. The near-field air quality analyses were conducted in accordance with EPA Guidelines for regulatory air modeling (40 CFR 51, Appendix W) and included the following:

- Ambient air quality analyses to evaluate compliance with NAAQS and compare to Class II increments and Significant Impact Levels (SILs);
- Ozone and secondary fine particulate formation analyses;
- Screening visibility and plume blight analysis;
- Screening Hg deposition analysis; and
- Screening nitrogen and sulfur species deposition analysis.

The Alternative 2 NSR inventory prepared for the PTC application indicates that the SGP would qualify as a minor source for NSR applicability (based on IDEQ review and approval). In this case, the state air permit application for a minor source is not required to provide a full analysis to show compliance with the Prevention of Significant Deterioration (PSD) criteria in Class I areas within the near-field analysis area. However, an analysis is required to ensure that the new emission sources do not cause or contribute to an exceedance of ambient air standards provided in the NAAQS. For this purpose, the LOM year with the highest air emissions was modeled, because other years with lower emissions would be expected to have lower impacts.

In the case of the SGP, an assessment of project impacts in comparison to Class II area PSD increments and SILs for informational purposes provides an additional gauge of the significance of air quality impacts. However, this assessment does not represent a full PSD increment compliance demonstration. In addition, comparison of maximum modeled impacts to the SILs for Class II areas can be used, as provided in EPA Guidance, as a measure of the significance of impacts from major or minor sources. A project impact shown to be below a SIL can be presumed to not cause or contribute to the violation of a NAAQS or PSD increment.

4.3.1.3.1 Ambient Air Quality Refined Modeling

Refined modeling techniques using the air quality model were used to estimate pollutant concentrations using the Alternative 1 and Alternative 2 EIS air emissions inventories (except for lead and ozone) at receptor locations. The most recent version (18081) of the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) dispersion analysis modeling system was used for this air quality analysis. The AERMOD modeling system is listed as the recommended model for short-range analysis (up to 50 km) in federal regulations (40 CFR 51, Appendix W).

Modeling of background sources was not warranted for this near-field analysis, because the region is generally uninhabited, and large sources of air emissions are absent. A review of state air quality permits showed that there are no permitted facilities located within a 50 km area (extent of near-field analysis area), of the Operations Area Boundary. The contribution to air quality conditions from background sources is accounted for in the selected baseline concentrations for the NAAQS analysis. These baseline concentrations were added to the highest predicted off-site concentrations due to the SGP sources, as represented in the Alternative 2 NSR inventory described in Section 4.3.2.2.1 under Alternative 2.

Monitored background or baseline concentrations should reflect the existing air pollutant concentrations in the modeling domain. These baseline values are added to the modeled concentrations due to action alternative sources to estimate total ambient concentration conditions due to the SGP, and the combined concentrations are compared against the applicable NAAQS. In accordance with IDEQ recommendation, the CO, NO_X, and SO_2 baseline concentrations were derived from the Northwest International Air Quality Environmental Science and Technology Consortium online tool (NW AIRQUEST), for monitored years 2014 to 2017, as provided through Washington State University (2018). These baseline concentrations were derived by photochemical modeling methods, which are allowed under EPA Guidelines (40 CFR 51, Appendix W). The O_3 concentration used as the baseline level was provided by IDEQ. The baseline concentrations for particulate species were derived from on-site monitoring data provided by Midas Gold, obtained by operation of an IDEQ- approved monitoring program (IDEQ 2015). The pollutant baseline concentrations accepted by IDEQ for the NAAQS air quality demonstration, in units of micrograms per cubic meter (µg/m^3), are listed in **Table 4.3-2**.

AERMOD requires an input of hourly meteorological data to estimate pollutant concentrations in ambient air resulting from modeled source emissions. For this analysis, one year (January 1, 2014 to December 31, 2014) of site-specific hourly surface meteorological data collected at the Stibnite monitoring station was used. When site-specific data are available, as in this case, use of a single year of meteorological data can be deemed sufficient for the analysis. A full 12 months of data are the minimum required for air quality assessments under EPA Guidelines (40 CFR 51, Appendix W) to account for seasonal effects. The methods and procedures used to collect this dataset were reviewed by IDEQ and approved in December 2013 (IDEQ 2013) based on the PSD meteorological data quality requirements specified in the EPA Appendix W Guidelines. The EPA-recommended preprocessor, AERSURFACE, was used to estimate surface parameters for use in AERMOD that are dependent on the land use and vegetative cover of the area being evaluated.

Table 4.3-2 Baseline Pollutant Concentrations for IDEQ NAAQS Air Quality Analysis

Pollutant	Averaging Time	Baseline Conc. (µg/m^3)	Primary NAAQS[1]
CO	8 hours	1110	10,000 µg/m^3
	1 hour	1740	40,000 µg/m^3
NO_2	Annual	0.9	100 µg/m^3
	1 hour	4.3	188 µg/m^3
O_3	8 hours	112.3	.15 µg/m^3
PM_{10}	24 hours	37.0	150 µg/m^3

Pollutant	Averaging Time	Baseline Conc. (µg/m3)	Primary NAAQS[1]
$PM_{2.5}$	Annual	3.5	12 µg/m^3
	24 hours	15.0	35 µg/m^3
SO_2	1 hour	12.3	196 µg/m^3
	3 hours	16.8	1300 µg/m^3

Table Source: Air Sciences 2020

Table Notes:

1 The NAAQS units are shown to agree with the modeling analysis approved by IDEQ.

ppb = parts per billion (volume).

µg/m^3 = micrograms per cubic meter.

CO = carbon monoxide.

NO_2 = Nitrogen dioxide.

PM_{10} = particulate matter 10 microns in diameter and smaller.

SO_2 = Sulfur dioxide.

O3 = ozone.

$PM_{2.5}$ = particulate matter 2.5 microns in diameter and smaller.

Several source categories are defined in AERMOD to reflect different release characteristics. Processing, refining, and ancillary sources with exhaust stacks, such as baghouse-equipped sources, fuel-burning equipment, and the refinery autoclave, retort, smelting furnace, carbon kiln, etc., were modeled as “point” sources. In general, the process sources without exhaust stacks, but where emissions have some inherent velocity on release (such as blasting, haul road dust, mechanical transfer of material, and ore screening and crushing) were modeled as “volume” sources. Unlike point sources, emissions from the numerous fugitive sources in the mining pits and process area (e.g., drilling, blasting, material loading, unloading, hauling, and wind erosion of exposed surfaces) were not modeled individually; rather, they were grouped together as combined “area” sources for these activity locations. The haul road network was divided into 22 sections, and these were sub-divided into 65-meter-long segments. Each segment was represented as an individual “volume” source in AERMOD.

Default particulate modeling methods, including deposition were used for estimating $PM_{2.5}$ and PM_{10} impacts. To account for particulate settling, published references were relied on for the particle properties and size distribution for combustion sources (Khalizov et al. 2012; University of Minnesota 2002). The ore and waste material particle densities were provided by Midas Gold (Air Sciences 2018b).

Pollutant emissions from combustion sources are partially composed of nitric oxide (NO) and NO_2. Once in the atmosphere, the NO can be converted to NO_2 through chemical reactions with ambient ozone. An approved conversion method to mathematically estimate the ambient NO_2 concentrations from EPA Guidelines (40 CFR 51, Appendix W), was used to estimate the 1-hour and annual NO_2 impacts for this analysis (EPA 2015b)

The Burntlog Route (under Alternative 1) was characterized in AERMOD by a series of “line” sources laid along the actual route. These sources were assigned a release height of 3 m, and an initial vertical dispersion of 2.8 m. These release parameters were based on an assumed 3.5 m vehicle height, which is representative of an overall approximation of anticipated vehicle heights (grader – 3.7 m, heavy- duty truck – 3.6 m, and pickup truck – 3.2 m [Caterpillar 2019]), and the area source parameter recommendations provided in the EPA Haul Road Workgroup Report (EPA 2012). The Burntlog Route emissions were evenly distributed along the full route by dividing the total road emissions by the total road total area; i.e., the complete Burntlog Route length (60,378 m = 37.5 miles) multiplied by the road width (6.1 m) (as described in Air Sciences [2018b]).

As the SGP is considered a minor source for NSR, it is not required to show compliance with the PSD increments as part of its minor NSR air permit application unless requested by IDEQ to do so. However, due to its proximity to the FCRNRW area and the Nez Perce Requested Analysis Area, the Class II air quality analysis performed for this EIS did include an assessment of the significance of SGP air quality impacts by comparison to the Class II PSD increments (Air Sciences 2018b). The near-field modeling performed using the Alternative 1 inventory was used to compare predicted ambient concentrations to the Class II increments at the areas of interest. This assessment does not represent a PSD increment compliance demonstration, which is a more detailed evaluation. It should be noted that the Alternative 1 inventory as described in Section 4.3.1.2.3 did include fugitive tailpipe emissions from vehicles operating at the mine site, but did not include sources related to the on-site generation of lime.

4.3.1.3.2 OZONE AND SECONDARY $PM_{2.5}$ ANALYSES

A quantitative evaluation of the impacts of ozone and secondary $PM_{2.5}$ resulting from action alternative sources was performed, applying recent guidance issued by the EPA (Air Sciences 2018b). Both criteria air pollutants are formed through chemical reactions in the atmosphere, so they are referred to as “secondary pollutants.” Ozone is not emitted directly from mining activities or processes, but rather is formed by reactions involving NO_X and VOCs in the atmosphere. Therefore, ozone direct effects cannot be evaluated by air dispersion modeling of emissions from a single source or facility. Warm temperatures, clear skies (abundant levels of solar radiation), and stagnant air masses (low wind speeds) increase the potential for ozone formation (EPA 2016).

In January 2017, the EPA promulgated an update to its Guideline on Air Quality Models (EPA 2017) in 40 CFR 51, Appendix W (1978), to incorporate a tiered demonstration approach to address the secondary chemical formation of ozone and $PM_{2.5}$ associated with precursor emissions from single sources. The 2017 Guideline on Air Quality Models outlined a two-tiered approach for addressing single-source ozone and secondary $PM_{2.5}$ impacts:

- Tier 1: The first tier of assessment involves those situations where existing technical information is available, such as the results from existing photochemical grid modeling, published empirical estimates of source-specific impacts, or reduced-form models. in combination with other supportive information and analyses for the purposes of estimating secondary impacts from a particular source. According to the EPA, the existing technical information should provide a credible and representative estimate of the secondary impacts.

- Tier 2: If appropriate information for a Tier 1 analysis is not available, then a Tier 2 analysis would be conducted involving the application of a case-specific air quality modeling analysis using chemical transport models.

4.3.1.3.2.1 Tier 1 Assessment Approach – Ozone

According to the EPA guidance, air quality modeling of hypothetical industrial sources that have similar source characteristics and emission rates of ozone precursors, and which are in similar atmospheric environments, are generally suitable for comparative Tier 1 assessments. To evaluate ozone impacts for this analysis, a Tier 1 assessment was performed based on review of the EPA's Modeled Emission Rates for Precursors (MERPs) guidance document, which includes the EPA's hypothetical source photochemical grid model (PGM) results (EPA 2019b). The PGM is a regional-scale atmospheric model that accounts for ozone-forming reactions and assigns the predicted ozone results as background to hypothetical sources of ozone precursors. This selected PGM source used in this case (number 18 in the PGM source roster) is the geographically closest to the mine site—210 miles (336 km) west-northwest of the mine site—in northeastern Oregon. Ozone impacts reported for the selected hypothetical source at a specified emission level were scaled to reflect the action alternative emission levels to estimate ozone impacts. The PGM-based estimates for ozone concentration changes were added to the baseline ozone concentrations to determine total estimated ozone impacts for comparison to the NAAQS (Air Sciences 2018b).

4.3.1.3.2.2 Tier 1 Assessment Approach – Secondary $PM_{2.5}$

Particulates smaller than 2.5 microns in diameter present in the atmosphere due to combustion or process sources consist of primary particulates, condensable particulates, and secondary particles. Primary particulates are the fraction of emissions that originates as solid particles (e.g., soot). Condensable particulates originate as gaseous chemical emissions and condense to form particles after exposure to the cooler temperatures of the atmosphere. Secondary particulate can be formed when exhaust gases, the most notable example being NO_X and SO_2 emissions from a process stack, interact with other chemical species in the downwind atmosphere to form fine particles (e.g., nitrates and sulfates).

To evaluate secondary $PM_{2.5}$ impacts, a Tier 1 assessment was performed based on the EPA MERPs guidance document (EPA 2019b). The same modeled hypothetical source in northeastern Oregon that was selected for the ozone assessment based on similarity in source characteristics, emission rates of precursors, and similar atmospheric environment, was selected to evaluate secondary $PM_{2.5}$ impacts. The PGM-based estimates for $PM_{2.5}$ concentration changes were added to the baseline $PM_{2.5}$ concentrations to determine total estimated $PM_{2.5}$ impacts for comparison to the NAAQS (Air Sciences 2018b).

4.3.1.3.3 Plume Visibility Screening Analysis

Plume visibility analysis is a means of quantifying the ability of a viewer to discern a visible plume released from a source and is usually evaluated for an observer at the closest point on the boundary of a Class I or Class II wilderness area of concern. For the plume visibility analysis in this case, the most recent version of the EPA visibility impairment screening model (VISCREEN, version 13190) (EPA 1992) was used to determine if a plume released from the action alternative sources could potentially be visible by a human observer. Plume blight occurs when a coherent plume from a source is perceptible to a casual observer against either a terrain or sky background. The VISCREEN model considers the absolute plume contrast and the difference in color contrast, which together provide a measure of the visible difference between a plume and background as perceived by humans.

For this analysis, plume visibility was evaluated for a hypothetical observer at the FCRNRW Class II wilderness area. A VISCREEN Level 2 screening analysis was performed, based on the maximum daily NO_X, PM, and PM_{10} emissions from point and fugitive emissions comprising the action alternative sources, including mobile machinery, mining activities, transportation (including Burntlog Route mobile sources), and process activities. Particulate emissions from diesel combustion were categorized as “soot” in the VISCREEN input rather than PM_{10} or $PM_{2.5}$. In this manner, the VISCREEN Level 2 analysis served as a general screening tool for FCRNRW plume blight impacts. Such impacts at more distant areas of concern would be of lesser magnitude, duration, and extent.

The VISCREEN model was run using site-specific wind data to estimate the worst-case visibility impacts for worst-case meteorological conditions (wind speed and stability) (EPA 1992). The annual background visual range of 270 km for the mine site location was provided by the Forest Service and is representative of IMPROVE visual range data in the region. Additional details of the VISCREEN analysis procedures are provided in Air Sciences (2018a).

To operate VISCREEN, the aggregated emissions from the action alternative sources were arranged to be released from a single point. This creates some uncertainty, because the emissions from the mine site and process operations area would spread out over several miles. To account for dispersed emission sources, accepted modeling practice is to determine a theoretical single-point plume origin correction distance. The calculated distance in this case was 17.8 km. Subsequently, this distance was added to the hypothetical observer distance at the FCRNRW area boundary, and the combined observer distance was used in the VISCREEN inputs.

VISCREEN results provide a comparison of the two calculated plume contrast parameters with criteria thresholds to determine the plume perceptibility by an observer. Contrast (C) is a measure of the difference in the transmitted light intensity without regard for color. Color contrast (ΔE) measures the difference in wavelength of perceived light rather than intensity. For this plume visibility assessment, VISCREEN results for both C and ΔE were evaluated for a plume against a backdrop of sky or terrain, and at solar angles of 10 degrees and 140 degrees. A result that exceeds the criteria thresholds for either C or ΔE indicates that a plume would be visible. Both daytime and nighttime hours were included in this analysis, although it should be recognized that any plume that occurs at night would not have sunlight to illuminate it.

4.3.1.3.4 MERCURY DEPOSITION ANALYSIS

In the atmosphere, the forms of Hg that contribute to the deposition to land and surface waters are gaseous Hg (Hg_2), particulate-borne Hg (HgP), and gaseous elemental Hg (Hg0). Speciation of the particulate forms of Hg is not certain; however, mercuric oxide particulates are formed in combustion systems by the oxidation of elemental Hg. The assessment of Hg deposition for the locale of the mine site was conducted using two different tools. EPA computer simulation results based on the Regional Modeling System for Aerosols and Deposition (REMSAD) are available to quantify Hg deposition in each of the lower 48 states (EPA 2008).

This modeling was based on Hg emission inventory data obtained from 2000 through 2006, so would be expected to be higher than more-recent Hg emission levels that reflect regulatory limitations. The REMSAD results were used to estimate background deposition in the locale of the SGP area. Sources of Hg deposition included in the EPA REMSAD modeling analysis were:

- Point- and area-source emission sources in the lower 48 U.S.;
- Emissions from sources in Canada and Mexico; and
- Global background deposition from the Chemical Transport Model, the Global/Regional Atmospheric Heavy Metals model, and the GEOS-Chem model (EPA 2008).

The second analysis tool to assess the contribution to Hg deposition due to the action alternative sources was screening-level dispersion simulation using AERMOD. It is recognized that AERMOD does not simulate the key physical processes affecting Hg in the environment (e.g., chemical transformation, re-emission, wet deposition, etc.) that are included in other models of Hg deposition. However, AERMOD was used in this case as a screening tool, to quantify the potential for increases in deposition of Hg species that could lead to impacts to biota. Complete discussion of the AERMOD method details and calculations are provided in the Air Quality Analysis report (Air Sciences 2018b).

4.3.1.3.5 NITROGEN AND SULFUR DEPOSITION SCREENING ANALYSIS

To evaluate near-field deposition due to action alternative sources of NO_X and SO_2, screening-level modeling was conducted using AERMOD for nitrogen and sulfur species. As in the case of Hg deposition, it is recognized that AERMOD does not include several physical processes involved in chemical deposition (e.g., atmosphere chemical transformation of NO_2 and SO_2) found in traditional acid deposition models. However, for purposes of this assessment, it served as a screening tool to conservatively identify potential for adverse deposition effects.

This screening analysis was conducted using the Level 2 procedures prescribed in the draft interagency near-field deposition modeling guidance (U.S. National Park Service [NPS] 2011). The Level 2 analysis assumes that 100 percent of the NO/NO_2 emissions are promptly transformed into soluble nitric acid on release to the atmosphere. This assumption results in a significant overestimation of potential nitrogen species deposition close to the facility and is viewed as conservative.

4.3.1.4 Far-Field Air Quality Analyses

Another area of air quality analysis was analysis of potential effects in Class I and Class II areas surrounding the SGP area. The Class I areas within 300 km of the Operations Area Boundary are shown in **Figure 3.3-1**. The distances and direction between the proposed mine site and the closest boundary of these Class I areas are listed in **Table 4.3-3**. As described below, a less extensive area was defined as the far-field modeling domain, and several Class II wilderness areas were considered along with the selected Class I areas.

The far-field analysis focused on four Class I areas that were among the closest to the mine site, and in different cardinal directions relative to the SGP area: SAWT, SELW, HECA, and CRMO. The adopted approach was to discern if potential impacts above thresholds were predicted in these areas. Assessment of impacts in these closer Class I areas are conservatively representative of impacts in the areas not included in the model. **Table 4.3-2** identifies the Class I areas that were not included in far-field modeling; however, if significant impacts had been identified in the closer Class I areas then additional analysis would be warranted to determine if there were potential impacts also could affect the more distant Class I areas (Air Sciences 2018a).

Table 4.3-3 Class I Areas in the Far-Field Analysis Area

Class I Area	Included in Far-Field Modeling	Distance, miles (km) and Direction
Sawtooth Wilderness (SAWT)	Yes	48.1 (77.5), South
Selway-Bitterroot Wilderness (SELW)	Yes	53.6 (86.5), North
Hells Canyon Wilderness (HECA)	Yes	62.0 (100.0), Northwest
Eagle Cap Wilderness	No	84.1 (135.6), West
Anaconda-Pintler Wilderness	No	98.6 (159.0), Northeast
Craters of the Moon National Monument (CRMO)	Yes	132.8 (214.2), Southeast
Flathead Reservation	No	156.7 (252.7), North-Northeast
Strawberry Mountain Wilderness	No	165.0 (266.1), West-Southwest
Red Rock Lakes National Wildlife Refuge	No	169.6 (273.5), East
Mission Mountains Wilderness	No	177.7 (286.7), North-Northeast

Table Source: Air Sciences 2018b

Four Class II wilderness areas also were included in the far-field analysis: FCRNRW, GOSPEL, HEMBLD, and WHTCLD. The FCRNRW area is a large wilderness adjacent to the Operations Area Boundary that extends well beyond 50 km from this boundary. For purposes of the far-field analysis, only the portion of the FCRNRW that lies beyond 50 km was considered in far- field modeling. The Nez Perce Requested Analysis Area also was included in the far-field analysis of visibility effects and chemical deposition impacts. The locations of these Class II areas of concern within the modeling domain are illustrated in **Figure 3.3-3**.

4.3.1.4.1 Modeling Methodology For Far-Field Analyses

For the far-field analyses, the CALPUFF dispersion model was selected. The CALPUFF model is a non-steady state, Lagrangian “puff” model that simulates the transport and chemical transformation of discrete puffs of pollutants released into the atmosphere. As wind flow changes geographically from hour to hour after the release, the path of each puff is altered by the model to follow the changing wind direction.

The CALMET processor, which simulates a three-dimensional wind field required by CALPUFF, was not used in this case. Rather, this analysis used a location-specific, 3-year wind field dataset generated by the Weather Research and Forecasting Model (WRF) in accordance with the federal Guideline on Air Quality Models (40 CFR 51, Appendix W). The WRF data was processed with the Mesoscale Model Interface (MMIF) program to prepare the meteorological fields for use in CALPUFF. This wind field spanned the entire modeling domain (420 km by 420 km, at a 4 km resolution [105 by 105 grid cells]) and was based on 3 years of regional data (2015 to 2017) (Air Sciences 2018b).

To assess data quality, the CALPUFF-ready wind field was evaluated against observational data from 15 established monitoring stations distributed throughout the CALPUFF modeling domain using the MMIF statistics program (MMIFStat). From the WRF meteorological data set, the MMIFStat package derives a few data quality metrics for air temperature, relative humidity, and winds. These computed metrics were compared to data quality benchmarks that have been commonly reported for mesoscale model evaluation. These benchmarks are available for both simple and complex terrain and are viewed as indicators of data adequacy and quality but are not used alone to accept or reject datasets.

In this case, the applicable complex terrain benchmarks for temperature and humidity data were generally met by the WRF dataset. However, some divergences from benchmarks were noted for wind speed and direction data. This was attributed to the elevated and complex terrain surrounding the various data monitoring sites, which can cause errors in wind direction simulation. Additional details of the meteorological data assessment procedures for operation of CALPUFF are presented in the Air Quality Analysis report (Air Sciences 2018b).

Sources from the near-field AERMOD modeling files were used to build the CALPUFF inputs, with some significant differences. For point sources having exhaust at ambient air temperature (e.g., dust control baghouses), the CALPUFF model differs from AERMOD, because it sets a constant release temperature approximating ambient air temperature (293.15 degrees Kelvin). In AERMOD, the mine pit sources were modeled as rectangular volume sources (OPENPIT routine), with individual lateral dimensions and release heights for each pit used to calculate initial vertical dispersion parameters. In CALPUFF, the pit sources were modeled as square area sources located with a release height at the top of the pit opening, with the pit located from the AERMOD lateral dimensions. The primary SGP plant access road was modeled in

AERMOD using several defined “line” sources. In CALPUFF, this access road was modeled as a set of widely spaced “volume” sources (Air Sciences 2018a).

Receptors for each Class I area were downloaded from the NPS Class I Area Receptors website (NPS 2018). For the Class II wilderness areas, receptor elevations were determined using the AERMAP program. Receptors were placed in the interior of each wilderness area at a 2-km grid spacing starting at 50 km from the mine site.

4.3.1.4.2 FAR-FIELD REGIONAL HAZE ASSESSMENT PROCEDURES

For the far-field assessments of regional haze impacts, the MESOPUFF II five-pollutant (nitric acid [HNO_3], NO_X, nitrate species, SO_2, and sulfate species [SO_4]) conversion algorithm was applied in CALPUFF to simulate atmospheric chemistry effects and contribution to regional haze. Action alternative source emissions were set at the LOM Year 7 maximum daily 24-hour emissions of NO_X, SO_2, SO_4, and fine and coarse PM. Additional details of the CALPUFF processing and post-processing methods are presented in the far-field modeling protocol and the Air Quality Analysis report (Air Sciences 2018a,b).

Use of the annual average natural visual range conditions and visibility background values are usually recommended by federal land manager guidance for Class I areas. The average natural conditions for the four Class I areas in this analysis were obtained from the IMPROVE sites representing those areas (Copeland 2018). For the Class II wilderness areas, Forest Service-recommended HECA background values were used for the Nez Perce Requested Analysis Area, and median background values from the four nearest Class I IMPROVE sites were used for the remaining Class II wilderness areas (Copeland 2018).

4.3.1.4.3 FAR-FIELD COMPARISONS WITH CLASS I AND CLASS II INCREMENTS

As the SGP is considered a minor source for NSR, it is not required to show compliance with the PSD increments in either Class II or Class I areas. In view of proximity of the mine site to the FCRNRW area and the Nez Perce Requested Analysis Area within a 50 km distance, a comparison of SGP air quality impacts with the Class II PSD increments was conducted as part of the near-field analysis using the Alternative 2 EIS inventory (refer to Section 4.3.1.3.1). Similarly, the far-field CALPUFF modeling was used to perform a comparison between maximum ambient concentrations with Class I and Class II increments for the areas of interest in the far-field domain beyond 50 km.

It should be noted that this modeling was based on the Alternative 2 inventory that includes the on-site generation of lime. This inventory was shown to have somewhat higher overall criteria pollutant emissions, generally due to the added combustion emissions of the lime kiln. Therefore, it was considered more conservative to perform this increment comparison for the action alternative with the higher quantified emissions. This inventory includes fugitive tailpipe emissions from vehicles operating at the mine site, in common with other non-regulatory modeling analyses such as the regional haze contributions and deposition screening modeling.

4.3.1.4.4 Far-Field Deposition Assessments

Total potential annual nitrogen (N) and sulfur (S) deposition from action alternative sources was determined as part of the air quality far-field analyses. The POSTUTIL routines in the CALPUFF model predict the deposition fluxes for both these chemical species at the receptors placed in the areas of concern. These post-processing routines were used to calculate the nitric acid/nitrite concentrations levels at each receptor, accounting for the hourly-occurring humidity and temperature conditions. Similarly, POSTUTIL routines in CALPUFF were applied to predict sulfuric acid/sulfate concentrations at each receptor. The modeling results for total potential N and S deposition are expressed in terms of the quantity of those two elements. Both dry and wet deposition were considered. Deposition impacts were compared to the Deposition Analysis Thresholds (DAT) as outlined in federal land manager guidance on N and S deposition (NPS 2011). In this guidance, the significance level for N and S deposition rates in Class I areas is listed as 0.005 kilogram per hectare-year.

4.3.1.5 Assumptions and Uncertainties

Assumptions and uncertainties for the air quality analyses includes: uncertainty in impact analysis due to changes in emissions sources in the proposed action that are different or were not included in the emissions inventory used for the air modeling and analysis; inherent uncertainties in EPA and industry emission factors used; and uncertainties due to lack of on-site background information including ambient air, soil conditions, and some meteorological data.

The Alternative 2 NSR emission inventory deemed complete by IDEQ for the NAAQS compliance demonstration included the emissions from the lime kiln, which reflects the highest SGP emissions scenario, and therefore, the highest predicted NAAQS impacts. However, this inventory did not include mine site mobile tailpipe emissions. Further, it should be recognized that modeled results, without onsite monitoring to substantiate them, are always subject to uncertainty.

Several areas of uncertainty result from the need to make assumptions about physical conditions, to predict regulatory review outcomes, and from incomplete information at the time of this analysis were identified:

- Use of the Alternative 1 emissions inventory prepared earlier in the SGP development process for non-regulatory air analyses presented in this EIS, rather than the later and more-conservative Alternative 2 NSR emissions inventory accepted by IDEQ for NAAQS compliance demonstration;
- Potential new and altered emission sources that may be added to the SGP under different action alternatives (e.g., Relocated and re-sized pits and waste rock areas, addition of a batch plant, and/or waste incinerator);
- Inability to quantify emissions related to antimony concentrate shipment, as the destinations (foreign and/or domestic), shipping methods (overland truck and/or rail) travel distances, load transfers, and selection of routes to transportation hubs for this product are not known;

- Use of industry blasting information from Australia (rather than EPA-based method), and predicted emissions for ore refining based on Nevada gold mine permits and technical documents, although these approved by IDEQ during the NSR permitting process; and,
- Use of estimated hourly and daily emissions and the related ambient air and visibility impacts due to construction over an assumed annual schedule of 355 days (with no activity assumed for 10 days per year), even though these activities would likely be compressed into approximately half that time each year due to weather constraints, resulting in higher short-term emission rates within the active months.

Additional information regarding assumptions and uncertainties is included in **Table 4.1-1**.

4.3.2 Direct and Indirect Effects

The air quality in each location is characterized by several properties that can be physically monitored and evaluated. From analysis of predicted air quality changes, the relative significance of impacts for the SGP can be estimated. These include the air quality indicators that were evaluated in this analysis as described in Section 4.3.1.1, Effects Analysis Indicators and Methodology of Analysis.

4.3.2.1 Alternative 1

4.3.2.1.1 Construction And Operations Air Emissions Inventory

Emissions were initially estimated for activities and process sources included in Alternative 1 for each LOM year. The LOM years presented in this discussion are based on years starting with Year 1 as the first year of construction. This does not align with Midas Gold timelines in supporting documents which assume the first year of construction as a negative year counting down to the first year of operations as Year 1. This EIS assumes Year 1 is the first year of any type of disturbance associated with the SGP, including construction and does not use negative years in discussing mine timelines (see **Figure 2.3-3**). As discussed in this section, the highest total air emissions would occur during LOM Year 7, which also corresponds to the year of the highest annual mine throughput. Analyses for the “non-regulatory” air quality characteristics were performed using the initial emission inventory, termed the Alternative 1 EIS inventory. For regulatory assessment of NAAQS compliance, the analysis utilized an inventory prepared the PTC application to IDEQ, and based on Alternative 2.

Air emission point sources for the construction phase of Alternative 1 would be composed of temporary engine-driven generators, portable conical crusher and screens, temporary diesel-fired heaters, and engine-driven air compressors. The fugitive sources related to mine construction and operations would be haul, access, and construction road dust from vehicle travel during the pre-production years, as well as earth-moving equipment, material transfers, storage in several temporary construction stockpiles and waste rock piles, tailpipe emissions and exploratory activities. The use of ammonium nitrate/fuel oil explosives also would be considered a mine construction phase source, as well as an ongoing operations phase source.

In the emissions inventory for Alternative 1, mining and ore processing operations are assumed to be capable of operating 365 days per year, so annual emissions, and ambient air and visibility impacts, were derived for that schedule. Most of the construction activities also are assumed to occur at a consistent rate for 355 days per year (with no activity assumed for 10 days per year). Consideration of these schedules allowed emissions to be estimated on a daily- average and hourly bases for modeling purposes. This assumed schedule is a source of uncertainty in the analysis, as weather conditions would affect the construction schedule, and would suggest higher daily activity during the months of May through November, and higher short-term emission rates. Details regarding the emission source roster, operating assumptions, and resulting emissions estimates for Alternative 1 are provided in **Appendix F-1**.

Starting in LOM year 4 (after up to 3 years of construction and pre-production activities), construction and mining activity emission sources would consist of conventional open-pit methods to extract ore and waste rock, including drilling, blasting, excavating, and hauling. The point sources for the operations phase, generally beginning in LOM year 4, include many of the same sources that would be used during mine construction. Added emission sources beyond the construction phase would consist of portable and stationary engine-driven generators, two propane-fired heaters for intake vent air, the primary jaw crusher system, and the mill building sources (Midas Gold 2016).

Two critical assumptions used in the emissions inventory on which the air effects analysis was based are included as required mitigation measures in the action alternatives, First, the emissions inventory and thus impact analysis assumed that all off-highway diesel engines would comply with EPA Tier IV emission standards or better across the action alternatives. Second, dust suppression methods that would be sufficient to maintain the control efficiency assumed for the Alternative 2 NSR inventory, or for the Alternative 2 EIS inventory, whichever is greater, would be included as required mitigation measures.

Mitigation measures for air pollutant emissions are incorporated at each step of the mining and processing operations. Several air pollution mitigation measures that were proposed by Midas Gold (2016) are common to all alternatives and are assumed to be a part of every action alternative impact assessment. For Alternative 1, emission control devices and designs would be put in place to abate emissions of particulate matter, Hg, and criteria pollutant emissions from internal combustion engines. Assessments of near-field and far-field impacts take these measures into consideration by applying emission factors based on data that include emission controls in compiling the Alternative 1 inventory. For off-highway truck travel, the efficiency of dust suppressants was based on vendor information (Air Sciences 2018c).

Tailpipe emissions for off-highway diesel engines included in Alternative 1 are controlled by use of engines that meet Tier IV or better EPA performance standards (e.g., stationary internal combustion new source performance standards, 40 CFR 60, Subparts IIII and JJJJ). Roadway dust and tailpipe emissions from vehicle travel on Burntlog Route from the mine site to Landmark also were calculated for both construction and operation periods. The traffic emissions included projected workforce, supply, and haulage vehicles (buses, light and heavy trucks) and road maintenance equipment (graders and dozers). Due to modeling limitations, although these emissions were calculated, the modeling of air quality effects accounted for emissions only in the SGP area. Warm Lake Road (County Road [CR] 10-579) emissions for the route from Landmark to Cascade for the remainder of on-road vehicle traffic also were estimated, but not included in the modeling of access roadways. The air impacts from fugitive dust and vehicle exhaust along intervals of roadway that were not modeled would be localized, and comparable to the roadways modeled within the SGP area. This is because wind patterns and traffic intensity are comparable along each interval of roadway.

Emissions from construction activities during LOM years 1 to 3 (site preparation, temporary power generation to support construction, mobile machinery use, transportation, etc.) vary within each year of the construction period. Therefore, annual emissions were calculated based on the maximum annual activity rates for each year. Daily emissions were calculated based on the maximum daily activity rates during each LOM Year. Most of the major construction activities would be concluded before the LOM year 7 (year 4 in Midas Gold timelines), which had the highest estimated emissions, so these early LOM-year construction activities are not included in the emission inventory used for the air quality impact analysis.

Midas Gold would design, construct, and operate SGP facilities with air pollution controls stipulated in applicable regulations and the air quality permit issued by IDEQ. The PTC would include stipulations that are based on applicable state and federal regulations, and that are consistent with best available control technology for new surface mining and processing operations. Details on the control measures and estimated control effectiveness for Alternatives 1 and 2, including additional measures that would be stipulated by the Forest Service, are provided in **Appendices F-1** and **F-2**, respectively. Specific examples include:

- Adherence to a robust fugitive dust control plan, containing standard operating procedures for dust control, surveillance, record-keeping, and reporting as may be required under best operating practices and/or conditions of air permits under IDEQ.
- The main ore processing facility building, and coarse ore stockpile would be enclosed.
- Water sprays and dust collection systems for ore processing facility material handling activities would be installed.
- Water sprays and/or bag house dust collectors would be installed at the ore-crushing system and at ore reclaim feeders that deliver ore to the grinding circuit.
- Hg emission controls, including particulate filters and carbon adsorption filters, would treat exhaust from the precipitate retort, autoclaves, carbon regeneration kiln, and induction furnaces.
- Internal combustion engines used for the construction and operational phases (diesel- or gasoline-powered) would be maintained in a manner that would promote fuel-efficient operation, and thereby reduce tailpipe emissions.
- Off-highway diesel engines would be rated for EPA Tier IV or better emission performance; operated in compliance with federal air quality applicable to internal

combustion engines (e.g.,40 CFR 60, Subparts IIII and JJJJ); and would observe limitations required by IDEQ air quality rules.

- Ultra-low sulfur diesel fuel would be used for mobile sources and stationary diesel engines, to comply with state regulations.

Projected emissions for the LOM year corresponding to maximum annual emissions (LOM Year 7) for stationary sources included in the SGP would be less than thresholds requiring either a PSD or Major Source (Title V) permit. Therefore, since these emission estimates have been accepted by IDEQ, then the implementation of the selected alternative would not require a major source Title V permit. As a minor source under the Clean Air Act, SGP would be required under the Idaho air permitting regulations to obtain a PTC from IDEQ that addresses the applicable federal and state emission limits and regulatory requirements.

Ore-grinding operations at the semi-autogenous grinder in the mill building would be fully enclosed and wet; therefore, the mill would not be a source of air emissions. The cyanide leach and carbon process for gold recovery occur in sealed vessels, so that emissions from this portion of the process are low. Emissions of volatized HCN are quantified as contributing to HAP emissions.

Figure 4.3-1 presents the annual Alternative 1 emissions inventory used in the non-regulatory EIS air analyses for the criteria pollutants for each LOM construction and operation year as derived from the maximum operating schedule for each type of operation. The construction emissions occur primarily in the pre-production year years (LOM year 1 through year 3), the mining emissions and ore processing emissions occur from LOM year 4 through year 15. Emissions from certain mine construction components that continue during the mine operation years are included with the applicable LOM year mining emissions. Note that the maximum potential ore processing emissions would not vary over the life of the mine. This is because ore processing emissions were calculated conservatively based on constant operation at the maximum daily ore production rate of 25,000 tpd, regardless of actual yearly ore production rates. The maximum emission rate LOM Year 7 shown in **Figure 4.3-1** was selected as the emission inventory basis for detailed non-regulatory assessment of Alternative 1, without evaluation of NAAQS compliance. That regulatory assessment was conducted in the context of Alternative 2, based on an emission inventory prepared for to support the PTC application to IDEQ (refer to Section 4.3.2.2.2).

The maximum annual pollutant emissions for the non-regulatory analyses for each LOM year are further detailed in **Table 4.3-4**. The highest aggregated criteria pollutant annual emissions (including fugitives) would be approximately 1,284 tons per year (tpy) and are predicted to occur for Alternative 1 in LOM Year 7, which would be the highest ore production year. The corresponding individual source emissions were taken as the basis for the air dispersion modeling exercises described in Sections 4.3.1 and 4.3.2. The variation in annual emissions reflects the progression in levels of mining activity in different open pits, and differing levels of haul road transport for the pits during their development (Air Sciences 2018b).

The predicted annual emissions summaries by source category for each criteria pollutant are provided in **Table 4.3-5**. It should be recognized that the stationary sources represented by the process and auxiliary category are the sources used to judge the applicability of major source permitting status. As shown in the table, these emissions are less than the annual threshold of 100 tpy that would trigger Title V permitting status. Emissions of particulate matter (total suspended particulate [TSP], PM_{10}, and $PM_{2.5}$) from fugitive sources represent the largest contributor to overall emissions. The operation of off-highway trucks and fuel-combusting equipment would constitute the largest sources of carbon monoxide and nitrogen oxides. Due to the low sulfur content of liquid fuels that would be used for the equipment at the mine site, and the federal emission standards for the recent model-year diesel engines, the emissions of SO_2 and VOC are relatively low.

Dust and tailpipe emissions due to the travel of off-highway trucks and other vehicles were accounted for in the dispersion modeling within the SGP Operations Area Boundary, in the mined pits, and along the Burntlog Route from the mine site. As listed in **Table 4.3-5**, these emissions were based on the access road and mine road configuration proposed in Alternative 1. The estimated operations phase emissions for SGP vehicle travel along Warm Lake Road (CR 10-579) from Landmark to Cascade also are estimated (refer to **Appendix F-1**), but not included in the dispersion modeling.

The level of traffic and related emissions for the transport of material beyond Cascade, such as the shipping of antimony concentrate, are not sufficiently predictable to be quantified. Based on current estimates, transport of concentrate would require two truck trips per day, so the contribution to SGP emissions would be small. However, for informational purposes emission factors per mile of travel for fully-loaded heavy transport trucks are provided in the Air Quality Analysis report for the Alternative 1 emission inventory (Air Sciences 2018b).

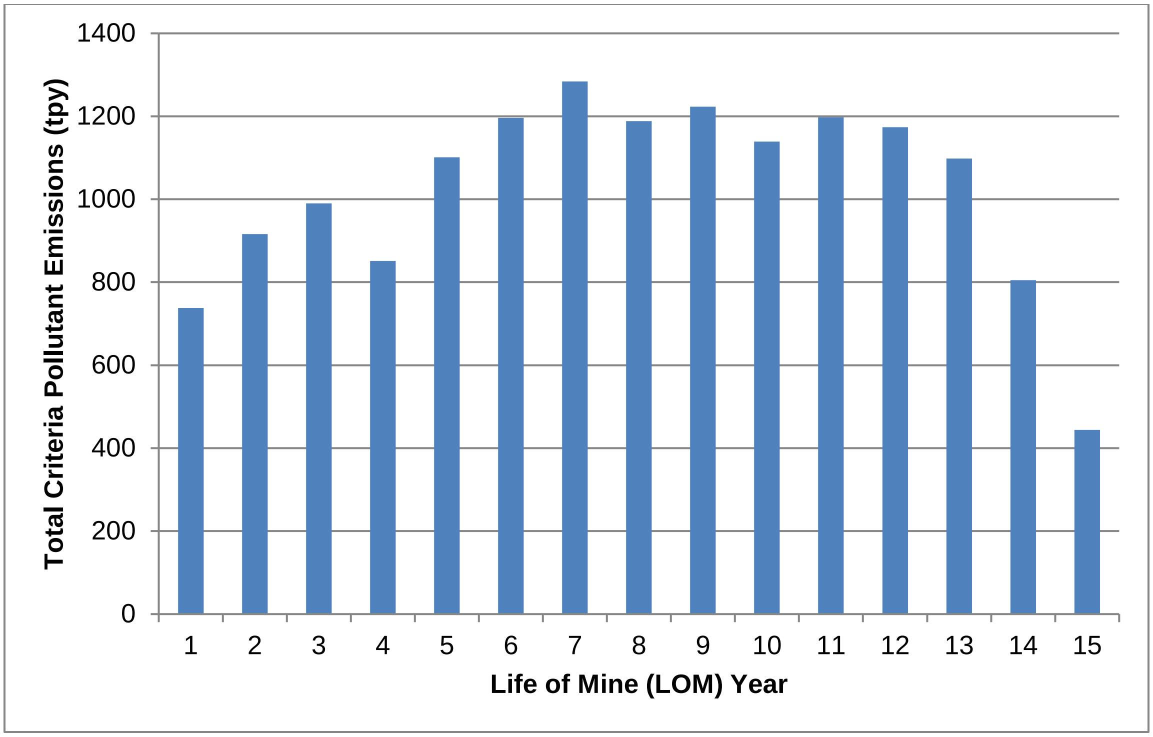


Figure Source: Total Emissions Data from Air Sciences 2018b

Figure Notes:

Life-of-Mine Years shown on the figure use the timeline adopted for this EIS. Midas Gold timelines presented in the Plan of Restoration and Operations (Midas Gold 2016) start with years -2 through 0 being construction phase, which and equate to Years 1 through 3 in this EIS.

Figure 4.3-1 Timeline of Maximum Annual Emissions by Life-of-Mine Year

Table 4.3-4 Maximum Criteria Pollutant Emissions Summary by Life-of-Mine Year (Alternative 1 EIS Inventory)

LOM Year [1, 2]	TSP (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	CO (tpy)	NO_X (tpy)	SO_2 (tpy)	VOC (tpy)	Total Alternative 1 Criteria Emissions [3] (tpy)
1	231.0	66.9	17.1	461.7	156.2	0.8	52.3	737.9
2	364.9	106.4	30.8	531.3	220.8	0.9	56.8	916.2
3	642.7	173.1	33.6	481.0	291.9	1.0	43.0	990
4	921.5	270.7	58.6	335.8	218.8	5.8	20.3	851.4
5	1,121.1	328.9	66.3	420.4	323.7	6.1	22.5	1101.6
6	1,157.0	345.0	66.6	491.8	330.2	6.1	22.9	1196
7 [4]	**1,229.5**	**365.0**	**68.7**	**537.8**	**351.1**	**6.1**	**23.7**	**1283.7**
8	1,116.3	333.2	64.9	485.0	341.3	6.1	23.0	1188.6
9	1,200.2	356.1	65.1	490.2	348.0	6.1	22.6	1223
10	1,116.6	335.5	62.7	476.2	299.7	6.0	21.4	1138.8
11	1,189.8	356.7	64.6	503.7	310.0	6.0	21.6	1198
12	1,172.2	348.9	64.2	486.5	310.4	6.0	22.1	1173.9
13	1,125.2	334.3	62.7	456.0	280.8	5.9	21.4	1098.4
14	774.1	239.4	52.1	329.6	211.7	5.8	18.6	805.1
15	477.4	154.9	42.0	170.8	101.2	5.5	11.6	444

Table Source: Air Sciences 2018b

Table Notes:

1 The LOM Years presented on the table represent LOM Years as numbered in this EIS. Midas Gold's Plan of Restoration and Operations (Midas Gold 2016) portrays the pre-operation years as negative numbers, so LOM years are numbered as -3, -2, -1, 1 through 12.

2. LOM years 1 through 3 represent construction and pre-production period. Mining and processing operations are fully active in LOM year 4.

3. Total Alternative 1 emissions are the sum of PM_{10}, CO, NO_X, SO_2, and VOC emission rates.

4 The highest overall annual emissions would occur in LOM year 7, which corresponds to the year of highest predicted mine output.

CO = carbon monoxide.

NO_X = Nitrogen oxides.

$PM_{2.5}$ = Particulate matter less than 2.5 micron diameter.

PM_{10} = Particulate matter less than 10 micron diameter.

SO_2 = Sulfur dioxide.

tpy = Tons per year.

TSP = Total suspended particulate.

VOC = volatile organic compounds.

Table 4.3-5 Maximum Annual Pollutant Emissions Summary – Life-of-Mine Year 7 (Alternative 1 EIS Emissions Inventory)

Source Category	CO (tpy)	NO_X (tpy)	TSP (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	SO_2 (tpy)	VOC (tpy)
Process and Auxiliary (Stationary)	13.0	21.8	53.0	37.2	28.7	5.2	4.7
Mining and Mobile	519.0	322.6	1,021.7	288.3	35.8	0.9	18.3
Burntlog Route – Off-site Roadway Dust and Tailpipe Emissions	5.8	6.7	154.9	39.5	4.2	0.02	0.7
Warm Lake Road (CR 10-579) (Landmark to Cascade) Roadway Dust and Tailpipe Emissions	1.84	5.60	85.9	17.9	4.5	0.009	0.5
Total	**537.8**	**351.1**	**1,229.6**	**365.0**	**68.7**	**6.1**	**23.7**

Table Source: Air Sciences 2018b

Table Notes:

CO = carbon monoxide.

$PM_{2.5}$ = Particulate matter less than 2.5-micron diameter.

PM_{10} = Particulate matter less than 10-micron diameter.

TSP = Total suspended particulate.

NO_X = Nitrogen oxides.

SO_2 = Sulfur dioxide.

tpy = Tons per year.

VOC = volatile organic compounds.

Most of the HAP emissions from operations come from the combustion of fossil fuels and fugitive dust containing trace metals. Other HAP emissions include:

- Hg from gold ore refining sources (e.g., autoclave, carbon kiln, retort and induction furnaces);
- Hg from exposed surfaces (stockpiles, development rock, tailings, and pits);
- Fugitive dust containing Hg released from mining and ore processing activities;
- HCN volatilization from the dilute cyanide solution in leach tanks, carbon-in-pulp tanks, and HCN detoxification tanks; and
- TSF impoundment of process tailings that would contain trace amounts of residual HCN.

The annual HAP and toxic pollutant emissions for LOM Year 7 are listed in **Table 4.3-6**, with Hg reported in pounds per year, and the other toxics in tpy. Details regarding the HAP and air toxics operating assumptions, and resulting emissions estimates for Alternative 1, are provided in **Appendix F-1.**

Regarding HCN emissions from gold mines, the EPA has examined U.S. gold ore processing and production facilities and concluded that measurements of HCN concentrations at these gold facilities “showed ambient concentrations below levels of public health and environmental concerns” (EPA 2010). The latter determination was based on several fence-line monitoring studies directed by EPA to measure HCN concentrations downwind of the gold facilities, and comparison with the applicable HCN reference concentration. The estimated SGP HCN emissions (1.9 tpy) would be less than the majority (6 out of 7) of the facility emissions evaluated in the EPA study. This group of existing facilities reported HCN emission rates ranging from 0.2 to 8.8 tpy, with an average of 3.8 tpy (EPA 2010). Based on this determination, no further analysis was conducted to address off-site impacts of the action alternative HCN emissions.

Hg is introduced to the ore processing system through the Hg content of the ore itself. Evaluation of potential Hg emission impacts was conducted, in part, to verify that emissions would comply with the EPA Hg emission standards provided in 40 CFR 63, Subpart EEEEEEE, for gold ore processing and production facilities. The SGP would be subject to these federal standards using a carbon-in-pulp process for capturing gold that has been extracted from the crushed ore using dilute HCN solutions and use of a retort for purifying the gold-laden precipitate from electrowinning. The projected Hg emissions from the gold ore processing sources would be controlled to less than 10 to 20 percent of these federal standards. The emissions released from gold-refining processes are controlled as listed below to mitigate particulate and gaseous Hg emissions. These control technologies are accounted for in the maximum emissions estimates in **Table 4.3-6**:

- Activated carbon regeneration kiln – wet scrubber and activated carbon filter;
- Retort – activated carbon canisters and filter pack; and
- Induction furnaces – baghouse filter and activated carbon filter pack.

Table 4.3-6 Maximum Annual HAP and Air Toxics Emissions Summary – Alternative 1 EIS Inventory

Source Category	HCN (tpy)	H_2SO_4 (tpy)	HAP (tpy)	Hg (lbs/yr)
Process and Auxiliary	1.8	8.9	1.2	24.8
Mining fugitive	0.0	0.0	2.0	8.5
Total	**1.8**	**8.9**	**3.2**	**33.3**

Table Source: Air Sciences 2018b

Table Notes:

H_2SO_4 = sulfuric acid, mist form. HAP = Hazardous Air Pollutants.

Hg = mercury (all forms). tpy. = Tons per year.

VOCs = Volatile Organic Compounds.

4.3.2.1.2 DIRECT AND INDIRECT EFFECTS – NEAR-FIELD ANALYSIS

4.3.2.1.2.1 Comparison of Maximum Pollutant Concentration Impacts with NAAQS

Assessment of conformance to the NAAQS is based on the highest receptor concentration in the modeling domain for the pollutants and averaging times corresponding to the standards. The modeled maximum concentration at this receptor is added to the selected baseline concentrations that represent current existing conditions. If the results from this computation are below the NAAQS, then impacts at other locations in the domain would be below the NAAQS as well.

Although a preliminary NAAQS modeling effort was conducted as part of the Air Technical Report (Air Sciences, 2018b), the NAAQS impact analysis has been updated in this document to reflect the refined NAAQS modeling conducted for IDEQ as the regulatory authority. Refer to this regulatory assessment presented in Section 4.3.2.2.1, based on the Alternative 2 NSR emission inventory that includes an on-site lime production process. Consequently, the Alternative 2 operating scenario would have higher annual and short-term emissions than Alternative 1. For this reason, predicted impacts compared to NAAQS for Alternative 1 can be assumed to be less than those presented for Alternative 2.

4.3.2.1.2.2 Comparison of Maximum Pollutant Impacts with Class II Increments

Comparison of the maximum modeled impacts to Class II increments and SILs is typically required as part of the PSD evaluation for major source ambient air quality assessments. However, for informational purposes relative to the SGP such comparisons provide an additional indicator of the relative significance of air quality impacts. The results in **Table 4.3-7** based on the Alternative 1 EIS maximum annual inventory show the near-field maximum modeled ambient concentrations derived from the non-regulatory, near-field analysis. For all pollutants, the modeled concentrations are less than the Class II increments. For pollutants other than SO_2, the maximum modeled concentrations are above the SILs. In the case of a major source, this outcome would indicate that more detailed analysis is warranted to confirm compliance with the NAAQS, and other criteria. For any new source, a project impact shown to be below a SIL is recognized as not causing or contributing to the violation of a NAAQS or PSD increment.

In general, instances of modeled project impacts that exceed a SIL may warrant a refined analysis to investigate whether a project will cause or contribute to a PSD increment violation. Given there are no substantial existing minor or major sources in the immediate vicinity of the mine site, it is viewed as unlikely that significant consumption of the PSD increment occurs in this area. Due to the relatively low maximum concentrations from near-field modeling for SGP, which are well below the PSD increment for all pollutants, it also is unlikely the SGP would cause or contribute to a violation of a PSD increment. If the IDEQ were to have sufficient concern that a PSD increment violation could occur, a full regulatory PSD increment compliance demonstration could be warranted even for a minor source under the state's NSR air permitting process.

Table 4.3-7 Comparison to Near-Field Class II Increments and Significant Impact levels Based on Alternative 1 EIS Inventory

Pollutant	Averaging Time [1]	Maximum Modeled Concentration (µg/m³)	Class II Significant Impact Level [3] (µg/m³)	Class II Increment (µg/m³)
NO_2	Annual	8.0	1.0	25
$PM_{2.5}$ [2]	Annual	1.2	0.2	4
	24-hour	3.6	1.2	9
PM_{10}	Annual	10.6	0.2	17
	24 hours	22.3	1	30
SO_2	Annual	0.8	1	20
	24 hours	1.9	5	91
	3 hours	3.5	25	512

Table Source: Air Sciences 2018b; EPA 2018

Table Notes:

1 Design Value Rank For any period other than an annual period, the applicable maximum allowable increase may be exceeded during one such period per year at any one location.

2 Includes secondary, condensable $PM_{2.5}$ impacts. The annual SIL was revised as described in EPA Guidance issued in April 2018 (EPA 2018).

3 These results show that, except for SO_2, the near-field modeled maximum concentrations are above the Significant Impact Levels, which would be relevant if SGP were a major source.

µg/m³ = micrograms per cubic meter.

NO_2 = Nitrogen dioxide.

SO_2 = Sulfur dioxide.

PM_{10} = Particulate matter less than 10-micron diameter. $PM_{2.5}$ = Particulate matter less than 2.5-micron diameter.

4.3.2.1.2.3 Ozone and Secondary $PM_{2.5}$ Impact Assessment

To evaluate ozone impacts from VOC and NO_X precursor emissions, a Tier 1 assessment as described in Section 4.3.1.3.2 was performed based on the Alternative 1 EIS emissions inventory for LOM year 7, the year of highest projected mine production. For that inventory, the facility-wide potential ozone precursor emissions were estimated in that inventory to be 364 tpy of NO_X and 23.7 tpy of VOCs. This assessment used the non-regulatory emissions inventory, therefore, mine site mobile source tailpipe emissions were included. Additional discussion regarding the ozone and secondary $PM_{2.5}$ analysis is provided in the Air Quality Analysis report (Air Sciences 2018b).

Following Tier 1 procedures, a representative industrial source as modeled by EPA was selected from the PGM roster to assess ozone impacts. This modeled source (number 18 in the PGM source roster) is geographically the closest to the mine site; 210 miles (336 km) west-northwest of the mine site, in northeastern Oregon. Given the location of number 18 downwind from the coal-fired (550 megawatts) Boardman Power Plant (17 miles (27 km) to the west-southwest), it can be expected that this PGM source would experience higher ozone concentrations than would be expected at the undeveloped SGP area. For hypothetical source 18, ozone contributions from precursor pollutant emissions of NO_X and VOCs (500 tpy each) were predicted to be 1.94 ppb and 0.46 ppb for NO_X and VOCs, respectively (Air Sciences 2018b; EPA 2019b).

On this basis, the corresponding ozone impact due to Alternative 1 sources was estimated by linearly scaling the source number 18 ozone impact by the relative precursor emission rates of the PGM source and Alternative 1. The result is provided in **Table 4.3-8**. This table also shows the baseline ozone concentration (refer to **Table 4.3-1**); the estimated total concentration for the highest modeled receptor. This analysis shows that the maximum modeled contribution to ozone levels are a small fraction of the existing baseline conditions.

Table 4.3-8 Maximum 8-hour Ozone Impact - Alternative 1 EIS Inventory and Modeling

Pollutant	Averaging Time	Maximum Concentration	Baseline Concentration	Total Concentration
Ozone	8 hours	1.4 ppb	60.0 ppb	61.4 ppb
Ozone	8 hours	0.003 $\mu g/m^3$	0.129 $\mu g/m^3$	0.131 $\mu g/m^3$

Table Source: Air Sciences 2018b

Table Notes:

ppb = parts per billion air concentration.

$\mu g/m^3$ = micrograms per cubic meter.

To evaluate secondary $PM_{2.5}$ impacts resulting from emissions of secondary $PM_{2.5}$ precursor emissions, a Tier 1 assessment was performed based on the Alternative 1 EIS emissions inventory prepared for the non-regulatory analysis. For this inventory, the maximum facility-wide potential emissions of secondary $PM_{2.5}$ precursor emissions would be 364 tpy of NO_X and 6.6 tpy of SO_2. This assessment used the same EPA- modeled hypothetical industrial source (number 18 in northern Oregon) for $PM_{2.5}$ precursor emissions and corresponding $PM_{2.5}$ maximum impacts.

Results of the analysis of primary and secondary $PM_{2.5}$ impacts are shown in **Table 4.3-9**. The PGM industrial source results provided both the primary (as emitted) $PM_{2.5}$ impacts and secondary $PM_{2.5}$ impacts that were scaled to represent Alternative 1 sources. For this analysis, the concentrations of both forms of $PM_{2.5}$ were added together and combined with the baseline $PM_{2.5}$ concentration. This comparison indicates that predicted primary and secondary $PM_{2.5}$ impacts from Alternative 1 would be about one-third or less of existing background conditions.

Table 4.3-9 Primary and Secondary $PM_{2.5}$ Impact - Alternative 1 EIS Inventory and Modeling

Pollutant	Averaging Time	Max. Primary $PM_{2.5}$ Concentration (µg/m³)	Max. Secondarily-Formed $PM_{2.5}$ Concentration (µg/m³)	Baseline Concentration (µg/m³)	Total $PM_{2.5}$ Impact (µg/m³)
Total $PM_{2.5}$	Annual	1.2	0.01	3.5	4.7
Total $PM_{2.5}$	24 hours	3.1	0.15	15.0	18.1

Table Source: Air Sciences 2018b

Table Notes:

µg/m³ = micrograms per cubic meter.

$PM_{2.5}$ = Particulate matter less than 2.5-micron diameter.

4.3.2.1.2.4 Class II Wilderness Area Plume Visibility Screening Results

Plume visibility modeling is a means of quantifying the ability of a viewer to discern a visible plume from a source and is usually evaluated for an observer at the closest point on the boundary of an area of concern. The model used in this case, VISCREEN, outputs a comparison of two calculated plume parameters to determine the possibility of plume perceptibility by an observer using thresholds based on human visual perception (EPA 1992). The two parameters are C and ΔE. Contrast is a measure of the difference in the light intensity without regard for color. Color contrast measures the difference in wavelength of light rather than intensity.

Applying the Level 2 screening approach as described in Section 4.3.1.3.3, VISCREEN results for both C and ΔE were evaluated for a modeled plume against a backdrop of sky or terrain, and at two solar angles (θ) of 10 degrees and 140 degrees. These solar angles generally correspond to a low angle at dawn and dusk, and a high angle that represents mid-day. A result that exceeds the threshold for either C or ΔE indicates that a plume would be visible. The VISCREEN analysis used the Alternative 1 EIS inventory that did not include the sources associated with on-site lime generation but did include mobile source dust and tailpipe fugitive emissions (Air Sciences 2019).

EPA's guidance for using the VISCREEN model for PSD Class I analyses is intended to provide a conservative, worst-case screening model for plume visibility impacts (EPA 1992). Following EPA's VISCREEN guidance, both daytime (6 a.m. to 6 p.m.) and nighttime (6 p.m. to 6 a.m.) are included in this analysis. Therefore, during the summer, the nighttime hours would include some hours when sunlight illuminates any plume and, conversely, during the shorter wintertime daylight hours, some hours analyzed as daytime would occur after the sun has set.

A summary of the VISCREEN results is provided in **Table 4.3-10** for daytime and nighttime hours, and for combinations of terrain or sky background and two solar angles (Forest Service 2019). These results show the frequency of visible plumes expressed as the highest percentage of time a plume could be visible for a given combination of viewing background and solar angle. The potential for a plume being visible to an observer at the FCRNRW is determined by comparing the modeled result for either C or ΔE to the appropriate perception screening threshold calculated by VISCREEN for each modeled hour during a year. A plume is deemed to be visible during each hour when modeled values of either C or ΔE would exceed the perception thresholds.

The Level 2 screening analysis performed for Alternative 1 addressed an observer at the FCRNRW and demonstrates that the aggregated emissions from Alternative 1 sources have the potential to cause visible plumes. Specific model assumptions could increase the frequency or magnitude of the modeled impacts, and VISCREEN is viewed as an inherently conservative model. When EPA's guidance is followed, actual impacts are usually presumed to be lower than those predicted by Level 2 VISCREEN. Given these considerations, the results provided in **Table 4.3-10** represent a screening-level indication that plume visibility impacts in the FCRNRW are likely, but there is uncertainty around the frequency and magnitude of those impacts. Frequency results for modeled combinations of background and solar angle are displayed for the percent of hours with valid meteorology over the screening criteria.

Table 4.3-10 Frequency of Modeled Visible Plumes - Screening Results for FCRNRW: Percent of Time when Perceptibility Threshold is Exceeded

Plume Parameter	Background	% Day Hours[3]: 10 Degrees[1]	% Night Hours[3]: 10 Degrees	% Day Hours[3]: 140 Degrees [2]	% Night Hours[3]: 140 Degrees
Plume Contrast (C)	Terrain	17.3	63.9	2.8	8.6
Color Contrast (ΔE)	Terrain	30.4	73.3	4.7	38.3
Plume Contrast (C)	Sky	20.1	67.2	8.0	58.9
Color Contrast (ΔE)	Sky	21.5	68.3	7.2	58.7

Table Source: (Forest Service 2019) based on Level 2 VISCREEN modeling (Air Sciences 2019)

Table Notes:

1 The 10-degree solar angle reflects conditions after sunrise (day), and before sunset (night).

2 The 140-degree solar angle reflects mid-day conditions.

C = modeled plume parameter that quantifies overall contrast or light impeded by a plume.

ΔE = modeled plume parameter that reflects the color difference or contrast with viewing background.

Results tabulated combine the stability classes and wind speed conditions that exhibit plume parameters above perception thresholds. Stability classes are not adjusted for elevation difference.

Results characterizing the magnitude of visible plume impacts are provided for combinations of viewing background and solar angle in **Table 4.3-11**. These results are expressed as the ratio of the maximum impact results to the perceptibility screening threshold. Higher ratios indicate that a plume would be more distinctly visible, and the highest values of this ratio are generally shown to occur during periods of very low wind (speed one mile per hour or less). Additional details regarding the plume visibility modeling method and results are provided in the supplement to the Air Quality Analysis report (Air Sciences 2019).

Table 4.3-11 Magnitude of Modeled Visible Plumes - Screening Results for FCRNRW: Ratio of Maximum Impact to Perceptibility Threshold

Plume Parameter	Background	Day (10 degrees)	Night (10 degrees)	Day (140 degrees)	Night (140 degrees)
Plume Contrast (C)	Terrain	9.0	12.6	1.6	1.8
Color Contrast (ΔE)	Terrain	23.6	29.3	2.2	4.5
Plume Contrast (C)	Sky	22.4	34.2	2.2	3.8
Color Contrast (ΔE)	Sky	21.1	26.5	4.9	6.9

Table Source: (Forest Service 2019) based on Level 2 VISCREEN modeling (Air Sciences 2019)

Table Notes:

1 The 10-degree solar angle reflects conditions after sunrise (day), and before sunset (night).

2 The 140-degree solar angle reflects mid-day conditions.

C = modeled plume parameter that quantifies overall contrast or light impeded by a plume.

ΔE = modeled plume parameter that reflects the color difference or contrast with viewing background.

Results tabulated combine the stability classes and wind speed conditions that exhibit plume parameters above perception thresholds. Stability classes are not adjusted for elevation difference.

Although sunlight would not be present during most of the year, it is noted that plume visibility is predicted for 63 to 73 percent of modeled “nighttime” hours (6:00 p.m. to 6:00 a.m.) due to the prevalence of relatively stable atmospheric conditions, characterized by lower wind speeds. For daytime conditions, a visible plume is predicted for up to 30 percent of annual daytime hours, with much greater potential for visible plumes at times of low sun angle. More hours of visible plume also would occur with terrain as the viewing background, compared to sky background.

4.3.2.1.2.5 Mercury Deposition Screening Results

Hg emissions can occur from both mining operations and ore processing, as a consequence of the processing methods used, and the naturally occurring Hg content of the ore and overburden material. This section describes the predicted Hg deposition flux rates in the near-field modeled area surrounding the mine site. The analysis combines the impacts of both existing background sources and the SGP sources.

As described in Section 4.3.1.3.4, one tool that describes the background effects for Hg deposition is the REMSAD. This model has been implemented by the EPA across the continental 48 states to quantify Hg deposition on a regional basis. The inventory information for this model was gathered between the years 2000 and 2006; therefore, it is likely higher than current emissions levels due to regulatory controls on Hg emissions (e.g., on coal-fired power plants) implemented since 2006, and the trend to replace coal-fired generation with gas-fired units. The sources of Hg deposition used in the EPA REMSAD modeling analysis included sources in the U.S., Mexico, and Canada; and contributions from global background deposition from Chemical Transport Model, the Global/Regional Atmospheric Heavy Metals model, and the GEOS-Chem model (EPA 2008).

The EPA REMSAD model was used to estimate the background Hg deposition in the SGP area, and three immediately surrounding hydrographic "sub-basins" that extend approximately 20 to 50 miles (32 to 80 km) from the mine site. Results of the REMSAD include both wet and dry deposition mechanisms. As listed in **Table 4.3-12**, total annual Hg deposition flux rate in the three hydrographic sub-basins ranges from 12.7 to 13.9 grams per square km per year (g/km^2-yr).

An AERMOD screening assessment included the point and fugitive Hg emissions that are in the form of elemental, Hg_2, and HgP. Gaseous Hg emission sources are controlled by activated carbon absorbers. Some of the HgP emissions would be converted by combustion to Hg0 particles, which are controlled by filters and a wet scrubber (Midas Gold 2016). A source of bias in the analysis is the use of this screening level modeling approach that does not account for recent findings showing the importance of Hg0 deposition to plants, and this flux being the largest point of entry for atmospheric Hg into terrestrial environments. Taking these factors into account suggests that total Hg deposition predicted by the model is likely biased low.

The results of the AERMOD screen modeling of Hg deposition based on the Alternative 1 EIS inventory are listed in **Table 4.3-12**. This analysis indicates a maximum estimated increase in Hg deposition rate of 18.6 percent or less of the existing background rate. However, it should be recognized that this rate underestimates the total Hg deposition, as the mechanism of Hg0 flux is not included in the screening model.

The range of increased deposition is less than 5 miles (8 km) from the mine site, covering the area generally east of the SGP Operations Area Boundary. Outside of this area, Hg deposition contribution due to Alternative 1 sources is estimated to be less than the minimum value that can be quantified by AERMOD. Additional details and mapping of the Hg deposition rates from REMSAD and the AERMOD analysis are provided in the Air Quality Analysis report (Air Sciences 2018b).

Table 4.3-12 SGP Contribution Above Estimated Hg Background using Alternative 1 EIS Inventory and Modeling

Hydrographic Sub-basin	REMSAD Background (g/km^2-yr)	AERMOD Screen Results[1] (g/km^2-yr)	Alternative 1 Contribution to Existing Background
Within SGP area and the sub-basin east of the mine site	13.9	2.58	18.6%
Sub-basin northeast of the mine site	13.6	0	0.00%
Sub-basin southeast of the mine site	12.7	0	0.00%

Table Source: Air Sciences 2018b; EPA 2008

Table Notes:

1 Modeled maximum result is at the SGP Operations Area Boundary; screening results show close to zero deposition at any location beyond 5 miles from the mine site.

g/km^2-yr = grams per square kilometer per year.

4.3.2.1.2.6 Nitrogen/Sulfur Deposition Screening Analysis Results

A screening analysis using the AERMOD dispersion model was performed following the approach described in Section 4.3.1.3.5 to predict the near- field deposition of nitrogen and sulfur species from NO_X and SO_2 precursor emissions as estimated in the Alternative 1 EIS inventory. Although AERMOD is not designed to simulate several natural processes that affect chemical deposition (e.g., atmospheric chemical transformations to acid compounds), it was used in this case as a conservative screening tool. As described in Section 4.3.1.4, this screening analysis was conducted using the Level 2 procedures prescribed in the draft interagency near-field deposition modeling guidance (NPS 2011). The Level 2 analysis assumes that 100 percent of Alternative 1 emissions of NO_X would be completely transformed into NO_2, and then HNO_3 on release to the atmosphere. This assumed extent of conversion is expected to result in a conservative over-estimation of nitrogen deposition.

The NO_2 dry deposition flux estimated by AERMOD was converted to the potentially absorbed nitrogen at the surface by multiplying the predicted NO_2 flux by the ratio of nitrogen to NO_2 molecular weights (equals 0.304). Similarly, the SO_2 dry deposition flux estimated by AERMOD was converted to sulfur by multiplying with the ratio of sulfur to SO_2 molecular weights (equals 0.5). For purposes of this analysis, deposition of SO_2 was converted to the equivalent amount of SO_4.

The resulting range of predicted screening-level nitrogen and sulfur deposition rates at the mine site Operations Area Boundary and at receptors approximately 10 km beyond that boundary are listed in **Table 4.3-13** in units of grams per square meter per year.

Table 4.3-13 Summary of Predicted Near-Field Nitrogen and Sulfur Deposition Rates due to Alternative 1 Sources

Chemical Element	Receptor Locations	Deposition Flux Rate (g/m^2-yr)
Nitrogen (N)	Mine Site Boundary	0.00077 – 0.0037
Nitrogen (N)	10 km from Boundary	0.00011 – 0.0037
Sulfur (S)	Mine Site Boundary	0.00001 – 0.0035
Sulfur (S)	10 km from Boundary	0 – 0.0002

Table Source: Air Sciences 2018b

Table Notes:

g/m^2-yr = grams per square meter per year.

km = kilometers.

4.3.2.1.3 Direct And Indirect Effects – Far-Field Analysis

The far-field analysis for regional haze contributions, increment, and chemical deposition was performed for four selected Class I areas: SAWT, SELW, HECA, and CRMO. In addition, four Class II wilderness areas were evaluated in the same manner: FCRNRW (beyond 50 km), GOSPEL, HEMBLD, and the WHTCLD. The nearby Nez Perce Requested Analysis Area also was included in this analysis. For Alternative 1, the far-field analyses described in this section are based on the Alternative 1 EIS inventory for criteria pollutant emissions.

4.3.2.1.3.1 Far-Field Evaluation of Regional Haze Impacts

The methodology for the analysis of the impairment of atmospheric clarity, or regional haze, is described in Section 4.3.1.4. For this analysis, maximum 24-hour Alternative 1 source emissions of SO_2, NO_X, SO_4, and fine and coarse PM were modeled using CALPUFF for the roster of Class I and Class II wilderness areas of interest. To account for atmospheric chemistry, the MESOPUFF II five-pollutant (SO_2, SO_4, NO_X, HNO_3, nitrate) conversion scheme was used. The POSTUTIL routine in CALPUFF was used to calculate concentrations of these chemical species that can act as haze precursors (Federal Land Managers' Air Quality Related Value Work Group [FLAG] 2010).

As described in Section 4.3.1.4, the CALPUFF-ready wind field was evaluated against 15 regional station observational data benchmarks for a span of 3 calendar years (2015 to 2017) using the MMIFStat statistics program. MMIFStat compiles statistics for air temperature, relative humidity, wind speed, and direction. Because much of the modeling domain is in mountainous terrain the "complex conditions" benchmarks were applied to evaluate whether the CALPUFF datasets were acceptable. These evaluations demonstrated that the meteorological data sets generally met acceptance benchmarks that have been commonly reported for mesoscale model evaluation for air quality modeling (Air Sciences 2018b).

The Class I and Class II wilderness area visibility analysis results are presented in **Tables 4.3-14** and **4.3-15**, respectively. These results show the modeled 98th percentile highest daily change in extinction parameters in each analyzed area. The net predicted reduction in atmospheric visibility is less than the 5 percent change in extinction threshold that is considered the significance criteria for Class I areas (FLAG 2010). Using the same stringent Class I criteria for the Class II wilderness areas included in this analysis demonstrates that the level of regional haze impact in these areas is predicted to be minor.

Table 4.3-14 Predicted Regional Haze Contributions in Class I Areas due to Alternative 1 Sources

Class I Area	98th Percentile 2015	98th Percentile 2016	98th Percentile 2017	Maximum 98th Percentile	Class I Extinction Threshold	Below Threshold (Yes/No)
CRMO	0.15%	0.07%	0.09%	0.15%	5%	Yes
HECA	0.33%	0.24%	0.61%	0.61%	5%	Yes
SAWT	0.54%	0.36%	0.46%	0.54%	5%	Yes
SELW	1.29%	1.12%	1.43%	1.43%	5%	Yes

Table Source: Air Sciences 2018b; FLAG 2010

Table Notes:

CRMO – Craters of the Moon National Monument.

HECA – Hells Canyon Wilderness.

SAWT – Sawtooth Wilderness.

SELW – Selway-Bitterroot Wilderness.

Table 4.3-15 Predicted Regional Haze Contributions in Class II Areas due to Alternative 1 Sources

Class II Area	98th Percentile 2015	98th Percentile 2016	98th Percentile 2017	Maximum 98th Percentile
HEMBLD	0.27%	0.17%	0.22%	0.27%
GOSPEL	0.77%	0.95%	2.08%	2.08%
NPRAA	1.87%	1.50%	2.63%	2.63%
FCRNRW	3.54%	4.73%	4.70%	4.73%
WHTCLD	0.39%	0.26%	0.34%	0.39%

Table Source: Air Sciences 2018b; FLAG 2010

Table Notes:

HEMBLD = Hemingway-Boulders Wilderness.

GOSPEL = Gospel-Hump Wilderness.

NPRAA = Nez Perce Requested Analysis Area.

FCRNRW = Frank Church-River of No Return Wilderness, area beyond 50 km from SGP Operations Area Boundary

WHTCLD = Cecil D. Andrus-White Cloud Wilderness.

4.3.2.1.3.2 Far-Field Class I and Class II Increment Comparison

Modeled maximum far-field concentrations of pollutants from the non-regulatory analysis for Alternative 2 were compared to the Class I SILs and increments for the Sawtooth, Selway-Bitterroot, Hells Canyon, and Craters of the Moon Class I areas. Similarly, maximum modeled concentrations of relevant pollutants in the Class II wilderness areas that were included in the far-field study were compared to the Class II SILs and increments. The results for the increment comparison for Alternative 2 are shown in Section 4.3.2.2.4. These results would be a conservative representation of the increment comparison for Alternative 1. Given the lower criteria pollutant emissions levels in Alternative 1, due to the absence of the lime kiln, the predicted ambient concentrations would be even lower.

4.3.2.1.3.3 Atmospheric Deposition Analysis in Class I and Class II Wilderness Areas

Total potential annual N and S deposition from Alternative 1 sources was determined through the same model, CALPUFF, used to assess regional haze effects. The total potential N and S deposition were assumed to be composed only of the N or S component of the different compounds included in the model. Both dry and wet deposition modes were considered. The maximum pollutant emission rates for the Alternative 1 EIS inventory were applied to modeling for three meteorological data years, 2015 through 2017.

Predicted deposition impacts, in grams of pollutant per hectare per year, were compared to the DAT as outlined in the 2011 interagency guidance on N and S deposition as an indicator of significance (NPS 2011). The DAT for N and S in the Class I area are listed as 5 grams per hectare per year (g/ha-yr).

For the three modeled years of 2015 through 2017, the maximum predicted annual deposition rates were below the DAT in each Class I and Class II area evaluated. The estimated maximum N and S deposition in g/ha-yr for the Class I areas evaluated for this analysis are provided in **Tables 4.3-16** and **4.3-17**. Predicted deposition rate in SELW is the highest, with N deposition rate of 1.13 g/ha-yr at the highest receptor location. This is well below the DAT of 5 g/ha-yr and indicates that deposition impacts from the SGP in Class I areas would likely be undetectable

Table 4.3-16 Summary of Predicted Nitrogen Deposition Rates in Class I Areas due to Alternative 1 Sources

Class I Area	Max. Receptor N Deposition Rate 2015 (g/ha-yr)	Max. Receptor N Deposition Rate 2016 (g/ha-/yr)	Max. Receptor N Deposition Rate 2017 (g/ha-yr)	3-Year Maximum N Deposition Rate (g/ha-yr)	Class I DAT (g/ha-yr)	Below Threshold (Yes/No)
CRMO	0.06	0.11	0.11	0.11	5	Yes
HECA	0.21	0.13	0.09	0.21	5	Yes
SAWT	0.44	0.44	0.48	0.48	5	Yes
SELW	1.00	0.99	1.13	1.13	5	Yes

Table Source: Air Sciences 2018b; NPS 2011

Table Notes:

g/ha-yr = grams per hectare per year.

DAT = Deposition Analysis Threshold.

CRMO = Craters of the Moon National Monument.

HECA = Hells Canyon Wilderness.

SAWT = Sawtooth Wilderness.

SELW = Selway-Bitterroot Wilderness.

Table 4.3-17 Summary of Predicted Sulfur Deposition Rates in Class I Areas due to Alternative 1 Sources

Class I Area	Max. Receptor S Deposition Rate 2015 (g/ha-yr)	Max. Receptor S Deposition Rate 2016 (g/ha-yr)	Max. Receptor S Deposition Rate 2017 (g/ha-yr)	3-Year Maximum S Deposition Rate (g/ha-yr)	Class I DAT (g/ha-yr)	Below Threshold (Yes/No)
CRMO	0.01	0.01	0.01	0.01	5%	Yes
HECA	0.03	0.01	0.01	0.03	5%	Yes
SAWT	0.05	0.05	0.05	0.05	5%	Yes
SELW	0.12	0.11	0.13	0.13	5%	Yes

Table Source: Air Sciences 2018b; NPS 2011

Table Notes:

g/ha-yr = grams per hectare per year.

DAT = Deposition Analysis Threshold.

CRMO = Craters of the Moon National Monument.

HECA = Hells Canyon Wilderness.

SAWT = Sawtooth Wilderness.

SELW = Selway-Bitterroot Wilderness.

Similarly, the estimated maximum N and S deposition in g/ha-yr for the four Class II areas and closest Tribal lands evaluated for this analysis are provided in **Tables 4.3-18** and **4.3-19**.

Predicted deposition rate in FCRNRW is the highest, with N deposition rate of 4.41 g/ha-yr at the highest receptor location. This reflects the position of the FCRNRW as the closest area of concern, essentially adjacent to the SGP area. Despite the proximity to the mine site, the highest deposition rate contribution is still predicted to be below the protective Class I DAT of 5 g/ha-yr.

Table 4.3-18 Summary of Predicted Nitrogen Deposition Rates in Class II Wilderness Areas and Nez Perce Requested Analysis Area

Class II Wilderness Area	Max. Receptor N Deposition Rate 2015 (g/ha-yr)	Max. Receptor N Deposition Rate 2016 (g/ha-yr)	Max. Receptor N Deposition Rate 2017 (g/ha-yr)	3-Year Maximum N Deposition Rate (g/ha-yr)
HEMBLD	0.25	0.19	0.18	0.25
GOSPEL	0.98	0.90	0.81	0.98
NPRAA	1.35	1.07	1.00	1.35
FCRNRW	3.20	3.20	4.41	4.41
WHTCLD	0.40	0.53	0.33	0.53

Table Source: Air Sciences 2018b; NPS 2011

Table Notes:

g/ha-yr = grams per hectare per year.

DAT = Deposition Analysis Threshold.

HEMBLD = Hemingway-Boulders Wilderness.

GOSPEL = Gospel-Hump Wilderness.

NPRAA = Nez Perce Requested Analysis Area.

FCRNRW = Frank Church-River of No Return Wilderness.

WHTCLD = Cecil D. Andrus-White Cloud Wilderness.

Table 4.3-19 Summary of Predicted Sulfur Deposition Rates in Class II Wilderness Areas and Nez Perce Requested Analysis Area

Class II Wilderness Area	Max. Receptor S Deposition Rate 2015 (g/ha-yr)	Max. Receptor S Deposition Rate 2016 (g/ha-yr)	Max. Receptor S Deposition Rate 2017 (g/ha-yr)	3-Year Maximum S Deposition Rate (g/ha-yr)
HEMBLD	0.03	0.02	0.02	0.03
GOSPEL	0.10	0.08	0.07	0.10
NPRAA	0.14	0.09	0.07	0.14
FCRNRW	0.40	0.39	0.61	0.61
WHTCLD	0.04	0.06	0.04	0.06

Table Source: Air Sciences 2018b; NPS 2011

Table Notes:

g/ha-yr = grams per hectare per year.

DAT = Deposition Analysis Threshold.

HEMBLD = Hemingway-Boulders Wilderness.

GOSPEL = Gospel-Hump Wilderness.

NPRAA = Nez Perce Requested Analysis Area.

FCRNRW = Frank Church-River of No Return Wilderness.

WHTCLD = Cecil D. Andrus-White Cloud Wilderness.

4.3.2.2 Alternative 2

Under Alternative 2, several changes to material handling and storage facilities would potentially affect air quality. The West End DRSF would be eliminated, which would remove several fugitive sources of air emissions but also may redistribute fugitive emissions to other areas of the mine site. Approximately 25 million tons of development rock scheduled to be placed in the West End DRSF under Alternative 1 would be redistributed primarily to the Hangar Flats pit and the Midnight pit (labeled the West End pit in other action alternatives), but a minor amount (1 million tons of limestone development rock) would go to lime generation plant that also is included in this alternative. The redistribution of waste rock and lime generation plant operation included in Alternative 2 would primarily take place during LOM years after initial construction, including the LOM year 7 that was modeled to assess Alternative 1 air impacts.

This alternative includes an additional on-site process to produce lime using crushed limestone development rock extracted from the West End pit. For the SGP processes, lime would be used in several of the ore processing circuits, including grinding, flotation, pressure oxidation, leaching, and tailings neutralization. For Alternative 2, there would be no need to haul lime in from offsite unless the lime plant is off-line for an extended period. This change would make unnecessary approximately 2,900 annual lime delivery trips, with related reduction in emissions from mobile sources. Mining limestone from the West End pit would begin during the last year of mine construction and continue through LOM year 15.

An on-site, Centralized Water Treatment Plant (WTP) would be included in the SGP only under Alternative 2, to be located generally on the northern portion of the processing area. This facility would operate in perpetuity, during mine operations and after mine closure.

For Alternative 2, a controlled access road through the mine site would be provided to serve as a connection between McCall-Stibnite Road (CR 50-413) to Thunder Mountain Road (National Forest System Road [FR] 50375). As proposed, the controlled access road would allow visitor access through the SGP Operations Area Boundary between Stibnite Road, at Sugar Creek; and Thunder Mountain Road, at Meadow Creek. This also would allow access to the Thunder Mountain recreation area from the village of Yellow Pine. Signage and security checkpoints would alert the visitors to mine access requirements. Vehicles arriving to take the route through the mine would be required to check in and out at the checkpoints, to not stop or loiter while traversing the operations area, and would be restricted by signage, fencing, berms and/or gates to restrict travel to the designated route. By these procedures the visitors would be considered “guests of the mine” and therefore the route would be excluded from the designation of ambient air and not be subject to NAAQS.

In the same manner as for Alternative 1, mitigation measures for air pollutant emissions would be incorporated at each step of the mining and processing operations. Several air pollution mitigation measures that were proposed by Midas Gold (2016), are common to all alternatives, and are described in Section 4.3.3.1. For this alternative, as in Alternative 1, emission control devices and designs would be put in place to abate emissions of particulate matter, Hg, and criteria pollutant emissions from internal-combustion engines. Assessments of near-field and far-field impacts for Alternative 2 take these measures into consideration by applying emission factors for limestone mining and the lime generation process, which include emission controls. Changes in net tailpipe emissions due to reduced lime deliveries by off-highway vehicles and limestone mining equipment also are considered in Alternative 2, using the same estimation techniques as under Alternative 1.

The SGP facilities would be designed, constructed, and operated with appropriate air pollution controls to comply with applicable regulations, and any air quality permits issued by IDEQ. The PTC would include stipulations that are based on applicable state and federal regulations, and that are consistent with best available control technology for new surface mining and processing operations. Key examples of these controls are described for the emission inventory under Alternative 1 in Section 4.3.2.1.1. Additional details on the control measures and estimated control effectiveness are provided in the Alternative 2 EIS emission inventory presented in the second half of **Appendix F-1**. Similar information for the Alternative 2 NSR emission inventory are provided in **Appendix F-2.**

4.3.2.2.1 Construction

The Midnight pit would be backfilled with approximately 6 million tons of development rock from the former West End pit. Like Alternative 1, pit backfilling would occur by end-dumping from several locations around the pit, including highwall edges; direct placement in the bottom of the pit also would occur. The Midnight pit backfill would be covered with 1 foot of growth media from the Midnight growth media stockpile and revegetated; which, over the long term, would tend to reduce fugitive dust emissions. The air emissions from these construction operations would be comparable in magnitude to the distribution of development rock to disposal facilities described under Alternative 1. Shifting the location of these emissions could influence the location and magnitude of off-site pollutant concentrations. However, the evaluation of high production year emissions and impacts for Alternative 1 is sufficiently conservative that relocation of this source would not affect the assessment.

Under Alternative 2, the Hangar Flats pit would be mined to the same bottom elevation and pit depth as Alternative 1. After mine operations in Hangar Flats pit cease, approximately 21 million tons of development rock would be used to partially backfill the Hangar Flats pit. At the end of LOM year 13, the open pit would be partially backfilled with development rock material to reduce the depth of the pit—and therefore—the depth of the pit lake. The air emissions from these construction operations would be comparable to, although in a different location than, the distribution of development rock described under Alternative 1.

The location and design of haul roads for Alternative 2 would be the same as Alternative 1, except there would be fewer miles of haul road constructed, because no haul road would be constructed to the West End DRSF. A haul road would be constructed from the West End pit to the processing facilities during construction for hauling of limestone. This haul road would be in use for the life of the mining operations. The net effect on air emissions from elimination of the West End DRSF haul roads would be a reduction in overall construction emissions for roads in the SGP area.

Access to the mine site via the Burntlog Route would be provided as described in Alternative 1, except for an approximately 5.3-mile section to be relocated in the Riordan Creek drainage. The Burntlog Route would be shortened by approximately 1.5 miles with inclusion of the Riordan Creek segment. The reduced length of the relocated road segment would likely reduce construction and operations phase air emissions for this portion of the Burntlog Route.

To generate lime from the limestone formation, the following additional equipment that constitute air emission sources would be installed in the ore processing area:

- Limestone crusher and conveyor;
- Propane-fired kiln with the capacity to process approximately 200 tpd;
- Kiln combustion air system including preheat heat exchanger;
- Roll crusher for kiln product discharge;
- Six conveyors moving feed and product materials;
- Off-gas particulate filter for kiln discharge;
- 500-ton storage bin for kiln feed material; and
- 1,000 to 11,000-ton storage bin for lime products.

For Alternative 2, controlled visitor vehicle access through the mine site would be provided by constructing a 12-foot-wide, gravel roadway to connect McCall-Stibnite Road (CR 50-413) to Thunder Mountain Road (FR 50375). The controlled access road would be constructed during the first year of mine operation (LOM Year 3). During this period, construction related fugitive emissions (vehicle tailpipe and dust) would increase near the roadway due to the earthmoving activities to construct the road. However, the total roadway area is small compared to the scope of earthmoving operations throughout the mine site. The separate controlled access roadway would be isolated from SGP vehicle traffic; constructed on a separate right-of-way (ROW) with bridges as needed to pass over the operating plant roads.

4.3.2.2.2 Operations Phase – On-Site Lime Generation and Water Treatment Plant

4.3.2.2.2.1 Process Effects on Pollutant Emissions

Under Alternative 2, lime and crushed limestone would be produced on site, supplied by a carbonate (marble) resource in the West End pit. The on-site lime plant would be the source for all the lime required during most of the LOM and would result in some air emissions increases at the mine site during that timeframe. Under the other action alternatives, lime usage requires approximately 2,900 deliveries annually (Midas Gold 2016). This alternative would replace lime delivery by truck with the generation of lime on site and avoid the air emissions resulting from those delivery trips. Approximately 130 additional delivery trips per year are anticipated under this alternative, to fuel the lime kiln.

Mining limestone to produce lime from the West End pit would begin during the last year of construction and continue through LOM Year 15. The tonnage of on-site limestone required to generate lime and crushed limestone would be up to a maximum (during LOM Year 7) of approximately 83,000 tpy (equates to an average of 267 tpd).

The limestone to be processed in the on-site lime kiln would be part of the existing development rock generated through mining operations; therefore, this alternative does not otherwise affect the mining production and operations as described under Alternative 1.The only facilities that the lime generating operation would share with the rest of the ore processing plant would be the run-of- mine stockpile area. Both ore and limestone would be temporarily stored at the run-of-mine stockpile, with minimal effect on net air emissions. Exhaust gases from the kiln would pass through a filter to abate particulate emissions. The limestone crusher, screens, conveyors, and feed bins would not be enclosed, and so contribute to processing emissions.

Operation of the on-site WTP would be included only in Alternative 2. This facility would operate in perpetuity, during mine operations and after mine closure. The WTP process would use inorganic chemicals (with the exception of a relatively small amount of organic flocculant) that in aqueous form would not be air pollutants, so the operation of the WTP itself would have negligible air quality effects. Added air emissions related to the WTP would occur due to additional truck traffic along the Yellow Pine Route for chemical deliveries and for the daily travel of the 2 to 4 employees that would operate the WTP. However, added vehicle travel due to the WTP would represent a small portion of the total travel related to the SGP. It is estimated there would be 40 additional truck trips annually for chemical delivery, and several additional bulk material truck trips per week to remove approximately 2 tpd of residual solids generated by water treatment. After closure of the mine, WTP deliveries and related truck travel would be about half of that during mining operations.

4.3.2.2.2.2 Alternative 2 Emission Inventories

Assessment of air quality effects due to Alternative 2 relied on two emissions inventories. One inventory compiled for Alternative 2 sources was used for assessment of non-regulatory ambient impacts other than NAAQS. This emission inventory, termed the Alternative 2 EIS inventory, reflected a representative distribution of mining activities for the year of maximum estimated mine throughput (Air Sciences 2018b). The Alternative 2 EIS inventory accounted for the increased process emissions due added material handling, crushing, and screening operations; additional on-site off-roadway truck operation; and combustion emissions from the lime kiln. This inventory also accounted for the net change in emissions due to elimination of lime deliveries to SGP, in combination with increased propane deliveries to fuel the lime kiln. The details of the Alternative 2 EIS inventory are provided in the second half of **Appendix F-1**.

A second Alternative 2 inventory was developed to support the IDEQ NSR process, and in particular to assess compliance with the NAAQS (Air Sciences 2020). This Alternative 2 NSR inventory included the stationary process source emissions due to operation of the lime generation process. However, the Alternative 2 NSR inventory did not include vehicle tailpipe emissions, which are not considered for stationary source NSR permitting. The Alternative 2 NSR inventory incorporated, at the direction of IDEQ, a number of changes to the engineering details and operational assumptions that altered the characterization of some modeled sources, and the related emission factors for those sources. In addition, a hypothetical “worst case” mine operation scenario was adopted for this inventory that assumed a total mine output rate approximately 50 percent higher than the Alternative 1 output[4]. Further, this mining activity was assumed to be confined in only one of the proposed pits, and development rock disposal to a single disposal facility, as described in Section 4.3.1.2.3. The details of the Alternative 2 NSR inventory and the underlying operating assumptions are shown in **Appendix F-2.**

As a result of these assumptions, the Alternative 2 NSR inventory showed comparable ore processing and refining source emissions related to the operation of the lime generation process, but much higher mining fugitive emissions of PM_{10} and $PM_{2.5}$ compared to the Alternative 2 EIS inventory. The conservatism of the mining fugitive emission scenarios resulted in modeled impacts relative to PM_{10} and $PM_{2.5}$ NAAQS that reflected a worst-case condition. Consequently, these results will allow the IDEQ to ensure that actual operating conditions allowed under the PTC would result in lower impacts.

[4] The maximum LOM Year 7 mine throughput is estimated at 42.7 million tons per year. For conservative NAAQS analysis purposes, the hypothetical maximum mine throughput was analyzed at 65.7 million tons per year.

A summary of the SGP emissions from the Alternative 1 EIS inventory and the two inventories used for analysis of Alternative 2 is tabulated in **Table 4.3-20**. Several comparisons between these inventories show the effects of different assumptions and characterizations regarding the emission sources. Each inventory corresponds to 25,000 tons ore processing throughput per day, which is the maximum rate for the SGP. The Alternative 1 and Alternative 2 EIS inventories have the same mining fugitive emissions, since both are based on the same mining activity scenarios. As described above, the Alternative 2 NSR inventory has substantially higher mining fugitive emissions of particulate matter species due to the conservatively high mine throughput and hypothetical operating pattern that was assumed However, both of the Alternative 2 inventories have higher ore processing and refining emissions that correspond to the addition of the lime generation process. Also, note the Alternative 2 NSR annual emissions of NO_X, SO_2, and VOC due to mining fugitives are much lower than the Alternative 2 EIS inventory because the NSR inventory includes only blasting emissions as the sole combustion source in the mine pits, and does not consider mobile source tailpipe emissions. Lastly, the comparison table shows the annual emissions derived in each inventory are less than the major source Title V permitting thresholds.

Estimated emissions for sources of HAP and other non-criteria pollutants under Alternative 2 are provided in **Table 4.3-21** for both ore processing and mining fugitive sources as prepared for the Alternative 2 NSR inventory. The HAP emissions for Alternative 2 are somewhat higher compared to Alternative 1, due to the additional propane combustion in the lime kiln. Details of the emissions estimates for the Alternative 2 NSR inventory are provided in **Appendix F-2**.

Table 4.3-20 Comparison of Alternative 1 and Alternative 2 Emission Inventories - 25,000 Tons per Day Ore Throughput

Alternative and Inventory	CO (tpy)	NO_X (tpy)	$PM_{2.5}$ (tpy)	PM_{10} (tpy)	SO_2 (tpy)	VOC (tpy)
Alternative 1 EIS - Ore Processing and Refining[1]	13.0	21.8	28.7	37.2	5.2	4.7
Alternative 1 EIS - Mining Fugitives[1]	525	329	40.0	328	0.9	19.0
Alternative 1 EIS Total	**538**	**351**	**68.7**	**365**	**6.1**	**23.7**
Alternative 2 EIS - Ore Processing and Refining[2]	31.1	38.9	32.1	46.9	6.6	5.4
Alternative 2 EIS - Mining Fugitives[2]	525	329	40.0	328	0.9	19.0
Alternative 2 EIS Total	**586**	**368**	**72.1**	**375**	**7.5**	**24.4**
Alternative 2 NSR - Ore Processing and Refining [3]	30.5	37.9	36.4	56.3	6.5	4.8
Alternative 2 NSR - Mining Fugitives [3]	636	17.1	98.9	986	0.034	0.0
Alternative 2 NSR Total	**667**	**55.0**	**135**	**1,042**	**6.5**	**4.8**

Table Sources: [1] - Air Sciences 2018b - Appendix A, see inventory summary in Section 4.3.2.1.1; [2] - Air Sciences 2018b - Appendix B, used for non-regulatory impact analyses for Alternative 2; [3] - Air Sciences 2020, used for NAAQS analysis as part of NSR permitting by IDEQ, the mining fugitive particulate matter was not included as an explicitly modeled source, but was included in the background concentration specified by IDEQ for the locale.

Table Notes:

CO = Carbon monoxide.

NO_x = Nitrogen oxides.

SO_2 = Sulfur dioxide.

PM_{10} = Particulate matter less than 10 micron diameter.

$PM_{2.5}$ = Particulate matter less than 2.5 micron diameter.

VOC = Volatile Organic Compounds.

tpy = tons per year.

Table 4.3-21 Maximum Annual HAP and Air Toxics Emissions Summary – Alternative 2 NSR Inventory [1]

Source Category	HCN (tpy)	H_2SO_4 (tpy)	HAP (tpy)	Hg (lbs/yr)
Ore Processing and Refining	0.97	8.9	1.8	24.9
Mining Fugitive	0.0	0.0	.0004	7.1
Total	**0.97**	**8.9**	**5.3**	**32.0**

Table Source: Air Sciences 2020

Table Notes:

1 - The HAP and Air Toxics emissions conform to the accepted PTC application to IDEQ.

H_2SO_4 = sulfuric acid, mist form.

HCN = hydrogen cyanide.

HAP = Hazardous Air Pollutants.

Hg = mercury (all forms).

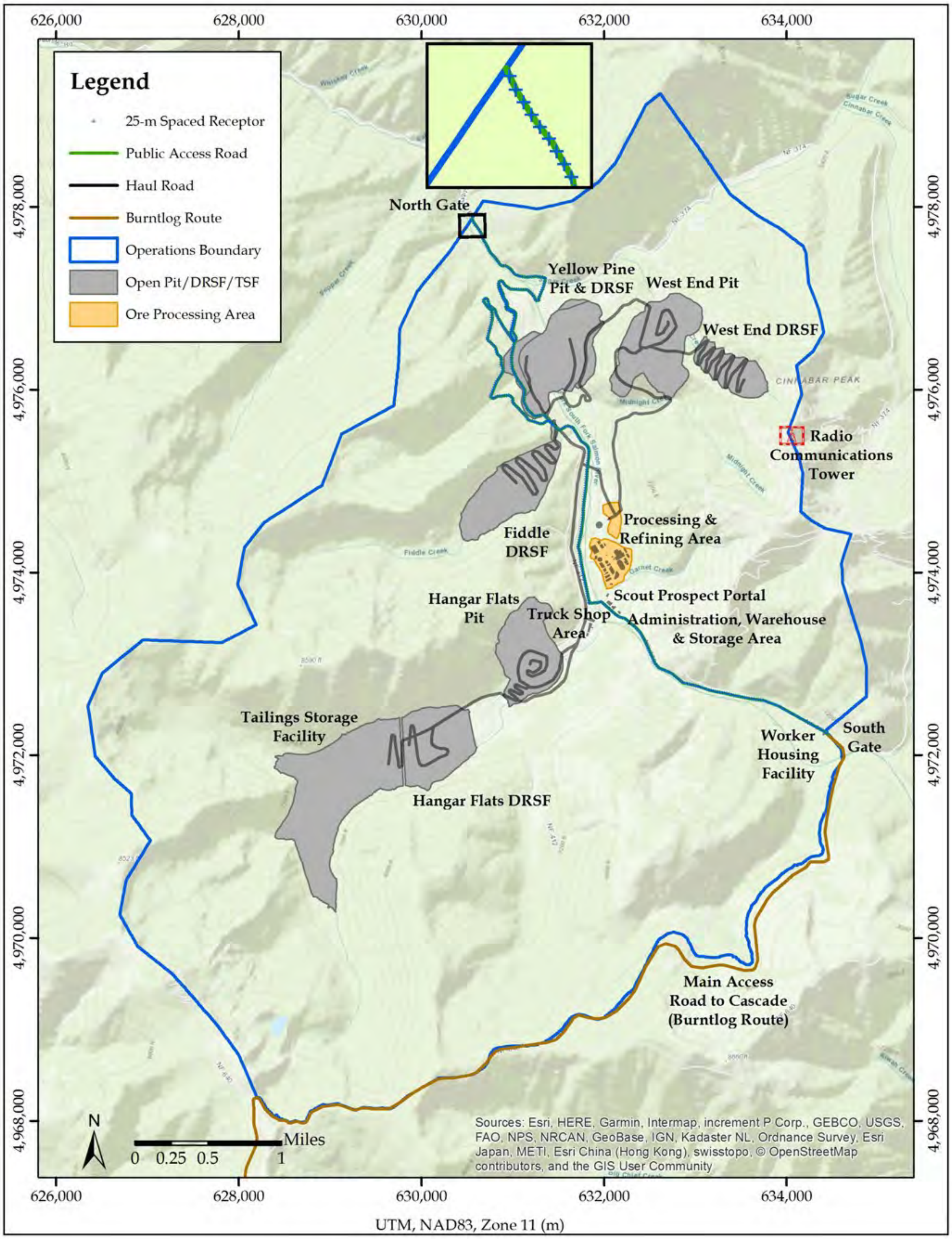
tpy. = Tons per year.

VOCs = Volatile Organic Compounds.

4.3.2.2.3 Operations Phase – Controlled Access Roadway

The controlled access road for Alternative 2 is shown in **Figure 4.3-2** as it was included in a supplemental dispersion modeling analysis for this alternative. Although the route would be hypothetically open to all vehicles year-round, the level of usage is expected to vary seasonally because the destination areas are generally inaccessible except to over-snow vehicles between December and March. Roadway dust emissions would be reduced or eliminated during the wet months and periods of snow cover. In consideration of this, the modeling of the roadway impacts was only performed for the period of April through November. In addition, the IDEQ determination that the road is not within the regulated ambient air means that NAAQS do not apply for protection of individuals using the road.

To assess possible risk due to use of the controlled access roadway, supplemental dispersion modeling for this alternative treated the path of the public access road as “ambient air.” This requires that model receptors be positioned along the route as illustrated in **Figure 4.3-2** to predict pollutant concentrations. Treatment of the access road as ambient air could be considered a conservative approach, because several measures would be in place, consistent with EPA policy regarding sufficient measures to restrict or control public access (EPA 2019a). All public traffic on the proposed road would be required to check in and out of the mine site, and therefore they could be considered guests of the mine. Public vehicles would need to be checked in at security checkpoints at either end of the route through the Operations Area Boundary. Because the roadway would be fenced off, and on a separate ROW, no public access to the mine site or other operational areas would be allowed. Taken together, these practices allowed IDEQ to determine that the controlled access roadway can be excluded from ambient air analyses.



Source: Air Sciences 2018b

Figure 4.3-2 Stibnite Controlled Access Road Receptors for AERMOD

4.3.2.2.4 DIRECT AND INDIRECT EFFECTS – NEAR-FIELD

The detailed modeling analyses of air quality impacts were based on Alternative 1 operations that would include 70,000 tpy of truck-delivered lime to the process areas via the Burntlog Route. To this set of operations, the production of lime on site was added under Alternative 2, along with the reduction in lime and limestone deliveries to the site by over 2,900 trips per year. Also, Alternative 2 modeling including the emissions from an average of 133 additional propane deliveries per year (Midas Gold 2016) in on-road delivery trucks with an 11,000-gallon capacity. As described in the Air Quality Analysis the net reduction in delivery vehicle emissions tends to offset the increase in material handling and combustion emissions due to the lime generation process. With the exception of the NAAQS analysis as described below, the air quality impacts for Alternative 2 were evaluated by a scaling method based on the relative emission rates and the modeling results for Alternative 1.

The air dispersion modeling results for the Alternative 2 sources and the comparison to the NAAQS are provided in **Table 4.3-22**. IDEQ has declared complete Midas Gold's application for a PTC, and that the Alternative 2 NSR inventory would be best suited for NAAQS compliance assessment. This application used the emissions inventory based on the lime kiln alternative and a hypothetical mine operating scenario since this resulted in the highest "worst case" emissions. It should be noted, however, that the modeling for the application did not include fugitive mobile source tailpipe emissions. These sources primarily contribute to NO_X and VOC emissions.

The AERMOD simulation of pollutant concentrations for Alternative 2 outside the SGP Operations Area Boundary is based on the combined construction and operations emissions presented in the Alternative 2 NSR inventory, which would have the highest total air emissions and mine throughput rate. These results in **Table 4.3-22** show the maximum modeled concentrations and total concentrations for evaluation of NAAQS compliance. These standard method results show compliance with the NAAQS for all pollutants. However, under different AERMOD settings a few points showed exceedances for PM_{10} NAAQS. The locations of the predicted high concentrations are along the SGP operations area boundary, or within 1 mile (1.6 km) of the boundary. Impacts at locations more distant from the mine site would be further below the NAAQS. As of the date of this EIS, Midas Gold and IDEQ are conducting an analysis of such "hotspots" using a weight-of-evidence approach that is under review. Alternative 1 can be assumed to have impacts lower than these results due to generally lower air emissions, and assuming Alternative 2 shows compliance to IDEQ's satisfaction, Alternative 1 can be assumed to be in compliance also.

Table 4.3-22 NAAQS Compliance Analysis - Alternative 2 NSR Inventory and Modeling

Pollutant	Averaging Time	Maximum Modeled Concentration[2] (µg/m³)	Baseline Concentration[3] (µg/m³)	Total Concentration (µg/m³)	NAAQS (µg/m³)
CO	8-hour	6218	1110	7328	10,000
	1-hour	17054	1740	18794	40,000
Pb	Rolling 3 Months	. Emissions are below regulatory concern levels; therefore, not evaluated.			
NO_2	Annual	2.3[3]	.9	3.2	100
	1-hour	116.7[3]	4.3	121.0	188
Ozone[4]	8-hour	3.0	117.4	120	137
$PM_{2.5}$ [1]	Annual	7.7	3.5	11.2	12
	24-hour	18.6	15.0	33.6	35
PM_{10}	24 hours	121.5	37.0	158.5	150
SO_2	3 hours	1.8[3]	16.8	18.6	1,300
	1 hour	3.2[3]	12.3	15.5	196

Table Sources: Air Sciences 2020

Table Notes:

1 Includes secondary, condensable $PM_{2.5}$ impacts.

2 Analysis for the application to IDEQ for PTC does not include fugitive tailpipe emissions.

3 Baseline Concentrations based on monitored data in Northwest International Air Quality Environmental Science and Technology Consortium tool, as identified by IDEQ, refer to **Table 4.3-1**.

4 Ozone modeling was not performed for IDEQ PTC. Ozone estimates are from Air Sciences 2018b.

µg/m³ = micrograms per cubic meter.

CO = carbon monoxide.

Pb = lead.

NO_2 = Nitrogen dioxide.

SO_2 = Sulfur dioxide.

PM_{10} = Particulate matter less than 10-micron diameter.

$PM_{2.5}$ = Particulate matter less than 2.5-micron diameter.

For the non-regulatory analyses, air quality impacts for Alternative 2 were evaluated by scaling the modeled impacts for Alternative 1, based on the LOM Year 7 inventory for those pollutants that contributed to near-field effects. The maximum receptor concentrations for increment analysis, annual period of plume visibility, and maximum chemical deposition rates for Alternative 2 were scaled as shown in the following equation, based on the relative change in emissions between the two alternatives (refer to **Table 4.3-20**):

Lime Kiln (Alternative 2) Impact = Alternative 1 Modeled Impact x (100 – % Emissions Change)/100

Based on this scaling analysis, the net emissions changes associated with a lime generation process were found to not affect the potential plume visibility at the nearest Class II wilderness area. The percentage of daytime hours per year that would potentially be affected by a visible plume would be unchanged under Alternative 2. Similarly, the total Hg deposition in the near-field region would not differ substantially under Alternative 2, because the total Hg emission rate, primarily from fuel combustion sources, was estimated to change by only 0.02 percent compared to Alternative 1. The total maximum deposition rates of nitrogen and sulfur species at the Operations Area Boundary were predicted to increase under Alternative 2, primarily due to additional propane combustion in the lime kiln. Total nitrogen deposition was estimated to increase by 5 percent; total relative sulfur deposition would be up to 24 percent higher.

To assess the potential risks to visitors along the controlled access road through the mine site, supplemental modeling was performed using AERMOD for the period of April 1 through November 30, when the road can be safely by wheeled vehicles. As part of the modeling analyses supporting the PTC application, the access road was excluded from the area defined as ambient air for modeling purposes. Several measures would be in place at SGP to restrict access. All public traffic on the proposed road would be required to check in and out of the mine site at security checkpoints, and therefore they could be considered guests of the mine. Because the roadway would be fenced off, and on a separate ROW, no public access to the mine site or other operational areas would be allowed. Taken together, these practices allowed IDEQ to approve the proposal that the access roadway be excluded from ambient air analyses.

Because anyone choosing to drive through SGP would be considered guests of the mine they would be subject to restrictions for their safety. However, since the roadway is excluded from areas considered ambient air, these guests cannot assume the health protections afforded by the NAAQS. A supplemental dispersion analysis was conducted that is addressed potential impacts on mine guests along the route by comparing the predicted access road receptor concentrations, plus baseline concentrations, to the NAAQS as an indication of risk. Receptors were spaced 25 meters on the controlled access road through the plant operations area. The controlled access road path and receptors are illustrated in **Figure 4.3-2**.

The results of the ambient air evaluation for the roadway receptors are provided in **Table 4.3-23,** based the Alternative 2 NSR inventory for the lime kiln alternative. In this assessment, the maximum concentration results for each pollutant and averaging time, as modeled for the controlled access road receptors, are added to the baseline concentrations identified for the SGP area. As shown in **Table 4.3-23**, the $PM_{2.5}$ “annual” average (computed as the mean values from April through November) and PM_{10} 24-hour average concentrations are predicted to be slightly over the respective NAAQS. Consequently, guests of the mine may encounter concentrations of particulate matter higher than the protective NAAQS thresholds. However, because the roadway is not considered ambient air it is not necessary that NAAQS compliance be achieved.

Table 4.3-23 Controlled Access Road Receptor Concentrations - Alternative 2 EIS Inventory and Modeling

Pollutant	Averaging Time	Modeled Alternative 2 Maximum Concentration[1] (µg/m³)	Baseline Concentration[2] (µg/m³)	Total NAAQS Impact[3] (µg/m³)	NAAQS[4] (µg/m³)	Below NAAQS?
CO	8 hours	263.0	1,077	1,340	10,000	Yes
	1 hour	550.6	1,690	2248.6	40,000	Yes
NO_2	1 year	58.3	0.94	59.2	100	Yes
	1 hour	148.4	4.3	152.7	188	Yes
$PM_{2.5}$	1 year	9.4	3.4	12.8	12	No
	24 hours	16.2	18.9	35.1	35	No
PM_{10}	24 hours	124.2	55.5	179.7	150	No
SO_2	3 hours	8.8	18.6	27.4	1,300	Yes
	1 hour	14.0	12.3	12.3	196	Yes

Table Source: Air Sciences 2018b

Table Notes:

1 The modeled maximum receptor impacts for the controlled access road path based on Alternative 2 EIS inventory emissions. Annual values are the mean average of hours during the months April through November only

2 Baseline concentrations obtained from local air monitoring data; refer to **Table 4.3-1**.

3 Total NAAQS impact is the sum of the highest modeled controlled access road receptor result, plus the baseline concentration.

4 NAAQS values as issued by EPA for each pollutant and averaging time; refer to **Table 3.3-1**.

NAAQS = National Ambient Air Quality Standards.

$\mu g/m^3$ = micrograms per cubic meter.

CO = Carbon monoxide.

NO_2 = Nitrogen dioxide.

SO_2 = Sulfur dioxide.

PM_{10} = Particulate matter less than 10-micron diameter.

$PM_{2.5}$ = Particulate matter less than 2.5-micron diameter.

It is important to reiterate that this controlled access road route would not be subject to NAAQS and, for those persons who choose to drive through the Operations Area Boundary, no assurance of NAAQS compliance can be given. Additionally, as guests of the mine, they would have to adhere to restrictions imposed for their safety. Several measures would be in place, consistent with EPA policy, to restrict or control visitor access to the mine site (EPA 2019a). All visitor traffic on the proposed access road would need to be checked in at security checkpoints at either end of the route through the Operations Area Boundary. Further this roadway would be fenced off so that no visitor access to the mine site or other operational areas would be allowed. These commitments to management of roadway access have lead IDEQ to allow the controlled access roadway to be excluded from NAAQS ambient air analyses.

4.3.2.2.5 DIRECT AND INDIRECT EFFECTS – FAR-FIELD

Although the more complex chemical interactions simulated in CALPUFF may not be directly linear with pollutant emission rate, this analysis applies the same linear scaling approach used for the near-field impacts. Scaling the far-field effects from Alternative 1 in proportion to total emission rates provides a good indicator of relative far-field effects, especially for the small changes in emission rates for Alternative 2, and at the distances to the areas of concern. On this basis, the scaled air quality impacts for Alternative 2 for the far-field analyses are provided in **Tables 4.3-24** and **4.3-25**.

As these tables show, there are slightly higher incremental impacts resulting from Alternative 2 sources with respect to haze effects and chemical deposition. This is primarily due to the net increases in haze precursor emissions from propane combustion at the mine site to fire the lime kiln. Some of these combustion emissions are offset by reduced fugitive tailpipe emissions for over 2,900 lime delivery trips that would not occur under Alternative 2. Although the incremental effects are predicted to be higher for Alternative 2, the predicted impacts are below the thresholds for significant effects established for regional haze and chemical deposition (FLAG 2010; NPS 2011)

Deposition of nitrogen and sulfur compounds under Alternative 2 was evaluated for areas of interest in the far-field by scaling the modeling deposition effects under Alternative 1. The results of this comparative analysis are shown in **Table 4.3-25**. The maximum deposition rates for both nitrogen and sulfur calculated for the Class I and Class II wilderness areas were found to be well below the deposition analysis thresholds.

Table 4.3-24 Alternative 2 Far-Field Haze Impacts

Areas	Max. Incremental Visibility Change Alt. 1 (%)	Max. Incremental Visibility Change Alt. 2 (%)	Class I Extinction Threshold	Below Threshold (Yes/No)
Class I[1]	1.43	1.47	5%	Yes
Class II Analysis Areas[2]	4.73	4.84	5%	Yes

Table Source: Air Sciences 2018a, b; FLAG 2010

Table Notes:

1 Class I area with highest predicted incremental regional haze effects in Alternatives 1 and 2 is Selway-Bitterroot Wilderness (SELW).

2 Class II analysis area with highest predicted incremental haze effects in Alternatives 1 and 2 is Frank Church – River of No Return Wilderness (FCRNRW).

Table 4.3-25 Alternative 2 Far-Field Sulfur and Nitrogen Deposition Impact Assessment

Deposition Areas	Max. Receptor N Deposition Rate Alt. 1 (g/ha-yr)	Max. Receptor N Deposition Rate Alt. 2 (g/ha-yr)	Max. Receptor S Deposition Rate Alt. 1 (g/ha-yr)	Max. S Deposition Rate Alt. 2 (g/ha-yr)	Class I DAT (g/ha-r)	Below Threshold (Yes/No)
Class I[1]	1.13	1.18	0.13	0.16	5	Yes
Class II Wilderness[2]	4.41	4.63	0.61	0.76	5	Yes

Table Source: Air Sciences 2018a,b; NPS 2011

Table Notes:

1 Class I area with highest predicted deposition effects in Alternatives 1 and 2 is Selway-Bitterroot Wilderness.

2 Class II wilderness area with highest predicted deposition effects in Alternatives 1 and 2 is Frank Church – River of No Return Wilderness.

N = Nitrogen.

S = Sulfur.

g/ha-yr = grams per hectare per years per day.

DAT = Deposition Analysis Threshold.

Modeled maximum far-field concentrations of pollutants from the non-regulatory analysis for Alternative 2 were compared to the Class I SILs and increments for the Sawtooth, Selway-Bitterroot, Hells Canyon, and Craters of the Moon Class I areas. Those results are shown in **Table 4.3-26**. Similarly, maximum modeled concentrations of relevant pollutants in the wilderness areas that were included in the far-field study were compared to the Class II SILs and increments. The Class II comparisons are shown in **Table 4.3-27**. Although this is not a full increment analysis as might be required for a major source permit under NSR, this comparison does provide an indication of this source's potential impact to the cumulative increment levels. These results show that far-field modeled ambient concentrations are below the SILs and the increments.

Table 4.3-26 Comparison of Modeled Concentrations to Far-Field Class I Increments and Significant Impact Levels for Alternative 2 - EIS Inventory and Modeling

Pollutant	Averaging Time [1]	Max Modeled Far-Field Class I Concentration (µg/m³)	Class I Significant Impact Level (µg/m³)	Class I Increment (µg/m³)
NO_2	Annual	0.010	0.1	2.5
$PM_{2.5}$ [2]	Annual	0.002	0.05	1
	24-hour	0.037	0.27	2
PM_{10}	Annual	0.010	0.2	4
	24 hours	0.162	0.3	8
SO_2	Annual	0.0002	0.1	2
	24 hours	0.006	0.2	5
	3 hours	0.012	1	25

Table Source: Air Sciences 2018b

Table Notes:

1 Design Value Rank For any period other than an annual period, the applicable maximum allowable increase may be exceeded during one such period per year at any one location.

2 Includes secondary impacts.

3 Includes secondary, condensable $PM_{2.5}$ impacts.

µg/m³ = micrograms per cubic meter.

NO_2 = Nitrogen dioxide.

SO_2 = Sulfur dioxide.

PM_{10} = Particulate matter less than 10-micron diameter.

$PM_{2.5}$ = Particulate matter less than 2.5-micron diameter.

Table 4.3-27 Comparison of Modeled Concentrations to Far-Field Class II Increments and Significant Impact levels for Alternative 2 - EIS Inventory and Modeling

Pollutant	Averaging Time [1]	Max Modeled Far-Field Class II Concentration (µg/m³)	Class II Significant Impact Level (µg/m³)	Class II Increment (µg/m³)
NO_2	Annual	0.039	1.0	25
$PM_{2.5}$ [2]	Annual	0.008	0.2	4
	24-hour	0.127	1.2	9
PM_{10}	Annual	0.039	0.2	17
	24 hours	0.563	1	30
SO_2	Annual	0.001	1	20
	24 hours	0.018	5	91
	3 hours	0.053	25	512

Table Source: Air Sciences 2018b

Table Notes:

1 Design Value Rank For any period other than an annual period, the applicable maximum allowable increase may be exceeded during one such period per year at any one location.

2 Includes secondary impacts.

3 Includes secondary, condensable $PM_{2.5}$ impacts.

µg/m³ = micrograms per cubic meter.
NO_2 = Nitrogen dioxide.
SO_2 = Sulfur dioxide.
PM_{10} = Particulate matter less than 10-micron diameter.
$PM_{2.5}$ = Particulate matter less than 2.5-micron diameter.

4.3.2.3 Alternative 3

4.3.2.3.1 CONSTRUCTION

As part of Alternative 3, The TSF and the Hangar Flats DRSF would be relocated to the East Fork South Fork Salmon River (EFSFSR) drainage. The Hangar Flats DRSF would be immediately downgradient of the TSF and would function to buttress the EFSFSR TSF. The EFSFSR DRSF and TSF would be constructed in the same manner as described for Alternative 1 and would have similar construction air emissions per unit of area. Under Alternative 3, rerouting of the EFSFSR would require construction of surface water diversion channels to intercept runoff water from the EFSFSR watershed around the TSF and DRSF. This construction activity would result in temporary construction and roadway dust and tailpipe emissions over approximately 7 miles of stream channel and tributaries. However, the net change due to this additional construction would be a small fraction of total emissions for the construction phase. The evaluation of construction phase emissions and impacts for Alternative 1 would apply to Alternative 3 and is sufficiently conservative that relocation of this source would not affect the assessment.

The Burntlog Route would be designed and constructed the same as Alternative 1. Due to the TSF and DRSF location, a 3.2-mile segment of Burntlog Route and the main gate entrance would be relocated to the Blowout Creek drainage. The mine security gate would be just past the intersection of Burntlog Route and Meadow Creek Lookout Road (FR 51290). Additionally, approximately 7.6 miles of Meadow Creek Lookout Road, from Burntlog Route at the upper portion of Blowout Creek drainage to Monumental Summit, would be improved for public access to connect with Thunder Mountain Road. The level of construction activity of these features would not be significantly different from Alternative 1 and would have similar construction phase emissions. Based on relative roadway length and areas affected, these changes in construction would represent an increase in overall construction phase emissions. However, the magnitude of the emissions difference would be small compared to total construction emissions during the first 3 LOM years.

4.3.2.3.2 OPERATIONS

The Alternative 3 TSF design, construction, and operation would be the same as described under Alternative 1; however, location of the air emissions for these facilities would be relocated approximately 1 mile to the east. The EFSFSR TSF would have capacity to store approximately 100 million tons of tailings within the 579-acre footprint. As described for Alternative 1, tailings would be delivered to the EFSFSR TSF by pipeline, and would be distributed throughout the TSF footprint. The operations phase air emissions of the TSF are generally proportional to the area of the impoundment. Because the final constructed area of the TSF is larger for Alternative 3 compared to Alternative 1, the net emissions from the EFSRSR TSF would be proportionately larger but represent a small fraction of overall Alternative 3 source emissions. Shifting the location of these emissions could influence the location and magnitude of off-site pollutant concentrations. However, the evaluation of high production year emissions and impacts for Alternative 1, which also would apply to Alternative 3, is sufficiently conservative that relocation of this source would not affect the assessment.

Under Alternative 3, there would be no public access through the mine site during mine construction and operation. The public access route around the mine site, when other public access options are not available, would be the Burntlog Route, connecting to Meadow Creek Lookout (FR 51290). Under this alternative, potential exposure to air pollution by the public traversing the mine site would be avoided.

Mitigation measures for air pollutant emissions that would be the same as Alternative 1 are incorporated at each step of the mining and processing operations. Several air pollution mitigation measures that were proposed by Midas Gold (2016) are common to all alternatives and are described in Section 4.3.3.1. For this alternative, like Alternative 1, emission control devices and designs would be put in place to abate emissions of particulate matter, Hg, and criteria pollutant emissions from internal-combustion engines. No specific abatement measures are specified by the Forest Service with respect to air emissions.

The SGP facilities would be designed, constructed, and operated with appropriate air pollution controls to comply with applicable regulations and any air quality permits issued by IDEQ. The

PTC would include stipulations that are based on applicable state and federal regulations, and that are consistent with best available control technology for new surface mining and processing operations. Key examples of these controls are described for the emission inventory under Alternative 1, in Section 4.3.2.1.1. Additional details on the control measures and estimated control effectiveness are provided in **Appendices F-1 and F-2.**

Projected emissions for the LOM Year 7 corresponding to maximum annual emissions would be less than thresholds requiring either a PSD or Major Source (Title V) permit. Therefore, if these emissions estimates receive final acceptance by IDEQ, then the implementation of Alternative 3 would not be expected to require a major source Title V permit. Even if the SGP is deemed a minor source under Alternative 3, it would be required under the Idaho air permitting regulations to obtain a PTC from IDEQ, as is currently underway for the SGP as described in Alternative 2. This permit would address the applicable federal and state emission limits and regulatory requirements.

4.3.2.4 Alternative 4

Under Alternative 4, the Yellow Pine Route would be used for access during mine construction, operations, and closure and reclamation (the Burntlog Route would not be constructed). The approximately 36-mile Yellow Pine Route consists of Johnson Creek Road (CR 10-413) and McCall-Stibnite Road (CR 50-412) from the village of Yellow Pine to the mine site. The road design and maintenance for the Yellow Pine Route would be the similar to the road design and maintenance described for Alternative 1 for the Burntlog Route. Construction material borrow sources would be developed along the Yellow Pine Route ROW for Alternative 4. Several changes to water and wildlife habitat management also would be included, but these would only affect air quality impacts during the construction phase.

For Alternative 4, controlled public access through the mine site during mining operations would be provided by an access road connecting McCall-Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375). Similar to this same feature described under Alternative 2, the public access road would be constructed during the first year of mine operation and would be isolated from SGP vehicle traffic; fences would prohibit public visitors on this road from having access to the mine site or support activities.

4.3.2.4.1 CONSTRUCTION

The Burntlog Route, which serves as the mine access for Alternatives 1 through 3, would not be constructed. Using the Yellow Pine Route for mine access would avoid disturbance-related air quality impacts from construction of approximately 20 miles of new road for the Burntlog Route. This would have the effect of decreasing overall roadway construction phase vehicle tailpipe and airborne dust emissions. The topographic features of the Yellow Pine Route (e.g., a portion of the route is along a river through a canyon) do not affect the nature of the air emissions during construction. However, the location of air pollutant concentrations may differ because construction activities would take place along a different ROW compared to other action alternatives.

During mine construction, Blowout Creek would be reconstructed to provide grade controls in the form of a series of step pools in the steep channel in place of the coarse rock drain of Alternative 1. It is expected that the step pools would fill with sediment over time. Reclamation of disturbed areas outside of the step pools would be the same as described for Alternative 1. To the extent that construction of the step pools represents an increase in overall construction phase emissions, there would be a temporary increase in air emissions during this activity.

The public access road through the mine site would be constructed during the first year of mine operation. The public access roadway would be isolated from SGP vehicle traffic; constructed on a separate ROW and on bridges as needed to pass over the operational plant roads. Emissions during construction of this roadway are not quantified as part of the air impact analysis. However, this activity would represent a small portion of the overall mine site construction emissions and would be temporary.

Under Alternative 4, no road widening or straightening of curves would be required for the Johnson Creek Road (CR 10-413) portion of the Yellow Pine Route. The McCall-Stibnite Road (CR 50-412) portion would be improved by widening curves to accommodate 55-foot semi-truck trailers. Approximately 1 mile of road through the village of Yellow Pine would be paved. Based on relative roadway length affected, these changes in roadway construction to improve the Yellow Pine Route would represent a decrease of overall construction phase emissions. However, the magnitude of the emissions difference would be small compared to total construction emissions during the first 3 LOM years. Also, the construction phase emissions for these upgrades to the Yellow Pine Route would be much less than the emissions for construction of approximately 20 miles of new road to develop the Burntlog Route under other action alternatives.

Alternative 4 would require an extra year for construction of the upgrades to the Yellow Pine Route and the mine site. As a result, operations would start in year 5 instead of year 4 and the highest impact year for emissions would be year 8 instead of year 7.

4.3.2.4.2 OPERATIONS

Under Alternative 4, the Yellow Pine Route would be used to access the mine site. The length of the Yellow Pine Route is approximately 1.5 miles shorter than the Burntlog Route, so that the overall tailpipe emissions for vehicles accessing the mine site would be slightly less for Alternative 4. The location of ambient air pollutant concentrations due to vehicle traffic would differ for Alternative 4, with such effects being located along the Yellow Pine Route ROW.

Public access through the SGP would be similar to Alternative 2, except the Johnson Creek temporary groomed over-snow vehicle route from Trout Creek to Landmark would be in use during mine construction and operation. Public access through the mine site would have the same air quality effects described in Section 4.3.2.2.4. Providing public access through the mine site reduces the miles of new motorized trails open to all vehicles in the Meadow Creek IRA, and this is expected to reduce net air quality effects due to vehicles traversing the SGP area.

Several air pollution mitigation measures that were proposed by Midas Gold (2016), are common to all alternatives, and are described in Section 4.3.3.1. Emission control devices and designs would be put in place to abate emissions of particulate matter, Hg, and criteria pollutant emissions from internal-combustion engines the same as Alternative 1. No specific abatement measures are specified by the Forest Service with respect to air emissions.

The facilities would be designed, constructed, and operated with appropriate air pollution controls to comply with applicable regulations and any air quality permits issued by IDEQ. The PTC would include stipulations for control of airborne dust from vehicle traffic along the Yellow Pine Route that are based on applicable state and federal regulations, and that are consistent with best available control technology for new surface mining and processing operations. Key examples of these controls are described for the emission inventory under Alternative 1, in Section 4.3.2.1.1. Additional details on the control measures and estimated control effectiveness are provided in **Appendices F-1 and F-2.**

The modeling demonstration for the public access road is described in more detail under Alternative 2 (refer to Sections 4.3.2.2.3 and 4.3.2.2). In the analysis under Alternative 2, the impacts to receptors along the controlled access road were examined using AERMOD for the period of April 1 through November 30, when the road conditions would allow the public access road to be safely traversed by cars and pickups. The results of the ambient air evaluation would be the same for Alternative 2, as provided in **Table 4.3-23**. As shown in **Table 4.3-23**, the $PM_{2.5}$ 1-hour and “annual” averages (the latter computed as the mean values from April through November) and PM_{10} 24-hour average concentrations are predicted to be slightly over the respective NAAQS.

It is important to reiterate that this route would not be subject to NAAQS and, for those persons who choose to drive through the Operations Area Boundary, no assurance of NAAQS compliance can be given. Additionally, as guests of the mine, they would have to adhere to restrictions imposed for their safety. All traffic on the proposed road would need to be checked in at security checkpoints at either end of the route through the Operations Area Boundary. Further this roadway would be fenced off so that no visitor access to the mine site or other operational areas would be allowed. These commitments to management of roadway access have led IDEQ to allow the controlled access roadway to be excluded from NAAQS ambient air analyses.

4.3.2.5 Alternative 5

Under Alternative 5, the No Action Alternative, there would be no surface (open-pit) mining or ore processing to extract gold, silver, and antimony, as described for the action alternatives. Therefore, the air emissions described in Section 4.3.3.1 for Alternative 1, or similar emissions for other action alternatives, would not occur.

Midas Gold may continue to implement surface exploration and associated activities that have been previously approved on NFS lands. Air emissions and related minor impacts for these activities, which are much lower than emissions under the action alternatives, would continue.

These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads) and drilling on both NFS and private lands at and in the vicinity of the mine site. Construction of these facilities in the future would result in temporary air quality effects due to earthmoving and equipment tailpipe emissions, which are described in the Golden Meadows Exploration Project Environmental Assessment (Golden Meadows EA) (Forest Service 2015).

Midas Gold would be required to continue to comply with reclamation and monitoring commitments included in the Golden Meadows EA, which include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices, and monitoring to ensure that sediment and stormwater best management practices are in place. These construction and reclamation activities would result in temporary air quality effects due to earthmoving and equipment tailpipe emissions.

If none of the action alternatives proceed, it can be assumed that current uses by Midas Gold and other users on patented mine/mill site claims and on the Payette National Forest and Boise National Forest would continue to follow all existing applicable air quality regulations. Uses of NFS lands that may result in air pollutant emissions include mineral exploration, dispersed off-highway-vehicle use, snowmobiling, and other forms of recreation.

4.3.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.3.4 Cumulative Effects

Past, present, and reasonably foreseeable future actions include activities, developments, or events that have the potential to change the physical, social, economic, and/or biological nature of a specified area. With respect to air quality, activities directly associated with the SGP and other reasonably foreseeable future actions having air pollutant emissions at a level that cause overlap with SGP-related effects in time and location, would result in cumulative impacts. The air quality cumulative effects analysis considers the potential contributions of actions that could occur in the relatively large analysis area. The cumulative effects study area for air quality is generally the same as the larger far-field region.

4.3.4.1 Alternative 1

Cumulative effects analysis for air quality considers the geographic range and timeframe of impacts from past, current, and foreseeable activities. In general, the air quality effects from past projects do not generate cumulative effects due to the transient nature of air quality conditions. The release of pollutants in the past in a region, even from several days earlier, would not contribute to measured conditions in that region afterward. Transport from far more distant urban regions, even overseas, may contribute to local air conditions (e.g., ozone) but are not in the scope of a cumulative effects analysis. Therefore, past operations by Midas Gold in the SGP area, such as exploratory drilling, monitoring wells, and roadway construction and maintenance, are not contributors to air quality cumulative effects. Similarly, past activities in the cumulative analysis area, such as prior roadway and infrastructure construction projects, and timber and underbrush harvesting, would not have effects that overlap in time with the SGP emissions, and therefore would not contribute to air quality cumulative effects.

The ambient air data for CO, NO_2, SO_2, and on-site data for PM_{10} and $PM_{2.5}$ indicate the existing impacts from off-site sources on air quality near the SGP area was reviewed for this analysis (refer to Section 3.3.4). These background ambient air measurements offer the best indication of cumulative effects due to current emissions sources. Although some background measurements of ozone in the Boise urban area are above the NAAQS, the ozone baseline value for this assessment recommended by the IDEQ is compliant with the NAAQS. The monitored baseline values used for the air quality impact assessment were obtained at locations that are more developed than the SGP area. By comparison, the cumulative effects in the analysis area due to current activities and air emission sources would be minor.

There are no other permitted sources of HAP emissions in the vicinity of the SGP area. One source, the Tamarack Mill, LLC is 75 miles from the mine site, and has reported minor source level emissions to IDEQ. The HAP emission inventory in the vicinity of the SGP area is unknown; however, given the absence of large HAP emission sources near the SGP area, it can be assumed that the baseline HAP cumulative effects are low.

Several reasonably foreseeable activities in the cumulative effects analysis region that were considered regarding cumulative air quality effects are listed in **Tables 4.3-28** and **4.3-29**. The nature of the air emissions and contributions to potential cumulative effects are described for each project. Activities that are anticipated to have overlapping impacts with the SGP related to air quality include forest fires and Big Creek fuels reduction.

Table 4.3-28 Reasonably Foreseeable Activities Considered Regarding Cumulative Air Quality Effects for Specific Planning Projects

Project Type	Project Names/Description	Nature of Air Emissions and Contribution to Cumulative Effects
Roadway Development and Maintenance	• Big Creek Road Plan of Operations Project EA • Morgan Ridge Exploration Project – Access Road Plan Such projects authorize the use of and/or improvement of roads to conduct exploration and development of locatable mineral claims.	Dispersed short-term local emissions of road dust and vehicle tailpipe emissions. Negligible long-term cumulative air quality effects in combination with the SGP.
Exploratory Drilling for Mineral Resources	• Morgan Ridge Exploratory Drilling Plan of Operations EA Project involves exploratory drilling for locatable minerals from remote drill pads approximately 10 miles north of the mine site. Project is reportedly on hold.	Local emissions from drilling equipment (e.g., compressor engines), road dust, and tailpipe emissions. The magnitude of emissions is not expected to be of sufficient magnitude to have overlapping pollutant concentration effects at this distance from the mine site.
Forest Maintenance and Fire Risk Reduction	• Big Creek fuels reduction project approx. 10 miles north of mine site • South Fork Restoration and Access Management Plan EA, 25 miles southwest of mine site Projects to reduce wildfire risk and fire severity/intensity on NFS lands and private property using commercial timber harvest, understory treatment, and prescribed burning.	Local emissions from portable generator equipment (e.g., compressor engines, road dust, and tailpipe emissions. Particulate emissions from lumbering activities and hauling. The Big Creek project may be of sufficient magnitude to have overlapping PM concentration effects at this distance from the mine site. The South Fork project is of sufficient distance that it would have negligible cumulative air quality effects.

Table 4.3-29 Reasonably Foreseeable Activities Considered Regarding Cumulative Air Quality Effects for Ongoing Projects and Foreseeable Emission Sources

Project Type	Project Names/Description	Nature of Air Emissions and Contribution to Cumulative Effects
Construction Projects	• Creek restoration • Trail construction and maintenance • Bridge and culvert replacement projects, generally located more than 10 miles north of the SGP area • Hydroelectric projects: small residential projects for power generation • Road maintenance	Short-term emissions during construction with no long- term emission impacts that would overlap with impacts related to the SGP.
Natural Emission Events	Wildland fires Between 2005 and 2015, over 88,000 acres of the Big Creek watershed have been burned. Between 1990 and 2013, over 330,000 acres have burned within the headwaters of East Fork South Fork Salmon River and Sugar Creek.	Areas devoid of trees and vegetation may have potentially large, short-term air quality effects, due to increased windblown dust.

Project Type	Project Names/Description	Nature of Air Emissions and Contribution to Cumulative Effects
Mining Activities	Ongoing mining activities on patented land Mineral exploration and mining have occurred in several locations around the SGP area. Exploration activities area ongoing for potential future mining development.	Local emissions from drilling equipment (e.g., compressor engines), road dust, and tailpipe emissions. Known mining operations are small in size (50 tpd or less) or are inactive. Locations of foreseeable projects with low emissions are at sufficient distances from the mine site to not contribute overlapping effects.
Recreation and tourism	Recreation and Tourist activities: • Sport hunting, fishing, trapping • Snowmobile trails • Fugitive dust and tailpipe emissions from traffic on unpaved roads • Boating and river recreation • Camping, hiking, backpacking • Outfitter/Guide Operations • Tourist Services – Big Creek Lodge • Off-highway vehicle use • Tourist Services – e.g., Big Creek Lodge	Collectively substantial air emissions from vehicles on unpaved roads and trails, boats, and stationary fuel combustion sources. Depending on the proximity of these activities to the SGP area, transient cumulative effects may occur.

4.3.4.2 Alternatives 2, 3, and 4

Although the magnitude and location of SGP air emission sources are different for the action alternatives, the differences are not large enough to significantly change off-site air quality impacts. For example, refer to the assessment of impacts for Alternative 1 in Sections 4.3.2.1.2 and 4.3.2.1.3, in comparison with the analysis of Alternative 2 in **Tables 4.3-22** through **4.3-25** with respect to NAAQS, regional haze, and chemical deposition. Consequently, the potential for cumulative air quality effects described above and in **Table 4.3-26** and **Table 4.3-27** for Alternative 1 would apply to all other action alternatives. The extent and magnitude of potential cumulative air quality effects due to foreseeable projects in the analysis area would be the same for the action alternatives.

4.3.4.3 Alternative 5

For Alternative 5, the nature and extent of cumulative effects is represented by the current air quality conditions in the analysis area. Ambient air data for CO, NO_2, SO_2, and on-site data for PM_{10} and $PM_{2.5}$ are available to serve as quantitative indicators for the impacts from current non-SGP sources on air quality (refer to Section 3.3.3, Existing Conditions). These background ambient air measurements offer the best indication of cumulative effects due to current emissions sources, absent the SGP. The monitored baseline values used for the air quality impact assessment were obtained at locations that are more developed than the SGP area. By comparison, the cumulative effects in the analysis area due to the current activities and air emission sources would be minor. Alternative 5 would not add to the cumulative effects of present and future projects and emissions.

4.3.5 Irreversible and Irretrievable Commitments of Public Resources

The CEQ guidelines require an evaluation of “any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented” (40 CFR 1502.16). Irreversible resource commitments generally refer to impacts on or a permanent loss of a resource, including land, air, water, and energy, which cannot be recovered or reversed.

Examples include the permanent removal of minerals, loss of cultural resources, or conversion of wetlands to another use. Irreversible commitments are usually permanent, or at least persist for a long time. Irretrievable resource commitments involve a temporary loss of the resource, or loss in its value, such as a temporary loss of agricultural production while the land is being used for another purpose.

4.3.5.1 Alternative 1

There are no irreversible or irretrievable commitments for air quality resources under Alternative 1. The pollution resulting from air emissions is not permanent. The Alternative 1 peak-year emissions and results of dispersion modeling for several air quality characteristics have been described in detail in Section 4.3.2.1.

Alternative 1 would result in an increase in the use of fuels and other resources (40 to 50 megawatts of electrical power) in the region. There would likely be some use of public resources to support the construction and operation phases, such as construction of new infrastructure in the area. These activities also would result in some indirect air pollutant emissions. However, these do not result in irreversible or irretrievable commitments for air quality resources, because the pollution resulting from these activities is temporary.

4.3.5.2 Alternatives 2 Through 4

There are no irreversible or irretrievable commitments for air quality resources under the action alternatives. The pollution resulting from air emissions is not permanent. For Alternative 2, the peak-year emissions and results of scaled Alternative 1 modeling results for several air quality characteristics have been described in detail in Section 4.3.2.2. The expected air quality effects for Alternatives 3 and 4 have been discussed in Sections 4.3.2.3 and 4.3.2.4, respectively.

The action alternatives would result in an increase in the use of fuels and other resources (40 to 50 megawatts of electrical power) in the region. There would likely some use of public resources to support the construction and operation phases, such as construction of new infrastructure in the area. These activities also would result in some indirect air pollutant emissions. However, these do not result in irreversible or irretrievable commitments for air quality resources, because the pollution resulting from these activities is temporary.

4.3.5.3 Alternative 5

Under Alternative 5, the SGP would not be undertaken. Consequently, there would be no change in the current status of air resources in the SGP area, and irretrievable or irreversible commitments of public resources with respect to air quality would not occur.

4.3.6 Short-term Uses versus Long-term Productivity

The CEQ guidelines require an evaluation of environmental sustainability considering the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity (40 CFR 1502.16). This section provides a brief overview of the short-term effects of the SGP versus the maintenance and enhancement of potential long-term productivity of the environmental resources in the SGP area. Short-term refers to the analysis period for the SGP (the 20-year life of the mine). Long-term refers to an indefinite period after mine closure.

4.3.6.1 Alternative 1

For Alternative 1, operation of the mining and production facilities and associated use of transport vehicles would have continual short-term emissions of air pollutants for the duration of the SGP. These short-term emissions and related air quality impacts for Alternative 1 have been described in Section 4.3.2.1.

There are no anticipated long-term effects related to air quality in the SGP area, after the reclamation and reforestation of the site. Once the SGP activities cease, air emissions and related effects would no longer occur.

4.3.6.2 Alternatives 2 Through 4

For the action alternatives, operation of the mining and production facilities and associated use of transport vehicles would have continual short-term emissions of air pollutants for the duration of the SGP. These short-term emissions and related air quality impacts for Alternative 2 have been described in Section 4.3.2.2. The expected air quality effects for Alternatives 3 and 4 have been discussed in Sections 4.3.2.3 and 4.3.2.4, respectively.

There are no anticipated long-term effects related to air quality in the SGP area, after the reclamation and reforestation of the site. Once activities cease at the mine site, air emissions and related effects would no longer occur.

4.3.6.3 Alternative 5

For Alternative 5, the impacts to the air quality resource would be same as current conditions. Alternative 5 would not affect short-term use or long-term productivity of the location with respect to air quality.

4.3.7 Summary

The air quality analysis conducted for the SGP examined impacts on defined geographic regions that relate to different types of modeling processes. First, a "near field" region surrounding the mine site was examined using appropriate air dispersion models to quantify ambient pollutant concentrations and related impacts. For the SGP, preliminary modeling confirmed that a 10-km domain size was adequate to characterize worst-case near-field air quality impacts. Air quality effects would decrease at distances beyond the modeled 10-km range.

Second, a much larger "far-field" region was defined that encompassed more-distant Class I areas, wilderness areas, and tribal lands. In these areas, specialized air quality modeling tools were applied to evaluate the combined effects of dispersion, deposition, and chemical transformations in the atmosphere. The models assessed SGP source contributions to regional haze, nitrogen deposition, and sulfur deposition.

Table 4.3-30 provides a summary comparison of air quality impacts for each alternative, based on the issue and indicators defined for the air quality resource.

4.3.7.1 Geographical Extent of Pollutant Concentrations and Deposition

Dispersion modeling based on a representative mine operating scenario and LOM Year 7, the year with highest estimated aggregated air emissions, demonstrated that ambient pollutant concentrations would not exceed the NAAQS. This conclusion applies for each action alternative for the area outside of the SGP Operations Area Boundary. Deposition of Hg, and nitrogen and sulfur species were predicted to be less than SILs. The comparable analysis for Alternative 2 shows slightly higher impacts, due primarily to the on-site lime generation process that would be included in this alternative. The differences in SGP emission sources for Alternatives 3 and 4 are not large enough or of a permanent nature (e.g., roadway construction emissions) to result in long-term pollutant concentration impacts that differ from Alternative 1. Close-in concentrations of pollutants from vehicle exhaust and airborne dust would be distributed differently for each action alternative, because some sources and roadways would be in different locations. Under Alternative 5, the SGP would not be constructed, so that the air quality in the area would remain the same as the existing baseline conditions.

4.3.7.2 Type and Volume of Air Pollutants Emitted

To characterize the highest anticipated annual emission levels for purposes of conservative air quality impact analysis, a complete emission inventory was compiled for each year from construction through LOM Year 15. The year of peak mine throughput, LOM Year 7, was found to have the highest aggregate pollutant emissions, including haze precursors, airborne dust, and HAPs. Compared to Alternative 1, Alternative 2 was found to have increased emissions from the material handling and kiln operation associated with the lime generation process included in Alternative 2.

4.3.7.3 Criteria Air Pollutant Ambient Concentrations Outside the Operations Area Boundary

Dispersion modeling based on Alternative 1 or Alternative 2 EIS inventories demonstrated that impacts would not exceed NAAQS outside the operations area boundary. The NAAQS analysis performed using a more conservative hypothetical mining scenario comprising the Alternative 2 NSR inventory and under certain AERMOD options for did predict localized exceedances for PM_{10} NAAQS near the SGP operations boundary. As of the date of this EIS, Midas Gold and IDEQ are evaluating the analysis of such "hotspots" using a weight-of-evidence approach and that analysis is under review.

A supplemental analysis for the controlled access road through the mine site included in Alternative 2 showed exceedances of the NAAQS for particulate matter (both PM_{10} and $PM_{2.5}$) along the roadway. However, as described for the Alternative 2 analysis this route would not be subject to NAAQS because unrestricted public access would not be allowed. Alternatives 3 and 4 do not entail emission source differences of a permanent nature (e.g., roadway construction emissions) to result in long-term criteria pollutant impacts that differ from Alternative 1 or 2 findings, respectively. Close-in concentrations of pollutants from vehicle exhaust and airborne dust would be distributed differently for other action alternative, since some sources and roadways would be in different locations. Under Alternative 5, the off-site concentrations of criteria pollutants would remain unchanged from the existing baseline conditions.

4.3.7.4 Comparison of Modeled Concentrations to Class I and Class II Increments

Both near-field and far-field modeling demonstrated that the Class I and Class II increments would not be exceeded outside the Operations Area Boundary. Although evaluation of incremental air quality impacts is not applicable to minor sources, such as the SGP, this provided an indicator of relative SGP impacts under Alternatives 1 and 2. Although not quantified, the far-field air quality impacts resulting from other action alternatives relative to the increment levels would not differ from the findings for Alternative 1. For Alternative 5, the off-site concentrations of criteria pollutants would remain unchanged from the existing baseline conditions.

4.3.7.5 HAP Emissions and Hg Deposition

Emissions of HAPs, including mercury, were quantified for LOM Year 7. These emissions, comprised of HCN, sulfuric acid, Hg, and organic HAPs from fuel combustion, were found to be well below federal major source thresholds. Near-field deposition analysis for Hg indicated that even the maximum predicted deposition rates would be less than significance thresholds.

4.3.7.6 Deposition Impacts for Nitrogen and Sulfur compounds at Class I areas and Specified Class II Wilderness Areas

Predicted deposition impacts, in grams pollutant per hectare per year, were obtained from far-field modeling for Alternative 1 peak year emissions. The modeled results were compared to the DAT an indicator of significance (NPS 2011). The DAT for N and S in the Class I area are listed as 5 g/ha-yr. For the three modeled years of 2015 through 2017, the maximum predicted annual deposition rates were below the DAT in each Class I and Class II area evaluated.

4.3.7.7 Near-field Plume Blight and Far-Field Regional Haze Impacts

The Level 2 screening analysis addressed an observer at the FCRNRW and demonstrated that the aggregated emissions from Alternative 1 sources would have the potential to cause visible plumes at that wilderness area. However, specific model assumptions may alter the frequency or magnitude of the modeled impacts, and VISCREEN is viewed as an inherently conservative model. Given these considerations, the results represent a screening-level indication that plume visibility impacts in the FCRNRW are likely, but there is uncertainty around the frequency and magnitude of those impacts.

For analysis of regional haze impacts, maximum 24-hour Alternative 1 source emissions of SO_2, NO_X, SO_4, and fine and coarse PM were modeled using the CALPUFF modeling system, supplemented by the MESOPUFF II model for atmospheric chemistry effects. The Class I and Class II wilderness area visibility analysis results show the modeled 98th percentile highest daily change in light extinction parameters, and therefore the change in atmospheric visibility, would be less than the 5 percent change in light extinction that is considered the significance criteria for Class I areas (FLAG 2010), Consequently the level of regional haze impact in the Class I and Class II areas evaluated was predicted to be minor.

This page intentionally left blank

Table 4.3-30 Comparison of Air Quality Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Air Quality Issue: The SGP may affect air quality characteristics and resources	Geographical extent of pollutant concentrations and deposition.	No SGP air emissions to affect existing conditions.	SGP air quality impacts would be less than NAAQS because emissions are lower than Alternative 2, and under deposition significance levels.	SGP air quality impacts would be less than NAAQS based on IDEQ permit modeling, and under deposition significance levels.	Same as Alternative 1.	Same as Alternative 2.	Same as Baseline Conditions.
Air Quality Issue: The SGP may affect air quality characteristics and resources	Type and volume of air pollutants emitted, including haze precursors, airborne dust, and HAPs.	No SGP air emissions to affect existing conditions.	Emission Inventories for construction through LOM Year 15 indicated that the peak year for aggregated pollutant emissions would be LOM Year 7, also the peak year for mine throughput.	Small net emissions increase compared to Alternative 1. if both lime kiln increases and vehicle emission decreases are considered. NAAQS analysis for IDEQ was based on increased emissions in Alternative 2.	Same as Alternative 1, except that changes in emissions due to relocated TSF and Hangar Flats DRSF facilities not quantified.	Same as Alternative 2, except that changes in emissions due to use of Yellow Pine Route in lieu of Burntlog Route not quantified.	Same as Baseline Conditions.
Air Quality Issue: The SGP may affect air quality characteristics and resources	Criteria air pollutant ambient concentrations outside the Operations Area Boundary anywhere the public is allowed unrestricted access.	Current air quality in the SGP area is good, and in attainment with air quality standards.	SGP air quality impacts would be less than NAAQS because emissions are less than Alternative 2, which was the basis for NAAQS compliance. and under deposition significance levels.	SGP air quality impacts would be less than NAAQS based on IDEQ permit modeling and conditions and under deposition significance levels. Particulate matter levels may be higher than NAAQS along some portions of access route through the SGP area, but this route wouldn't be subject to NAAQS	Same as Alternative 1, except that the magnitude and locations of off- site concentrations may differ due to relocated emissions sources.	Same as Alternative 2, except that the magnitude and locations of off- site concentrations may differ due use of Yellow Pine Route rather than Burntlog Route. Particulate matter levels may be higher than NAAQS along some portions of access route through the SGP area, but this route wouldn't be subject to NAAQS.	Same as Baseline Conditions.
Air Quality Issue: The SGP may affect air quality characteristics and resources	Comparison of modeled concentrations to Class I and Class II increments.	Current air quality in the SGP area is good, and in attainment with air quality standards.	SGP air quality impacts would be less than the Class I and Class II increments.	Same as Alternative 1, except that the magnitude of off-site concentrations would increase due to lime kiln process emissions.	Same as Alternative 1, except that the magnitude and locations of off-site concentrations may differ due to relocated emissions sources.	Same as Alternative 1, except that the magnitude and locations of off-site concentrations may differ due use of Yellow Pine Route rather than Burntlog route.	Same as Baseline Conditions.
Air Quality Issue: The SGP may affect air quality characteristics and resources	HAPs (including Hg emissions and Hg deposition.	Background concentrations and deposition occurs due to transport from distant industrial and urban sources.	Emissions HAPs, HCN, and Hg estimated for peak mine production year. Deposition of Hg limited in extent and well below health-based thresholds.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Baseline Conditions.
Air Quality Issue: The SGP may affect air quality characteristics and resources	Deposition impacts from nitrogen and sulfur compounds at Class I areas and specified Class II wilderness areas.	Existing deposition rates occur due to transport from distant industrial and urban sources.	Modeling of N and S deposition in areas of concern show that deposition rates are below acceptable levels for Class I areas.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Baseline Conditions.
Air Quality Issue: The SGP may affect air quality characteristics and resources	Near-field plume blight and far-field regional haze impacts in protected areas.	No SGP sources to create visible near-field plumes. Existing regional haze occurs due to transport from distant industrial and urban sources.	SGP sources may cause visible plumes at the closest Class II wilderness area (FCRNRW) for a significant fraction of daylight hours. Far-field modeling of regional haze shows contribution from SGP sources would be below federal significance. level.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Baseline Conditions.

This page intentionally left blank

4.4 CLIMATE CHANGE

4.4.1 Effects Analysis Indicators and Methodology of Analysis

4.4.1.1 Issues and Indicators

The analysis of effects of the Stibnite Gold Project (SGP) on climate change and the effects of climate change in combination with the SGP on the environment include the following issues and indicators:

Issue: The SGP activities could contribute to factors that influence climate change.

Indicators:

- Greenhouse Gas (GHG) emissions from SGP activities (construction, operations, and closure and reclamation), expressed as metric tons (MT) of carbon dioxide (CO_2) equivalent (CO_2eq) of GHGs.

Issue: Changing climatic conditions, in synergy with the SGP (including construction, operations, and closure and reclamation), could impact the physical, biological, and social resources.

Indicators:

- Changes in hydrologic patterns (drought, precipitation variability, and seasonality);
- Changes in temperature (extreme heat/cold, or overall change in annual or seasonal temperatures); and
- Changes in extreme weather events (flash flooding, wildfires, severe storms).

This section analyzes the expected climate change impacts in the SGP area by examining:

- **GHG Emissions** – an analysis of anticipated GHG emissions associated with each action alternative as an indicator of their potential impact on climate change trends. This includes both direct and indirect emissions attributable to the SGP.
- **Effects of Climate Change** – an analysis of how climate change, in synergy with the SGP, could impact the physical, social, and biological resources in the SGP area.

This analysis will review direct effects represented by the GHG emissions from the alternative components, and the combined (indirect) potential impacts to resources that could be impacted by climate change. The scope of analysis for the effects of climate change on resources in the SGP area is discussed in the context of each resource, except for noise.

The emission estimates were derived using published emission factors for the emission of GHG constituents for various fuel-combustion equipment (e.g., diesel-fueled engines, propane fired heaters). Based on the GHG emission levels for action alternative's emission inventories, the potential for climate change effects was assessed in the context of statewide GHG emissions, as reported by the Idaho Department of Environmental Quality. In addition, the potential for climate change effects, in tandem with SGP activities, on the physical, biological, and social resources in the analysis area, were evaluated using scientific literature reviews, and information and analysis documented in reports prepared for the SGP.

4.4.1.2 Relation of Greenhouse Gas Emissions to Climate Change

The most recent Council on Environmental Quality (CEQ) draft guidance for addressing GHG emissions in National Environmental Policy Act (NEPA) analyses suggests the quantification of the direct and indirect GHG emissions from SGP components may be used as a proxy for assessing potential climate effects (CEQ 2019). This guidance is used as the principal framework for evaluation of the direct and indirect effects of GHG emissions for the action alternatives. GHG emissions from a source or even a group of sources cannot be directly attributed to any specific climate change impact area.

In the assessment of environmental consequences, this analysis first quantifies potential GHG emissions associated with each action alternative (Alternatives 1 through 4) and then describes the context of the cumulative GHG emissions over the duration of any alternative using the current and projected GHG emissions for the state of Idaho. A discussion is provided of the features associated with each action alternative that would reduce its direct GHG emissions, as well as the qualitative potential for indirect climate change effects.

4.4.1.3 Mining and Gold Ore Processing GHG Sources

Surface mining activities release GHG to the atmosphere primarily due to the operation of engine-driven vehicles and equipment. For the action alternatives, the largest source category is operation of diesel-fueled vehicles and equipment engines. Gasoline-fueled vehicles also would be GHG emission sources, as would propane-fueled process heating and heating of buildings. However, these latter two fuels each account for less than 10 percent of fuel consumption, by volume, compared to the total use of diesel fuel.

GHG inventory data generally includes surface mines, other than coal, in the industrial sector. CO_2 accounts for over 99 percent of the industrial sector GHG emissions in Idaho (Idaho Department of Environmental Quality 2010). For the industrial sector, nationwide emissions in 1990 were about 841 million MT CO_2eq and have decreased to 771 million MT CO_2eq by 2020 (U.S. Environmental Protection Agency [EPA] 2017). Additional details regarding the historic trends in GHG emission inventory for Idaho and the United States are provided in Section 3.4.3.1, GHG Inventory Information.

4.4.1.4 GHG Emission Factors

An overall assessment of GHG emissions for the alternatives can be based on the total fuel consumption as estimated for non-road equipment and mobile sources. Under all action alternatives, the required equipment would be fueled with conventional, low-sulfur No. 2 distillate diesel fuel. In addition, there are gasoline vehicles, propane-fired heaters and, under Alternative 2, the operation of a propane-fired limestone kiln. The EPA provides generic GHG emissions factors that can be applied to the non-road vehicles and other fuel-combustion equipment (EPA 2015). The factors used for this analysis are listed in **Table 4.4-1**.

Table 4.4-1 Fuel-Combustion Source Emission Factors for SGP GHGs

Emission Source Category	Carbon Dioxide (CO_2)[1] (kg/gallon)	Methane (CH_4)[2] (g/gallon)	Nitrous Oxide (N_2O)[2] (g/gallon)
Mobile Combustion Engine Sources Distillate No. 2 Fuel [1]	10.21	0.57	0.26
Mobile Combustion Engine Sources - Motor Gasoline Fuel	8.78	0.50	0.22
Stationary Combustion Units - Propane Fuel	5.72	0.27	0.05

Table Source: EPA 2015

Table Notes:

1 For engines, from the Mobile Combustion CO_2, Diesel Fuel and Motor Gasoline categories. For propane-fueled equipment, from general stationary combustion factor category.

2 For engines, from the Mobile Combustion for Non-Road Vehicle category, Diesel Construction or Gasoline Construction categories. For propane-fueled equipment, from general stationary combustion factor category.

g/gallon = grams per gallon kg/gallon = kilograms per gallon

4.4.1.5 Emissions Monetization Policy

Qualitatively, the societal costs of GHG emissions and climate change generally encompass the financial, environmental, and societal costs resulting from sea level rise, diminishing water supplies, loss of plant and wildlife species, changes in ecosystems, increased wildfires, among other effects. As described in Section 3.4.2, Relevant Laws, Regulations, Policies, and Plans, no federal or state rules or regulations currently limit or curtail emissions of GHGs from sources in the State of Idaho. Therefore, no regulatory mechanism currently exists for quantifying a monetized costs and benefits assessment of the significance of the GHG emissions associated with the alternatives.

Draft CEQ 2019 guidance has not changed the policy established in 2016 CEQ guidance (since rescinded) with respect to monetizing climate benefits and costs of a specific project (CEQ 2019). Consequently, the current policy is that individual agencies have the discretion to disclose such an analysis if it would be relevant to the choice among alternatives. The social cost of carbon refers to a method to express in monetary terms the magnitude of the effects associated with an incremental increase in carbon emissions. It is intended to quantify climate change-induced effects, without attempting to determine potential meteorological and weather changes that are hypothetically related to those emissions. For purposes of this environmental impact statement (EIS), qualitative analysis is appropriate because quantifying the relative costs and benefits of the alternatives is not practically feasible and would be subject to high uncertainty. Consequently, a social cost of carbon calculation has not been conducted for this analysis.

4.4.1.6 Assumptions and Uncertainties

Assessment of current baseline climate conditions that, in theory, could be compared to future trends in regional climate is subject to uncertainty that these baseline conditions accurately represent the SGP area. Therefore, discussion of climate conditions in Idaho and surrounding states was generally qualitative in this analysis. Information regarding the recent climatological conditions for Idaho and the Northwest is summarized in Section 3.4.3.2, Climate Change Trends. In the same manner, this analysis will qualitatively describe the type and extent of potential climate change impacts on the physical, social, and biological resources in the analysis area, since information is not available to address such effects with quantitative certainty.

There is a degree of uncertainty in the GHG emission rate estimates developed using emission factor methodology. This type of uncertainty is discussed in Section 4.3.1.2, Air Emission Inventory Methodology, in relation to the nature of emission factors and emission models representing an average from a population of specific type of emission sources. However, there is no GHG emissions data that is specific to the conditions of the SGP area and the models and designs of the specific equipment that would be utilized for any action alternative. Although reasonable estimates for GHG emissions may be derived for a specific activity, there is uncertainty in evaluating longer-term emissions levels and the relationship between GHG sources and sinks over a lengthy and uncertain timeframe.

4.4.2 Direct and Indirect Effects

This section quantifies GHG emissions, qualitatively discusses potential climate change and SGP impacts to physical, social, and biological resources in the analysis area.

The following analysis of effects are considered in the overall context of regional and statewide GHG emissions and climate change trends. Several aspects of the context for this analysis include:

- GHGs emission inventory for the State of Idaho (represents a basis for comparison with action alternative GHG emission estimates);
- GHGs emitted from diesel-fueled and gasoline-fueled engines, and propane combustion for either process needs or heating of buildings, which can be estimated for the action alternatives;
- How GHG emissions may be mitigated for the action alternatives, given the lack of a regulatory framework for managing and permitting GHG sources; and

- Observable climate change trends in Idaho and the Northwest region of the U.S., such as increased annual average temperatures, precipitation variability, and decreased snowpack and streamflow (see Section 3.4.3.2, Climate Change Trends).

Climate change effects occur over decades and on a global scale, such that the CEQ considers climate change to be inherently a cumulative issue (CEQ 2014). Guidance provided by the U.S. Forest Service (Forest Service) has indicated that, “it is not currently feasible to quantify the indirect effects of individual or multiple projects on global climate change and therefore determining significant effects of those projects or project alternatives on global climate change cannot be made at any scale” (Forest Service 2009). On a global scale, climate change is suspected to cause changes in regional temperature cycles, rainfall amounts, and seasonal distribution or precipitation that can result in flooding, droughts, or more frequent and severe heat waves.

4.4.2.1 Alternative 1

4.4.2.1.1 GHG Emissions

Implementation of Alternative 1 (**Figure 2.3-1** and **Figure 2.3-2**) would result in a total construction, operation, and closure cycle of approximately 20 years, which includes approximately 3 years of initial site treatment of previous disturbance from past mining and redevelopment and construction activities; an estimated 12 years for mining and ore processing activities with continued concurrent reclamation/mitigation; and 5 years for final closure and reclamation work. There also would likely be several years of follow-up monitoring to ensure the ultimate success of the reclamation work.

Additional potential direct sources of emissions have not been included in the analysis, because they are difficult to estimate and are expected to be minor. These are:

- CO_2 release from crushing and grinding carbonate rocks would be minor, and such releases typically only occur when the minerals are heated.
- Carbon concentrations in existing soils are relatively low, and Alternative 1 includes provisions for soil salvage, preservation, and re-use. Therefore, this limited source would not release much additional CO_2 to the environment.

4.4.2.1.1.1 Direct GHG Emissions

The direct GHG emissions associated with Alternative 1 would be CO_2, methane (CH_4), and nitrous oxide (N_2O) emitted from the exhaust of diesel engine-driven vehicles and, to a much smaller extent, from other fuel- fired equipment. Under this alternative, mining would be conducted in three open pits. Mining equipment would include blast-hole drills, shovels, front-end loaders, and non-road haul trucks. Mobile sources working at the mine site would include bulldozers, rubber-tired dozers, motor graders, water trucks, and other support equipment. These vehicles and mobile mining equipment would be almost entirely diesel fuel fired, and combustion emissions would contain GHG constituents, predominantly CO_2.

Additional GHG emissions related to vehicle fuel use at the mine site would contribute smaller amounts of GHGs to the overall direct effects. These activities may produce fuel combustion emissions from heaters, engines, boilers, etc. The petroleum fuels would be transported to the mine site by tanker trucks, estimated to require approximately 50 truck trips per month. Blasting explosives also are recognized as a source of limited GHG emissions, as their use is a form of combustion. The primary explosive would be a mixture of ammonium nitrate and fuel oil. The relatively minor contribution for blasting operations is described in the air quality modeling report prepared for Midas Gold Idaho, Inc. (Midas Gold) (Air Sciences 2018).

The estimated annual consumption of petroleum fuels for Alternative 1 is summarized in **Table 4.4-2**. Stationary fuel-combustion sources include water pumps, generators, and heaters that would be diesel engine or propane-fired units. Consumption of diesel fuel and gasoline represents use by highway and off-highway vehicles (OHVs), non-road construction and earthmoving equipment, and stationary engines. Combustion of propane from propane-fired heaters is represented by the total delivered and stored pressurized bulk liquid.

An overall estimate of GHG emissions (expressed in CO_2eq) for annual operations of Alternative 1 also is provided in **Table 4.4-2**. Based on estimated annual use of petroleum fuels for all uses, the total GHG emissions would be 67,400 MT CO_2eq/year. The combustion product CO_2 accounts for over 99 percent, even though CH_4 and N_2O have substantially higher global warming potential factors. The contributions for CH_4 and N_2O are 0.1 percent and 0.7 percent, respectively, in terms of MT CO_2eq per year. Most of this (95 percent) is from mobile sources. Only approximately 3,215 MT CO_2eq/year would be from stationary sources.

Development and related operations of Alternative 1 would result in an increase in regional GHG emissions compared to existing conditions, and therefore could be viewed to contribute, incrementally, to climate change. Between 2000 and 2010, statewide total GHG emissions averaged 29.6 million MT CO_2eq, as presented in **Table 3.4-1**. On this basis, Alternative 1 annual emissions represent approximately 0.23 percent of the statewide GHG emission inventory, and slightly over 5 percent of the industrial process category for Idaho, which includes mining. On a national scale, Alternative 1 emissions would represent 0.01 percent of the national GHG inventory. This fact precludes meaningful quantification of the indirect effects that operations may have on climate. The potential for incremental contribution to the global GHG inventory can be viewed qualitatively based on reported emissions compared to the current state inventory.

Table 4.4-2 Fuel-Combustion Source Annual GHG Emissions for Alternative 1

Emission Source Category	Fuel Consumption (gal/yr)	Carbon Dioxide (CO_2) [1] (MT/yr)	Methane (CH_4) [2] (MT/yr)	Methane (CH_4) [3] ($MTCO_2eq/yr$)	Nitrous Oxide (N_2O) [2] (MT/yr)	Nitrous Oxide (N_2O) [3] ($MTCO_2eq/yr$)	Emissions Totals ($MTCO_2eq/yr$)
Mobile Combustion Engine Sources Distillate No. 2 Fuel [1]	5,800,000	59,218	3.31	82.6	1.51	449.4	**59,755**
Mobile Combustion Engine Sources - Motor Gasoline Fuel	500,000	4,390	0.25	6.3	0.11	32.8	**4,430**
Stationary Combustion Units - Propane Fuel	560,000	3,203	0.15	3.8	0.03	8.3	**3,215**
Subtotals for MT Emissions and CO2eq MT/yr	N/A	**66,811**	**3.71**	**92.7**	**1.65**	**490.5**	**67,400**
Percent of Total Annual Emissions (MTCO2eq Basis)	N/A	99.2	--	0.1	--	0.7	N/A

Source: Midas Gold 2016

Table Notes:

1 CO_2 emissions are calculated from the annual fuel consumption in gallons/yr, multiplied by the EPA emission factors in **Table 4.4-1**.

2 For CH_4 and N_2O calculated from the annual fuel consumption in gallons/yr, multiplied by the EPA emission factors in **Table 4.4-1**.

3 CO_2eq results are MT emissions multiplied by the global warming potential for CH_4 and N_2O.

gal/yr = gallon per year; yr = year; N/A = not applicable; MT/yr = metric tons per year; $MTCO_2eq/yr$ = metric tons carbon dioxide equivalent per year

Overall, as shown in **Table 4.4-2**, implementation of Alternative 1 would be expected to generate a total of approximately 67,400 MT CO_2eq/year. There is no guidance for GHG significance levels considering mobile source emissions, which represent the majority of the emissions from Alternative 1. It also should be noted the stationary source emissions for Alternative 1 would not exceed the 25,000 MT CO_2eq reporting threshold for the 2009 Mandatory GHG Reporting Rule, which is to consider contributions from stationary sources only. The combined stationary and mobile source emissions of Alternative 1 would not exceed the EPA's threshold of 100,000 MT/year CO_2eq, at which major stationary source permitting would be required.

Alternative 1 includes several SGP design and operational features, such as implementing air emission controls on the oxidation and neutralization, gold and silver leaching and carbon adsorption, and gold and silver electrowinning and refining processes, which serve to limit GHG contributions. Additionally, revegetation of disturbance areas also would occur under Alternative 1.

Although reasonable estimates for GHG emissions may be derived for a specific activity, there is uncertainty in evaluating longer-term emissions levels and the relationship between GHG sources and sinks over a lengthy and uncertain timeframe. Because climate change effects resulting from GHG emissions are global in scale, there is no reliable way to quantify whether or to what extent local GHG emissions contribute to observed regional trends, or the larger global phenomenon. Therefore, meaningful connection of Alternative 1 GHG emissions to climate change effects at the state, regional, or global level cannot be provided.

4.4.2.1.1.2 Indirect GHG Emissions

Two indirect sources of GHG emissions associated with Alternative 1 are: 1) electrical power generated off-site but used on-site; and 2) energy costs for transport and refinement of antimony concentrate.

4.4.2.1.2 Off-Site Generated Power

Electricity for the mine site would be provided via a transmission line connected to the grid. The supplier of the electricity would be the Idaho Power Company (IPCo). IPCo obtains approximately half its energy from hydropower, which does not emit GHGs. The remaining power is derived from coal-fired power plants, as well as other sources. Between 2010 and 2019, IPCo generated electricity at an average CO_2 emission rate of 848 pounds per megawatt hour (MWh). This rate is 29 percent lower than it was in 2005, and IPCo plans to maintain an emissions intensity of at least 15 to 20 percent below 2005 levels through 2020. Emissions in 2019 were 543 pounds per MWh (IPCo 2019).

Alternative 1 is estimated to utilize approximately 40 to 50 MWs at full production, which would be equivalent to approximately 394,200 MWh annually. Therefore, Alternative 1 would be indirectly responsible for emissions of approximately 214 million MT of CO_2 annually, using current IPCo emission rates per MWh. However, it should be noted this existing utility source of electricity would not be considered a new source and would not trigger additional Clean Air Act permitting under the New Source Review or Title V operating permits.

4.4.2.1.3 Emissions from Antimony Transport and Processing

Under Alternative 1, gold would be primarily purified on-site and poured into doré bars (an alloy of gold and silver). GHG emissions associated with this process are accounted for in the indirect electricity-related emission estimates. However, the antimony-bearing froth/slurry would be separated and processed off-site. The antimony concentrate would be transported from the mine site for off-site smelting and refining. It is unknown at this time where or how the concentrate from the mine would be processed, and depending on the buyer, it could be processed by any number of companies, in any number of states or foreign countries.

Transportation of the antimony concentrate for off-site processing also would result in indirect GHG emissions under Alternative 1. Because it is unknown at this time where the concentrate from the mine would be processed, GHG estimations associated with the transport of antimony concentrate are speculative and cannot be quantified. However, emissions per mile of transport can be estimated to quantify this indicator. Alternative 1 estimates one truck per day of antimony concentrate hauled from the mine site. About 22.5 pounds (10.2 kilograms) of CO_2 are produced from burning 1 gallon of diesel fuel (see **Table 4.4-1**), and at the fuel consumption rate of typical on-road haulage trucks, approximately 135 pounds of CO_2 would be generated per mile for each truck.

There is very little information on the energy usage, and GHG emissions, of smelting and refining antimony concentrate. None of the major countries that actively produce antimony (i.e., China, Russia, Bolivia, Tajikistan, Turkey, and Myanmar) report GHG emissions from the process; however, this specialized mining sector is not considered a substantial source of GHG emissions worldwide. GHG emissions from gold smelting have been shown to have electrolytic refining requirements of approximately 325 kilowatt hours per metric ton of gold (Norgate and Haque 2012). Assuming a similar electrolytic refining requirement for the estimated 44,015 metric tons of antimony concentrate that would be generated at the site (as described under Alternative 1), refining antimony would require approximately 14,304,875 kilowatt hours (14,304 MWh). Using IPCo's CO_2 current emission rate of 543 pounds per MWh, refining all the antimony concentrate would generate an additional 8,940,000 pounds (4,055 metric tons) of GHG emissions. While this calculation provides an estimate of GHG emissions from electrolytic refining of gold, rather than antimony, it can be used as part of the indicator for overall SGP GHG emissions.

4.4.2.1.4 Climate Change Impacts To Analysis Area Resources

Effects of ongoing climate change in the SGP area following implementation of Alternative 1 would be largely the same as those that would occur regionally and in Idaho without the SGP. Due to the nature of the resource, noise would not be impacted by climate change.

4.4.2.1.4.1 Geologic Resources and Geotechnical Hazards

Changes in landcover and slope stability (e.g., pit slopes or slopes adjacent to roadways) due to changing climate conditions and SGP activities could exacerbate certain geologic hazards in the analysis area under Alternative 1. Geotechnical design standards have been proposed to help minimize and mitigate the extent of stability impacts, but climate change could increase the severity of impacts to geologic characteristics over time. Changes in landcover and slope stability due to climate change could create conditions that cause more frequent landslides, damaging vegetation and other forest resources. Landslides also could potentially impact surface water resources through increased sedimentation and runoff.

4.4.2.1.4.2 Air Quality

Alternative 1 would require obtaining an air quality permit from Idaho Department of Environmental Quality and implementing various air quality controls that would likely have the associated benefit of reducing GHG emissions compared to uncontrolled conditions. The sources affected would include surface mining, fugitive dust from off-highway trucks, and process emissions. Additional SGP design measures would be adopted to reduce air quality impacts also would reduce GHG emissions. Busing and/or vanpooling would be provided to minimize traffic, which also would reduce dust emissions, sediment runoff, and GHGs from vehicle tailpipes.

These mitigation measures or design features would tend to reduce particulate matter emissions that otherwise would be higher as a result of climate change. One example is disposal of thickened tailings that would form a hardened crust at the tailings storage facility (TSF) at the mine site (Midas Gold 2016). This method would limit the potential for wind erosion and fugitive dust as climate change affects local winds, precipitation, and temperature. “Smart grid” technology also would be used to reduce energy consumption and emissions of GHGs due to lower power use at the mine site. Additionally, selection of road construction materials and application of natural and chemical dust suppressants would limit the potential for roadway dust emissions as climate change affects local precipitation and temperature. These processes and controls will help to minimize impacts to air quality as a result of climate change during construction and operation of Alternative 1; however, increased particulate matter and other criteria pollutants as a result of climate change (e.g., potential for increased wildfires and decreased groundcover resulting in more particulates in the air) could persist within the SGP area (Jacob and Winner 2009).

4.4.2.1.4.3 Soils and Reclamation Cover Materials

Alternative 1 would include reclamation of impacted soils in the SGP area. Much of this soil is currently poor quality (for example, old tailings piles), and would be unlikely to naturally revegetate at a normal rate. Proposed improvements to soil as part of preparing the soil for reclamation activities under Alternative 1, such as increasing fines and the addition of organic carbon, could allow the soil to retain more moisture during the summer, even as climate change is expected to reduce summer precipitation (Halofsky et al. 2018; Runkle et al. 2017).

Reclamation would help minimize the climate-induced impacts to soils in the short-term; however, changes in soil moisture and temperature could lead to changes in soil properties and functions, potentially diminishing the soil quality over time (Halofsky et al. 2018). Consequently, diminished soil quality could hinder reclamation efforts involving revegetation of disturbed areas in the SGP area.

4.4.2.1.4.4 Hazardous Materials

Under Alternative 1, various materials and chemical reagents, including fuel, explosives, and ore processing reagents, would be transported for use at the mine site. Aboveground tanks also would be used to store fuels, lubricants, coolants, hydraulic fluids, propane, explosive materials, and nitric and sulfuric acid. To minimize risk of spills, Midas Gold would comply with the EPA Toxic Release Inventory Program; develop a Spill Prevention, Control, and Countermeasure Plan; and develop a Hazardous Materials Handling and Emergency Response Plan. Although these procedures would minimize the risk and likelihood of a spill, climate change could potentially affect the severity of a spill. Climate-change related trends with respect to annual periods of frozen ground, variability in the groundwater tables, increased precipitation and flooding, and conditions affecting the ability of crews to quickly implement response measures would all factor into spill severity. These impacts would be experienced during construction, operation, and closure and reclamation, and should be considered in the development of the Spill Prevention, Control, and Countermeasure Plan and Hazardous Materials Handling and Emergency Response Plan.

4.4.2.1.4.5 Surface Water and Groundwater (Quality and Quantity)

Water would be required for ore processing, surface and underground exploration, dust control, and potable or domestic use under Alternative 1. It would be supplied from a combination of collected runoff water, water recycled from ore processing facilities, and water reclaimed from the TSF (Midas Gold 2016). Much of this water supply and the supporting infrastructure is dependent on streamflow, which is vulnerable to the physical factors of climate change.

Regional climate change could affect the ability of SGP area streams to maintain previous flow rates and recharge of water supply due to changes in Idaho snowpack and precipitation patterns (Halofsky et al. 2018). The ore processing facility would represent the primary consumer of water associated with mining operations and approximately 80 percent of this water would be continually recycled. This practice would improve resiliency of water availability and would help to minimize adverse effects from changes in regional streamflow by maintaining instream flows and protecting aquatic species and downstream uses.

Streams in the mine site could potentially be less impacted than nearby natural streams if water handling methods associated with Alternative 1 adjust with changing precipitation conditions. For example, it is predicted that winter flows would slightly increase while spring and summer flows would decrease (Halofsky et al. 2018); this means that structures that retain winter precipitation (such as the post-mining pit lakes) could help maintain adequate flow in the summer. Changes designed to increase infiltration of surface water may work to extend flow and recharge the water supply during drier periods. Without consideration of climate change impacts during construction and operation, Alternative 1 could exacerbate impacts such as diminished water quality from lower average streamflows.

Climate conditions causing decreased streamflow and warmer water temperatures could lead to diminished water quality for streams in the SGP area. Alternative 1 components such as diversions of the West End Creek, the East Fork South Fork Salmon River (EFSFSR) around the existing Yellow Pine pit, and the lower reaches of Midnight Creek and Hennessy Creek have been designed to help improve water quality in the SGP area (see Section 4.9, Surface Water Quality); however, the additional impacts to water quality from climate change may require supplementary measures to mitigate these impacts. There have been no additional, supplementary, mitigation measures developed at this time.

A portion of the water supply for Alternative 1 would come from fresh water pumped from groundwater dewatering wells around the Hangar Flats pit in the Meadow Creek drainage and around the Yellow Pine pit in the EFSFSR. Groundwater in central Idaho is recharged by precipitation and snowmelt, and reductions in the longevity of snowpack and variable precipitation may lead to faster runoff and less groundwater recharge (Halofsky et al. 2018). Climate change impacts to groundwater could decrease the availability of groundwater and the groundwater quality in the area, which could be exacerbated by construction and operation activities under Alternative 1.

4.4.2.1.4.6 Vegetation: General Vegetation Communities, Botanical Resources, and Non-Native Plants

Construction activities under Alternative 1 would require removal of vegetation, including whitebark pine individuals, which is a potential candidate plant species and can be at risk to the spread of insects and disease in a changing climate (Keane et al. 2017). As an ongoing component of the operational phase, and later closure and reclamation, Alternative 1 would involve revegetating areas disturbed by historic mining, construction, and operation activities in the SGP area. Seed mixtures would consist of certified weed-free native herb and grass species, adjusted to fit elevation and aspect ranges in the area, and would be approved by the Forest Service. Native trees and shrubs also would be planted, as well as disease-resistant whitebark pine seedlings.

Revegetation efforts would likely represent an improvement over areas of existing poor-quality soils; however, revegetation of the disturbed mine site and legacy impacted areas would likely be difficult due to current trends for climate change. Adaptive management strategies, such as noxious weed-free seed mixes, could provide opportunities for more successful revegetation efforts. Longer periods of precipitation deficit in the summer paired with decreasing snowpack could create new challenges for vegetation ecosystems (Halofsky et al. 2018). Reclamation of heavily degraded ecosystems usually requires intensive management techniques, which may include soil enrichment, weed treatment, and seeding and/or planting of desirable species. Reclamation efforts in heavily degraded systems usually require repeated efforts, and successful revegetation may not be achieved for decades (Stanturf et al. 2014). Additionally, long-term reclamation may require adaptive revegetation strategies and a focus on ecosystem function rather than species composition, as initial revegetation plans may become infeasible due to changing climate conditions and land use requirements (Stanturf et al. 2014). It will be important to consider possible future changes in weather patterns, precipitation amounts and seasonality, and resilience of species to fire and drought when identifying reclamation methods and goals.

4.4.2.1.4.7 Wetlands and Riparian Resources

Final closure and reclamation of the mine site, conducted under an agency-approved Reclamation and Closure Plan, would reestablish wetlands impacted by Alternative 1 during construction and operation where feasible and practical. Depending on the type of wetland and adjacent environmental conditions, certain wetlands in the SGP area may be able to recover rapidly from construction and operation-related impacts and would likely be the least affected by longer-term climate change. However, some wetlands with narrower environmental tolerances, or those that take longer to reestablish and stabilize, would be vulnerable to additional impacts from climate change trends such as lower streamflows and less groundwater recharge (Halofsky et al. 2018). Alternative 1 would involve constructing features on the East Fork of Meadow Creek (Blowout Creek) to raise groundwater levels and address ongoing erosion, which would help to stabilize the existing wetlands in the valley and reclaim the pre-reservoir conditions that support wetlands and riparian features. Implementing these types of features in other areas would help to minimize climate change impacts by supporting wetland reestablishment.

4.4.2.1.4.8 Fish Resources and Fish Habitat

Under Alternative 1 fish habitat would be reconstructed as part of the reclamation phase, which may mitigate some expected climate change impacts, such as warmer water temperatures and reduced stream flows. However, the structure and function of fish habitats would need to be fully reclaimed to minimize species vulnerability. Additionally, if stream habitat is restricted by these changing conditions, the Hangar Flats pit lake (the only body of water in the SGP area that would be accessible to fish) could potentially act as a refuge for aquatic species. However, this may have adverse consequences; for example, juvenile Chinook salmon would be at higher risk of predation from bull trout in the Hangar Flats pit lake (see Section 4.12, Fish Resources and Fish Habitat). Habitat connectivity also is an important consideration during operations and reclamation because sensitive species like the bull trout and other migratory species would be the most vulnerable to climate change impacts and loss of habitat connectivity.

4.4.2.1.4.9 Wildlife and Wildlife Habitat

Climate change impacts to wildlife and wildlife habitat in the SGP area would include habitat loss and fragmentation, physiological sensitivities, and alterations in the timing of seasonal life cycles. Habitat loss and fragmentation may occur in the region and analysis area due to the increased potential for wildfire that is anticipated from changing climatic conditions (Halofsky et al. 2018). Under Alternative 1, construction and operation of the mine site, access roads, utilities, and off-site facilities would further exacerbate wildlife impacts from habitat loss and fragmentation. Reclamation activities are intended to achieve post-mining land use for wildlife habitat, which would help to reclaim habitat connectivity. However, the post-closure reclamation activities were developed to help offset Alternative 1 wildlife impacts, and were not designed to offset wildlife impacts due to climate change impacts.

4.4.2.1.4.10 Timber Resources

Timber resources in the SGP area are vulnerable to climate change impacts such as changing temperatures and precipitation patterns, increased wildfire frequency and intensity, and insects and disease. Direct effects of climate change on timber (e.g., temperature and precipitation) are likely to be minor, but indirect effects from various disturbances (e.g., increased temperatures and warmer winters causing insect and disease outbreaks) may be significant for the timber industry (Halofsky et al. 2018).

Alternative 1 would result in ground disturbance in locations currently covered by forested vegetation, and constructing facilities associated with the mine site, access roads, utilities, and off-site facilities would require the removal of timber resources in the SGP area. Post-closure, all disturbed areas would be revegetated under Alternative 1. This would be achieved through a combination of infrastructure removal, soil preparation, direct seeding, and tree planting. To address losses of vegetation from disturbance associated with Alternative 1, the Reclamation and Closure Plan proposes to replant 472 acres with conifer and other tree species, which will be located completely within the mine site (see Section 4.14, Timber Resources). Some reclamation efforts would be concurrent with operations, but the success of the reclamation cannot be predicted due to the increased risk of wildfire and tree decay from insects and disease (American Forests 2017; Halofsky et al. 2018). Therefore, these reclamation efforts cannot be relied upon to offset the GHG emissions from Alternative 1.

4.4.2.1.4.11 Land Use and Land Management

Alternative 1 would alter land use in areas of new or expanded right-of-way and easements to accommodate access roads, utilities, and off-site facilities. Climate change could impact how lands in the SGP area are used, altering the surrounding environment (e.g., decreasing ground cover, larger burn areas, decreased stream flows impacting how the area is used for recreational or designated tribal purposes) and impacting accessibility. Alternative 1 would maintain public access in recreational areas surrounding the SGP area, but would restrict activities at the mine site during construction, operation, and closure and reclamation, which minimize climate change impacts to land use be helping help to support current recreational land uses within the SGP area. Land management is not expected to be impacted by Alternative 1.

4.4.2.1.4.12 Access and Transportation

Access to and through the SGP area would be maintained under Alternative 1 during construction, operation, and closure and reclamation, except there would be no public access through the mine site during construction and operations. Climatic changes causing an increase in catastrophic events, such as floods, landslides, and avalanches, can add stress to roadways and other infrastructure, which may result in more frequent maintenance and repairs. Roads and infrastructure near their design life are more susceptible to climate change impacts. Additionally, the magnitude of impacts may vary for infrastructure and access roads located in the valley versus ridgetop locations. Road maintenance during construction, operation, and reclamation would involve repair to deteriorated roadway segments or for emergency road repairs, which would help to minimize climate change impacts. Continual attention to road conditions would help to address damage or other issues that may occur due to climate change; however, catastrophic damages due to flash floods, avalanches, or landslides could impact access roads and other transportation infrastructure in the SGP area.

4.4.2.1.4.13 Cultural Resources and Tribal Rights and Interests

Alternative 1 would impact ten historic properties, due to extensive ground and visual disturbance in the SGP area. Changing climatic conditions are expected to exacerbate the damage and loss of cultural resources and natural areas designated for tribal uses such as hunting, fishing, and gathering in the SGP area through increased soil erosion, more frequent and intense wildfires, flooding, degraded water quality, and wildlife and fish habitat impacts. There are mitigation measures to avoid and minimize impacts to cultural resources and tribal rights and interests under Alternative 1 in the SGP area, which also may help to minimize potential effects from climate change.

4.4.2.1.4.14 Public Health and Safety

Climate change impacts to public health and safety would be experienced through impacts to air, soil, and water quality. Alternative 1 has the potential to impact public health and safety through the release of chemicals to the environment, natural environmental hazards, economic impacts, changes to public services and infrastructure, and impacts to the local population.

Climate change could exacerbate some Alternative 1 impacts to public health and safety by affecting the way spills are handled or enter the environment. It also could increase the frequency and amplify the impacts of natural hazards such as avalanches and landslides, flash floods, and wildfires (Halofsky et al. 2018). More frequent heat waves could increase employee health risks due to extreme heat exposure, especially for employees with pre-existing health conditions or who work outdoors. More extreme heat days and higher temperatures over time could increase air quality and health risks over both the short and long term, impacting the public and the employees’ abilities to work (Runkle et al. 2017).

4.4.2.1.4.15 Recreation

Much of the SGP area is used for recreation year-round, which would be both directly and indirectly impacted by climate change. Alternative 1 has the potential to impact recreational access, recreation facilities, dispersed recreation areas, special use permits, recreational motorized travel, and recreation use affected by changes in recreation facilities, opportunities and setting. Direct impacts from climate change would include variable precipitation and rising temperatures, which could affect individual decisions to recreate in a certain area. Indirect impacts from climate change would be experienced through the changing conditions that may alter the recreation facilities, opportunities, and setting.

Recreation access and other facilities could be negatively impacted by road or structural damage caused by flooding, landslides, or avalanches. Changing climatic conditions could alter the ecological conditions that affect the quality of the recreation experience, including warmer water temperatures, decreased streamflow, and habitat loss and fragmentation. In the Rocky Mountain region, it is expected that snow-based activities (skiing, snowmobiling) would be impacted negatively by climate change due to warmer futures (Halofsky et al. 2018). Primitive area use, horseback riding on trails, motorized water activities, birding, hunting, and fishing in the region also are expected to be negatively influenced by climate change; however, longer periods of warmer temperatures are expected to increase participation in warm-weather activities such as swimming and hiking (Askew and Bowker 2018).

4.4.2.1.4.16 Scenic Resources

Alternative 1 would impact scenic resources in the SGP area through construction and operation of new facilities and roads. Because much of the SGP area vegetation has been characteristically burned by past wildfires, the visual impacts of these new facilities would be amplified as there are less trees to block views. Under Alternative 1, the Forest Service would be consulted for concurrence with visual quality objectives to reduce visual contrast of structures and surfaces; however, if changing climate conditions continue to increase the frequency and intensity of wildfires, more vegetation in the SGP area could be lost, creating greater visibility of the mine site and associated facilities and infrastructure.

4.4.2.1.4.17 Social and Economic Conditions

Socioeconomic impacts from Alternative 1 are predominantly associated with the development and operations at the mine site and off-site facilities. Alternative 1 would create more efficient recreation access to support tourism and employ both local and non-local residents in the trade industry that would commute in and out of the area and purchase local goods and services. Although warmer temperatures could increase participation in some warm-weather activities, many other recreation activities could be negatively impacted by climate change. Mine site construction and operations could help to support the viability of local communities and offset potential adverse climate change impacts.

4.4.2.1.4.18 Environmental Justice

Alternative 1 has the potential to impact Native American communities by restricting their access to traditional hunting and fishing lands. Changing climate conditions could exacerbate the impacts felt by these communities as warmer water temperatures, decreased streamflow, and habitat loss and fragmentation continue to impact the natural resources in the SGP area.

4.4.2.1.4.19 Special Designations

Climate change impacts would not directly impact the special designations of areas under Alternative 1 but could impact the environmental conditions in these areas and cause indirect effects to these designations. Variable precipitation, decreased streamflow, and more precipitation falling as rain instead of snow could impact the characteristics and quality of these areas. The Burntlog Route and other alternative components would be constructed adjacent to or within wilderness areas, eligible wild and scenic rivers, Inventoried Roadless Areas (IRAs), and Research Natural Areas (RNAs) under Alternative 1. This would impact wildlife, wildlife habitat, and wilderness characteristics by fragmenting habitat, bringing noise and light disturbance to previously undisturbed areas, and increasing the potential for non-native invasive plant species, pathogens, or insects to spread to these areas. Climate change may further intensify impacts to special designation areas by contributing to habitat fragmentation, magnifying the potential for insects and disease to spread, or hindering the ability for native vegetation to reestablish as disturbed areas are revegetated during reclamation efforts.

4.4.2.2 Alternative 2

Alternative 2 includes modifications to component alternatives that are anticipated to result in relatively small increases in GHG emissions (**Figure 2.4-1** and **Figure 2.4-2**). Although there are no modifications designed to specifically reduce GHG emissions or address climate change impacts, some of the Alterative 2 design features may help to minimize various resource impacts. Alternative 2 includes a limestone kiln, which would increase GHG emissions through propane fuel combustion and release of CO_2 by reactions during the limestone calcining process (i.e., heating to a high temperature). The added GHG emissions for the limestone kiln operation are quantified for Alternative 2 below. The on-site generation of lime would reduce the number of lime delivery truck trips annually to the mine site by more than 2,900, but would require an average of 133 additional propane deliveries per year (Midas Gold 2016).

Alternative 2 also would include the addition of a Centralized Water Treatment Plant (WTP) near the Ore Processing Facility as part of a Water Quality Management Plan. The Centralized WTP would require approximately 40 additional annual truck trips during operations for water treatment-related chemical deliveries. Post-closure, the Centralized WTP would continue to operate in perpetuity (with approximately 34 annual truck trips for chemical deliveries and removal of residuals). Operation of the Centralized WTP in perpetuity also would require continued operation of the new transmission line.

Although the Centralized WTP would require additional truck trips, there would be an overall net reduction of operational truck activity under Alternative 2 due to the on-site generation of lime. However, the reduced GHG emissions for the net reduction in delivery truck activity would largely be offset by off-highway mining haul truck traffic bringing limestone to the lime generation process, at approximately two trucks per day. These trucks are much larger, and while they travel a short distance, they carry much larger volumes of materiel (400 tons per load) and burn 100 gallons of fuel per hour of operation. Assuming each truck operates one hour per day, five days per week, that is 200 gallons of diesel per day. At 19.4 pounds/gallon CO_2 emissions, over 260 days per year, that is approximately 500 tons of CO_2 per year from limestone hauling.

Alternative 2 also includes several changes to access roads in the SGP area, to surface water management, and the construction of a public access road through the mine site. Since the overall construction activity for the SGP would not be significantly affected by these roadway changes, it can be assumed the GHG emissions related to the road construction and operation under Alternative 2 would not differ substantially from those described under Alternative 1.

4.4.2.2.1 GHG EMISSIONS

The GHG emissions increases from operation of the lime generation process on an annual basis are shown in **Table 4.4-3**. In Section 4.3, Air Quality, the relative annual emission rates were quantified for pollutants related to fuel combustion (carbon monoxide and nitrogen oxides) compared to Alternative 1. These sources were estimated to have between a 4 or 5 percent higher emission rate for Alternative 2, primarily due to the higher propane consumption required for the on-site limestone kiln. These incremental increases also consider the reduction in truck delivery traffic that would average eight delivery trips per day over the Burntlog Route (basis: 2,900 trips per 365 days). It is reasonable to assume that GHG emissions due to more vehicle travel at the mine site (lime haul) under Alternative 2 would have comparable increases in annual emission rates. Additionally, no measurable increase in GHG emissions is expected from the 40 annual truck trips associated with the Centralized WTP.

Overall, the net GHG emissions related to the lime generation process and related mining and material handling represents a small portion of air emissions from the action alternative sources. For the limestone kiln, GHG emissions would occur due to propane combustion and loss of CO_2 by reactions in the kiln. Details of the emissions estimates for Alternative 2 are provided in **Appendix F-1** (Lime Generation Option), which were reproduced from Appendix A of the report entitled Air Quality Analysis prepared for Midas Gold (Air Sciences 2018).

Table 4.4-3 Fuel-Combustion Source Annual GHG Emissions for Alternative 2

Emission Source Category	Alternative 2 Fuel Consumption or Limestone Feed	Carbon Dioxide (CO_2)[1] (MT/yr)	Methane (CH_4)[2] (MT/yr)	Methane (CH_4)[3] ($MTCO_2eq/yr$)	Nitrous Oxide (N_2O)[2] (MT/yr)	Nitrous Oxide (N_2O)[3] ($MTCO_2eq/yr$)	Emissions Totals ($MTCO_2eq/yr$)
Lime Kiln Operation – Propane Combustion	152,629 MMBtu/yr.	10,580	12.5	313	30.0	8,940	19,876
Lime Kiln Operation – Loss by Reaction	83,000 ton/yr.	30,311	No Emissions	No Emissions	No Emissions	No Emissions	30,311
Mobile Combustion Engine Sources Distillate No. 2 Fuel [1]	5,800,000	59,218	3.31	82.6	1.51	449.4	59,755
Mobile Combustion Engine Sources - Motor Gasoline Fuel	500,000	4,390	0.25	6.3	0.11	32.8	4,430
Stationary Combustion Units - Propane Fuel	560,000	3,203	0.15	3.8	0.03	8.3	3,215
Subtotals for MT Emissions and CO_2eq MT/yr	N/A	107,702	16.2	405.7	31.7	89,430.5	117,587

Table Source: Midas Gold 2016

Table Notes:

1 CO_2 emissions are calculated from the annual fuel consumption, multiplied by the EPA emission factors in **Table 4.4-1**.

2 For CH_4 and N_2O calculated from the annual fuel consumption, multiplied by the EPA emission factors in **Table 4.4-1**.

3 CO_2eq results are MT emissions multiplied by the global warming potential for CH_4 and N_2O.

gal/yr = gallon per year; MMBtu/yr = Million British Thermal Units per year; MT/yr = metric tons per year; $MTCO_2eq/yr$ = metric tons carbon dioxide equivalent per year; N/A = not applicable; yr = year

4.4.2.2.2 Climate Change Impacts To SGP Area Resources

The anticipated climate change impacts in synergy with the SGP for Alternative 2 would be the same as those discussed under Alternative 1 for the following resources of this EIS: geologic resources and geotechnical hazards, air quality, soils and reclamation cover materials, hazardous materials, vegetation (including general vegetation communities, botanical resources, and non-native plants), wetlands and riparian resources, timber resources, land use and land management, access and transportation, cultural resources, recreation, scenic resources, social and economic conditions, environmental justice, special designations, and tribal rights and interests. Surface water and groundwater (quality and quantity), fish resources and fish habitat, wildlife and wildlife habitat, and public health and safety impacts under Alternative 2 are described below.

4.4.2.2.2.1 Surface Water and Groundwater (Quality and Quantity)

Alternative 2 includes changes in surface water management in response to potential effects on streamflow, water temperatures, and water quality. Alternative 2 also would include process and design modifications in response to potential issues related to surface water and groundwater. Although the anticipated impacts from climate change would be the same as Alternative 1, it is expected that the proposed modifications under Alternative 2 would help to minimize the severity of climate change impacts to surface water and groundwater quality and quantity. This would occur through changes in water management that are designed to improve streamflow and water quality in the SGP area, such as rerouting Hennessy Creek during mining, lining the Meadow Creek diversion channel further down the drainage, piping low flows in stream diversions to prevent water warming, and continuing to use the rapid infiltration basins during seasonal low flows.

4.4.2.2.2.2 Fish Resources and Fish Habitat

The anticipated impacts from climate change would be the same as Alternative 1 for fish resources and fish habitat; however, the Alternative 2 changes in surface water management also would help to minimize the severity of climate change impacts to fish resources and fish habitat. Lower streamflows, increased water temperatures, and decreased water quality would adversely impact aquatic species and habitat. Process and design modifications, such as rerouting Hennessy Creek, Lining the Meadow Creek diversion channel, piping low flows, and continued use of rapid infiltration basins would help to minimize these impacts.

4.4.2.2.2.3 Wildlife and Wildlife Habitat

Alternative 2 includes process and design modifications that were developed in response to potential issues related to wildlife habitat. Although the impacts from climate change would be the same as Alternative 1, some of the modifications would help to mitigate impacts to wildlife and wildlife habitat by minimizing habitat loss and fragmentation. This would occur through shortening the Burntlog Route, decreased truck traffic on access roads due to on-site lime generation, and surface water management changes that would benefit wildlife species that prey on fish or otherwise use the mine site streams.

4.4.2.2.2.4 Public Health and Safety

Alternative 2 includes changes in surface water management in response to potential effects on streamflow, water temperatures, and water quality (see Section 4.4.2.2.2.1, Surface Water and Groundwater [Quality and Quantity]) under Alternative 1. Although the anticipated impacts from climate change would be the same as Alternative 1, these additional water management measures could help to minimize impacts to public health and safety by improving water quality issues resulting from climate change.

4.4.2.3 Alternative 3

The components under Alternative 3 were developed to reduce adverse impacts to federally listed fish species, and surface water primarily related to water quality and temperature by moving the TSF location. (**Figure 2.5-1** and **Figure 2.5-2**). Although there are no modifications designed to specifically reduce GHG emissions or address climate change impacts, some of the changes may help to minimize various resource impacts. Meadow Creek TSF and Hangar Flats Development Rock Storage Facility (DRSF) would be relocated under Alternative 3 to the EFSFSR valley. This also would require realigning several mine site facilities and rerouting approximately 2.5 miles of new transmission line from the Johnson Creek substation to the mine site. Surface water management would be the same as Alternative 1, except channels would divert the EFSFSR and runoff around the TSF (the diversion of Meadow Creek would not be needed). An approximately 3.2-mile segment of the Burntlog Route would be rerouted through Blowout Creek valley, and there would be no public access through the mine site during mine operations. Additionally, the OHV connector would not be constructed under Alternative 3.

4.4.2.3.1 GHG Emissions

In general, the GHG emissions for Alternative 3 will be the same as Alternative 1. Possible differences between these two alternatives would not be greater than the uncertainty in the GHG emission estimates derived by generalized emission factors for fuel combustion.

Relatively small changes in roadway routes would be involved under Alternative 3, which are not substantive enough to affect GHG emissions overall. The Burntlog Route would be designed and constructed the same as Alternative 1. Due to the TSF and DRSF location, a 3.2-mile segment of Burntlog Route and the main gate entrance would be relocated to the Blowout Creek drainage. Based on relative roadway length and areas affected, these changes in alignment would represent a small increase in overall construction phase GHG emissions. However, the magnitude of the emissions difference would be small compared to total construction GHG emissions.

4.4.2.3.2 Climate Change Impacts To SGP Area Resources

The anticipated climate change impacts for Alternative 3 would be the same as those discussed under Alternative 1 for the following resources of this EIS: geologic resources and geotechnical hazards, air quality, soils and reclamation cover materials, hazardous materials, surface water (quantity) and groundwater (quality and quantity), vegetation (including general vegetation communities, botanical resources, and non-native plants), wetlands and riparian resources, timber resources, land use and land management, access and transportation, cultural resources, public health and safety, scenic resources, social and economic conditions, recreation, environmental justice, and tribal rights and interests. Impacts to surface water (quality), fish resources and fish habitat, wildlife and wildlife habitat, and special designations under Alternative 3 are described below.

4.4.2.3.2.1 Surface Water (Quality)

Although surface water management under Alternative 3 would be the same as Alternative 1, the Meadow Creek TSF and Hangar Flats DSRF would be relocated to the EFSFSR valley. Relocating the TSF would serve to reduce adverse impacts to water quality and temperature in Meadow Creek. These measures are expected to minimize the severity of climate change impacts resulting in degraded water quality and warmer surface water temperatures.

4.4.2.3.2.2 Fish Resources and Fish Habitat, and Wildlife and Wildlife Habitat

Alternative 3 would relocate the Meadow Creek TSF and Hangar Flats DSRF to the EFSFSR valley to potentially address issues related to Endangered Species Act-listed candidate species habitat and communities, as well as IRAs in the SGP area. Although the impacts from climate change would be the same as Alternative 1, there would be somewhat less fragmentation of the terrestrial and fish habitat for the altered features in Alternative 3. The OHV connector would not be constructed, which would minimize terrestrial habitat fragmentation, and the TSF would be relocated to avoid fish and fish habitat impacts in Meadow Creek. These design features could assist wildlife and fish and aquatic species to tolerate future climate change because of less fragmentation from SGP.

4.4.2.3.2.3 Special Designations

Alternative 3 would relocate the Meadow Creek TSF and Hangar Flats DSRF to the EFSFSR valley drainage to potentially address issues related to IRAs in the SGP area. Although the impacts from climate change impacts would be the same as Alternative 1, it is expected that the improvements to avoid fragmentation would help to minimize impacts to IRAs.

4.4.2.4 Alternative 4

Under Alternative 4 the Yellow Pine Route would be used for access to the mine site during mine construction, operations, and closure and reclamation (**Figure 2.6-1** and **Figure 2.6-2**). The Burntlog Route would not be constructed under this alternative, which avoids the construction GHG emissions for this activity; however there would be construction activities required to improve the Yellow Pine Route specifically along Johnson Creek Road (County Road [CR] 10-413) and the Stibnite portion of the McCall-Stibnite Road (CR 50-412). Controlled public access through the mine site during mining operations for Alternative 4 would be provided by a road connecting Stibnite Road (CR 50-412) to Thunder Mountain Road (National Forest System Road 50375), in a similar manner as Alternative 2.

There are no modifications designed to specifically reduce GHG emissions or address climate change impacts; however, several other design features under Alternative 4 also would provide opportunities to minimize the severity of GHG and climate change impacts than the other action alternatives. The Johnson Creek temporary groomed over-snow vehicle trail would be kept open during construction and operations for winter public access, step pools would be created in Blowout Creek to reduce water velocity and sediment in its lower reaches and restore the eroded channel, Meadow Creek and Blowout Creek would be routed in a pipeline instead of a surface diversion channel, and cell tower construction within IRAs would be via helicopter.

4.4.2.4.1 GHG EMISSIONS

The Burntlog Route, which serves as the main mine access for Alternatives 1 through 3, would not be constructed. This would have the effect of decreasing overall construction phase GHG emissions; however, the construction activities to complete major improvements on the Yellow Pine Route would likely offset the decrease and would likely end up very similar to Alternative 1. The Stibnite Road (CR 50-412) portion of Yellow Pine Route would be improved by widening curves to accommodate 55-foot long semi-truck trailers. Approximately 1 mile of road through the village of Yellow Pine would be paved. Using Yellow Pine Route for mine access would avoid some construction-related GHG emissions that would otherwise occur under other alternatives. Based on relative roadway length affected, these changes in roadway construction would represent a slight decrease of overall construction phase GHG emissions. However, the magnitude of the emissions difference would be small compared to total construction emissions during the construction phase.

To the extent that construction of the step pools represents an increase in overall construction phase emissions, there would be a temporary increase in GHG emissions during this activity. Reclamation of disturbed areas outside of the step pools would be the same as described for Alternative 1, so there would be no net GHG emission difference for this phase resulting from construction of step pools.

For Alternative 4, controlled public access through the mine site would be provided similar to Alternative 2. The public access road would be constructed during the first year of mine operation, with resultant slight increase in GHG emissions for that aspect of the construction phase. Accommodating public access through the mine site would reduce the miles of motorized trails open to all vehicles within the Meadow Creek IRA by not constructing the OHV connector; this is expected to reduce net GHG emissions inside of, and in the vicinity of, the SGP area.

4.4.2.4.2 CLIMATE CHANGE IMPACTS TO SGP AREA RESOURCES

The anticipated climate change impacts for Alternative 4 would be the same as those discussed under Alternative 1 for the following resources of this EIS: geologic resources and geotechnical hazards, air quality, soils and reclamation cover materials, hazardous materials, groundwater (quality and quantity), timber resources, land use and land management, access and transportation, cultural resources, public health and safety, scenic resources, social and economic conditions, recreation, environmental justice, and tribal rights and interests. Impacts to surface water (quality and quantity), wetlands and riparian resources, vegetation (including general vegetation communities, botanical resources, and non-native plants), fish resources and fish habitat, wildlife and wildlife habitat, and special designations under Alternative 4 are described below.

4.4.2.4.2.1 Surface Water (Quality and Quantity)

Alternative 4 would include the construction of step pools in Blowout Creek to reduce water velocity and sediment in lower reaches of Blowout Creek, and to restore the eroded channel. Climate change is expected to create more extreme precipitation events, leading to increases in flash flooding, sedimentation, and erosion in waterways (Halofsky et al. 2018). Although the impacts of climate change would be the same as Alternative 1, it is expected these design improvements would help to minimize the severity of impacts by more efficiently managing surface water after extreme precipitation events.

4.4.2.4.2.2 Wetlands and Riparian Resources

Not constructing the Burntlog Route under Alternative 4, as well as routing Meadow Creek and Blowout Creek in a pipeline instead of a surface diversion channel, would avoid impacts to wetlands and riparian areas. Although the impacts of climate change would be the same as Alternative 1, these Alternative 4 design features would minimize the severity of impacts to wetlands and riparian resources.

4.4.2.4.2.3 Vegetation: General Vegetation Communities, Botanical Resources, and Non-Native Plants; Fish Resources and Fish Habitat; Wildlife and Wildlife Habitat; and Special Designations

The Burntlog Route would not be constructed under Alternative 4, avoiding the construction of approximately 20 miles of roadway by using the Yellow Pine Route for mine access. Although the impacts of climate change would be the same as Alternative 1, it is expected that not constructing the Burntlog Route would help to minimize the severity of impacts to sensitive plant species (whitebark pine), federally listed fish species, wildlife and wildlife habitat, and IRAs. There would be less fragmentation of habitat without construction of the Burntlog Route, and there would be fewer opportunities for insects and disease to spread to special designation areas. Additionally, cell tower construction via helicopter would further reduce fragmentation in IRAs and minimize climate change impacts to IRAs and sensitive plant species (whitebark pine) within the IRAs.

4.4.2.5 Alternative 5

Under Alternative 5, the analysis area would continue to be impacted by current climate change trends. As the no action alternative, Alternative 5 represents the baseline condition against which potential GHG emission and climate change effects are evaluated for the analysis area. The Forest Service would not approve the mining plan that would allow development of the mine site, ore processing, and related activities. For example, the earth-moving and vehicle traffic that would represent direct GHG emission effects associated with the action alternatives would not occur. The use of petroleum fuels for existing generators, water pumps, vehicles and other approved exploration-related operations would be ongoing, as well as other Forest Service and local activities such as prescribed fire and road construction and use. Mineral exploration would continue to occur as part of the Golden Meadows Exploration Project, creating emissions from fuel consumption and fugitive dust emissions associated with exploration activities; however, the magnitude of impacts from these activities would be very low compared to the action alternatives. Consequently, on a regional level the effects of GHG emissions from activities within the analysis area would be unchanged from current conditions.

Areas of the mine site disturbed by previous mining activities would remain as they are and (without targeted revegetation efforts tied to required mine reclamation) would be anticipated to recover at a natural, although very slow, rate as new soil forms and plants are established.

4.4.2.5.1 GHG Emissions

If the SGP does not proceed, it can be assumed that current uses by Midas Gold and other users on patented mine/mill site claims and on the Payette National Forest and Boise National Forest would continue to comply with all existing applicable air quality regulations. Uses of National Forest System lands that may result in GHG emissions include mineral exploration, dispersed OHV use, snowmobiling, recreational driving, and other forms of recreation.

No long-term direct effects on GHG emissions or climate change are anticipated for Alternative 5. The removal of existing vegetation that would be necessary to develop the action alternatives would not occur, and the disturbed areas due to historic mining would not be reclaimed or actively reforested. Emissions of GHGs associated with the continuation of approved exploration activities at the mine site and associated reclamation and monitoring commitments would be small and intermittent across a limited area within the SGP area boundary. Given these characteristics of Alternative 5, GHG emissions would not be expected to change compared to current conditions, and an emissions analysis has not been performed.

4.4.2.5.2 Climate Change Impacts To SGP Area Resources

Potential incremental contributions to GHG emissions and climate change effects discussed in preceding sections for the action alternatives would not occur under Alternative 5. Any of the action alternative components that would potentially represent net climate change impacts to various resources in the SGP area would not be constructed. The existing climate change trends and indirect effects that are being observed on a regional level, as described in Section 3.4.3.2, Climate Change Trends, would continue to affect the SGP area under Alternative 5.

4.4.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the

Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.4.4 Cumulative Effects

In accordance with NEPA and the CEQ guidelines, cumulative effects are to be analyzed as a component of any project undergoing a NEPA analysis. Cumulative effects are additive or interactive effects that would result from the incremental impact of the proposed action [or alternatives] when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (40 Code of Federal Regulations 1508.7). Past and present actions and reasonably foreseeable future actions include activities, developments, or events that have the potential to change the physical, social, economic, and/or biological nature of a specified area. By this definition, GHG emission sources directly associated with the alternatives, and reasonably foreseeable future actions having emissions that may or may not overlap with the alternatives in time, could result in cumulative climate change impacts, even though it is not possible to quantify such incremental effects.

Regional levels of GHG emissions will change due to many factors, the primary ones being trends in industrial activity, pace of energy resource development, transportation fuel consumption rate, and population growth. But within this generalized framework, it cannot be predicted with certainty the extent to which the mix of all these activities will collectively contribute to the global phenomenon of climate change. Therefore, defining a specific cumulative impact on climate change cannot be related to emissions from the SGP or sources that would contribute to overall cumulative GHG emissions.

As described in Section 3.4.2, Climate Change, Relevant Laws, Regulations, Policies, and Plans, no federal or state rules or regulations currently limit or curtail emissions of GHGs from sources in the State of Idaho. Therefore, at present no regulatory mechanism exists for assessing in a quantitative manner the significance of GHG emissions or cumulative effects. Draft guidance on climate change analysis published by the CEQ (CEQ 2019) has indicated that a quantitative analysis of GHG emissions and the relationship to climate change is not required in every project-level NEPA analysis. Based on this guidance, this analysis has adopted a qualitative approach.

4.4.4.1 Action Alternatives

Cumulative effects analysis for GHG emissions as an indicator of climate change effects considers the geographic range and timeframe of emissions from current and foreseeable activities. In theory, GHG emissions from past projects have already contributed to current climate conditions, even if the mechanisms creating those conditions are global in scale. Transport of GHGs from far more distant urban regions, even overseas, may contribute to regional climate changes, but are not within the scope of a cumulative effects analysis. Based on these considerations, past operations by Midas Gold in the analysis area, such as exploratory drilling, monitoring wells, roadway construction and maintenance, are not contributors to future GHG-related cumulative effects. Similarly, past activities within the cumulative analysis area, such as prior roadway and infrastructure construction projects, and vegetation management have both contributed to and offset some of the cumulative GHG emissions in the SGP area.

While the magnitude and location of air emission sources associated with the SGP are different for the action alternatives, the differences are not sufficiently large enough to significantly affect GHG emission and climate change. The extent and magnitude of potential cumulative GHG emission and climate change effects due to foreseeable projects in the analysis area when added to the GHG emissions and climate effects (**Table 4.4-4**) would be the same for all action alternatives.

4.4.4.2 Alternative 5

Under Alternative 5, the SGP would not be implemented and therefore would not contribute to cumulative effects. The same cumulative effects contributions from potential development in the surrounding area would be the same as described above.

Past and ongoing activities in the region surrounding the SGP area include forest management (e.g., prescribed burns), motorized use of roads for land management and recreation, and fire suppression. These activities would continue as relatively small GHG contributors in the context of the total GHG inventory for Idaho, and would not be expected to add to substantial cumulative GHG-related effects in the region or to climate change in general.

Table 4.4-4 Current and Reasonably Foreseeable Activities Considered Regarding Cumulative GHG Emissions

Project Type	Project Names/Description	Nature of Air Emissions and Contribution to Cumulative Effects
Exploratory Drilling for Mineral Resources	• **Morgan Ridge Exploratory Drilling** Project involves exploratory drilling for locatable minerals from remote drill pads approximately 10 miles north of the mine site. Project is reportedly on hold.	Local GHG emissions from drilling equipment (e.g., compressor engines), and vehicle tailpipe emissions. Expected to have GHG emissions that are a very small portion of the Idaho inventory.
Forest Maintenance and Fire Risk Reduction	• **Big Creek Fuels Reduction Project,** approximately 10 miles north of mine site • **South Fork Restoration and Access Management,** 25 miles southwest of mine site • **East Fork Salmon River Restoration and Access Management,** approximately 5 miles northwest of mine site	Local GHG emissions from portable generators equipment (e.g., compressor engines, and vehicle tailpipe emissions. Expected to have GHG emissions that are temporary and a very small portion of the Idaho inventory.

Project Type	Project Names/Description	Nature of Air Emissions and Contribution to Cumulative Effects
	Projects to reduce wildfire risk and fire severity/intensity on National Forest System lands and private property using commercial timber harvest, understory treatment, and prescribed burning.	
Construction Projects	• **Creek restoration** • **Trail construction and maintenance** • **Bridge and culvert replacement projects,** generally located more than 10 miles north of SGP area • **Hydroelectric projects: small residential projects for power generation** • **Road maintenance**	Short-term GHG emissions during construction with no long-term emission impacts that would overlap with impacts related to the SGP.
Natural Emission Events	**Wildland fires** • Between 2005 and 2015, over 88,000 acres of the Big Creek watershed have been burned. Between 1990 and 2013 over 330,000 acres have burned within the headwaters of East Fork South Fork Salmon River and Sugar Creek.	Future fires may add additional GHG to the atmosphere.
Mining Activities	**Ongoing mining activities on patented land** • Mineral exploration and mining have occurred in several locations around the SGP area. Exploration activities area ongoing for potential future mining development.	Local emissions from drilling equipment (e.g., compressor engines), and tailpipe GHG emissions. Known mining operations are of small size (50 tons per day or less) or are inactive. Expected to have GHG emissions that are temporary and a very small portion of the Idaho inventory.
Recreation and tourism	**Recreation and Tourist activities:** • Sport hunting, fishing, trapping • Snowmobile trails • Fugitive dust and tailpipe emissions from traffic on unpaved roads • Boating and river recreation • Camping, hiking, backpacking • Outfitter/Guide Operations • Tourist Services – Big Creek Lodge • OHV use • Tourist Services – e.g., Big Creek Lodge	Collectively substantial GHG emissions from vehicles on unpaved roads and trails, boats, and stationary fuel combustion sources. These sources are already included in the Idaho inventory.

4.4.5 Irreversible and Irretrievable Commitments of Public Resources

4.4.5.1 Action Alternatives

Alternative 1 would result in an increase in the use of fuels and other resources (40 to 50 MWs of electrical power) in the region. There would be use of public resources to support this effort, such as using public roads to access construction areas or infrastructure in the area; this would result in additional indirect GHG emissions related to all action alternatives. However, this use of fuels and other resources could have a compensating benefit of improving economic conditions in the area by offsetting some of the public resource expenditures. In addition, all action alternatives would result in a minor use of public resources for permitting and compliance assurance activities.

4.4.5.2 Alternative 5

Under Alternative 5, the resources associated the SGP would not be expended. As such, there would be no irreversible and irretrievable commitment of public resources.

4.4.6 Short-term Uses versus Long-term Productivity

4.4.6.1 Action Alternatives

The operation of the action alternatives generate short-term emissions of GHG for the duration of construction, operation, and closure and reclamation of the SGP. The long-term productivity of the SGP area would be an economic benefit to Idaho. Elements of the action alternatives, including reclamation of some historically disturbed areas, also may be a long-term benefit. These improvements in the long-term productivity of the mine site may help to minimize the severity of climate change impacts resulting from warmer temperatures, variable precipitation, decreased snowpack, lower stream flows, warmer stream temperatures, and changes in wildfire patterns.

4.4.6.2 Alternative 5

Under Alternative 5, the SGP would not be implemented. The long-term productivity of the analysis area would not be impacted by short-term uses, and current climate change trends would continue to persist in the analysis area.

4.4.7 Summary

Alternative 1 would create a total of 67,400 MT CO_2eq annual GHG emissions, approximately 0.23 percent of the annual Idaho statewide total GHG emissions. Indirect GHG emission sources associated with Alternative 1 include electrical power generated off-site (but used on-site), and emissions from antimony transport and processing. Changes in hydrologic patterns, temperature, and extreme weather events would contribute to a varying level and degree of impacts between resources.

Changes in hydrologic patterns and overall increasing temperatures are expected to result in decreased or degraded soil moisture and quality, air quality, annual streamflows, groundwater recharge, and water quality. Increased surface water temperatures; increased spread of insects and diseases; changes in the timing, duration, and severity of fire seasons; as well as habitat loss and fragmentation also are expected to occur. Closure and reclamation activities under Alternative 1 could reduce climate change impacts by improving soil quality and implementing best management practices during all phases of the SGP would help to reduce air quality impacts and GHG emissions.

Although geotechnical design standards have been developed to help minimize and mitigate the extent of potential stability impacts under Alternative 1, extreme precipitation events and flash flooding, could lead to more frequent and severe landslides and avalanches. Roads and other infrastructure near their design life also are more susceptible to extreme weather events. Road maintenance during all SGP phases could improve resilience of the access roads and transportation infrastructure against climate change impacts.

The addition of the lime kiln under Alternative 2 would increase direct GHG emissions from Alternative 1 by approximately 74 percent 117,587 MT CO_2eq annual GHG emissions. Indirect GHG emissions would be the same as those discussed under Alternative 1.

Direct and indirect GHG emissions and their associated impacts would be the same under Alternative 3 as those discussed under Alternative 1. Direct climate change impacts to SGP area resources under Alternative 3 would be the same as those discussed under Alternative 1; however, Alternative 3 would relocate the Meadow Creek TSF and Hangar Flats DSRF and the OHV connector would not be constructed, leading to less fragmentation in the SGP area. There would be fewer direct impacts to IRAs and wildlife habitat helping to indirectly minimize climate change impacts and assist sensitive species to tolerate future climate change.

Direct and indirect GHG emissions and their associated impacts would be the same under Alternative 4 as those discussed under Alternative 1. Direct impacts from climate change under Alternative 4 would be the same as those discussed under Alternative 1; however, the Burntlog Route would not be constructed under Alternative 4, leading to less habitat fragmentation in the SGP area. This would help to indirectly minimize climate change impacts experienced by wildlife, wildlife habitat, wilderness areas, IRAs, and Research Natural Areas.

Exploration activities associated with the Golden Meadows Exploration Project would continue under Alternative 5. Therefore, baseline conditions would continue and direct and indirect GHG emissions in the vicinity of the SGP area would not change. Current climate trends are expected to continue under Alternative 5, such as increased average annual temperatures, variable precipitation, decreased snowpack, reductions in stream flows, warmer stream temperatures, and changes to wildfire patterns. No additional impacts beyond current trends are expected to occur to the physical, social, and biological resources in the area.

Table 4.4-5 provides a summary comparison of climate change impacts by issues and indicators for the baseline condition and each alternative.

Table 4.4-5 Comparison of Climate Change Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP activities could contribute to factors that influence climate change.	GHG emissions from SGP activities (construction, operations, and closure and reclamation), expressed as MT of CO_2eq of GHGs.	No emissions.	67,400 MT of CO_2eq of total annual GHG emissions.	117,587 MT of CO_2eq of total annual GHG emissions.	Same as Alternative 1.	Small incremental differences from Alternative 1. GHG emissions would be reduced because the Burntlog Route would not be constructed; however, the construction activities required on the Yellow Pine Route would likely offset the decrease and would likely end up very similar to Alternative 1.	Same as baseline emissions
Changing climatic conditions, in synergy with the SGP (including construction, operations, and closure and reclamation), could impact the physical, biological, and social resources.	• Changes in hydrologic patterns (drought, precipitation variability and seasonality). • Changes in temperature (extreme heat/cold, or overall change in annual or seasonal temperatures). • Changes in extreme weather events (flash flooding, wildfires, severe storms).	• Current trends show variable annual average precipitation and drought patterns, decreases in snowpack, and decreases in streamflow. • Current trends show increases in annual average temperature and more frequent temperature extremes. • Current trends show increased frequency and intensity of extreme weather events.	Changing climatic conditions are expected to result in decreased soil moisture and quality; air quality; annual streamflow; groundwater recharge; water quality; increased surface water temperatures; increased spread of insects and diseases; changes in the timing, duration, and severity of fire seasons; and habitat loss and fragmentation.	Same as Alternative 1, except the severity of climate change impacts may be reduced for surface water and groundwater (quality and quantity), fish resources and fish habitat, wildlife and wildlife habitat, and public health and safety.	Same as Alternative 1, except the severity of climate change impacts may be reduced for surface water (quality), fish resources and fish habitat, wildlife and wildlife habitat, and special designations (IRAs).	Same as Alternative 1, except the severity of climate change impacts may be reduced for surface water (quality and quantity), wetlands and riparian resources, vegetation (including general vegetation communities, botanical resources, and non-native plants), fish resources and fish habitat, wildlife and wildlife habitat, and special designations.	Same as baseline.

This page intentionally left blank

4.5 SOILS AND RECLAMATION COVER MATERIALS

4.5.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to soils and reclamation cover materials (RCM) includes the following issues and indicators:

Issue: The Stibnite Gold Project (SGP) may result in long-term adverse impacts to soil resources.

Indicators:

- Acres and proportion of the total soil resource commitment (TSRC) activity area that are converted from a productive site to a non-productive site (as defined in the both the Payette National Forest Land and Resource Management Plan [Payette Forest Plan] and Boise National Forest Land and Resource Management Plan [Boise Forest Plan]).
- Acres and proportion of detrimental soil disturbance (DD) activity area that have altered soil characteristics resulting in a loss of productivity and altered soil-hydrologic conditions (as defined in both the Payette and Boise Forest Plans).

Issue: Available RCM may not be of sufficient quantity or quality to achieve reclamation objectives of returning disturbed areas to productive conditions that sustain long-term wildlife, fisheries, land, and water resources, as defined in the Reclamation and Closure Plan (RCP) (Tetra Tech 2019).

Indicators:

- Volume of RCM available for reclamation compared to expected demand to achieve reclamation objectives.
- Quality and suitability of RCM available for reclamation.

The assessment of potential effects is organized and analyzed for each alternative by the three main issue and indicator topics: TSRC, DD, and RCM. The definition and application of these three indicator topics in this analysis is defined as follows:

- TSRC: As defined in the Payette Forest Plan (U.S. Forest Service [Forest Service] 2003) and Boise Forest Plan (Forest Service 2010), this is the conversion of a productive site to an essentially non-productive site for a period of more than 50 years. Mining excavations and dumps, roads, dedicated trails, parking lots, and other dedicated facilities (e.g., landfills, borrow sites, surface water management features, etc.) are examples of TSRC. Productivity on these areas range from 0 to 40 percent of natural background. Proposed activities that may affect soil resources are required to meet Standard SWST03 which states:

a) In an activity area where existing conditions of TSRC are below 5 percent of the area, management activities shall leave the area in a condition of 5 percent or less TSRC following completion of the activities.

b) In an activity area where existing conditions of TSRC exceed 5 percent of the area, management activities shall include mitigation and restoration so that TSRC levels are moved back toward 5 percent or less following completion of the activities.

Effects are determined for a defined activity area, which for TSRC is “an all-inclusive area where effects to soil commitment could occur or are occurring” (Payette Forest Plan 2003 and Boise Forest Plan 2010). The Forest Plans further describe activity areas as “the smallest logical land area where the effect that is being analyzed or monitored is expected to occur.” The activity area for TSRC has been defined as the National Forest System (NFS) lands within the 6th field Hydrologic Unit Codes within which the SGP takes place. The sixth level classification of these units, subwatersheds, was selected as it is a reasonable extent to which some of the potential indirect effects of the SGP might extend, such as soil erosion and sedimentation. The activity area excludes private lands per established methodology for TSRC analysis on the Payette National Forest (PNF), which in the case of the mine site is Midas Gold Idaho, Inc.’s (Midas Gold’s) patented mining claims. The activity area also excludes from the TSRC analysis Inventoried Roadless Areas (IRAs), Research Natural Areas, and Wilderness because these areas of NFS lands typically do not meet the “expected to occur” criteria for TSRC analysis. However, it should be noted that the SGP proposes certain facilities with portions that would occur within IRAs. Thus, the TSRC activity areas specific to each of the four action alternatives retain the footprints of those portions of facilities that occur within IRAs for the purpose of TSRC analysis. The TSRC analysis includes a determination of existing conditions of TSRC and anticipated post-SGP conditions within the activity area. Two separate activity areas are analyzed based on Forest Plan jurisdiction: one for the PNF sub-watersheds and one for the Boise National Forest (BNF) subwatersheds (**Figure 4.5-1**). Additional discussion of the methodology is provided in **Appendix G-1** (TSRC Methodology).

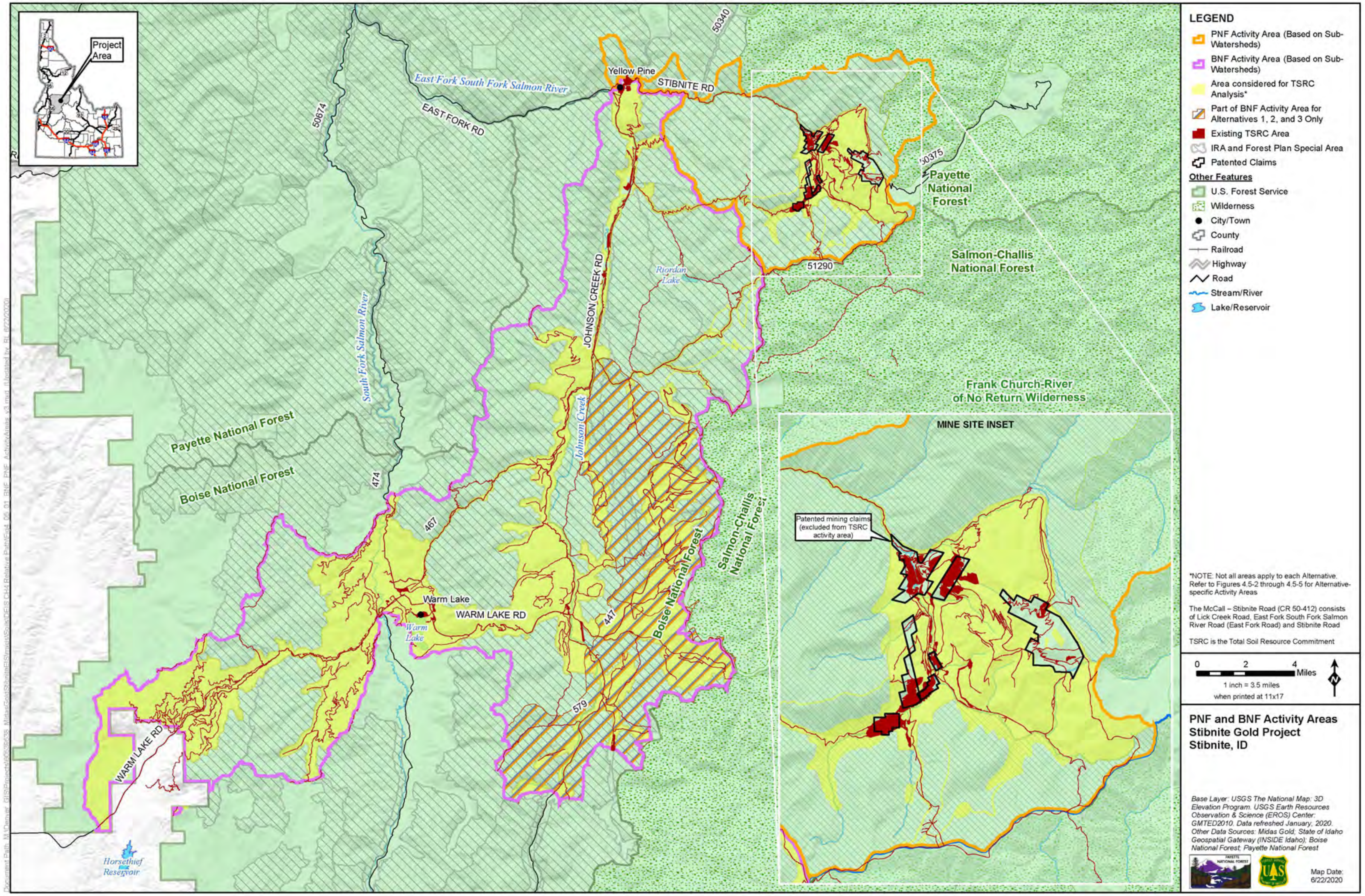


Figure Source: AECOM 2020

Figure 4.5-1 PNF and BNF Activity Areas

This page intentionally left blank

- DD: As defined in the Forest Plans, DD is the alteration of natural soil characteristics that results in immediate or prolonged loss of soil productivity and soil-hydrologic conditions. Proposed activities that may affect soil resources are required to meet Standard SWST02 which states:

  a) In an activity area where existing conditions of DD are below 15 percent of the area, management activities shall leave the area in a condition of 15 percent or less detrimental disturbance following completion of the activities.

  b) In an activity area where existing conditions of DD exceed 15 percent of the area, management activities shall include mitigation and restoration so that DD levels are moved back toward 15 percent or less following completion of the activities.

  Mining excavations and dumps, roads, parking lots, and other dedicated facilities are excluded from this requirement. The mine site, the Burntlog Route and access roads, and offsite facilities are all dedicated facilities and are therefore assessed for TSRC and not DD. DD does apply to vegetation clearing for new and upgraded utility corridors in areas that are available for multiple uses on Forest Service lands. DD is represented by any or all these characteristics: Soil Displacement, Soil Compaction, Soil Puddling, and Severely Burned Soil. Effects are determined for a defined activity area, which is the specific area where proposed actions may have detrimental soil impacts. The activity area for DD has been defined as the new and upgraded transmission line corridor where it occurs on NFS lands. A DD analysis includes a determination of existing conditions of DD and anticipated post-SGP conditions within the activity area.

- RCM: The discussion of volume of available RCM is based largely from the soil salvageability calculations from the RCP and the stated commitments made by Midas Gold for salvage and creation of growth media through composting (Tetra Tech 2019). The assessment of quality and suitability of the available RCM focuses on the primary site-specific challenges for reclamation that are associated with low organic matter, high rock content, and background metals concentrations of the soils, as well as challenges with long-term stockpiling of RCM. Note that the information in this discussion with respect to metals concentrations in soils is strictly limited to plant growth and issues of phytotoxicity; consideration of ecological effects of elevated metals concentrations is presented in Section 4.12, Fish Resources and Fish Habitat, and Section 4.13, Wildlife and Wildlife Habitat, and consideration of human health risks is presented in Section 4.18, Public Health and Safety.

4.5.2 Direct and Indirect Effects

The following analysis of effects associated with soils and RCM is considered within the overall context of being situated in a historic mining district with soils at the mine site that are generally characterized as weakly developed and coarse-textured with a high prevalence of coarse fragments. Elements of this context include:

- Thin, poorly developed surface and subsurface layers (A and B horizons) that have formed on steep slopes (30 to 80 percent gradient);
- Soil formation occurring on parent materials and landforms that are common throughout this part of Idaho (i.e., residuum and colluvium developed in intrusive igneous bedrock of the Idaho Batholith; alpine glacial till and glacial outwash; and alluvium);
- Being situated in a highly mineralized zone, where background concentrations of some metals (e.g., arsenic, antimony, and mercury) are known to be relatively high in some soils and underlying layers (i.e., the mean concentration of arsenic in soil samples adjacent to the site was found to be five times higher than U.S. Environmental Protection Agency's ecological soil screening level for arsenic; refer to Section 4.5.2.1.3, Reclamation Cover Materials, for further discussion); and
- The mine site being located within an area previously disturbed by historical mining and related activities, resulting in the presence of legacy mining features and existing soil contamination and commitment of soil resources.

4.5.2.1 Alternative 1

4.5.2.1.1 TOTAL SOIL RESOURCE COMMITMENT

4.5.2.1.1.1 Payette National Forest

Under Alternative 1, the SGP would occur within three subwatersheds in the PNF, totaling approximately 43,355 acres: Headwaters East Fork South Fork Salmon River (EFSFSR) (approximately 15,973 acres); Sugar Creek (approximately 11,497 acres); and No Man's Creek-EFSFSR (approximately 17,886 acres); refer to **Table 4.5-1**. These three subwatersheds would contain the entire mine site and portions of the Burntlog Route and new transmission line corridor. The TSRC activity area for the PNF (i.e., excluding IRAs, Research Natural Areas, Wilderness, and Midas Gold's private patented mining claims) totals approximately 7,467 acres. Existing conditions of TSRC within this activity area was estimated to cover approximately 259 acres, or roughly 3 percent (**Table 4.5-1** and **Figure 4.5-1**).

Table 4.5-1 Payette National Forest Subwatersheds, Activity Area, and Existing Total Soil Resources Commitment (Alternative 1)

Subwatershed	Subwatershed (acres)	Activity Area (acres)	Existing TSRC in Activity Area (acres)	Percent Existing TSRC in Activity Area
Headwaters EFSFSR	15,974	5,034	171	3%
Sugar Creek	11,497	2,021	57	3%
No Man's Creek-EFSFSR[1]	17,885	413	31	1%
TOTAL	**45,356**	**7,468**	**259**	**3%**

Table Source: AECOM 2020

Table Notes:

1 The western portion of the No Man's Creek-EFSFSR subwatershed is within the BNF. The acreage provided here is only for the area that is within the PNF.

TSRC = Total Soil Resource Commitment.

Construction of the various facilities, structures, infrastructure, and water management features at the mine site would result in the removal of native soils and/or disturbance of soil resources and RCM. For the open pits, development rock storage facilities (DRSFs) and tailings storage facility (TSF), soil disturbance would occur incrementally throughout mining operations as these facilities expand. The majority of construction, mining production, and closure activities would involve excavation, grading, and/or filling of the existing soils that would severely reduce or eliminate soil productivity. Various portions of the mine site would be affected at different times during the life of the mine. The portion of Burntlog Route within this activity area consists of its approach into the mine site from Thunder Mountain Road (National Forest System Road [FR] 50375) down into and along the EFSFSR drainage, including two borrow source areas along the approach. Soil disturbance associated with construction activities for this portion of Burntlog Route would include cut and fill, culvert installation, and retaining walls. The portion of the new transmission line corridor within this activity area consists of its approach into the mine site from Horse Heaven/Powerline Road (FR 416W) and NFS Trail 233 (no name) along the ridge north of the Meadow Creek drainage down into the central portion of the mine site near confluence of Meadow Creek and EFSFSR. Soil disturbance would be associated with structure work areas, transmission line access roads, laydown yards, pulling and tensioning sites, and access roads for the three cell tower location options. Midas Gold conceives of a 3-year construction period, approximately 12-year production period, 5-year closure period, and 5-year plus post-closure period. The proposed surface disturbance schedule from the RCP is illustrated in **Figure 1** in **Appendix G-2** (TSRC Analysis Figures). Note that the RCP (Tetra Tech 2019) includes a schedule that reports SGP construction as negative years (-3, -2, and -1) counting down to when operations begin at the mine site in year 1. This differs from the timeline presented in Chapter 2 of this Environmental Impact Statement (**Figure 2.3-3**), which begins at year 1 aligning with the first year of SGP construction-related activity. The use of RCP timing is repeated throughout this discussion of soils and RCM because the RCP is the primary source for the reclamation details and RCM salvageability calculations presented below.

According to the RCP, Midas Gold intends to reclaim all of the SGP-related disturbance except for approximately 357 acres associated with the Hangar Flats pit lake and high walls, the West End pit lake and high walls, the Midnight pit lake, and Yellow Pine pit high walls. These areas would remain a permanent commitment of soil resources (a large portion of which would occur on private patented mining claims).

For all other areas in the activity area, disturbance would be subject to the reclamation activities detailed in the RCP (Tetra Tech 2019). The reclamation schedule from the RCP is provided in **Figure 2** of **Appendix G-2**. The stated goal of the RCP is to stabilize and reclaim areas of proposed exploration, mining, and processing activities (which would include areas within the footprint of disturbance that have been impacted by historical mining activities) “to productive conditions that sustain long-term, post-SGP wildlife, fisheries, land, and water resources.” “Productive conditions” are not further defined in the RCP, and there is no direct correlation with TSRC (i.e., a reclaimed site may or may not continue to meet the Forest Plan definition of TSRC, which requires a greater than 40 percent recovery of natural background soil productivity within 50 years of disturbance). The RCP utilizes reclamation strategies that are common on mined land in the mountain west region. The aim of these strategies is to return a site to a stable condition that would not require ongoing maintenance or inputs over the long term and would not contribute to erosion or sedimentation that would adversely impact post-mining uses or downstream resources. Many of the reclamation activities proposed relate to achieving soil and slope stability through management and best management practices of surface and groundwater, grading and slope configurations; and establishing persistent vegetation cover. Planting prescriptions are primarily intended to provide fast-growing native ground cover that would initiate the long-term process of succession towards native forest communities. Performance monitoring is tied to slope and soil stability, sediment, and vegetation cover.

Achieving persistent vegetation cover and slope stabilization also would benefit soil amelioration processes. However, the rate of restoration of soil productivity would vary greatly based on the quality of the reclamation cover materials, and site characteristics including slope position, shape and gradient, aspect; elevation, parent materials, seed and propagule sources, and other considerations. As a general rule, the processes responsible for restoration of soil productivity occur over a very long timeframe (centuries) and do not directly correlate to successful reclamation, which is mainly oriented to short-term objectives. The short target timeframe for achievable reclamation measures (e.g., 5 to 10 years) would not be sufficient to establish trends in soil resources and productivity that would take many centuries and up to millennia to develop within the conditions that pertain to the activity area, especially with respect to the short growing season and harsh winters. Important measures of long-term soil productivity would include: development of a litter layer, biotic crust and/or A horizon (organic matter-enriched surface layer); development of soil structure to support water and air movement; physical and chemical weathering of coarse fragments to add soil fines and nutrients; and development of the soil food web, nutrient cycles, and microbial community, especially the mycorrhizal network. Thus, the following considerations make the recovery of greater than 40 percent soil productivity within a 50-year timeframe to be unlikely:

- The short growing season (generally less than 90 days) that restricts soil development and amelioration processes;
- Organic matter and fine and large woody debris (critical components to achieve sustainable improvement of soil quality and productivity) are limited at the mine site due to past mining activities and fires. Organic soils (histosols) and soils with high organic matter content would be primarily used for the wetland and stream reconstruction areas, leaving the remaining growth media (GM) intended for non-wetland areas to consist of poorer quality material (refer to Section 4.5.2.1.3, Reclamation Cover Materials, for further discussion);
- GM salvaged from upland areas (mixed typic cryorthents soil unit) would make up approximately 61 percent of the salvageable volume at the mine site and Burntlog Route and has poor suitability for reclamation due to generally coarse textures and high coarse fragment content which limit water and nutrient holding capacity. Proposed soil amendments, including small amounts of organic composts and fertilizers, may not be retained by this GM.
- The mine site occurs in a highly mineralized zone, and background concentrations of some metals (i.e., arsenic, antimony, mercury, and silver) are known to be relatively high in some soils and regolith. The re-use of soil and rock with high metals concentrations at the site has the potential to complicate revegetation plans for reclaimed areas by requiring use of local adapted genotypes and frequent testing of growth media prior to and after placement (refer to Section 4.5.2.1.3, Reclamation Cover Materials, for further discussion);
- For most of the areas to be reclaimed, there would be a long delay (18 to 20 years) between the time when the site is initially disturbed and when it undergoes final reclamation (refer to **Figures 1** and **2** of **Appendix G-2**). This would substantially reduce the number of years remaining to successfully recover soil productivity prior to the 50-year threshold associated with TSRC. For example, there would be a 20- to 22-year delay from initial disturbance to final reclamation of the TSF, and DRSFs would range from an 8- to 18-year delay;
- Final reclamation does not mean that the reclamation goals and objectives are immediately achieved. The reclamation is expected to provide the initial conditions for soil and site recovery that may take years or decades to fully develop. The modest reclamation performance standards for the mine site are expected to take 5 years or longer to achieve, and these goals are not directly tied to soil amelioration/productivity;
- Reclamation would be performed using GM that would be stored in deep stockpiles for years, which would undergo changes to bulk density, organic matter content, nutrients, and microbial activity that would persist until soil structure and organic matter build up occurred (Thompson and Sorvig 2000; refer to Section 4.5.2.1.3, Reclamation Cover Materials, for further discussion of effects to soil quality from stockpiling); and

- The productive inter-relationships between vegetation, soil organic matter, and soil microbial communities of natural forests would be disrupted at the reclamation sites, even when organic amendments are applied (Macdonald et al. 2015). Soil organic carbon is a prime indicator of soil quality recovery in post-mining soils because it is tied to so many important soil functions including nutrient and water holding capacity; moderation of soil climate; development of soil structure; air and water movement into and through the soil; and development of microbial communities and nutrient cycling. Native soil organic carbon forms and levels generally take decades to recover in post-mining GM. Soil organic carbon recovery at the mine site would be expected to be especially slow due to the short growing season (refer to Section 4.5.2.1.3, Reclamation Cover Materials, for further discussion and detail).

Furthermore, certain facilities such as the TSF and DRSFs present inherent problems for soil productivity. Mining substrates derived from deep in the earth present challenges to ecosystem restoration (Cooke and Johnson 2002). These include physical characteristics of very coarse substrate in waste rock, and chemistry that is highly variable but generally deficient in essential nutrients, and potentially high in other elements (metals) that may affect plant growth. The DRSFs at the mine site would store (near the surface) waste rock that was excavated from deep in the ground and the TSF would store the tailings left over from ore processing. Selected development rock would serve as the rooting zone for reclamation-related planting as opposed to the natural underlying unconsolidated mantle of weathered rock and soil material (i.e., the loose earth materials above solid rock, or “native regolith”) for other facilities that would preserve the underlying native regolith. As such, in addition to the considerations listed above, the root zone material from waste rock (with potentially higher concentrations of arsenic and other heavy metals) would be up to 70 percent coarse fragments that may facilitate fines in the overlying GM to migrate into the underlying coarse rock below, and the DRSF outer slopes would be at steep gradients (3:1 or steeper), which further restricts soil development and amelioration in these areas.

The additional reclamation challenges associated with these types of facilities is consistent with observations of nearby, previously reclaimed mining areas having mixed vegetative cover success (e.g., Dewey Mine/Thunder Mountain Mining District), as well as previous efforts by Midas Gold and others at the mine site to establish a self-sustaining cover of vegetation on previously mined lands that were met with limited success. The reclamation proposed by Midas Gold is very similar to that which occurred in the 1990s and early 2000s at the mine site and vicinity. The reclamation plan for the Garnet Creek Pit and Haul Road (Greystone 1994), for instance, specified reapplication of at least 6 inches of salvaged soil on reclaimed areas, in addition to application of large woody debris or mulch. The primary goal of the plan was to stabilize the watershed by quickly establishing vegetative cover. However, reclamation projects such as this continue to contain locations that would not currently meet target benchmarks.

For all of these reasons, this analysis of TSRC assumes that all SGP-related disturbances in the PNF activity area would be considered TSRC due to the site-specific challenges and the duration and nature of soil disturbance to support the proposed mining activities.

SGP-related TSRC within the PNF activity area under Alternative 1 would total approximately 1,477 acres, with approximately 120 of these acres occurring over areas of existing TSRC (e.g., existing roads and trails, past mining disturbance, etc.). Overall TSRC under Alternative 1 would be approximately 1,616 acres, or 20 percent of the activity area. **Table 4.5-2** provides the overall summary of TSRC considerations as a proportion of the activity area, which is depicted in **Figure 4.5-2**.

Table 4.5-2 Alternative 1 Total Soil Resource Commitment for Payette National Forest

TSRC	PNF Activity Area[1] (acres)	TSRC within Activity Area (acres)	Existing TSRC Outside Disturbance Footprint[2] (acres)	Overall TSRC in Activity Area (acres)	Percent TSRC in Activity Area
Existing TSRC	7,468	259	--	259	3%
TSRC with Alternative 1	8,060	1,477[3,4]	139	1,616	20%

Table Source: AECOM 2020

Table Notes:

1 Activity area differences between Existing TSRC and TSRC with Alternative 1 are due to the addition of the footprints of Alternative 1 facilities that would occur within IRAs.

2 Existing TSRC outside of the disturbance footprint is TSRC that is within the activity area (affecting the percent TSRC) but is not overlapped by or attributed to the SGP. It is included within the “Overall TSRC in Activity Area” column.

3 Alternative 1 overlaps approximately 120 acres of existing TSRC (which is included in this total).

4 Approximately 5 acres associated with the Burntlog Route would occur within the Upper Indian Creek subwatershed in the Salmon-Challis National Forest. These areas, immediately adjacent to the Headwaters EFSFSR subwatershed, would be administered by the PNF and have some overlap with existing National Forest System Roads; adding 5 acres to the overall TSRC total would not change the percent TSRC within the activity area.

TSRC = Total Soil Resource Commitment.

It should be noted that an additional 558 acres of SGP-related disturbance would occur within areas excluded from the activity area (associated with Midas Gold’s private patented mining claims) of which approximately 338 acres would occur over existing soil disturbance (see **Table G-4** in **Appendix G-1**).

This page intentionally left blank

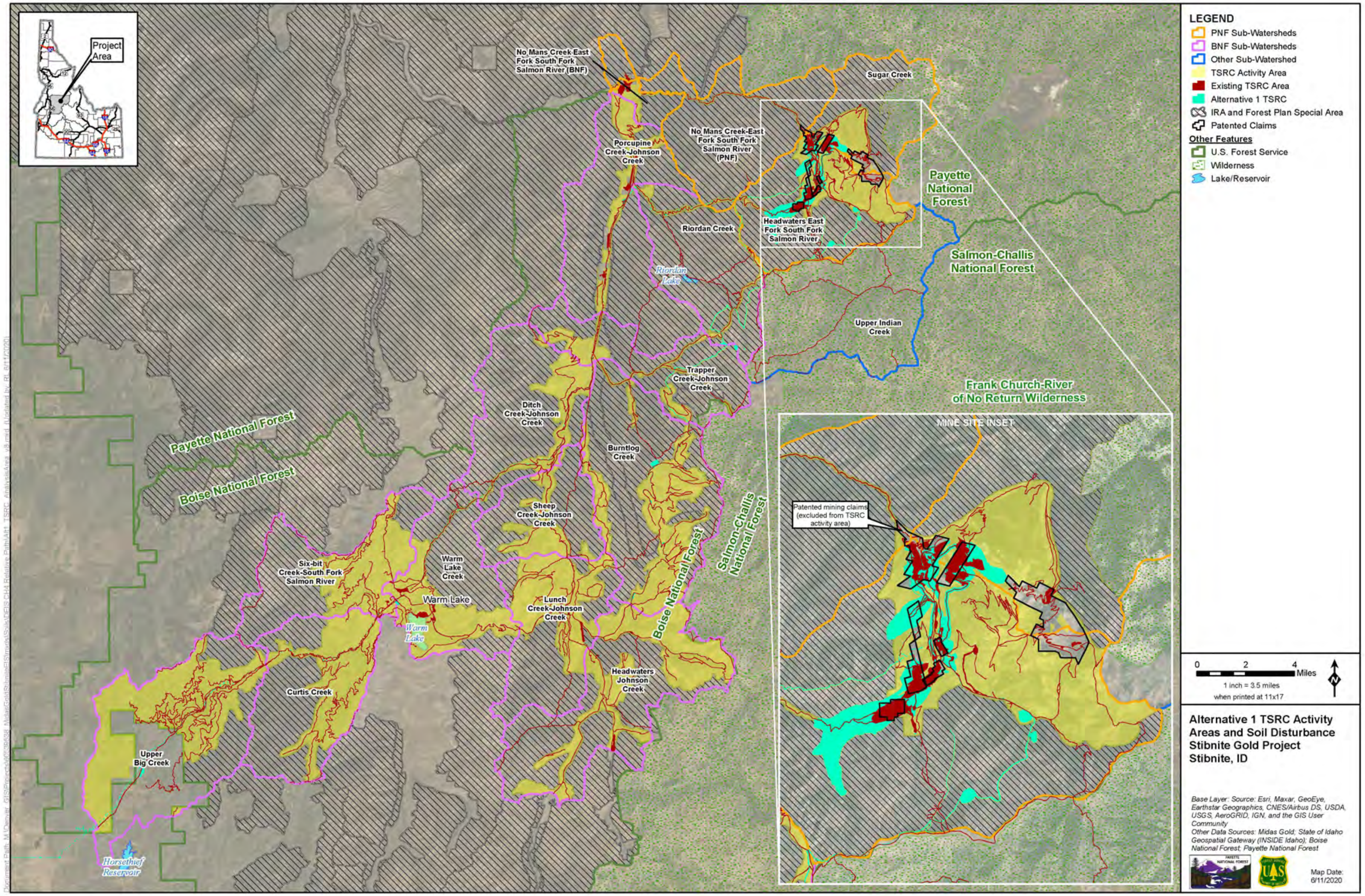


Figure Source: AECOM 2020

Figure 4.5-2 Alternative 1 TSRC Activity Areas and Soil Disturbances

This page intentionally left blank

The magnitude of impacts to soil resources within the PNF activity area includes excavation, grading, or filling of 1,616 acres (approximately 120 acres of which are already disturbed to some degree from historical mining activities or other TSRC), and a net increase of TSRC in the PNF activity area of approximately 1,357 acres (from an existing 259 acres to 1,616 acres).

The duration of impacts would vary by component based on the disturbance and reclamation schedule. Most disturbances would be initiated during the construction or early production phase and continue for a number of years until final reclamation is initiated. A select number of components would be reclaimed concurrently during active mining operations, so that duration of impacts would be lessened. Nevertheless, this analysis assumes recovery of greater than 40 percent soil productivity of natural background within a 50-year timeframe to be unlikely (due to the nature of disturbance and the conditions at the site) and, therefore, the duration of impacts would be longer-term, well beyond the 50-year threshold. For the TSF and DRSFs, where selected development rock would serve as the rooting zone for reclamation-related planting instead of native regolith, recovery of soil productivity to 40 percent of natural background would be on a much longer timescale (e.g., likely hundreds to thousands of years) such that they would be considered permanent TSRC. Un-reclaimed areas associated with the open pits (pit lakes and highwalls) also would be permanent TSRC.

Not included in the Alternative 1 TSRC total in **Table 4.5-2** are approximately 65 acres associated with new surface exploration pads and temporary roads (no spatial information is available for these pads and roads but they are assumed to be on PNF-administered lands; see Chapter 2, Section 2.3.6, Surface and Underground Exploration, for additional details of this disturbance). Adding 65 acres to the overall 1,616 acres of TSRC within the PNF activity area would still result in TSRC as approximately 20 percent of the activity area.

4.5.2.1.1.2 Boise National Forest

SGP-related TSRC within the BNF differs from the PNF in that the commitment of soil resources would occur along two relatively narrow supporting infrastructure corridors (access and transmission) that traverse numerous subwatersheds. Under Alternative 1, the SGP would occur within 13 subwatersheds in the BNF, totaling approximately 206,604 acres (refer to **Table 4.5-3**). These 13 subwatersheds would contain the majority of the Burntlog Route, portions of the new and upgraded transmission line corridor, and the Landmark Maintenance Facility. The TSRC activity area for the BNF (i.e., excluding IRAs, Research Natural Areas, Wilderness, and private land ownership) totals approximately 76,196 acres. Existing conditions of TSRC within this activity area was estimated to cover approximately 904 acres, or 1 percent (**Table 4.5-3** and **Figure 4.5-1**).

Table 4.5-3 BNF Subwatersheds, Activity Area, and Existing TSRC (Alternative 1)

Subwatershed	Subwatershed (acres)	Activity Area (acres)	Existing TSRC in Activity Area (acres)	Percent Existing TSRC in Activity Area
No Man's Creek-EFSFSR[1]	1,837	516	11	2%
Porcupine Creek-Johnson Creek	21,516	2,796	78	3%
Riordan Creek	14,411	883	17	2%
Trapper Creek-Johnson Creek	12,129	2,518	37	1%
Ditch Creek-Johnson Creek	16,222	3,628	48	1%
Burntlog Creek	25,194	9,417	99	1%
Sheep Creek-Johnson Creek	10,403	3,178	28	1%
Lunch Creek-Johnson Creek	15,414	7,322	98	1%
Headwaters Johnson Creek	23,385	10,305	89	1%
Warm Lake Creek	15,093	6,820	160	2%
Six-Bit Creek South Fork Salmon River	15,087	7,105	63	1%
Curtis Creek	17,476	8,280	74	1%
Upper Big Creek	18,436	13,429	103	1%
TOTAL	**206,604**	**76,196**	**904**	**1%**

Table Source: AECOM 2020

Table Notes:

1 The eastern portion of the No Man's Creek-EFSFSR subwatershed is within the PNF. The acreage provided here is only for the area that is within the BNF.

TSRC = Total Soil Resource Commitment.

Under Alternative 1, the Burntlog Route would include both new road sections (approximately 14.9 miles) and upgrades to existing roads (approximately 20 miles). Soil disturbance would be associated with cut and fill and full bench road construction (including culvert installation, approximately 1.5 miles of soil nail retaining walls, and rock cuts) borrow source areas, and construction staging areas. Soil disturbance associated with upgrading of the existing transmission line and construction of the new transmission line would involve laydown yards, pulling and tensioning areas, new access/spur roads, and structure work areas.

As discussed in the RCP, construction of the Burntlog Route would begin during the first year of the SGP construction phase (year -3). It would not be reclaimed until all final closure/reclamation and related environmental closure monitoring work has been completed at the end of the post-closure phase (year 23). During construction, some portions of the existing Burnt Log Road (FR 447) would be abandoned in areas where sharp corners or steep slopes require short new road segments to be constructed. These abandoned road segments would be obliterated as part of the construction process. For reclamation, the new road sections would be obliterated and reclaimed, while the upgrades to existing road portions would be narrowed to their current conditions, and the excess width would be reclaimed. However, due to the improved road layout of certain parts of the upgraded road sections (flatter grades and gentler curves), these improved roadway conditions would remain.

The RCP defines obliteration of created roads as consisting of partially filling cut sections or partially removing fill from fill sections to create erosionally stable slopes that mimic surrounding slopes as practicable, as well as removing culverts and creating armored stream crossings in their place, roughening disturbed surfaces and seeding all disturbance. As appropriate, water bars or other erosion control structures would be left in place. Compacted surfaces would be scarified, deep-ripped or otherwise left in a roughened condition prior to placement of GM and revegetation. At least 6 inches of GM would be placed over most of the reclamation areas, except where steep slopes (>45 percent) limit the use of equipment. GM placement on the widened road segments would be placed as practical, but this area is not included in the GM salvage and replacement balance calculated for the Burntlog Route. Additionally, the soil nail retaining walls on the cut side would be left in place, with regrading performed to the foot of the wall. The Forest Service would require road obliteration design features (see **Table D-1** of **Appendix D**) to restore slope contours to the natural slope profile, improve soil productivity, improve soil-water infiltration, and re-establish ground water flow paths and hydrologic function.

The new and upgraded transmission line corridor and access roads would be constructed during the 3-year SGP construction phase. The construction laydown areas, tensioning areas, and some of the new roads would be reclaimed immediately following construction. Final reclamation of the new transmission line corridor would occur during the post-closure period beginning after SGP year 18. After final closure of the mine, the upgraded section of transmission line would remain in use by Idaho Power Company (IPCo), so there would be no post-closure reclamation or monitoring requirements for Midas Gold. The new transmission line would be removed and reclaimed during the closure and reclamation phase. Any remaining access roads or disturbed areas would be recontoured to match surrounding topography, scarified, capped with 6 inches of GM, seeded and mulched. Culverts would be removed, and stream channels in the access road corridor would be excavated to original grades.

The Landmark Maintenance Facility also would be located within the BNF and would be constructed on approximately 3.5 acres near the intersection of Warm Lake and Johnson Creek (County Road [CR] 10-579) roads. Interim reclamation at this site would entail seeding slopes and other disturbed areas that would not be actively used for vehicle traffic, equipment, or materials storage. Final reclamation would occur during the closure and reclamation phase and would entail grading to smooth slopes, placement of 6 inches of GM, and reseeding, which may include planting trees.

The same considerations made for the analysis of TSRC on the PNF apply to the access and transmission infrastructure corridors and the off-site facility on the BNF. The short target timeframe for achievable reclamation measures (e.g., 5 to 10 years) would not be sufficient to establish trends in soil resources and productivity that may take decades to develop within the conditions that pertain to the activity area, especially with respect to the short growing season and harsh winters. The loss of productivity of GM stored in long-term stockpiles and the long delay between the time when the site is initially disturbed and when it undergoes final reclamation would affect GM quality and would substantially reduce the number of years remaining to successfully recover soil productivity prior to the 50-year threshold associated with TSRC. For example, there would be a 26-year delay from initial disturbance to initiation of final reclamation of the Burntlog Route. This analysis of TSRC assumes that all SGP-related disturbances in the BNF activity area would be considered TSRC due to the site-specific challenges and the duration and nature of soil disturbance.

Table 4.5-4 provides an overall summary of TSRC considerations as a proportion of the activity area, which also is depicted in **Figure 4.5-2**.

SGP-related TSRC within the BNF activity area under Alternative 1 would total approximately 481 acres, with approximately 66 of these acres occurring over areas of existing TSRC (e.g., existing roads and trails, past borrow sources, etc.). Overall TSRC under Alternative 1 would be approximately 1,318 acres, or 2 percent of the activity area.

The magnitude of impacts to soil resources within the BNF includes excavation, grading, or filling of 481 acres (approximately 66 acres of which are already disturbed due to overlap with and use of existing dedicated roadways, etc.), and a net increase of TSRC in the BNF activity area of approximately 414 acres (from 904 acres to 1,318 acres).

Table 4.5-4 Alternative 1 Total Soil Resource Commitment for Boise National Forest

TSRC	BNF Activity Area[1] (acres)	TSRC within Activity Area (acres)	Existing TSRC Outside Disturbance Footprint[2] (acres)	Overall TSRC in Activity Area (acres)	Percent TSRC in Activity Area
Existing TSRC	76,196	904	--	904	1%
TSRC with Alternative 1	76,338	481[3]	838	1,318	2%

Table Source: AECOM 2020

Table Notes:

1 Activity area differences between Existing TSRC and TSRC with Alternative 1 are due to the addition of the footprints of Alternative 1 facilities that would occur within IRAs.

2 Existing TSRC outside of the disturbance footprint is TSRC that is within the activity area (affecting the percent TSRC) but is not overlapped by or attributed to the SGP. It is included within the “Overall TSRC in Activity Area” column.

3 Alternative 1 overlaps approximately 66 acres of existing TSRC (which is included in this total).

TSRC = Total Soil Resource Commitment.

The duration of impacts would vary by component based on the disturbance and reclamation schedule. Most disturbances would be initiated during the construction or early production phase and continue for a number of years until final reclamation is initiated. This analysis assumes recovery of greater than 40 percent soil productivity of natural background within a 50-year timeframe to be unlikely (due to the nature of disturbance and the conditions at the site) and, therefore, the duration of impacts would be longer-term, well beyond the 50-year threshold. For full bench road construction and road cuts, including soil nail walls and rock cuts, recovery of soil productivity to 40 percent of natural background would be on a much longer timescale (e.g., likely hundreds to thousands of years) such that they would be considered permanent TSRC. Transmission line access roads and structure footings associated with the upgraded transmission line would be retained and used by IPCo after mining ceases, which also would be permanent TSRC. The Stibnite Gold Logistics Facility (approximately 25 acres) would be located on private land outside of NFS lands, and therefore is not considered in the analysis of TSRC. However, it should be noted that the post-mining land use for the Stibnite Gold Logistics Facility site is designated as light industry, where the facility would remain un-reclaimed after mining operations (a permanent commitment of land) and transferred to a third-party for light industrial uses.

4.5.2.1.2 DETRIMENTAL DISTURBANCE

This analysis of DD addresses clearing of vegetation using heavy equipment within the transmission line right-of-way (ROW). Up to 500 acres of the transmission line ROW could be affected by vegetation clearing (Tetra Tech 2019). This represents the maximum extent of clearing, because many areas contain only low shrubs or herbaceous vegetation and would not require clearing. Only tall trees and shrubs would be cleared.

Initial vegetation clearing would occur during the 3-year SGP construction phase. Vegetation management to remove trees or maintain low vegetation height would continue throughout the operations phase. After final closure of the mine, the upgraded section of transmission line would be retained by IPCo, so there would be no post-closure reclamation or monitoring requirements for Midas Gold. Final reclamation of the new transmission line corridor would occur during the closure and reclamation phase beginning after SGP year 18. Reclamation of the cleared transmission line ROW would simply entail letting the vegetation grow back and managing weeds and invasive plant species.

DD resulting from clearing of tall vegetation within the transmission line ROW could occur as a result of equipment operations on steep slopes, uncohesive soils, and/or wet soils. Detrimental soil displacement could occur where at least 2 inches of the A horizon is removed through impacts of wheeled or tracked equipment or dragging of logs across the site. Detrimental soil compaction and soil puddling/rutting could occur through equipment use mainly on poorly drained mineral or organic soils. Compaction in deep soil layers would not normally occur without repeated disturbance. Burned areas also may be susceptible to DD where the organic litter layer has been removed. Conditions of DD can potentially reduce soil productivity by reducing soil fertility and aeration, limiting root growth, reducing soil infiltration and permeability, and increasing runoff and soil erosion.

DD within the transmission line ROW would be limited by the fact that clearing would typically only occur within forested areas, which for this analysis are assumed to make up approximately one-third of the ROW (36 percent of the mapped corridor contained forest [Tetra Tech 2018]). For this analysis, existing DD within the transmission line ROW is estimated at 8 percent. This is a very rough estimate based on average extent of DD from ground-based forest harvesting operations in the Forest Service Northern Region (Reeves et al. 2012). It is estimated that SGP-related vegetation clearing could initially result in DD as high as 16 percent of the ROW. This is the highest Forest Service-modeled average extent of DD based on variables of Landtype, topography, and harvest season for ground-harvesting in Northern Region forests (Reeves et al. 2012). However, based on the estimate of forest land within the ROW, proportion of highly erodible soils, the limited extent of forested wetlands, and the infrequency and short duration of ground disturbing impacts, DD would more likely be somewhere between 8 percent and 15 percent. Additionally, the Forest Service would require mitigation measures (see **Table D-1** of **Appendix D**) designed to minimize DD impacts. Measures that would reduce DD involve soil moisture operability requirements, slope restrictions for ground-based operations, guidelines for skidding (i.e., tree removal within forest) and skid trail construction/use, etc.

The DD activity area is the area within the transmission line ROW that would be subject to vegetation clearing only and is estimated at up to 500 acres. The magnitude of impacts from vegetation clearing potentially include detrimental soil displacement, compaction and puddling on a conservative estimate of up to 75 acres (15 percent) within the ROW, which would be further reduced by the Forest Service-required mitigation measures that target DD.

The duration of impacts from vegetation clearing would be considered long term (>15 years), because disturbance would begin the first year of the construction phase and would continue at least through SGP year 18. Clearing impacts would continue indefinitely on the upgraded transmission line corridors that would continue to be maintained by IPCo after mining ceases.

4.5.2.1.3 Reclamation Cover Materials

Suitable RCM (also referred to as growth media or GM) within the SGP area would be salvaged for subsequent use in reclamation. The salvaged material would come from the soil O (approximately 24 percent), A and B (approximately 32 percent), and C (approximately 44 percent) horizons[1]. Growth media stockpiles (GMSs) would be strategically placed and located around the mine site to prevent erosion, disturbance, and/or contamination. Measures would be taken to divert water around the stockpiles, and the stockpiles would be stabilized with an interim seed mix to minimize erosion. Salvaged material from the mine site would be redistributed directly on the disturbed areas of the mine site to the extent possible or stockpiled in designated areas for later use.

4.5.2.1.3.1 Volume of Available RCM

The GM balance refers to the volume of suitable soils available for salvage within the disturbance footprint versus the volume of GM needed for replacement to achieve reclamation goals (Tetra Tech 2019). Volume of GM needed for reclamation of the mine site is based on specified placement depths which vary according to mine site facility and proposed “root zone” material. The “root zone” refers to the near surface materials underlying the GM layer, either native regolith or waste rock, into which reestablished native plant communities would extend roots for moisture and anchoring.

Depth of GM placement would be dictated by the nature of the root zone material. Reclamation of uplands on the TSF and DRSFs would involve placement of 3 feet of suitable waste rock at the surface, on top of which 12 inches of suitable GM would be placed. Reclaimed upland sites over native regolith or C horizon material would only receive 6 inches of GM. Reclaimed wetlands and channel reaches would receive a combined 6 inches of GM and seed bank materials[2] (SBM), except for wetlands and channel reaches on the TSF, which would receive 6 inches of GM and 6 inches of SBM (Tetra Tech 2019).

According to the GM balance calculations in the RCP, a total of 1,884,000 bank cubic yards (BCY) of suitable soils would be salvaged from the mine site and be available for reclamation. A total of 1,918,000 BCY of GM and SBM would be required to meet the specified reclamation

[1] Proportions of soil O, A, B, and C horizons were calculated using average solum thickness for each soil map unit based on soil profile descriptions in the Soil Salvage Report (Tetra Tech 2017); refer to **Appendix G-3** for calculations.

[2] Seed bank material is soil dominated by or containing a high content of organic matter and an established wetland seed bank. Generally, organic soil material from the O and A horizons of hydric soil solum. In the RCP (Tetra Tech 2019), SBM is considered salvageable from the frigid oxyaquic dystrocryepts and frigid typic haplosaprists soil map units from 0 to 1-foot depth.

areas and GM/SBM thicknesses. The GM deficit is thus estimated at approximately 34,000 BCY.

Options being considered by Midas Gold for developing additional GM for the mine site include:

- Salvage of previously reclaimed areas within the mine site (it is unknown if suitable GM exists in these areas);
- Utilize excess GM salvaged from the Burntlog Route disturbance that would not be needed for reclamation of the route (see discussion below); and/or
- Utilize alluvial material that would be excavated during mining of the Hangar Flats ore deposit that would otherwise be disposed in the Hangar Flats DRSF.

As discussed in the RCP, GM salvage and placement volumes for the Burntlog Route (including the Landmark Maintenance Facility) were calculated separately from the mine site. Salvage volumes were only calculated for the new portion of the Route and assumed that 40 percent of the mixed typic cryorthents soil map unit was practically salvageable using heavy equipment. GM salvaged on slopes less than 15 percent would be stored in GMSs located within Burntlog Route borrow sources. GM salvaged on slopes from 15 to 45 percent would be stored in windrows along the toe of fill slopes and other locations determined to be appropriate for GM storage (Tetra Tech 2019). A total of 321,000 BCY of GM and SBM are estimated to be available for salvage. Of this, 66,000 BCY would be stockpiled, while 255,000 BCY would be stored in windrows. However, storing material in windrows for approximately 20 years along a roadway in mountainous terrain is not a typical practice. The potential for losses of this material over time from erosion (i.e., washed away down steep slopes) is expected to be high, and much higher than for traditionally stockpiled material.

Final reclamation of the Burntlog Route would involve placement of a 6-inch layer of GM on up to approximately 227 acres of disturbed area, which would require approximately 183,000 BCY of GM (Tetra Tech 2019). With the 321,000 BCY of stockpiled and windrowed material stored along Burntlog Route, it is calculated in the RCP that a surplus of up to 138,000 BCY of GM and SBM would remain, which could be used to address the GM deficiency identified at the mine site. However, it should be noted that all calculations for quantity of GM and SBM in the RCP do not include any reduction in GM/SBM volume to account for material loss during haulage and/or stockpiling (Tetra Tech 2019).

Additional salvage of GM also would be supplemented through composting. Feedstock materials for composting may come from on-site sources such as vegetation and kitchen wastes (estimated at 2,500 tons over life of the SGP) and slash from harvested trees (estimated at 5,000 tons or more); however, they also may include materials from off site.

Sources for off-site materials could include manure from dairy or feedlot operations in southern Idaho, biosolids from wastewater treatment systems in the McCall area or the Boise area; or certified weed-free alfalfa hay from the Cascade-McCall area. Other sources for feedstock have been investigated by Midas Gold, including spent mash from local breweries, paper wastes, and wood wastes from sawmills.

Composting facilities would be located adjacent to and within multiple GMSs prior to GM addition to GMSs and as GM is removed from GMSs. The GMS areas would represent available work space during the early stages of the SGP before they are filled up, and they also would provide for easy mixing of completed compost into GM and reduce the need for re-handling and transportation of compost.

Midas Gold anticipates that compost (and potentially other soil amendments) would be applied to salvaged GM to improve their suitability (see Section 4.5.2.1.3.2 for discussion of RCM quality). Soil amendment application rates would vary according to the source and quality of suitable GM available and the properties of the compost generated at the mine site as well as other soil amendments considered. Non-merchantable timber and slash from Burntlog Route, West End DRSF, and other SGP-related disturbed areas would be considered as sources of material to generate GM and soil amendments.

Midas Gold has committed to salvage the appropriate volume of GM and to create the volume of compost necessary as an amendment to provide suitable quality of GM to cover the areas to be reclaimed. Following placement of suitable GM in areas prepared for concurrent and final reclamation 10 tons/acre of compost would be incorporated into the top 3 to 6 inches of GM. Approximately 1,539 acres of disturbance would be reclaimed using GM salvaged from the mine site. Therefore, approximately 15,390 tons of compost (which represents roughly 22,000 BCY) would need to be generated at the mine site to improve the quality of GM placed on disturbed areas. This compost amendment total is in addition to the 34,000 BCY GM deficit identified for Alternative 1.

4.5.2.1.3.2 Quality and Suitability of Available RCM

There are three primary challenges associated with the quality and suitability of available RCM for the SGP: (1) the overall relatively poor existing quality of the upland soils (unit mixed typic cryorthents) that make up approximately 61 percent of the salvageable volume at the mine site and Burntlog Route (see **Appendix G-3**); (2) the long-term stockpiling of material; and (3) the high background concentrations of metals in the soil.

Quality of Existing Soils

The quality of RCM would vary based on its source, the best material coming largely from the organic and alluvial soils of the Meadow Creek valley. Most of this material would be used for GM and SBM for wetland restoration. Organic matter and fine and large (coarse) woody debris (critical components to achieve sustainable improvement of soil quality and productivity) are limited at the mine site due to past mining activities in valley bottoms and stand replacement fires. GM used for upland reclamation sites would mostly come from relatively poor upland soils. Overall, the majority of GM used would rate as poor or fair (per suitability criteria), due primarily to texture and coarse fragment content (Tetra Tech 2019).

As discussed, Midas Gold anticipates that compost (and potentially other soil amendments) would be applied to salvaged GM to improve their suitability. The RCP identifies 10 tons per acre of compost would be incorporated into the top 3 to 6 inches of GM; however, the volume specified is minimal, translating to less than 0.25 inch of compost to be mixed into 6 inches of GM. This small amount of compost is not expected to provide sufficient long-term benefits to the GM that would be important for revegetation. On disturbed areas with greater than 30 percent slope, Midas Gold also would apply mulch to aid in stabilizing the area and promote revegetation. Straw mulch would be certified as weed-free and applied over a roughened seed bed at a rate of about 3,000 pounds per acre. The straw mulch also would be considered a nominal amount, and it would have a short duration of effectiveness due to its quick rate of decomposition and susceptibility to wind.

The Forest Service would require mitigation measures (see **Table D-1** of **Appendix D**) to incorporate coarse woody debris (>3 inches diameter) onto reclaimed lands as evenly distributed as possible in the tonnages and diameters described in the Forest Plan. The objective would be to meet the upper range of tons per acre by "potential vegetation group" or greater with larger-diameter material. The importance of coarse woody debris in the structure and function of forest ecosystems is well documented. Its use in reclamation of forest communities on disturbed sites has been shown to provide numerous long-term benefits, including: improved infiltration and reduced runoff and erosion; regulation of soil temperature and moisture; increased soil organic matter content; creation of microsites for flora and fauna; increase in populations and diversity of microorganisms; and improved nutrient cycling (Kwak et al. 2015).

Stockpiling

RCM quality also would vary with the duration and depth of stockpiling, ranging from live-handled material, to material that remains in deep stockpiles for 10 or more years. Direct-placement, or "live-handling" refers to the removal of soils/GM from one site prior to disturbance, and its haulage and immediate placement on another site prepared for final reclamation. This avoids many of the adverse consequences of extended stockpiling. The RCP prioritizes live-handling of GM where possible. However, due to the extended period of operations, and logistical issues, only about 150,000 BCY out of a total of 1,918,000 BCY of GM would be live-handled. The remainder would be stored in deep stockpiles with a combined capacity to store up to 2,230,000 BCY. These stockpiles would be up to 28 feet tall, and the time between GM salvage and placement would vary greatly between different mine site facilities but could remain in stockpiles for as long as 10 to 20 years. Potential adverse effects associated with salvage and stockpiling activities include:

- Soil compaction and disturbance of soil structure from equipment operations and handling of soil;
- Loss/oxidation of soil organic matter and reduction in microbial populations depending on methods and duration of soil salvage and stockpiling; and
- Increase in bulk density, reduction in nutrient cycling, and loss or reduction of viable propagules and seeds from extended stockpiling (Strohmayer 1999).

Anaerobic conditions approximately 2 to 3 feet below the surface of the GMSs are anticipated to predominate and would likely lead to a decline in microbial respiration and a shift from an aerobic respiration endpoint of carbon dioxide to an anaerobic endpoint of anhydrous ammonia or, depending on the soil moisture content, nitrogen gas or nitrous oxide. Oxygen may, however, penetrate to a greater depth in stockpiles composed of coarse-textured soils when compared to stockpiles composed of fine-textured soils, thereby slightly reducing the impacts of stockpiling on soil productivities. Regardless, soil productivity within the majority of the GM/SBM mass stored with stockpiles would decline during the time of residence within stockpiles. Anaerobic conditions tend to be more prevalent in deeper and older stockpiles (Harris et al. 1989; Sheoran et al. 2010) and would certainly occur in some of the GMS at the mine site. Although conditions would be expected to improve upon placement of the GM, there is uncertainty as to how long it would take for full recovery of microbial communities, including mycorrhizal communities, nutrient cycling and soil structure that are the basis of soil productivity. Fresquez and Aldon (1984) noted that RCM stored for years has little biological resemblance to the undisturbed surface soil, and the resulting reduction to the fungal genera and microorganisms result in an unstable and unbalanced soil ecosystem. Prolonged storage increases the loss of the bacterial element in soil, and mycorrhizal fungi are often destroyed or reduced. Additionally, salvage and stockpiling of wet soils and organic soils present special problems as these are easily compacted, and organic carbon becomes susceptible to oxidation when these soils dry out.

Midas Gold would implement salvage and stockpile measures to minimize the loss of soil productivity within stockpiled GM/SBM, which would include:

- Haulage to and stockpiling in nearest GMS;
- Separate stockpiling of GM and SBM from wetlands;
- SBM may be dried prior to stockpiling to preserve seed viability;
- Salvage and storage conducted during dry periods when practical to reduce likelihood of soil compaction;
- Surface area of stockpiles maximized within site constraints;
- Erosion control and drainage best management practices instituted for the GMS;
- Surface of the GMS would be roughened;
- Seeding of GMS with an interim seed mix;
- Mulching of GMS with wood fiber matrix or straw mulch; and
- Mixing of upper 2 to 3 feet of the GMS with deeper layers of the stockpile prior to use for reclamation.

Despite these measures the storage of GM within deep stockpiles for years would still result in the loss of soil productivity, which would affect the overall quality of this material at the time of placement.

Suitability of Available RCM (Metals)

The mine site occurs in an area containing numerous highly mineralized zones, and natural background concentrations of some metals are known to be relatively high in some soils and regolith. In addition, elevated levels of arsenic, antimony, and mercury have been observed in soils contaminated by legacy mining operations (URS Corporation 2000). Some known locations of contamination were cleaned up in the past, but it is possible that additional areas of contamination would be exposed and observed during SGP-related construction and operations. Note that the information in this discussion is strictly limited to plant growth and issues of phytotoxicity with respect to metals concentrations in soils; consideration of ecological effects of elevated metals concentrations is presented in Sections 4.12 and 4.13, and consideration of human health risks are presented in Section 4.18.

To assess trace metal concentrations in vegetated soil in the vicinity of the mine site, Midas Gold evaluated 4,828 exploration soil samples collected from undisturbed areas surrounding the mine site. The mean concentrations of antimony (11.63 parts per million [ppm]) and mercury (0.94 ppm) from the samples are high but are within the highest screening-level phytotoxicity criteria concentrations from various literature references and federal agencies in U.S. and Canada cited in the RCP’s Development Rock and Tailings Root Zone Suitability Analysis (Tetra Tech 2019). The mean concentration of arsenic (94.40 ppm) from the samples[3] is five times higher than U.S. Environmental Protection Agency’s ecological soil screening level for arsenic and nearly twice as high as the highest screening-level phytotoxicity criteria concentration from the various sources (Tetra Tech 2019). While the soil sample evaluation shows that natural vegetation in the vicinity of the mine site is tolerant of the naturally elevated metals concentrations in soils, these background levels may still complicate reclamation efforts by impeding or retarding vegetation growth.

As these soils do currently support native vegetation of some type, it is difficult to identify an upper concentration above which vegetation establishment and growth would be impeded during reclamation. The screening-level phytotoxicity criteria identified in the RCP vary widely and are not specific to environmental factors or plant species. Soils near the mine site that exceed the screening-level phytotoxicity criteria do continue to sustain native vegetation. How this would translate to use of similar soils for RCM in reclamation is unknown. Potential phytotoxicity would depend on the natural variability of soils based on geology and other environmental factors, and the natural variability in plant tolerances to each metal and the various forms that the metals occur in.

Recommendations in the RCP’s Development Rock and Tailings Root Zone Suitability Analysis are that “the upper-quantile values be used to assess whether on-site soils could support plant growth and development, therefore Chebyshev’s rule of inequality value for arsenic of 450 ppm would likely provide an upper statistical bound for the concentration in soil that would be

[3] It should be noted the samples were not analyzed using U.S. Environmental Protection Agency-approved methodologies for environmental analysis. Samples were analyzed using exploration lab methodologies that have more aggressive extraction methods (resulting in potentially higher concentration outputs), which are not typically compared to these environmental screening levels.

expected to support plant growth and development on site." Using the rule, the upper bound is determined as the mean plus 2 standard deviations. For antimony this would be 68.33 ppm; for mercury 17.07 ppm. Based on the tables in the Development Rock and Tailings Root Zone Suitability Analysis, it appears that over 95 percent of the soil samples would be within the upper bounds for supporting plants.

The RCP does not include screening levels of trace metals as part of the GM suitability guidelines for plant growth. Total arsenic concentration is used for the root zone suitability guidelines (material that would underlie the GM). However, the upper limit for suitable root zone material was set at 3,000 ppm, which is much higher than the 450-ppm suggested by Chebyshev's rule. This is justified in the RCP based on three soil profiles at Hecla reclamation sites, where vegetation was found to occur on sites with up to 3,000 ppm arsenic. This concentration of arsenic is similar to concentrations found in mine waste from the Yellow Pine pit. The root zone material is intended to provide a cap 2 to 3 feet deep of suitable development rock for plant roots above mine tailings and undifferentiated development rock.

Arsenic was identified in the RCP as the primary trace metal of concern in native undisturbed soils as well as mine wastes. The ratio of maximum arsenic concentrations in development rock and tailings to the highest and lowest screening-level criteria was at least 19 to 11 times higher than any other trace metal of concern. A review of the soils and reclamation literature did not provide any readily applicable suitability/screening levels for naturally occurring arsenic in RCM and revegetation of native plant communities. Some studies in reclamation of mine sites contaminated with arsenic and other trace metals do provide information that could be useful for reclamation of the SGP.

Arsenic found in soils normally forms insoluble complexes with iron, aluminum, and magnesium oxides found in soil surfaces. This form of arsenic is relatively immobile and not bioavailable to plants (Nejad et al. 2017). However, certain conditions can cause arsenic to become mobile. Arsenic that is in solution becomes available for plant uptake, primarily by roots, which can lead to accumulation of phytotoxic levels. Mobile forms of arsenic can be associated with differences in reducing conditions, pH, sulfide ion concentrations, temperature, salinity, and soil biota. This makes it extremely difficult to predict how arsenic will react in RCM.

The use of phosphate fertilizers has been known to induce arsenic solubility in soils (Kilgour et al. 2008; Peryea 1991). This phenomenon has been observed in lead arsenate-contaminated soils and others that have been amended with ammonium phosphate. The released arsenic becomes available for uptake by plants, and phytotoxicity has been observed, even after multiple wetting and drying cycles. The use of chemical fertilizers is a proposed activity identified in the RCP and Midas Gold has identified some measures to limit the transport and exposure to soil-borne arsenic (e.g., surface water runoff routed to sediment basins, erosion-, sediment-, and dust-control best management practices, etc.).

Overall, the naturally high background levels of trace metals at the mine site represents a challenge with regards to the suitability of RCM and reclamation-related revegetation efforts. The 3,000-ppm limit for suitable root zone material is high (and much higher than the mean plus

2 standard deviations for soil samples taken). However, in addition to the root zone limits, the Forest Service also would require limits on the GM (that would overlay the root zone material) for arsenic, mercury, and antimony, and would require a Sampling and Analysis Plan that would include in-situ screening of soils as well as laboratory testing (see **Table D-1** of **Appendix D**). Additionally, Section 4.18 provides recreational risk-based (human health) soil screening level calculations for the GM.

Summary

As discussed above, the overall relatively poor quality of the soils at the mine site (outside of valley bottom soils), the long-term stockpiling of GM/SBM, and the high background concentrations of metals in soils would affect the quality and suitability of available RCM. These challenges, coupled with the harsh winter climate (short growing season) and generally steep slopes of the area, would compound to present difficulties in growing and/or maintaining persistent vegetation cover over reclaimed areas. This is consistent with the mixed vegetative cover success of nearby reclaimed mining areas and the previous efforts by Midas Gold and others at the mine site to establish self-sustaining cover on previously mined lands that have had some limited success. Additionally, there would be a 34,000 BCY GM deficit at the mine site according to the balance calculations in the RCP. This deficit may be met with an anticipated surplus of material calculated in the RCP from the Burntlog Route GM/SBM (if of sufficient quantity and quality) or could be met through additional composting of both on- and off-site feedstock (which would be separate from the 22,000 BCY of composting proposed as soil amendments to the GM). Thus, there is presently some uncertainty regarding the specific source of material to meet the identified GM/SBM deficit under Alternative 1.

However, Midas Gold has committed to salvage the appropriate volume of GM and to create the volume of compost necessary as an amendment to provide suitable quality and quantity of the GM to cover the areas to be reclaimed. In addition, Midas Gold has committed to performance criteria tied to slope and soil stability, sediment, and vegetation cover, which would need to be met prior to release of a reclamation performance bond (i.e., when all performance standards would be achieved and the mechanism of bond release and demonstration of reclamation would be formally agreed to by Forest Service, Idaho Department of Lands, and Midas Gold).

4.5.2.2 Alternative 2

4.5.2.2.1 TOTAL SOIL RESOURCE COMMITMENT

4.5.2.2.1.1 Payette National Forest

SGP-related disturbance within the PNF activity area under Alternative 2 would total approximately 1,389 acres, with approximately 104 of these acres occurring over areas of existing TSRC (e.g., existing roads and trails, past mining disturbance, etc.). Adding the remaining 155 acres of existing TSRC within the activity area that do not overlap with the disturbance associated with Alternative 2, the total area of committed soil resources would be approximately 1,544 acres, or approximately 19 percent of the activity area (see **Table 4.5-5** and **Figure 4.5-3**). Under Alternative 2, the backfilling of the Midnight pit (i.e., new Midnight DRSF), partial pit backfilling of Hangar Flats pit, and the associated elimination of the West End DRSF, would result in a smaller mine site disturbance footprint compared with all action alternatives that would result in some differences in the overall amount of reclamation and TSRC in the PNF activity area.

Table 4.5-5 Alternative 2 Total Soil Resource Commitment for Payette National Forest

TSRC	PNF Activity Area[1] (acres)	TSRC within Activity Area (acres)	Existing TSRC Outside Disturbance Footprint[2] (acres)	Overall TSRC in Activity Area (acres)	Percent TSRC in Activity Area
Existing TSRC	7,468	259	--	259	3%
TSRC with Alternative 2	8,060	1,389[3,4]	155	1,544	19%

Table Source: AECOM 2020

Table Notes:

1 Activity area differences between Existing TSRC and TSRC with Alternative 2 are due to the addition of the footprints of Alternative 2 facilities that would occur within IRAs.

2 Existing TSRC outside of the disturbance footprint is TSRC that is within the activity area (affecting the percent TSRC) but is not overlapped by or attributed to the SGP. It is included within the "Overall TSRC in Activity Area" column.

3 Alternative 2 overlaps approximately 104 acres of existing TSRC (which is included in this total).

4 Approximately 5 acres associated with the Burntlog Route would occur within the Upper Indian Creek subwatershed in the Salmon-Challis National Forest. These areas, immediately adjacent to the Headwaters EFSFSR subwatershed, would be administered by the PNF and have some overlap with existing National Forest System Roads; adding 5 acres to the overall TSRC total would not change the percent TSRC within the activity area.

TSRC = Total Soil Resource Commitment.

An additional 555 acres of SGP-related disturbance would occur within Midas Gold's private patented mining claims (excluded from the TSRC activity area) of which approximately 334 acres would occur over existing soil disturbance (see **Table G-5** in **Appendix G-1**).

4.5.2.2.1.2 Boise National Forest

TSRC for the Burntlog Route under Alternative 2 would be the same as for Alternative 1, except for the Riordan Creek segment reroute, which would reduce the overall length and disturbance footprint of the Burntlog Route as well as the amount of required soil nail retaining walls (0.5 mile instead of 1.5 miles of retaining walls). Additionally, the maintenance facility would be relocated approximately 4.4 miles east of the junction of Johnson Creek Road (CR 10-579) and Warm Lake Road, becoming the Burntlog Maintenance Facility. It would be constructed within the footprint of a Burntlog Route borrow source and, as such, would contribute to a small reduction in overall TSRC within the BNF compared to Alternative 1. SGP-related TSRC within the BNF activity area under Alternative 2 would total approximately 467 acres, with approximately 66 of these acres occurring over areas of existing TSRC (e.g., existing roads and trails, past borrow sources, etc.). Overall TSRC under Alternative 2 would be approximately 1,304 acres, or 2 percent of the activity area. **Table 4.5-6** provides an overall summary of TSRC considerations as a proportion of the activity area; refer also to **Figure 4.5-3**.

Table 4.5-6 Alternative 2 Total Soil Resource Commitment for Boise National Forest

TSRC	BNF Activity Area[1] (acres)	TSRC within Activity Area (acres)	Existing TSRC Outside Disturbance Footprint[2] (acres)	Overall TSRC in Activity Area (acres)	Percent TSRC in Activity Area
Existing TSRC	76,196	904	--	904	1%
TSRC with Alternative 2	76,327	467[3]	838	1,304	2%

Table Source: AECOM 2020

Table Notes:

1 Activity area differences between Existing TSRC and TSRC with Alternative 2 are due to the addition of the footprints of Alternative 2 facilities that would occur within IRAs.

2 Existing TSRC outside of the disturbance footprint is TSRC that is within the activity area (affecting the percent TSRC) but is not overlapped by or attributed to the SGP. It is included within the “Overall TSRC in Activity Area” column.

3 Alternative 2 overlaps approximately 66 acres of existing TSRC (which is included in this total).

TSRC = Total Soil Resource Commitment.

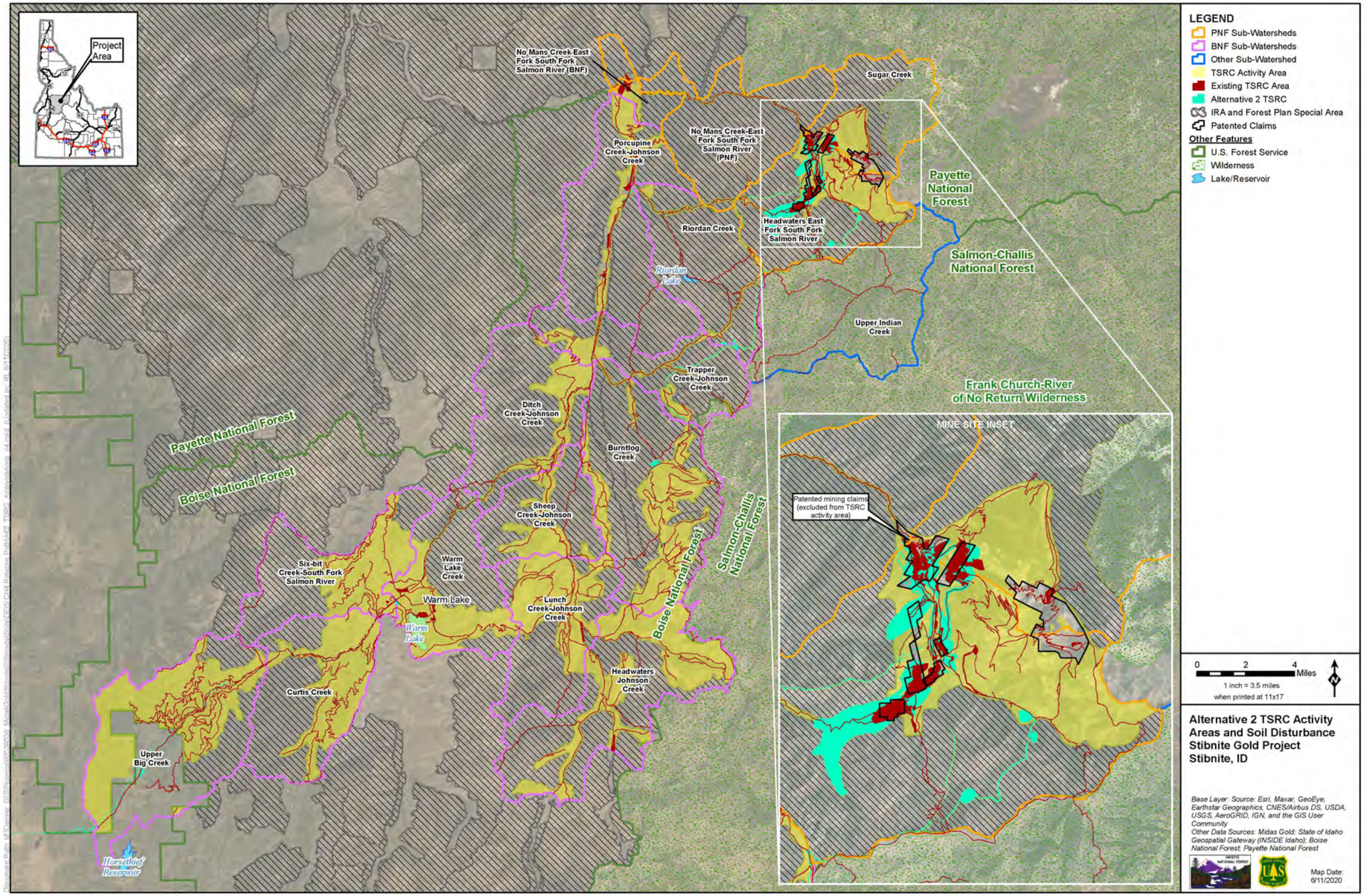


Figure Source: AECOM 2020

Figure 4.5-3 Alternative 2 TSRC Activity Areas and Soil Disturbances

This page intentionally left blank

4.5.2.2.2 DETRIMENTAL DISTURBANCE

Under Alternative 2, DD would be the same as for Alternative 1. Changes to the transmission line corridor associated with Alternative 2 (e.g., the Thunder Mountain Estates Bypass that would require new tree removal along the bypass) would not be located on NFS lands.

4.5.2.2.3 RECLAMATION COVER MATERIALS

Reclamation activities associated with Alternative 2 would be the same as those in Alternative 1, except the new transmission line into the mine site would not be reclaimed under Alternative 2, as this facility would remain in perpetuity to provide power to the Centralized Water Treatment Plant at the mine site as part of the post-closure Water Quality Management Plan. “The Centralized Water Treatment Plant also would remain in perpetuity. Additionally, the amount of GM required for reclamation, and the anticipated GM deficit, would differ for Alternative 2 as a result of changes to the disturbance footprint (i.e., backfilling of the Midnight pit and partial pit backfilling of Hangar Flats pit, resulting in the elimination of the West End DRSF) but the same challenges and considerations regarding volume and quality/suitability of available RCM would apply.

4.5.2.3 Alternative 3

4.5.2.3.1 TOTAL SOIL RESOURCE COMMITMENT

4.5.2.3.1.1 Payette National Forest

SGP-related disturbance within the PNF activity area under Alternative 3 would total approximately 1,568 acres, with approximately 121 of these acres occurring over areas of existing TSRC (e.g., existing roads and trails, past mining disturbance, etc.). Adding the remaining 135 acres of existing TSRC within the activity area that do not overlap with the disturbance associated with Alternative 3, the total area of committed soil resources would be approximately 1,706 acres, or approximately 21 percent of the activity area (see **Table 4.5-7** and **Figure 4.5-4**). Under Alternative 3, the moving of the TSF from Meadow Creek to the EFSFSR drainage (and associated move of the buttressing DRSF and worker housing facility) and improved public access along Meadow Creek Lookout Road (FR 51290), would result in a slightly larger disturbance footprint compared to all action alternatives that would result in some changes to the overall amount of reclamation and TSRC in the PNF activity area.

Table 4.5-7 Alternative 3 Total Soil Resource Commitment for Payette National Forest

TSRC	PNF Activity Area[1] (acres)	TSRC within Activity Area (acres)	Existing TSRC Outside Disturbance Footprint[2] (acres)	Overall TSRC in Activity Area (acres)	Percent TSRC in Activity Area
Existing TSRC	7,468	259	--	259	3%
TSRC with Alternative 3	7,963	1,568[3,4]	138	1,706	21%

Table Source: AECOM 2020

Table Notes:

1 Activity area differences between Existing TSRC and TSRC with Alternative 3 are due to the addition of the footprints of Alternative 3 facilities that would occur within IRAs.

2 Existing TSRC outside of the disturbance footprint is TSRC that is within the activity area (affecting the percent TSRC) but is not overlapped by or attributed to the SGP. It is included within the “Overall TSRC in Activity Area” column.

3 Alternative 3 overlaps approximately 121 acres of existing TSRC (which is included in this total).

4 Approximately 19 acres associated with the Burntlog Route and improved public access along Meadow Creek Lookout Road (FR 51290) would occur within the Upper Indian Creek subwatershed in the Salmon-Challis National Forest. These areas, immediately adjacent to the Headwaters EFSFSR subwatershed, would be administered by the PNF and have some overlap with existing National Forest System Roads; adding 20 acres to the overall TSRC total would not change the percent TSRC within the activity area.

TSRC = Total Soil Resource Commitment.

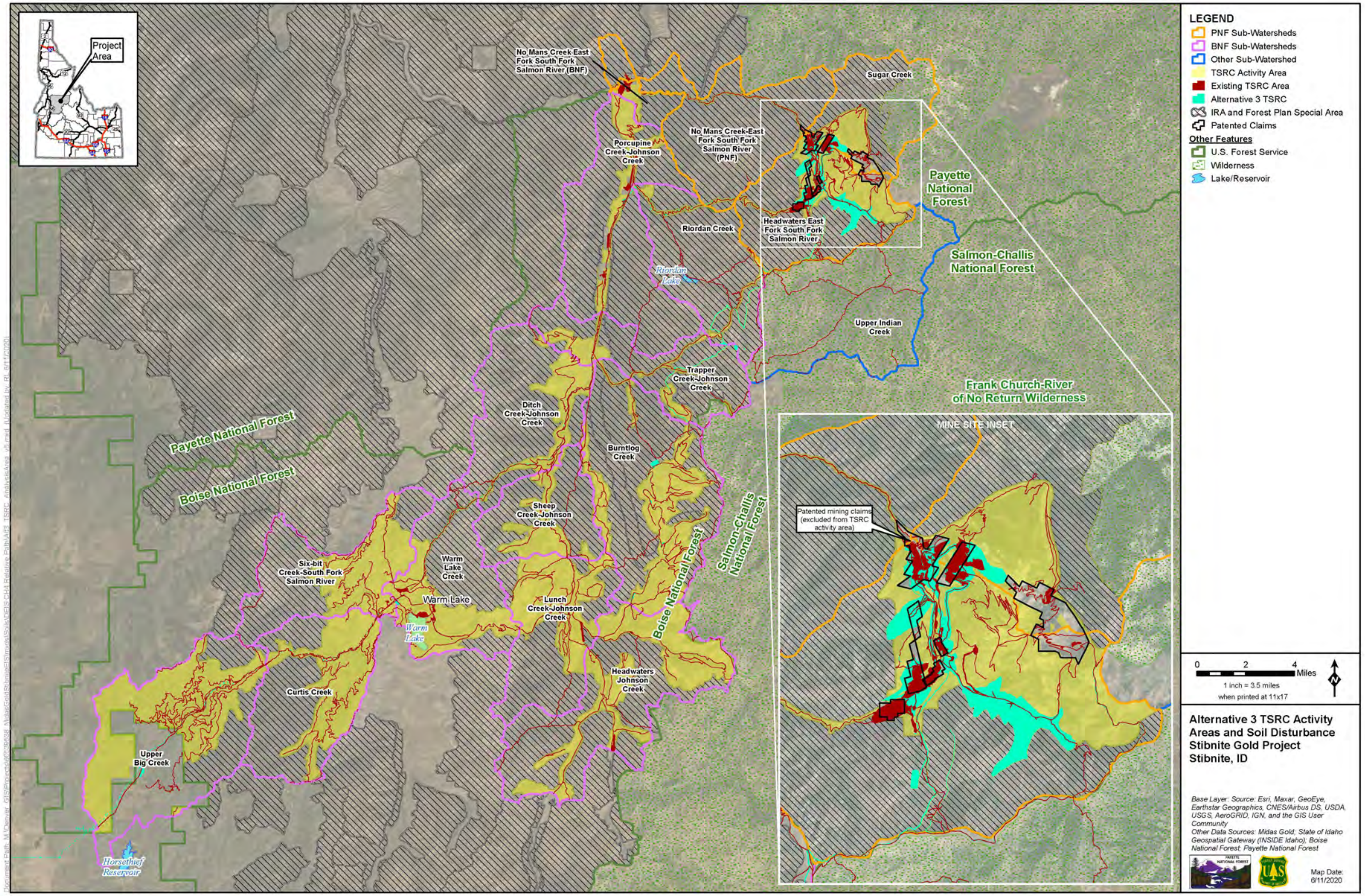


Figure Source: AECOM 2020

Figure 4.5-4 Alternative 3 TSRC Activity Areas and Soil Disturbances

This page intentionally left blank

An additional 512 acres of SGP-related disturbance that would occur within Midas Gold's private patented mining claims (excluded from the TSRC activity area) of which approximately 298 acres would occur over existing soil disturbance (see **Table G-6** in **Appendix G-1**).

4.5.2.3.1.2 Boise National Forest

TSRC within the BNF activity area under Alternative 3 would be the same as for Alternative 1 (**Table 4.5-4**), as all changes that would have an effect on TSRC would occur within the PNF activity area.

4.5.2.3.2 DETRIMENTAL DISTURBANCE

Under Alternative 3, DD would be the same as for Alternative 1, except for the approach of the new transmission line into the mine site that would be aligned through the Meadow Creek valley (instead of along the ridgetop above the valley). The location of tree removal-related DD would shift compared to Alternative 1, but the assumption that DD would be somewhere between 8 percent and 15 percent of the ROW would be the same, the same Forest Service-required measures targeting DD (see **Table D-1** of **Appendix D**) would apply, and DD would be comparable.

4.5.2.3.3 RECLAMATION COVER MATERIALS

Reclamation activities associated with Alternative 3 would be the same as those in Alternative 1. However, the amount of GM required for reclamation, and the anticipated GM deficit, would differ for Alternative 3 as a result of changes to the disturbance footprint (i.e., approximately 1,568 total acres under Alternative 3) but the same challenges and considerations regarding volume and quality/suitability of available RCM would apply.

4.5.2.4 Alternative 4

4.5.2.4.1 TOTAL SOIL RESOURCE COMMITMENT

4.5.2.4.1.1 Payette National Forest

SGP-related disturbance within the PNF activity area under Alternative 4 would total approximately 1,432 acres, with approximately 153 of these acres occurring over areas of existing TSRC (e.g., existing roads and trails, past mining disturbance, etc.). Adding the remaining 106 acres of existing TSRC within the activity area that do not overlap with the disturbance associated with Alternative 4, the total area of committed soil resources would be approximately 1,539 acres, or approximately 19 percent of the activity area (see **Table 4.5-8** and **Figure 4.5-5**). TSRC within the PNF activity area under Alternative 4 would be the same as for Alternative 1 for mine site-related components but would differ due to use of the Yellow Pine Route instead of the Burntlog Route for mine site access and the public access route through the mine site.

Table 4.5-8 Alternative 4 Total Soil Resource Commitment for Payette National Forest

TSRC	PNF Activity Area[1] (acres)	TSRC within Activity Area (acres)	Existing TSRC Outside Disturbance Footprint[2] (acres)	Overall TSRC in Activity Area (acres)	Percent TSRC in Activity Area
Existing TSRC	7,468	259	--	259	3%
TSRC with Alternative 4	7,972	1,432[3,4]	106	1,539	19%[4]

Table Source: AECOM 2020

Table Notes:

1 Activity area differences between Existing TSRC and TSRC with Alternative 4 are due to the addition of the footprints of Alternative 4 facilities that would occur within IRAs.

2 Existing TSRC outside of the disturbance footprint is TSRC that is within the activity area (affecting the percent TSRC) but is not overlapped by or attributed to the SGP. It is included within the “Overall TSRC in Activity Area” column.

3 Alternative 4 overlaps approximately 153 acres of existing TSRC (which is included in this total).

4 It should be noted under Alternative 4 that borrow sources would be developed along the Yellow Pine Route for materials needed for road improvements and maintenance; Midas Gold has not yet identified the locations of these areas along the Yellow Pine Route, thus, the TSRC acreage does not reflect these areas (for comparison those identified along the Burntlog Route total approximately 98 acres; it is unlikely all of the Alternative 4 borrow areas would occur within the PNF activity area).

TSRC = Total Soil Resource Commitment.

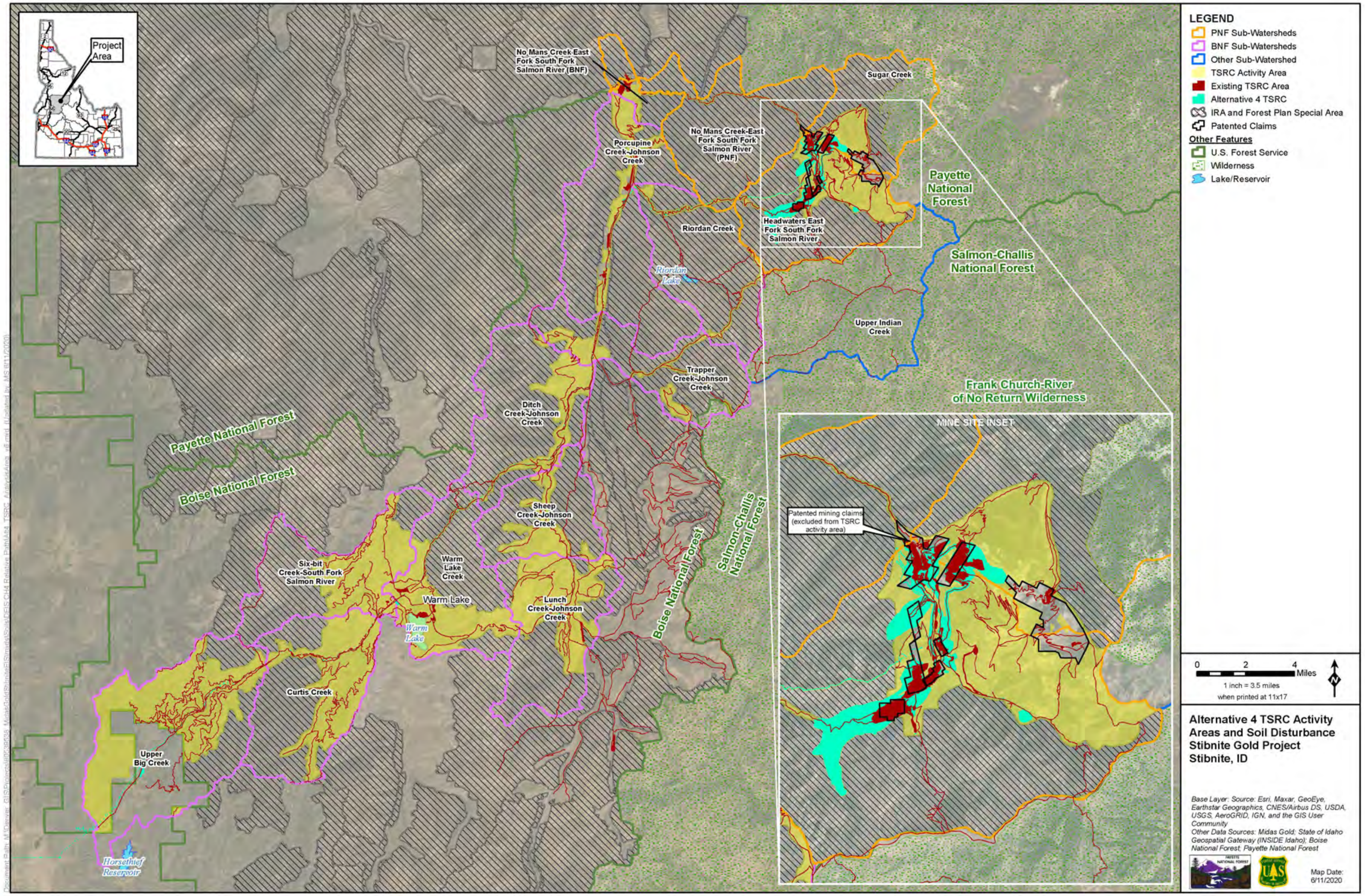


Figure Source: AECOM 2020

Figure 4.5-5 Alternative 4 TSRC Activity Areas and Soil Disturbances

This page intentionally left blank

An additional 563 acres of SGP-related disturbance would occur within Midas Gold's private patented mining claims (excluded from the TSRC activity area) of which approximately 340 acres would occur over existing soil disturbance (see **Table G-7** in **Appendix G-1**).

4.5.2.4.1.2 Boise National Forest

Under Alternative 4, access to the mine site would be provided via the Yellow Pine Route instead of constructing the Burntlog Route. Not constructing the Burntlog Route would reduce the BNF activity area under Alternative 4 from 13 to 11 subwatersheds, totaling approximately 158,025 acres (refer to **Table 4.5-9** and **Figure 4.5-1**).

Table 4.5-9 BNF Subwatersheds, Activity Area, and Existing TSRC (Alternative 4)

Subwatershed	Subwatershed (acres)	Activity Area (acres)	Existing TSRC in Activity Area (acres)	Percent Existing TSRC in Activity Area
No Man's Creek-EFSFSR[1]	1,837	516	11	2%
Porcupine Creek-Johnson Creek	21,516	2,796	78	3%
Riordan Creek	14,411	883	17	2%
Trapper Creek-Johnson Creek	12,129	2,518	37	1%
Ditch Creek-Johnson Creek	16,222	3,628	48	1%
Sheep Creek-Johnson Creek	10,403	3,178	28	1%
Lunch Creek-Johnson Creek	15,414	7,322	98	1%
Warm Lake Creek	15,093	6,820	160	2%
Six-Bit Creek South Fork Salmon River	15,087	7,105	63	1%
Curtis Creek	17,476	8,280	74	1%
Upper Big Creek	18,436	13,429	103	1%
TOTAL	**158,025**	**56,474**	**716**	**1%**

Table Source: AECOM 2020

Table Notes:

1 The eastern portion of the No Man's Creek-EFSFSR subwatershed is within the PNF. The acreage provided here is only for the area that is within the BNF.

TSRC = Total Soil Resource Commitment.

Road widening and straightening, along with drainage and bridge improvements, would be required for the Johnson Creek Road (CR 10-579) portion of the Yellow Pine Route. The McCall-Stibnite Road (CR 50-412) portion of the Yellow Pine Route (occurring within the part of No Man's Creek-EFSFSR subwatershed within the BNF) would be improved by straightening curves, constructing retaining walls, and installing culverts. It is likely that most of these improvements would be permanent, and therefore considered permanent TSRC. SGP-related TSRC within the BNF activity area under Alternative 4 would total approximately 346 acres, with approximately 133 of these acres occurring over areas of existing TSRC (e.g., existing roads and trails, past borrow sources, etc.). Overall TSRC under Alternative 4 would be approximately 929 acres, or 2 percent of the activity area. **Table 4.5-10** provides an overall summary of TSRC considerations as a proportion of the activity area; refer also to **Figure 4.5-5**.

Table 4.5-10 Alternative 4 Total Soil Resource Commitment for Boise National Forest

TSRC	BNF Activity Area[1] (acres)	TSRC within Activity Area (acres)	Existing TSRC Outside Disturbance Footprint[2] (acres)	Overall TSRC in Activity Area (acres)	Percent TSRC in Activity Area
Existing TSRC	56,474	716	--	716	1%
TSRC with Alternative 4	56,480	346[3,4]	583	929	2%[4]

Table Source: AECOM 2020

Table Notes:

1 Activity area differences between Existing TSRC and TSRC with Alternative 4 are due to the addition of the footprints of Alternative 4 facilities that would occur within IRAs.

2 Existing TSRC outside of the disturbance footprint is TSRC that is within the activity area (affecting the percent TSRC) but is not overlapped by or attributed to the SGP. It is included within the “Overall TSRC in Activity Area” column.

3 Alternative 4 overlaps approximately 133 acres of existing TSRC (which is included in this total).

4 It should be noted under Alternative 4 borrow sources would be developed along the Yellow Pine Route for materials needed for road improvements and maintenance; Midas Gold has not yet identified the locations of these areas along the Yellow Pine Route, thus, the TSRC acreage does not reflect these areas, some of which would likely occur within the BNF activity area.

TSRC = Total Soil Resource Commitment.

4.5.2.4.2 Detrimental Disturbance

Under Alternative 4, DD would be the same as for Alternative 1.

4.5.2.4.3 Reclamation Cover Materials

Reclamation activities associated with Alternative 4 would be the same as those in Alternative 1. The amount of GM required for reclamation at the mine site, and the anticipated GM deficit, also would be the same and the same challenges and considerations regarding volume and quality/suitability of available RCM would apply. However, because Alternative 4 would not include the Burntlog Route, reclamation of the access road would not be required, but any potential GM surpluses from the Burntlog Route would not be available to address the GM deficiency identified at the mine site.

4.5.2.5 Alternative 5

Under Alternative 5, there would be no large-scale mining operations by Midas Gold, and soil resources and RCM would continue to be disturbed by currently permitted Midas Gold drilling activities for exploration. Consequently, there would be little change in the current status of soil resource conditions at the mine site other than natural erosive and soil formation processes.

Past mining activities have resulted in long-term impacts to soils, and past cleanup/remediation projects have attempted to mitigate some of those mining impacts. Under Alternative 5, existing impacts would remain as developed roads, on existing waste piles (historic development rock and tailings), and at other past mining related locations (Tetra Tech 2019). It is not anticipated that soils in most of these areas would recover naturally.

Midas Gold would continue to implement surface exploration and associated activities that have been previously approved on NFS lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project Environmental Assessment (EA) (Forest Service 2015). These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads), and drilling on both NFS and private lands at and in the vicinity of the mine site. The continuation of approved exploration activities at the mine site by Midas Gold would result in the continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip.

Midas Gold would be required to continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and EA, which include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices, and monitoring to ensure that sediment and stormwater best management practices are in place and effective so that soil erosion and other potential resource impacts are avoided or minimized.

4.5.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.5.4 Cumulative Effects

4.5.4.1 Action Alternatives

The cumulative effects analysis area for soils and RCM is the same as the larger analysis area defined in Section 3.5 that encompasses the various activity areas used for analysis of TSRC and DD. Thus, the cumulative effects analysis area for this resource includes the sixth-level (12-digit hydrologic unit code) subwatersheds within which disturbance of SGP components would occur.

Past and ongoing activities in the SGP area include forest management, mining and mine reclamation, mineral exploration (e.g., Golden Meadows Exploration Project), motorized use of road systems, fire suppression, prescribed fire and wildfire, dispersed camping, fishing, and hunting.

The potential for cumulative effects to soils and reclamation cover materials, as it relates to the analysis of the issues and indicators for the SGP, would be additional soil disturbance within the activity area(s) for TSRC of the considered subwatersheds or incremental detrimental soil disturbance within the vicinity of SGP components. Other than the potential for wildland fires (that could further limit the availability of organic matter and fine and large woody debris) there are no reasonably foreseeable future actions located at the mine site that could have an effect on RCM salvage or use. Ongoing mineral exploration activities associated with Midas Gold's Golden Meadows Exploration Project in the vicinity of the mine site would contribute a very small (less than 5 acres) incremental increase in disturbance within the PNF. Additionally, Midas Gold would continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and EA, which would include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices.

Wildland fires that occur in the SGP area could temporarily (i.e., 0 to 3 years) remove ground cover that holds soil in place, leading to increased erosion and sedimentation from burned areas, or lead to increased detrimental soil disturbance, especially if logging (or motorized use) were to occur in the area shortly after.

4.5.4.2 Alternative 5

Under Alternative 5, no action alternative would be approved and there would be no open-pit mining or ore processing at the mine site, or other supporting infrastructure corridors and facilities. The effects of past mining activities and their long-term impacts to soils would remain. Although none of the reasonably foreseeable future actions identified in **Table 4.1-2** would physically overlap with action alternative disturbance footprints, forest management, motorized use of road systems, fire suppression, prescribed fire and wildfire, dispersed camping, fishing, and hunting activities would continue in the cumulative effects area and vicinity, which would continue to utilize dedicated facilities (areas of TSRC) or contribute to incremental DD effects. Under Alternative 5, Midas Gold would continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and EA, which include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices; however, as described in the Golden Meadows EA, the exploration and subsequent reclamation activities would have an insignificant direct effect to geology and soils and therefore an insignificant cumulative contribution to effects upon soils and RCM.

4.5.5 Irreversible and Irretrievable Commitments of Public Resources

From a soils standpoint, areas of the mine site utilized for the TSF and DRSFs, as well as the un-reclaimed pit lakes and highwalls, would be permanent TSRC (recovery of soil productivity to 40 percent of natural background would be on a much longer timescale compared to other disturbances [e.g., likely hundreds to thousands of years]). Full bench road construction and large road cuts, including soil nail wall and rock cuts, would have a similar longer timescale for recovery. These disturbances would be considered an irreversible effect with regards to the commitment of soil resources. However, certain facilities would recover soil productivity faster than others. This would be most likely in areas of wetland and stream reconstruction that would receive the highest quality GM and seedbed material from organic and alluvial soils, or for those surficial facilities or shallower ground disturbances (especially where occurring in areas of flatter topography). These areas would regain productive capacity relatively faster when compared to reclamation over the TSF and DRSFs due to more favorable conditions, including underlying native regolith for plant rooting (compared to waste rock), and the efforts and strategies identified in the RCP that would be implemented by Midas Gold. These types of mine site facilities would be some haul roads, surficial facilities associated with the ore processing facility and worker housing facility, GMSs, etc. Examples of access road- and transmission line-related facilities that would likely recover faster would be the construction laydown and pulling and tensioning areas along the transmission line corridor and the widened shoulders of the upgraded road portions of Burntlog Route (especially in areas of flatter terrain. It is possible for these facilities to eventually recover productivity such that they would be considered an irretrievable commitment of soil resources spanning more than 50 years.

4.5.6 Short-term Uses versus Long-term Productivity

The SGP would result in short-term uses of the soil resources for mining purposes. Development of the mine site and associated infrastructure would result in complete removal of native soil horizons in many locations. A loss of productivity would occur in some soils from compaction, rutting, erosion, and other physical and chemical changes due to the removal of soils for stockpiling and reclamation.

Some residual impacts from legacy mining operations would be reclaimed prior to construction and operation of the mine site. Most of the proposed disturbance area is anticipated to be reclaimed upon completion of all mining operations. Long-term productivity of soils that are reclaimed over the TSF and DRSFs is expected to be affected due to the waste rock and tailings substrates that would be present under reclaimed soils, and existing productivity of areas that would remain un-reclaimed (pit lakes and highwalls) would be eliminated.

4.5.7 Summary

Table 4.5-12 provides a summary comparison of soil and reclamation cover material impacts by issues and indicators for each alternative.

4.5.7.1 Total Soil Resource Commitment

TSRC is the conversion of a productive site to an essentially non-productive site for a period of more than 50 years. Productivity on these areas range from 0 to 40 percent of natural background. Forest Plan Standard SWST03 requires, in an activity area where existing conditions of TSRC are below 5 percent of the area, management activities to leave the area in a condition of 5 percent or less TSRC following completion of the activities. The PNF activity area has existing conditions of TSRC at 3 percent (**Table 4.5-1**). The BNF activity area has existing conditions of TSRC at 1 percent (**Table 4.5-3** for Alternatives 1, 2, and 3 and **Table 4.5-9** for Alternative 4). The analysis of TSRC conservatively assumes TSRC in all applicable areas of soil disturbance because of the challenges and considerations detailed for the SGP area (e.g., short growing season, limited organic matter and fine and large woody debris, high coarse fragment content of salvageable material, high background metals concentrations of the soils, long delays between disturbance and reclamation, reclamation goals are not directly tied to soil amelioration/productivity, loss of soil quality from long-term storage in stockpiles, overall disruption of productive inter-relationships between vegetation, soil organic matter, and soil microbial communities, etc.) that make the recovery of greater than 40 percent soil productivity within a 50-year timeframe to be unlikely. For the PNF activity area the magnitude of impacts to soil resources as a result of the SGP would have a net increase in TSRC that would raise the post-SGP percent TSRC to well above 5 percent under all action alternatives (i.e., +1,357 acres to 20 percent under Alternative 1, +1,285 acres to 19 percent under Alternative 2, +1,447 acres to 21 percent under Alternative 3, and +1,280 acres to 19 percent under Alternative 4; see **Table 4.5-12**). For the BNF activity area, the magnitude of impacts to soil resources varies by alternative (net increases in TSRC of approximately +414, +400, +414, and +213 acres, respectively by action alternative), increasing from 1 to 2 percent TSRC of the BNF activity area under all action alternatives (see **Table 4.5-12**).

4.5.7.2 Detrimental Disturbance

DD is the alteration of natural soil characteristics that results in immediate or prolonged loss of soil productivity and soil-hydrologic conditions, where Forest Plan Standard SWST02 requires, in an activity area where existing conditions of DD are below 15 percent of the area, for management activities to leave the area in a condition of 15 percent or less TSRC following completion of the activities. Dedicated facilities considered under TSRC are excluded from this requirement. DD, which is represented by characteristics of Soil Displacement, Soil Compaction, Soil Puddling, and Severely Burned Soil, applies to SGP vegetation clearing for new and upgraded utility corridors in areas that are available for multiple uses on Forest Service lands.

For this analysis (which is comparable among all 4 action alternatives), existing DD within the transmission line ROW is estimated at 8 percent based on average extent of DD from ground-based forest harvesting operations in the Forest Service Northern Region (Reeves et al. 2012). It is estimated that SGP-related vegetation clearing could initially result in DD as high as 16 percent of the ROW, which is the highest Forest Service-modeled average extent of DD based on variables of Landtype, topography, and harvest season for ground-harvesting in Northern Region forests (Reeves et al. 2012). However, based on the estimate of forest land within the ROW, proportion of highly erodible soils, the limited extent of forested wetlands, and the infrequency and short duration of ground disturbing impacts, DD would more likely be somewhere between 8 percent and 15 percent (**Table 4.5-12**). Additionally, the Forest Service would require mitigation measures (see **Table D-1** of **Appendix D**) designed to minimize DD impacts. Measures that would reduce DD involve soil moisture operability requirements, slope restrictions for ground-based operations, guidelines for skidding (i.e., tree removal within forest) and skid trail construction/use, etc.

The DD activity area is the area within the transmission line ROW that would be subject to vegetation clearing only and is estimated at up to 500 acres. The magnitude of impacts from vegetation clearing potentially include detrimental soil displacement, compaction, and puddling on a conservative estimate of up to 75 acres (15 percent) within the ROW, which would be further reduced by the Forest Service-required mitigation measures that target DD.

4.5.7.3 Quantity and Quality/Suitability of Reclamation Cover Materials

The overall relatively poor quality of the soils at the mine site (outside of valley bottom soils), the long-term stockpiling of GM/SBM, and the high background concentrations of metals in soils would affect the quality and suitability of available RCM. These challenges, coupled with the harsh winter climate (short growing season) and generally steep slopes of the area, would compound to present difficulties in growing and/or maintaining persistent vegetation cover over reclaimed areas. This is consistent with the mixed vegetative cover success of nearby reclaimed mining areas and the previous efforts by Midas Gold and others at the mine site to establish self-sustaining cover on previously mined lands that have had some limited success. Additionally, there would be a 34,000 BCY GM deficit at the mine site according to the balance calculations in the RCP. This deficit may be met with the surplus of material calculated in the RCP from the Burntlog Route GM/SBM (if of sufficient quantity and quality) or could be met through additional composting of both on- and off-site feedstock (which would be separate from the 22,000 BCY of composting proposed as soil amendments to the GM). Thus, there is presently some uncertainty regarding the specific source of material to meet the identified GM/SBM deficits under all alternatives. The balance calculations in the RCP are for Alternative 1, but they would generally be comparable (with disturbance footprint-related adjustments) under the other action alternatives (**Table 4.5-11**). According to the RCP, Midas Gold intends to reclaim all the SGP-related disturbance except for approximately 357 acres (Alternative 1) associated with the Hangar Flats pit lake and high walls, the West End pit lake and high walls, the Midnight pit lake, and Yellow Pine pit high walls. Under Alternative 2 the backfilling of the Midnight pit (i.e., new Midnight DRSF), partial pit backfilling of Hangar Flats pit, and the associated elimination of the West End DRSF, would result in a smaller mine site disturbance footprint (approximately 90 fewer acres) and would result in fewer acres of unreclaimed pits/highwalls (not quantified in the RCP). Alternative 2 would, however, not reclaim the new transmission line into the mine site, as this facility would remain in perpetuity to provide power to the permanent post-closure Centralized Water Treatment Plant. Under Alternative 3, the moving of the TSF from Meadow Creek to the EFSFSR drainage and the improved public access along Meadow Creek Lookout Road (FR 51290), would result in a slightly larger disturbance footprint compared to Alternative 1 (approximately 100 additional acres) requiring reclamation. Alternative 4 would be the same as for Alternative 1 for mine site-related components but would differ due to use of the Yellow Pine Route instead of the Burntlog Route and the public access route through the mine site. Because Alternative 4 does not include Burntlog Route, it would therefore not have any potential surplus salvage from Burntlog Route, as calculated in the RCP, to compensate for the GM deficit at the mine site.

However, Midas Gold has committed to salvage the appropriate volume of GM and to create the volume of compost necessary as an amendment to provide suitable quality and quantity of the GM to cover the areas to be reclaimed. In addition, Midas Gold has committed to performance criteria tied to slope and soil stability, sediment, and vegetation cover, which would need to be met prior to release of a reclamation performance bond (i.e., when all performance standards would be achieved and the mechanism of bond release and demonstration of reclamation would be formally agreed to by Forest Service, Idaho Department of Lands, and Midas Gold).

Additionally, the naturally high background levels of trace metals at the mine site represents a challenge with regards to the suitability of RCM and reclamation-related revegetation efforts. Midas Gold’s proposed 3,000-ppm limit for suitable root zone material is high (and much higher than the mean plus 2 standard deviations for evaluated soil samples). However, in addition to the root zone limits, the Forest Service also would require limits on the GM (that would overlay the root zone material) for arsenic, mercury, and antimony, and would require a Sampling and Analysis Plan that would include in-situ screening of soils as well as laboratory testing.

Table 4.5-11 Comparison of Soil and Reclamation Cover Material Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may result in long-term adverse impacts to soil resources.	Acres and proportion of TSRC activity area that are converted from a productive site to a non-productive site (TSRC, as defined in the Payette Forest Plan). Acres and proportion of DD activity area that have altered soil characteristics resulting in loss of productivity and altered soil-hydrologic conditions.	**TSRC** Existing conditions of TSRC in the PNF activity area is approximately 259 acres within the combined subwatershed activity areas (7,468 acres), or roughly 3 percent. Existing conditions of TSRC in the BNF activity area is approximately 904 acres of the combined subwatershed activity areas (76,196 acres), or roughly 1 percent. **DD** Existing conditions of DD within the transmission line ROW is estimated at 8 percent.	**TSRC** PNF Activity Area The magnitude of impacts to soil resources within the PNF activity area includes excavation, grading, or filling of 1,616 acres (approximately 120 acres of which are already disturbed to some degree from historical mining activities or other TSRC). This results in a net increase of TSRC in the PNF activity area of approximately 1,357 acres (from an existing 259 acres to 1,616 acres). Overall TSRC under Alternative 1 would increase from approximately 3 percent to 20 percent of the PNF activity area. BNF Activity Area The magnitude of impacts to soil resources within the BNF activity area includes excavation, grading, or filling of 481 acres (approximately 66 acres of which are already disturbed due to overlap with and use of existing dedicated roadways, etc.) This results in a net increase of TSRC in the BNF activity area of approximately 414 acres (from 904 acres to 1,318 acres). Overall TSRC under Alternative 1 would increase to 2 percent of the BNF activity area. **DD** The DD activity area is the area within the transmission line ROW that would be subject to vegetation clearing only and is estimated at up to 500 acres. The magnitude of impacts from vegetation clearing potentially include detrimental soil displacement, compaction and puddling on up to a conservatively estimated 75 acres (15 percent) within the ROW.	**TSRC** PNF Activity Area The magnitude of impacts to soil resources within the PNF activity area includes excavation, grading, or filling of 1,389 acres (approximately 104 acres of which are already disturbed to some degree from historical mining activities or other TSRC). This results in a net increase of TSRC in the PNF activity area of approximately 1,285 acres (from an existing 259 acres to 1,544 acres). Overall TSRC under Alternative 2 would increase from approximately 3 percent to 19 percent of the PNF activity area. BNF Activity Area The magnitude of impacts to soil resources within the BNF activity area includes excavation, grading, or filling of 467 acres (approximately 66 acres of which are already disturbed due to overlap with and use of existing dedicated roadways, etc.) This results in a net increase of TSRC in the BNF activity area of approximately 400 acres (from 904 acres to 1,304 acres). Overall TSRC under Alternative 2 would increase to 2 percent of the BNF activity area. **DD** Comparable to Alternative 1 (15 percent of ROW).	**TSRC** PNF Activity Area The magnitude of impacts to soil resources within the PNF activity area includes excavation, grading, or filling of 1,568 acres (approximately 121 acres of which are already disturbed to some degree from historical mining activities or other TSRC). This results in a net increase of TSRC in the PNF activity area of approximately 1,447 acres (from an existing 259 acres to 1,706 acres). Overall TSRC under Alternative 3 would increase from approximately 3 percent to 21 percent of the PNF activity area. BNF Activity Area Same as Alternative 1. **DD** Comparable to Alternative 1 (15 percent of ROW).	**TSRC** PNF Activity Area The magnitude of impacts to soil resources within the PNF activity area includes excavation, grading, or filling of 1,432 acres (approximately 153 acres of which are already disturbed to some degree from historical mining activities or other TSRC). This results in a net increase of TSRC in the PNF activity area of approximately 1,280 acres (from an existing 259 acres to 1,539 acres). Overall TSRC under Alternative 4 would increase from approximately 3 percent to 19 percent of the PNF activity area. BNF Activity Area The magnitude of impacts to soil resources within the BNF activity area includes excavation, grading, or filling of 346 acres (approximately 133 acres of which are already disturbed due to overlap with and use of existing dedicated roadways, etc.) This results in a net increase of TSRC in the BNF activity area of approximately 213 acres (from 716 acres to 929 acres). Overall TSRC under Alternative 4 would increase to 2 percent of the BNF activity area. **DD** Comparable to Alternative 1 (15 percent of ROW).	Same as baseline conditions, but Midas Gold to implement surface exploration and associated activities that have been previously approved on NFS lands and would be required to continue to comply with reclamation and monitoring commitments, which include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices, and monitoring.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Available RCM may not be of sufficient quantity or quality to achieve reclamation objectives of returning disturbed areas to productive conditions that sustain long-term wildlife, fisheries, land, and water resources.	Volume of RCM available for reclamation compared to expected demand to achieve reclamation objectives. Quality and suitability of RCM available for reclamation.	RCM availability is based on soil type, subsurface and bedrock character and topography in previously undisturbed areas within the SGP area.	According to the GM balance calculations in the RCP, a total of 1,884,000 BCY of suitable soils would be salvaged from the mine site and be available for reclamation. A total of 1,918,000 BCY of GM and SBM would be required to meet the specified reclamation areas and GM/SBM thicknesses. The GM deficit is thus estimated at approximately 34,000 BCY. The quality of RCM would vary based on its source, the best material coming largely from the organic and alluvial soils of the Meadow Creek valley. Most of this material would be used for GM and SBM for wetland restoration. GM used for upland reclamation sites would mostly come from relatively poor upland soils. Overall, the majority of GM used would rate as poor or fair (per suitability criteria), due primarily to texture and coarse fragment content (Tetra Tech 2019). Additionally, the naturally high background levels of trace metals at the mine site represents a challenge for reclamation-related revegetation efforts. Midas Gold's proposed 3,000-ppm limit for suitable root zone material is high; however, the Forest Service also would require limits on the GM (that would overlay the root zone material) for arsenic, mercury, and antimony, and would require a screening of soils as well as laboratory testing.	Comparable to Alternative 1, with disturbance footprint-related adjustments for required GM/SBM and GM deficit. The new transmission line into the mine site would not be reclaimed, as this facility would remain in perpetuity to provide power to the permanent post-closure Centralized Water Treatment Plant.	Comparable to Alternative 1, with disturbance footprint-related adjustments for required GM/SBM and GM deficit.	Comparable to Alternative 1, with disturbance footprint-related adjustments for required GM/SBM and GM deficit. No potential Burntlog Route surplus salvage to compensate for the GM deficit at the mine site.	Only minor amounts of RCM would be needed for currently permitted Midas Gold drilling activities for exploration.

4.6 NOISE

This section addresses impacts on human noise-sensitive receivers during construction, operation, and closure of the Stibnite Gold Project (SGP). Potential noise impacts on recreational users are included; however, potential indirect impacts on recreational or other social resources that may occur due to changes in the noise environment are discussed in the relevant resource sections of this environmental impact statement as applicable. Potential noise impacts on biological resources, such as fish and wildlife, and threatened and endangered species are discussed in Sections 4.12, Fish Resources and Fish Habitat, and Section 4.13, Wildlife and Wildlife Habitat.

4.6.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects of noise includes the following issue and indicators:

Issue: The SGP may cause disturbance to Noise Sensitive Receivers (NSRs) such as occupied residences and campgrounds.

Indicators:

- SGP-attributed noise exceeds 55 decibels on the A-weighted scale (dBA) day-night noise level (L_{DN}) at the exterior use area of an NSR, or 55 dBA average hourly noise level (L_{EQ1h}) at any time at an exterior use area.
- SGP-attributed noise exceeds 45 dBA L_{DN} at the interior portion of a residential NSR.
- SGP-attributed noise causes the baseline outdoor ambient (i.e., existing) noise level to increase by more than 5 dBA in the vicinity of an NSR.
- SGP-attributed noise causes the resulting indoor or outdoor ambient noise level to exceed 60 dBA equivalent sound level (L_{EQ}).

Predicted increases in outdoor noise levels due to the SGP are calculated at a given sensitive receiver using reference sound levels of typical equipment, with typical acoustical usage factors (i.e., its loudest condition) for each type of equipment (Federal Highway Administration [FHWA] 2006), and baseline ambient noise data. Except where otherwise specified, noise levels are calculated using the noise analysis tool developed by the U.S. Department of Transportation, FHWA Roadway Construction Noise Model (RCNM) version 1.1 (FHWA 2006), using the following equations:

- To add equal sound pressure levels (SPLs):

  SPLTotal = SPL1 + 10Log10(N)

  Where: SPLTotal = total sound pressure level produced by multiple identical sources

  SPL1 = SPL of one source

  N = number of identical sources to be added (must be more than 0)

- To add unequal sound pressure levels:

  SPLTotal = 10Log10[10SPL1/10 + 10SPL2/10 + 10SPLn/10]

  Where: SPLTotal = total sound pressure level produced.

  SPL1, SPL2, and SPLn represent the first, second, and nth SPL, respectively.

- To calculate a noise level from a point source at a receiver:

  dBA2 = dBA1 + 20Log10(D1/D2)

  Where: dBA1 = noise level at a distance D1 from the point source.

  dBA2 = noise level at distance D2 from the same point source.

- To calculate a noise level from a line source at a receiver:

  dBA2 = dBA1 + 10Log10(D1/D2)

  Where: dBA1 = noise level at a distance D1 from the point source.

  dBA2 = noise level at distance D2 from the same point source.

Traffic noise levels are calculated using the noise analysis guidance provided in the Federal Transit Administration's (FTA's) Transit Noise and Vibration Assessment Guidance, using the following equations (FTA 2018):

- To calculate average hourly traffic noise levels:

  L_{EQ} (h) = SELref + 10log(V) + CsLog(S/50) – 35.6

  Where: SEL = Sound exposure level and SELref = Source exposure reference level at 50 feet from roadway, at 50 miles per hour (mph).

  V = hourly volume of vehicle type, in vehicles per hour.

  Cs = Speed constant.

  S = average vehicle speed, in mph.

- SELrefs provide in Table 4-11 of the FTA guidance (2018) for diesel-powered buses (82 dBA) and for automobiles and vans (74 dBA) is used to represent heavy and light trucks and light vehicles, respectively.

Blasting noise levels are calculated using guidance provided in Dyno Nobel 2010.

The following assumptions and approaches were used in the noise impact analyses:

- SGP-related noise levels and noise level increases at NSR locations are predicted by considering noise generated by major SGP-related noise sources (e.g., the mine site, access roads, utilities, and off-site facilities) during construction, operations, and closure activities, as well as the existing ambient or background noise levels at NSR locations. Generally, predicted noise levels conservatively apply only three attenuation (i.e., reduction) factors: geometric divergence (i.e., distance), ground absorption, and atmospheric absorption.

- The estimate of total average hourly noise levels from a noise source is considered to be conservative, assuming the simultaneous operation of all the equipment listed in the respective equipment list tables for a particular SGP component and/or SGP phase.
- L_{DN} levels are considered to be the baseline ambient noise levels at residential sites and campgrounds due to the sensitivity of these NSRs to nighttime noise levels. The average daytime ambient L_{EQ1h} level is considered to be the baseline ambient noise level at non-residential sites, and other recreational areas.
- SGP-related noise levels at NSRs would depend upon the type and number of equipment operating at the same time in specific locations or areas, the exact distance between the noise source or sources and the NSR, in addition to atmospheric conditions and intervening ground, vegetation, and terrain conditions.
- The predicted SGP-related noise levels at NSRs are compared to the noise indicators listed above to assess the intensity of the noise impact.
- For purposes of this noise analysis, and because the distance between the mine site and the nearest NSR is considerably greater than the largest dimension of the area that encompasses the mine pits, development rock storage facilities, tailings storage facility, and processing facilities associated with the mine site, the entire mine site is represented by a single aggregate acoustical point source that is co-located with the rock crushing plant (in the Ore Processing Plant Area) exposed to the outdoors (**Figure 2.3-2**, Alternative 1 Mine Site Layout).

4.6.2 Direct and Indirect Effects

4.6.2.1 Alternative 1

4.6.2.1.1 Construction

Noise generated during the construction phase would include noise from construction activities at the mine site, in addition to noise from the construction of off-site access roads, utilities, and facilities. Noise levels generated by these activities are described below, followed by a discussion of noise impacts on identified NSRs.

4.6.2.1.1.1 Mine Site

Construction activities at the mine site would require the use of a variety of heavy industrial-type equipment. **Table 4.6-1** lists noise levels for construction equipment that would likely be used at the mine site during the construction phase.

Table 4.6-1 Major Noise Sources and Estimated Maximum Noise Levels at the Mine Site During the Construction Phase

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 feet (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
Front-end wheel loader (Cat 994 or equivalent)	1	40	79	75
Front-end loader (Cat 990 or equivalent)	1	40	79	75
Haul trucks (Cat 789 or equivalent w/200-ton capacity)	3	40	76	77
Haul Trucks (Cat 740 or equivalent)	3	40	76	77
Dozers (D10 or equivalent)	2	40	82	81
Dozers (D6 or equivalent)	1	40	82	78
Water trucks (Cat 777 chassis or equivalent)	1	40	76	72
Motor Graders (Cat 160M or equivalent)	2	40	85	84
Excavator (Cat 349 or equivalent)	1	40	81	77
Low-boy tractor (Cat 777 chassis or equivalent)	1	40	84	80
Vibratory compactor (Cat CS76 or equivalent)	1	20	83	76
Mobile Light Plants	6	50	81	86
Fuel Service Truck	1	40	76	72
Mechanics Service Truck	2	40	75	74
Lube Service Truck	1	40	76	72
Welding Service Truck	2	40	74	73
Boom Truck	2	40	74	70
Skid Steer Truck	1	40	79	75
Tire Handler Truck	1	40	79	75
Crew vans	7	40	75	77
Pickups	25	40	75	83

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 feet (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
ATVs & UTVs	20	50	75	85
Front end loader (Cat 992 or equivalent)	1	40	79	75
Small wheel loader (Cat 930 or equivalent)	1	40	79	75
Off-road extended boom forklift	2	20	75	71
Standard forklifts	2	20	75	71
Skid steer loader (S160 Bobcat or equivalent)	2	40	79	78
Mobile crane	1	16	81	73
Flatbed supply and stake trucks (flatbed truck)	2	40	74	73
Service trucks with compressors and welders	2	40	74	73
Trash truck	1	40	76	72
Total Average Hourly Noise Level				94

Table Source: AECOM 2020

Table Notes:

1 Equipment lists as provided in Midas Gold Idaho, Inc. (Midas Gold) 2016, Table 9-2 and Table 10-1, assuming the minimum number of units of each equipment type would be operating at the mine site during the construction phase.

2 The total number of equipment units represents an estimated total number of units that would be operating at the mine site during different stages of construction.

3 The acoustical usage factor is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation. Acoustical usage factor provided in the table are equivalent to default values in FHWA RCNM version 1.1.

4 The noise levels listed represent A-weighted maximum sound level (L_{MAX}) (per equivalent measured level provided in FHWA RCNM version 1.1,) measured at a distance of 50 feet from the equipment. The provided L_{MAX} reference values are for general categories of equipment, not specific models.

5 Estimated total noise levels emitted by multiple units of the same type, using the equation in Section 4.6.1 for adding equal sound pressure levels.

ATV = All-terrain vehicle; N/A = not applicable; UTV = utility task vehicle.

The estimated total average hourly noise levels from the mine site during the construction phase would be 94 dBA L_{EQ} at the reference distance of 50 feet. Noise from the mine site would attenuate to the threshold of 55 dBA approximately 0.8 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from the mine site would attenuate to 55 dBA approximately 0.38 mile from the source of activity. Mine development and associated noise during the construction phase would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.).

4.6.2.1.1.2 Access Roads

Access roads associated with the SGP include the Yellow Pine Route and Burntlog Route. The Yellow Pine Route is the current summer access and includes access from State Highway 55 via Warm Lake Road (County Road [CR] 10-579). The actual Yellow Pine Route is defined as the Johnson Creek Road (CR 10-413) (in summer) or South Fork Salmon River Road (National Forest System Road [FR] 50674) (in winter), and then Stibnite Road portion of the McCall-Stibnite Road (CR 50-412). The Burntlog Route includes a combination of existing roads and a new road connector segment. The Burntlog Route includes access from State Highway 55 via Warm Lake Road (CR 10-579). Additionally, for the Burntlog Route, Burnt Log Road (FR 447) and Thunder Mountain Road (FR 50375) would be upgraded, and Burnt Log Road would be extended to connect to Thunder Mountain Road. The Yellow Pine Route would be used to access the mine site during the first one to two years of construction only, while the proposed Burntlog Route is being constructed. After which, all SGP-related traffic would use the Burntlog Route to access the mine site.

The evaluation of noise impacts from the access roads includes separate analyses for road construction activities along the Burntlog Route, for SGP-related traffic on both the Yellow Pine Route (during the first year of construction) and on the Burntlog Route once it is completed, and from borrow areas along the Burntlog Route.

Road Construction

Road construction activities along the Burntlog Route would involve upgrading existing roads (Burnt Log Road [FR 447] and Thunder Mountain Road [FR 50375]) and constructing a new section of roadway to connect the Burnt Log Road to Thunder Mountain Road. Road construction would include cut and fill; embankment stabilization; laying road base and surfacing material; installing new bridges, drainage channels and culverts; replacing or upgrading existing bridges, culverts, and drainages; and associated activities. Construction activities along the Burntlog Route would be limited to the first year of the construction phase. Construction noise would be short-term, intermittent, and transitory in any one location. **Table 4.6-2** lists noise levels for construction equipment that would likely be used along the Burntlog Route during the construction phase. In the absence of a detailed schedule of equipment for road construction, it was assumed that equipment used would be similar to road maintenance mobile equipment detailed for use during the operations phase, along with a dozer, crane, and two haul trucks.

Table 4.6-2 Major Noise Sources and Estimated Maximum Noise Levels at the Mine Access Road (Burntlog Route) during the Construction Phase

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 feet (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
Motor Graders (Cat 160M or equivalent)	2	40	85	84
Plow Trucks	2	40	85	84
Snow Blower	1	50	85	82
Water trucks (Cat 725 or equivalent)	2	40	76	75
Binding Agent Application Truck	1	40	76	72
Vibratory compactor (Cat CS76 or equivalent)	1	20	83	76
Fuel Service Truck	1	40	76	72
Light Vehicles	2	40	75	74
Rock Rakes (all other equip.)	2	50	84	84
Dozer	1	40	82	78
Crane	1	16	81	73
Haul trucks	2	40	76	75
Total Average Hourly Noise Level				**91**

Table Source: AECOM 2020

Table Notes:

1 Equipment list as provided in Midas Gold 2016, Table 7-1, with the addition of a dozer, crane, and two haul trucks. Assumes the maximum number of units of each equipment type listed in Table 7-1 would be operating along the access road during the construction phase.

2 The total number of equipment units represents an estimated total number of units that would be operating along the access road during different stages of construction.

3 The acoustical usage factor is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation. Acoustical usage factor provided in the table are equivalent to default values in FHWA RCNM version 1.1.

4 The noise levels listed represent L_{MAX} (per equivalent specifications provide in FHWA RCNM version 1.1, except as noted) measured at 50 feet from the equipment. The provided L_{MAX} reference values are for general categories of equipment, not specific models.

5 Estimated total noise levels emitted by multiple units of the same type, using the equation in Section 4.6.1 for adding equal sound pressure levels.

N/A = not applicable.

The estimated total average hourly noise levels from construction on the Burntlog Route would be 91 dBA L_{EQ} at the reference distance of 50 feet. Noise from access road construction would attenuate to the threshold of 55 dBA approximately 0.57 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from access road construction would attenuate to 55 dBA approximately 0.28 mile from the source of activity. Road construction and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.).

SGP-Related Traffic During Construction

During the first year of construction, while the Burntlog Route is being built, access to the mine site would be via the Yellow Pine Route. Once construction of the Burntlog Route is completed. SGP-related traffic is assumed to be on the mine access road 24 hours per day.

During the first year of the construction phase, SGP-related traffic volumes on the Yellow Pine Route access roads are estimated at 65 average annual daily traffic (AADT). Heavy vehicles are estimated at 45 AADT and light vehicles at 20 AADT (Midas Gold 2016). Vehicles per peak hour were assumed to be 10 percent of AADT (Washington State Department of Transportation 2018). Based on the estimated traffic volumes and vehicle mix, and typical vehicle speeds of 25 mph, estimated average hourly noise levels from SGP-related traffic on the mine access route during the construction phase would be 48 dBA L_{EQ} at 50 feet from the roadway. This is well below the impact threshold level of 55 dBA.

After it is completed, SGP-related traffic will move from the Yellow Pine Route to the Burntlog Route. SGP-related traffic volumes during this portion of the construction phase are estimated at 68 AADT (48 heavy vehicles and 20 light vehicles; vehicles per hour is assumed to be 10 percent of AADT for peak hour traffic). Estimated average hourly traffic noise levels would be approximately 49 dBA L_{EQ} at 50 feet from the roadway, also below the impact threshold of 55 dBA.

Borrow Areas

The extraction and processing of various types of granular material at borrow sites during the construction phase would require an excavator, loader, and portable rock crusher. **Table 4.6-3** lists noise levels for construction equipment that would likely be used at the borrow sites.

Table 4.6-3 Major Noise Sources and Estimated Maximum Noise Levels from Borrow Sources during the Construction Phase

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 ft (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
Front-end loader	1	40	79	75
Excavator	1	40	81	77
Mobile/portable rock crusher	1	50	85	82
Total Average Hourly Noise Levels				**84**

Table Source: AECOM 2020

Table Notes:

1 Equipment lists as provided in Midas Gold 2016.

2 The total number of equipment units represents an estimated total number of units that would be operating at the borrow site during different stages of construction.

3 The acoustical usage factor is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation. Acoustical usage factor provided in the table are equivalent to default values in FHWA RCNM version 1.1.

4 The noise levels listed represent L_{MAX} (per measured levels provided in FHWA RCNM version 1.1, except as noted) measured at 50 feet from the equipment. The provided L_{MAX} reference values are for general categories of equipment, not specific models.

5 Estimated total noise levels emitted by multiple units of the same type, using the equation in Section 4.6.1 for adding equal sound pressure levels.

The estimated total average hourly noise levels from each borrow site during the construction phase would be 84 dBA L_{EQ} at the reference distance of 50 feet. Noise from the borrow sites during construction would attenuate to the threshold of 55 dBA approximately 0.26 mile from the source based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from the borrow sites during construction would attenuate to 55 dBA approximately 0.15 mile from the source of activity. Facilities construction and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.).

4.6.2.1.1.3 Utilities

Utilities associated with the SGP include transmission lines, substations, and radio and cell phone communications towers. The SGP involves upgrading 63 miles of Idaho Power Company's existing transmission lines from its Lake Fork Substation south of McCall along its existing right-of-way (ROW) to the Warm Lake Substation to 138 kilovolts (kV) and constructing 8.5 miles of transmission line from the new Johnson Creek substation to the mine site. Transformers would reduce the voltage to 24.9 kV for distribution to facilities within the mine site. The SGP also would involve upgrades to the existing microwave relay tower located atop a 9,000-foot peak to the east of the mine site and installing radio repeaters and cell phone towers at existing communications sites, including the Meadow Creek Lookout, the Thunderbolt Lookout, the new Landmark Maintenance Facility, and on additional private parcels as needed. Noise impacts associated with utilities would occur primarily during the construction phase. Construction activity associated with the transmission line upgrade and new transmission line construction work is expected to generate the highest noise levels. Substations and communications tower upgrades and construction work is expected to generate lower noise levels; therefore, these are not assessed as separate subcomponents.

Upgrading the existing 63 miles of transmission lines between Lake Fork and the Johnson airstrip would involve replacing existing utility poles and associated equipment (e.g., transformers, cross arms, guy wires, fuses, switches, insulators, etc.). Tree removal and incidental brush and tree trimming also may be required. Constructing the 8.5-mile transmission line between the Johnson Creek Substation to the mine site would involve construction of new permanent and temporary access roads, improvements to existing access roads, removal of danger trees, and the placement of utility poles, conductor, and associated equipment. Helicopters may be used to install utility poles and conductor. Construction noise associated with material and equipment staging, site preparation, brush and danger tree removal, ROW clearing, construction of access roads, installation of transmission line structures including tensioning, and construction-related traffic would be short-term, intermittent, and localized, as construction proceeds along the transmission line corridor.

In the absence of a detailed schedule of equipment for utility construction, it was assumed that the equipment used would be similar to other transmission line projects. **Table 4.6-4** lists equipment for typical construction projects, and associated noise levels. Equipment and noise levels for the construction of permanent or temporary access roads to the transmission line are the same as provided in **Table 4.6-4** for construction of the mine access road.

The estimated total average hourly noise levels for the Lake Fork to Johnson Creek substations transmission line upgrade and Johnson Creek Substation to the mine site transmission line construction would be 84 dBA L_{EQ} at the reference distance of 50 feet. Noise from transmission line construction would attenuate to the threshold of 55 dBA approximately 0.28 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from transmission line construction would attenuate to 55 dBA approximately 0.15 mile from the source of activity.

Johnson Creek Substation to the mine site construction may require helicopter use, which would temporarily increase average hourly noise levels up to 100 dBA L_{EQ} for short periods of time. Noise from transmission line construction with helicopter use would attenuate to the threshold of 55 dBA approximately 1.70 miles from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from transmission line construction with helicopter use would attenuate to 55 dBA approximately 0.66 mile from the source of activity.

Assuming similar equipment usage as for the Burntlog Route construction, the estimated total average hourly noise levels from transmission line access road construction or upgrades would be 91 dBA L_{EQ} at the reference distance of 50 feet. Noise from transmission line access road construction would attenuate to the threshold of 55 dBA approximately 0.57 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from utility access road construction would attenuate to 55 dBA approximately 0.28 mile from the source of activity. The Lake Fork to Johnson Creek substations transmission line upgrade is not expected to include new access road work. Transmission line work and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.).

Table 4.6-4 Major Noise Sources and Estimated Maximum Noise Levels for Transmission Line Upgrade and Construction during the Construction Phase

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 feet (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
Bucket Truck	1	20	75	68
Backhoe	1	40	78	74
Auger Drill	1	20	84	77
Excavator	1	40	81	77
Tensioner/Puller Truck	1	40	76	72
Boom crane	2	16	81	76
Flatbed supply trucks	2	40	74	73
Crew vans	2	40	75	74
Pickup trucks	2	40	75	74
Total Average Hourly Noise Level without Helicopter Use				**84**
Total Average Hourly Noise Level with Helicopter Use				**100**

Table Source: AECOM 2020

Table Notes:

1 Equipment list based on similar transmission line projects.

2 The total number of equipment units represents an estimated total number of units that would be operating along the transmission line corridor during different stages of construction.

3 The acoustical usage factor is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation. Acoustical usage factor provided in the table are equivalent to default values in FHWA RCNM version 1.1.

4 The noise levels listed represent L_{MAX} (per measured levels provided in FHWA RCNM version 1.1, except as noted) measured at 50 feet from the equipment. The provided L_{MAX} reference values are for general categories of equipment, not specific models.

5 Estimated total noise levels emitted by multiple units of the same type, using the equation in Section 4.6.1 for adding equal sound pressure levels.

4.6.2.1.1.4 Off-Site Facilities

Off-site facilities associated with Alternative 1 include the Stibnite Gold Logistics Facility (SGLF) on Warm Lake Road and the Landmark Maintenance Facility near the intersection of Warm Lake (CR 10-579) and Johnson Creek (CR 10-413) roads.

Construction of the off-site facilities would require the use of a variety of heavy construction equipment. **Table 4.6-5** lists noise levels for construction equipment that would likely be used over the course of the off-site facility construction.

Table 4.6-5 Major Noise Sources and Estimated Maximum Noise Levels from Off-site Facilities during the Construction Phase

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 ft (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
Dozer	1	40	82	78
Dump Truck	1	40	77	73
Grader	1	40	85	81
Man Lift	1	20	85	68
Paver	1	50	85	74
Flat Bed Truck	1	40	84	70
Generator	1	50	82	78
Pickup Trucks	3	40	75	76
Total Average Hourly Noise Levels				**85**

Table Source: AECOM 2020

Table Notes:

1 The total number of equipment units represents an estimated total number of units that would be operating at the off-site facilities during different stages of construction.

2 The acoustical usage factor is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation. Acoustical usage factor provided in the table are equivalent to default values in FHWA RCNM version 1.1.

3 The noise levels listed represent L_{MAX} (per equivalent measured level provided in FHWA RCNM version 1.1, except as noted) measured at 50 feet from the equipment. The provided L_{MAX} reference values are for general categories of equipment, not specific models.

4 Estimated total noise levels emitted by multiple units of the same type, using the equation in Section 4.6.1 for adding equal sound pressure levels.

N/A = not applicable.

The estimated total average hourly noise levels from each facility during the construction phase would be 85 dBA L_{EQ} at the reference distance of 50 feet. Noise from facility construction would attenuate to the threshold of 55 dBA approximately 0.67 mile from the source based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from facility construction would attenuate to 55 dBA approximately 0.32 mile from the source of activity. Facilities construction and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.).

4.6.2.1.1.5 Noise Impacts

Table 4.6-6 provides predicted noise levels at NSR locations during the construction phase under Alternative 1, followed by a discussion of predicted noise levels and source-specific impacts at each NSR.

Table 4.6-3 Alternative 1 – Estimated SGP-Attributed Noise Levels at Analysis Locations During the Construction Phase

NSR ID	NSR Name	Ambient Background Noise Level (dBA L_{EQ})	Ambient Background Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})[1]	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	**84 / 84**[2]	**82 / 82**[2]
Site 3	Meadow Creek Lookout	45	N/A	41 / 25	39 / 23
Site 5	Forest Service Camp at Landmark	N/A	34	**53/47**	51/45
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	21 / 21	19 / 19
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	21 / 21	19 / 19
Site 8	Granite Excavation Shop in Cascade	N/A	61	48 / 49	46 / 47
Site 9	Southern Pines Plantation Property	N/A	51	**64 / 64**[2]	**62 / 62**[2]
Site 10	Yellow Pine	N/A	50	33 / 6	31 / 4
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	**63 / 63**[2]	**61 / 61**[2]
Site 12	Mule Hill Trailhead	40	N/A	40 / 31	38 / 29

Table Source: AECOM 2020

Table Notes:

1 Noise level with SGP-related traffic on Yellow Pine Route / Burntlog Route.

2 Temporary Short-term exceedances of the recommended noise level.

N/A = not available.

Site 2. Miller Residence adjacent to Johnson Road

Transmission line upgrade work is the only SGP-related activity that would contribute to the noise environment at Site 2 during the construction phase. Noise from the mine site, access road construction along the Burntlog Route, utility access road construction, off-site buildings, and borrow sites would not contribute to noise levels at Site 2 during the construction phase due to distance. SGP-related traffic on the Yellow Pine Route would generate average hourly noise levels of approximately 41 dBA at Site 2. This is below background ambient levels at the site and would have no effect on noise levels at Site 2.

Daytime noise levels at Site 2 could temporarily reach as high as 84 dBA when work is occurring at the closest location along the transmission line but would be lower as the distance increases. The closest distance between Site 2 and transmission line work is 53 feet. Noise levels at Site 2 would fall below the 55-dBA impact threshold when transmission line work is approximately 800 feet away. Helicopter use is not anticipated in this area. Average L_{DN} at Site 2 would be 82 L_{DN} and would fall to 53 dBA L_{DN} when transmission line work is at least 800 feet away.

Absent transmission line work, daytime noise levels at Site 2 are estimated at 41 dBA and average L_{DN} are estimated at 39 dBA L_{DN} during the construction phase, both below existing ambient noise levels.

Alternative 1 would have a temporary impact on the noise environment at Site 2 during the construction phase while transmission line work is occurring in the immediate vicinity. Noise levels at Site 2 would fall below the 55 dBA L_{DN} impact threshold when transmission line work is approximately 800 feet away.

Site 3. Meadow Creek Lookout

Construction activity on the Burntlog Route would be the greatest contributor of SGP noise at Site 3 during the construction phase. However, combined noise levels would still be well below the 55-dBA threshold and background ambient noise levels. Alternative 1 would have no impact on the noise environment at Site 3 during the construction phase.

Site 5. Forest Service Camp at Landmark

Access road construction on the Burntlog Route, facilities construction at the Landmark Maintenance Facility, and SGP-related traffic on the Yellow Pine Route would be the greatest contributors of SGP noise at Site 5 during the construction phase. Noise from all SGP-related activities combined would attenuate to approximately 56 dBA at Site 5, resulting in a temporary increase in noise levels above the 55-dBA threshold.

SGP-related noise would decrease to approximately 54 dBA once construction activity on the Burntlog Route and Landmark Maintenance Facility is completed and SGP-related traffic moves from the Yellow Pine Route to the Burntlog Route. This is below the threshold of 55 dBA.

Alternative 1 would have a temporary impact on the noise environment at Site 5 during the construction phase while access road work is occurring nearby. The closest distance between Site 5 and the access road is approximately 0.4 mile. When access road work is approximately 0.5 mile away, noise levels from all SGP-related activities combined would fall to the 55-dBA impact threshold.

Site 6. Forest Service Summer Camp at Warm Lake

Transmission line upgrade work is the only SGP-related activity that would contribute to the noise environment at Site 6 during the construction phase. However, daytime noise levels would still be well below the 55-dBA threshold and background ambient noise levels at the site. Alternative 1 would have no impact on the noise environment at Site 6 during the construction phase.

Site 7. Warm Lake Camp

Transmission line upgrade work and construction activity on the Burnt Log Road (FR 447) are the only SGP-related activities that would contribute to the noise environment at Site 7 during the construction phase. However, combined noise levels would still be well below the 55-dBA threshold and background ambient noise levels at the site. Alternative 1 would have no impact on the noise environment at Site 7 during the construction phase.

Site 8. Granite Excavation Shop in Cascade

Transmission line upgrade work is the only SGP-related activity that would contribute to the noise environment at Site 8 during the construction phase. Noise from the mine site, access road construction along the Burntlog Route, utility access road construction, off-site buildings and borrow sites would not contribute to noise levels at Site 8 during the construction phase due to distance. However, combined noise levels would still be well below the 55-dBA threshold and background ambient noise levels at the site. Alternative 1 would have no impact on the noise environment at Site 8 during the construction phase.

Site 9. Southern Pine Plantations Property

Transmission line upgrade work and facilities construction at the SGLF are the only SGP-related activities that would contribute to the noise environment at Site 9 during the construction phase. Noise from the mine site, access road construction along the Burntlog Route, utility access road construction, and borrow sites would not contribute to noise levels at Site 9 during the construction phase due to distance.

Transmission line upgrade work would be the primary contributor of SGP noise. Daytime noise levels at Site 9 could reach as high as 64 dBA when transmission line work is occurring at the closest location along the transmission line but would be lower as the distance increases. The closest distance between transmission line work and Site 9 is 317 feet. When transmission line work is 800 feet away, SGP-related noise levels would fall to 55 dBA. Helicopter use is not anticipated in this area. Average L_{DN} at Site 9 would be 62 L_{DN} when transmission line work is the closest and would fall to 53 L_{DN} when transmission line work is at least 800 feet away.

Absent transmission line work, noise from facilities construction would attenuate to approximately 38 dBA at Site 9 and average L_{DN} are estimated at 36 L_{DN} during the construction phase, well below the 55-dBA threshold and background ambient levels.

Alternative 1 would have a temporary impact on the noise environment at Site 9 during the construction phase while transmission line work is occurring in the immediate vicinity. Noise levels at Site 9 would fall below the 55 dBA L_{DN} impact threshold when transmission line work is approximately 800 feet away.

Site 10. Yellow Pine

SGP-related traffic on the Yellow Pine Route access road would be the greatest contributor of SGP noise at Site 10 during the construction phase. However, combined noise from all SGP-related activities would attenuate to approximately 33 dBA at Site 10, well below the 55-dBA threshold and background ambient noise levels. Alternative 1 would have no impact on the noise environment at Site 10 during the construction phase.

Site 11. Ice Hole Campground in Boise National Forest

Transmission line upgrade work and SGP-related traffic on the Yellow Pine Route are the only SGP-related activities that would contribute to the noise environment at Site 11 during the construction phase. Noise from the mine site, access road construction along the Burntlog Route, utility access road construction, off-site buildings, and borrow sites would not contribute to noise levels at Site 11 during the construction phase due to distance.

Transmission line upgrade work would be the primary contributor of SGP noise. Daytime noise levels at Site 11 could reach as high as high as 63 dBA at Site 11 when work is occurring at the closest location along the transmission line but would be lower as the distance increases. The closest distance between Site 11 and transmission line work is 370 feet. When transmission line work is at approximately 850 feet away, noise levels will fall to below 55 dBA. Average L_{DN} at Site 11 would be 61 dBA L_{DN} when transmission line work is closest and would fall to 53 dBA L_{DN}.

Absent transmission line work, noise from SGP-related traffic on the Yellow Pine Route noise from would attenuate to approximately 45 dBA L_{EQ} and 43 dBA L_{DN} at Site 11, well below the 55-dBA threshold and background ambient levels.

Alternative 1 would have a temporary impact on the noise environment at Site 11 during the construction phase while transmission line work is occurring in the immediate vicinity. Noise levels at Site 11 would fall below the 55 dBA L_{DN} impact threshold when transmission line work is approximately 800 feet away.

Site 12. Mule Hill Trailhead

SGP-related noise at Site 12 during the construction phase would be highest during the first year when construction is occurring on Burnt Log Road (FR 447). Noise from access road construction on the Burntlog Route, the nearest borrow site, and the mine site would be the greatest contributors of SGP noise at Site 12 during the construction phase. Noise from the transmission line upgrade work, and SGP-related traffic on the Yellow Pine Route would not contribute to noise levels at Site 12 during the construction phase due to distance. However, combined noise levels would still be well below the 55-dBA threshold and background ambient noise levels at the site. Alternative 1 would have no impact on the noise environment at Site 12 during the construction phase.

Frank Church-River of No Return Wilderness Areas

To evaluate potential noise impacts at dispersed recreational resource areas in the Frank Church-River of No Return Wilderness (FCRNRW) east of the Burntlog Route, noise levels from three construction-related scenarios/sources at a range of distances from the roadway were calculated (**Table 4.6-7** through **Table 4.6-9**). Based on sound levels measured at the Meadow Creek Lookout and along Burnt Log Road (FR 447), ambient sound levels within the FCRNRW are estimated at 40 to 45 dBA L_{EQ1h}.

In these and subsequent tables regarding FCRNRW, noise levels are calculated at incremental distances of 500 up to 8,000 feet into the area since there are no discrete NSRs identified within the FCRNRW. The baseline ambient is assumed to be 40 to 45 dBA L_{EQ} throughout the FCRNRW. The ‘SGP-Attributed Noise Level’ column is the calculated SGP only noise level; the ‘SGP Plus Baseline Level’ column is the energy sum of the assumed baseline (40 to 45 dBA L_{EQ1h}) and the calculated SGP level; and the ‘Increase above Baseline Noise Level’ column is the difference between the assumed baseline noise level and the energy sum of SGP plus baseline level. For the 8,000-foot distance from Burntlog Route in **Table 4.6-7** for example, the lower range of the baseline ambient is 40 dBA, the predicted SGP-only level is 34 dBA, the energy sum of 40 and 34 dBA is 41 dBA, resulting in the difference between the combined SGP + background ambient as 41 minus 40, or 1 dBA.

Road construction activities (**Table 4.6-7**) along the Burntlog Route would result in noise level increases ranging from 10 to 26 dBA above ambient noise levels approximately 500 to 1,500 feet from the roadway and would be at or above the recommended noise level of 55 dBA L_{EQ1h} for outdoor use areas. Roadway construction noise would dominate the noise environment at these distances and would be similar to noise levels in a busy commercial or urban environment. Resulting noise levels approximately 1,500 to 2,000 feet from the roadway would be below the recommended noise level of 55 dBA L_{EQ1h} for outdoor use areas; however, noise increases above ambient sound levels would be readily noticeable to twice as loud, depending upon actual distance. Direct effects on recreationists could include general annoyance or sleep annoyance at campsites in wilderness areas. Indirect effects could include a reduction in the overall quality of the remote wilderness experience. Resulting noise levels would attenuate to ambient levels at approximately 8,000 feet (**Table 4.6-7**).

Overall, the greatest potential noise impacts from road construction would occur where the Burntlog Route closely borders the FCRNRW Area. These potential noise impacts would be temporary (lasting only through the first year of the construction phase), and local (would impact a discrete area of the FCRNRW that is within approximately 4,000 feet of the Burntlog Route).

In the vicinity of the Meadow Creek Lookout, a section of the Burnt Log Road (FR 447) closely borders the FCRNRW Area. To evaluate potential noise impacts at dispersed recreational resource areas in this region of the FCRNRW, noise levels at a range of distances from the roadway also were estimated (**Table 4.6-8**). SGP-related traffic noise from the Burntlog Route would attenuate to well below the average ambient daytime sound levels within the FCRNRW Area, within 500 feet from the roadway.

Table 4.6-4 Estimated Noise Levels from the Mine Access Road Construction (Burntlog Route)

Distance from Access Route (feet)	SGP-Attributed Noise Level (dBA L_{EQ})	SGP Plus Baseline Level[1] (dBA L_{EQ})	Increase above Baseline Noise Level[2] (dBA L_{EQ})
500	66	66	21-26
1,000	59	59	14-19
1,500	55	55	10-15
2,000	52	52-53	8-12
4,000	44	45-48	3-5
8,000	34	41-45	0-1

Table Source: AECOM 2020

Table Notes:

1 Based on ambient sound levels measured at the Meadow Creek Lookout and along Burnt Log Road, average ambient daytime sound levels within the FCRNRW Area are estimated at 40 to 45 dBA L_{EQ1h}.

2 Reported increase over baseline is increase in combined SGP + baseline over baseline.

Table 4.6-5 Estimated Noise Levels from Traffic on the Mine Access Road (Burntlog Route) During the Construction Phase

Distance from Access Route (feet)	SGP-Related Traffic Noise Level (dBA L_{EQ})	SGP Plus Baseline Level[1] (dBA L_{EQ})	Increase above Baseline Noise Level[2] (dBA L_{EQ})
500	34	41-45	0-1
1,000	30	40-45	0
2,000	26	40-45	0
3,000	23	40-45	0
4,000	20	40-45	0

Table Source: AECOM 2020

Table Notes:

1 Based on ambient sound levels measured at the Meadow Creek Lookout and along Burnt Log Road, average ambient daytime sound levels within the FCRNRW Area are estimated at 40 to 45 dBA L_{EQ1h}.

2 Reported increase over baseline is increase in combined SGP + baseline over baseline.

Several potential borrow areas are located along the Burntlog Route close to the FCRNRW. To evaluate potential noise impacts at dispersed recreational resource areas in the FCRNRW east of the Burntlog Route and the potential borrow areas, noise levels at a range of distances from the borrow areas also were calculated (**Table 4.6-9**).

Borrow area activities along the Burntlog Route would result in noise level increases ranging from 8 to 19 dBA above baseline noise levels within approximately 1,000 feet from a borrow area. SGP-related noise levels would be at or above the recommended noise level of 55 dBA for outdoor use areas within 500 feet, but below this level farther way. Resulting noise levels approximately 3,000 feet from the roadway would be within the range of average ambient L_{EQ} levels in the area, and below the recommended noise level of 55 dBA for outdoor use areas. Direct effects on recreationists within 1,000 to 2,000 feet of borrow areas could include general annoyance or sleep disturbance at campsites in wilderness areas. Indirect effects could include a reduction in the overall quality of the remote wilderness experience.

Overall, potential noise impacts on recreationists from borrow areas would be limited to a discrete area within approximately 1,000 to 2,000 feet of borrow areas located along the Burntlog Route where it closely borders the adjacent wilderness area. Noise from these borrow areas would likely be periodic or intermittent, but ongoing throughout the construction phase.

Table 4.6-6 Estimated Noise Levels from Borrow Areas along the Burntlog Route During the Construction Phase

Distance from Access Route (feet)	SGP-Related Borrow Area Noise Level (dBA L_{EQ})	SGP Plus Baseline Level[1] (dBA L_{EQ})	Increase above Ambient Noise Level[2] (dBA L_{EQ})
500	59	59	14-19
1,000	52	52-53	8-12
2,000	45	46-48	3-6
3,000	41	44-46	1-3
6,000	31	41-45	0-1

Table Source: AECOM 2020

Table Notes:

1 Based on ambient sound levels measured at the Meadow Creek Lookout and along Burnt Log Road, average ambient daytime sound levels within the FCRNRW Area are estimated at 40 to 45 dBA L_{EQ1h}.

2 Reported increase over baseline is increase in combined SGP + baseline over baseline.

4.6.2.1.2 OPERATIONS

Noise generated during the operations phase would include noise from the mine site, in addition to noise from traffic and maintenance activities on the mine access road, utility operations, and off-site facilities and borrow site operations. Noise levels generated by these activities are described below, followed by a discussion of noise impacts on identified NSRs.

4.6.2.1.2.1 Mine Site

Operations at the mine site would involve development rock and legacy tailings removal, ore mining, materials loading and transport, ore processing and legacy tailings reprocessing, and routine maintenance of mine-site support facilities and infrastructure. Major noise-generating activities would include: the operation of heavy industrial-type earth moving equipment; drilling and blasting activities to extract rock from the ground; materials loading, hauling, and unloading activities; and rock crushing and grinding at the Process Plant Area. The Primary Rock Crusher would be located outside at the Process Plant Area, while rock grinding and other ore processing activities would be located inside a series of buildings. **Table 4.6-10** lists noise levels for equipment that would be used at the mine site during the operations phase.

Table 4.6-7 Major Noise Sources and Estimated Maximum Noise Levels at the Mine Site during the Operations Phase

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 feet (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
Primary crusher	1	100[6]	95[7]	95
Front end loader	1	100[6]	79	79
Blast-hole drills (Cat MD6290 or equivalent)	5	20	84	84
Pioneer drill (Cat MD 5150 or equivalent)	3	20	84	82
Front-end wheel loader (Cat 994 or equivalent)	4	40	79	81
Front-end loader (Cat 990 or equivalent)	3	40	79	80
Haul trucks (Cat 789 or equivalent w/200-ton capacity)	20	40	76	85
Haul Trucks (Cat 740 or equivalent)	5	40	76	79
Dozers (D10 or equivalent)	5	40	82	85
Dozers (D6 or equivalent)	2	40	82	81
Water trucks (Cat 777 chassis or equivalent)	2	40	76	75
Motor Graders (Cat 160M or equivalent)	3	40	85	86
Excavator (Cat 349 or equivalent)	2	40	81	80
Low-boy tractor (Cat 777 chassis or equivalent)	2	40	84	83

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 feet (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
vibratory compactor (Cat CS76 or equivalent)	2	20	83	79
Mobile Light Plants	10	50	81	88
Fuel Service Truck	2	40	76	75
Mechanics Service Truck	3	40	75	76
Lube Service Truck	2	40	76	75
Welding Service Truck	3	40	74	75
Boom Truck	2	40	74	73
Skid Steer Truck	3	40	79	80
Tire Handler Truck	2	40	79	78
Crew vans	8	40	75	80
Pickups	25	40	75	85
ATVs & UTVs	25	50	75	86
Front end loader (Cat 992 or equivalent)	2	40	79	78
Small wheel loader (Cat 930 or equivalent)	2	40	79	78
Off-road extended boom forklift	3	50	75	77
Standard forklifts	3	50	75	77
Skid steer loader (S160 Bobcat or equivalent)	3	40	79	80
Boom truck	2	40	74	73
Mobile crane	2	16	81[8]	76
Flatbed supply and stake trucks	3	40	74	75
Service trucks with compressors and welders	2	40	74	73
Trash truck	2	40	76	75
Crew vans	5	40	75	78

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 feet (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
Pickup trucks	15	40	75	83
Blasting	1	0.0035[9]	144[10]	99
Total Average Hourly Noise Level (L_{EQ1h}) without Blasting				**99**
Total Average Hourly Noise Level (L_{EQ1h}) with Blasting Included[11]				**102**

Table Source: AECOM 2020

Table Notes:

1 Equipment lists as provided in Midas Gold 2016, Table 9-2 and Table 10-1, assuming the maximum number of units of each equipment type will be operating at the mine site during the construction phase.

2 The total number of equipment units represents an estimated total number of units that would be operating at the mine site during different stages of construction.

3 The acoustical usage factor is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation. Acoustical usage factor provided in the table are equivalent to default values in FHWA RCNM version 1.1.

4 The noise levels listed represent L_{MAX} (per measured levels provided in FHWA RCNM version 1.1, except as noted) measured at 50 feet from the equipment. The provided L_{MAX} reference values are for general categories of equipment, not specific models.

5 Estimated total noise levels emitted by multiple units of the same type, using the equation in Section 4.6.1 for adding equal sound pressure levels.

6 Acoustical factors for primary crusher and front-end loader at the ore processing facility as provided in Midas Gold 2016, pp. 10-4.

7 Reference noise level for primary crusher as provided in Chuitna Coal Project Supplemental Environmental Impact Statement (U.S. Environmental Protection Agency 1990).

8 Reference noise level as provided in FHWA Noise Construction Handbook, Table 9.9, FTA Construction Equipment Noise Levels (FHWA 2006).

9 Acoustical usage factors as provided in Midas Gold 2016.

10 Estimated noise level from blasting event calculated using airblast calculation method as provided in Dyno Nobel 2010.

11 Blasting events are impulsive noise events that would be initiated near midday or during mid to later afternoon.

ATV = All-terrain vehicle; N/A = not applicable; UTV = utility task vehicle.

The estimated total average hourly noise levels from the mine site during the operations phase would be 99 dBA L_{EQ} at the reference distance of 50 feet. Noise from the mine site would attenuate to the threshold of 55 dBA at approximately 1.5 miles away based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from the mine site would attenuate to 55 dBA approximately 0.60 mile from the source of activity.

During blasting, noise levels could temporarily increase to 102 dBA L_{EQ}. Noise from the mine site with the addition of blasting would attenuate to the threshold of 55 dBA at approximately 2.2 miles based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from the mine with the addition of blasting would attenuate to 55 dBA at approximately 0.78 mile from the source of activity. Mine operations and associated noise would occur 24 hours per day. Blasting noise would occur intermittently for short periods of time.

4.6.2.1.2.2 Access Roads

The evaluation of noise impacts from the access roads during the operations phase includes road maintenance and SGP-related traffic along the Burntlog Route.

Road Maintenance

Table 4.6-11 shows a typical list of road maintenance equipment that would be operating on the Burntlog Route periodically during the operations phase.

The estimated total average hourly noise levels from road maintenance activity on the Burntlog Route would range from 88 dBA L_{EQ} at the reference distance of 50 feet during the summer months to 90.2 dBA L_{EQ} during the winter months when snow removal is required. Noise from access road summer maintenance would attenuate to the threshold of 55 dBA at approximately 0.42 mile based on distance alone and noise from access road winter maintenance would attenuate to the threshold of 55 dBA approximately 0.54 mile from the source of activity. Accounting for ground absorption and atmospheric absorption, noise from summer access road maintenance would attenuate to 55 dBA approximately 0.22 mile away and noise from winter access road maintenance would attenuate to 55 dBA approximately 0.27 mile from the source of activity. Access road maintenance and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.).

Table 4.6-8 Major Noise Sources and Estimated Maximum Noise Levels from Maintenance of the Mine Access Road (Burntlog Route) during the Operation Phase

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 feet (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
Motor Graders (Cat 160M or equivalent)	2	40	85	84
Water trucks (Cat 725 or equivalent)	2	40	76	75
Binding Agent Application Truck	1	40	76	72
vibratory compactor (Cat CS76 or equivalent)	1	20	83	76
Fuel Service Truck	1	40	76	72
Light Vehicles	2	40	75	74
Rock Rakes (all other equip.)	2	50	84	84

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 feet (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
Plow Trucks	2	40	85	84
Snow Blower	1	50	85	82
Total Average Hourly Noise Level – Summer				**88**
Total Average Hourly Noise Level – Winter				**90**

Table Source: AECOM 2020

Table Notes:

1 Equipment list as provided in Midas Gold 2016, Table 7-1. Assumes the maximum number of units of each equipment type listed in Table 7-1 would be operating periodically along the access road during the operations phase.

2 The total number of equipment units represents an estimated total number of units that would be operating along the access road during different stages of construction.

3 The acoustical usage factor is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation. Acoustical usage factor provided in the table are equivalent to default values in FHWA RCNM version 1.1.

4 The noise levels listed represent L_{MAX} (per measured noise levels provided in FHWA RCNM version 1.1, except as noted) measured at 50 feet from the equipment. The provided L_{MAX} reference values are for general categories of equipment, not specific models.

5 Estimated total noise levels emitted by multiple units of the same type, using the equation in Section 4.6.1 for adding equal sound pressure levels.

N/A = not applicable.

SGP-Related Traffic During Operation

During the operations phase, SGP-related traffic volumes on the mine access road (the Burntlog Route) are estimated at 68 AADT (average annual daily traffic). Heavy vehicles are estimated at 49 AADT and light vehicles at 19 AADT (Midas Gold 2016). Based on the estimated traffic volumes and vehicle mix, and assuming typical vehicle speed of 25 mph and 10 percent of AADT traffic volume at peak hours conditions, estimated average hourly noise levels from SGP-related traffic on the Burntlog Route during the operations phase would be 49 dBA L_{EQ}. This is well below the threshold of 55 dBA. SGP-related traffic is assumed to be on the mine access road 24 hours per day.

Borrow Areas

Activity, equipment, and noise levels at borrow areas would be the same as during the construction phase (**Table 4.6-3**). The estimated total average hourly noise levels from each borrow site would be 84 dBA L_{EQ} at the reference distance of 50 feet. Noise from the borrow sites during operations would attenuate to the threshold of 55 dBA approximately 0.26 mile from the source based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from the borrow sites would attenuate to 55 dBA approximately 0.15 mile from the source of activity.

4.6.2.1.2.3 Utilities

The existing transmission lines and substations that would be used to serve the SGP are not new sources of noise within the affected environment. New sources of noise associated with the operation of utilities would be limited to the Johnson Creek substation to the mine site transmission line and new substations. During stormy or very humid weather, audible corona noise from a wetted transmission line operating at 230 kV or greater can contribute to ambient noise and, under the right conditions and at distances close enough to the conductors, be audible to a listener on the ground. But under such poor weather conditions (e.g., precipitation) that cause corona noise to be more audible, other acoustical contributors to the outdoor ambient sound environment like rainfall on leafy vegetation, road surfaces, and structure surfaces (rooves) also rise in magnitude. Under fair weather conditions, audible corona noise is much less and likely inaudible under most conditions. Hence, audible corona noise from the Johnson Creek-mine site transmission line operating at 138 kV would likely not increase ambient levels beyond the transmission line ROW.

A typical operating substation might be expected to generate combined noise levels (due to on-site transformer hum, cooling fans, etc.) of up to 80 dBA L_{EQ1h} at 3 feet from a geographic acoustical center-point position. Substation noise would attenuate to the 55-dBA threshold approximately 53 feet from the substation.

4.6.2.1.2.4 Off-Site Facilities

Operational noise sources associated with off-site facilities (Landmark Maintenance Facility and SGLF) would generally be limited to vehicles entering and leaving these facilities, and heating, ventilation, and air conditioning equipment associated with facility buildings, but no heavy equipment routinely operating at these facilities. The combined noise generated by these sources would be substantially less than SGP traffic and/or the road maintenance noise presented in **Table 4.6-11**, which would occur along the access roads that these facilities would be located immediately adjacent to.

4.6.2.1.2.5 Noise Impacts

Table 4.6-12 provides estimated noise levels at noise receiver locations during the operations phase under Alternative 1, followed by a discussion of estimated noise levels and impacts at each NSR.

Table 4.6-9 Alternative 1 - SGP-Attributed Noise Levels at Analysis Locations during the Operations Phase

ID	Name	Baseline Noise Level (dBA L_{EQ})	Baseline Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})[1]	SGP-Attributed Day-Night Noise Level (dBA L_{DN})[2]
Site 2	Miller Residence	N/A	50	14 / 14	12
Site 3	Meadow Creek Lookout	45	N/A	40 / 40	38

ID	Name	Baseline Noise Level (dBA L_{EQ})	Baseline Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})[1]	SGP-Attributed Day-Night Noise Level (dBA L_{DN})[2]
Site 5	Forest Service Camp at Landmark	N/A	34	**51 / 51**[5]	**49**
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	<1 / <0	<1
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	5 / 5	3
Site 8	Granite Excavation Shop in Cascade	N/A	61	25 / 25	23
Site 9	Southern Pines Plantation Property	N/A	51	25 / 25	23
Site 10	Yellow Pine	N/A	50	<1/<1	<1
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	35 / 35	33
Site 12	Mule Hill Trailhead	40	N/A	33 / 33	31

Table Source: AECOM 2020

Table Notes:

1 Noise levels without blasting / noise levels with blasting.

2 Noise level without blasting.

3 Temporary short-term exceedance of the recommended noise level.

4 Short-term exceedance of the recommended noise level.

5 Long-term, periodic or intermittent exceedance of the recommended noise level.

6 Long-term, continuous exceedance of the recommended noise level.

N/A = not available.

Site 2. Miller Residence adjacent to Johnson Road

Average hourly noise from all SGP-related activities combined, both without and with blasting, would attenuate to approximately 14 dBA at Site 2, and would have no effect on background ambient noise levels. Alternative 1 would have no impact on the noise environment at Site 2 during the operations phase.

Site 3. Meadow Creek Lookout

Average hourly noise from all SGP-related activities combined, both without and with blasting, would attenuate to approximately 40 dBA at Site 3, and would have no effect on the background ambient noise levels. Access road maintenance on the Burntlog Route would be the greatest contributor of SGP noise at Site 3 during the operations phase. However, combined noise levels would still be well below the 55-dBA threshold and background ambient noise levels at the site.

Alternative 1 would have no impact on the noise environment at Site 3 during the operations phase.

Site 5. Forest Service Camp at Landmark

In the absence of blasting, access road maintenance on the Burntlog Route is the greatest contributor of SGP-related noise at Site 5 during the operations phase. Average hourly noise from all SGP-related activities combined, both without and with blasting, would attenuate to approximately 51 dBA at Site 5 during access road maintenance, below the 55-dBA threshold, but well above background ambient noise levels.

In the absence of access road maintenance activity, SGP-related noise would attenuate to approximately 26 dBA at the site, well below background ambient noise levels. Access road maintenance is expected to be temporary in any single location and intermittent throughout the year, though more frequent during the winter.

Alternative 1 would have long-term, periodic impacts at Site 5 during road maintenance activity throughout the operations phase.

Site 6. Forest Service Summer Camp at Warm Lake

Average hourly noise from all SGP-related activities combined, both without and with blasting, would attenuate to 0 dBA at Site 6 during the operations phase, and would have no effect on background ambient noise levels. Alternative 1 would have no impact on the noise environment at Site 6 during the operations phase.

Site 7. Warm Lake Camp

In the absence of blasting, access road winter maintenance on the Burntlog Route is the only SGP-related activity that would contribute to the noise environment at Site 7 during the operations phase. However, average hourly noise from all SGP-related activities combined, both without and with blasting, would attenuate to attenuate to 5 dBA at Site 7, well below the 55-dBA threshold and background ambient noise levels, and would have no effect on existing noise levels. Alternative 1 would have no impact on the noise environment at Site 7 during the operations phase.

Site 8. Granite Excavation Shop in Cascade

Substation noise is the only SGP-related noise that would contribute to the noise environment at Site 8 during the operations phase. However, average hourly noise from all SGP-related activities combined, both without and with blasting, would attenuate to 25 dBA at Site 8 due to distance, and would have no effect on background ambient noise levels. Alternative 1 would have no impact on the noise environment at Site 8 during the operations phase.

Site 9. Southern Pine Plantation

Substation noise is the only SGP-related noise that would contribute to the noise environment at Site 9 during the operations phase. However, average hourly noise from all SGP-related activities combined, including blasting, would attenuate to 25 dBA at Site 9 due to distance, and would have no effect on background ambient noise levels. Alternative 1 would have no impact on the noise environment at Site 9 during the operations phase.

Site 10. Yellow Pine

Average hourly noise from all SGP-related activities combined, including blasting would attenuate to 0 dBA at Site 10 during the operations phase, and would have no effect on background ambient noise levels. Alternative 1 would have no impact on the noise environment at Site 10 during the operations phase.

Site 11. Ice Hole Campground in Boise National Forest

Substation noise is the only SGP-related noise that would contribute to the noise environment at Site 11 during the operations phase. However, average hourly noise from all SGP-related activities combined, including blasting, would attenuate to 33 dBA at Site 11, and would have no effect on background ambient noise levels. Alternative 1 would have no impact on the noise environment at Site 11 during the operations phase.

Site 12. Mule Hill Trailhead

Noise from all SGP-related activities combined, including blasting would attenuate to approximately 33 dBA at Site 12 during the operations phase, below the 55-dBA threshold and background ambient sound levels. Alternative 1 would have no impact on the noise environment at Site 12 during the operations phase.

Frank Church-River of No Return Wilderness Areas

Noise levels at a range of distances from the Burntlog Route also were estimated to evaluate SGP-related noise from road maintenance activity in portions of the adjacent FCRNRW Area east of the Burntlog Route that closely borders the roadway (**Table 4.6-13**).

Based on ambient sound levels measured at the Meadow Creek Lookout and along Burnt Log Road (FR 477), average ambient daytime sound levels within the FCRNRW Area are estimated at 40 to 45 dBA L_{EQ}. Road maintenance noise from the Burntlog Route would result in maximum noise level increases of 24 to 26 dBA (summer-winter) above ambient sound levels 500 feet from the roadway (higher winter levels due to assumed additional equipment used for roadway snow removal). Areas within approximately 4,000 feet from the roadway would experience increases approximately 5 dBA L_{EQ1h} or greater. Direct effects on recreationists within approximately 4,000 feet from the roadway could include general annoyance. Indirect effects could include a reduction in the overall quality of the remote wilderness experience. Noise level impacts would be lower farther from the access road and would attenuate to a less than perceptible difference (1 to 2 dBA) at approximately 6,000 feet.

Table 4.6-10 Estimated Road Maintenance Noise Levels from the Mine Access Road (Burntlog Route) during the Operations Phase

Distance from Access Route (feet)	SGP-Related Road Maintenance Noise Level (dBA L_{EQ}, summer-winter)	SGP plus Baseline Noise Level[1] (dBA L_{EQ}, summer-winter)	Increase above Baseline Noise Level (dBA L_{EQ}, summer-winter)
500	64-66	64-66	24-26
1,000	57-59	57-59	17-19
2,000	49-52	50-52	10-12
3,000	45-47	46-48	6-8
4,000	41-43	44-45	4-5
5,000	38-40	42-43	3-4
6,000	36-38	41-42	1-2

Table Source: AECOM 2020

Table Notes:

1 Based on ambient sound levels measured at the Meadow Creek Lookout and along Burnt Log Road, average ambient daytime sound levels within the FCRNRW Area are estimated at 40 dBA L_{EQ1h}.

2 Reported increase over baseline is increase in combined SGP + baseline over baseline.

Overall, the greatest potential noise impacts from road maintenance would occur where the Burntlog Route closely borders the FCRNRW Area. These potential noise impacts would be long-term, but periodic or intermittent, and local (would impact a discrete area of the FCRNRW that is within approximately 4,000 feet of the Burntlog Route).

Noise levels at a range of distances from the Burntlog Route also were estimated to evaluate SGP-related traffic noise in portions of the adjacent FCRNRW Areas that closely border the roadway (**Table 4.6-14**). Based on ambient sound levels measured at the Meadow Creek Lookout and along Burnt Log Road, average ambient daytime sound levels within the FCRNRW Area are estimated at 40 to 45 dBA L_{EQ1h}. SGP-related traffic noise from the Burntlog Route would attenuate to well below the average ambient daytime sound levels within the FCRNRW Area 500 feet from the roadway. Overall, aside from the noise impact predicted for Site 5, SGP-related traffic during the operations phase would have negligible to no effect on the ambient sound environment at nearby NSRs.

If the borrow areas along the Burntlog Route adjacent to the FCRNRW Area are utilized during the operations phase, potential impacts to recreationists within approximately 1,000 to 2,000 feet of these borrow areas would be the same as during the construction phase (**Table 4.6-9**).

Table 4.6-11 Estimated SGP-Related Traffic Noise Levels from the Mine Access Road (Burntlog Route) During the Operations Phase

Distance from Access Route (feet)	SGP-Related Traffic Noise Level (dBA, L_{EQ})	SGP Plus Baseline Noise Level[1] (dBA, L_{EQ})	Increase above Baseline Noise Level[2] (dBA, L_{EQ})
500	34	41-45	0-1
1,000	30	40-45	0
2,000	26	40-45	0
3,000	23	40-45	0
4,000	21	40-45	0

Table Source: AECOM 2020

Table Notes:

1 Based on ambient sound levels measured at the Meadow Creek Lookout and along Burnt Log Road, average ambient daytime sound levels within the FCRNRW Area are estimated at 40 to 45 dBA L_{EQ1h}.

2 Reported increase over baseline is increase in combined SGP + baseline over baseline.

4.6.2.1.3 CLOSURE AND RECLAMATION

4.6.2.1.3.1 Mine Site

Major noise-generating activities at the mine site during the closure phase would include the operation of heavy industrial-type earth moving equipment for the placement of materials, grading, contouring, and similar activities associated with reclamation. In the absence of a detailed list of equipment to be used during the closure phase, a conservative assumption was made that equipment and numbers of each equipment type would be the same or similar to the construction phase, as listed in **Table 4.6-1**.

The estimated total average hourly noise levels from the mine site during the closure and reclamation phase would be 94 dBA L_{EQ} at the reference distance of 50 feet. Noise from the mine site would attenuate to the threshold of 55 dBA approximately 0.8 mile from the source based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from the mine site would attenuate to 55 dBA approximately 0.38 mile from the source of activity. Mine closure and reclamation activities, during this phase would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.).

4.6.2.1.3.2 Access Roads

During the closure phase, the mine access road would continue to be in use. Potential noise sources from the access road during the closure phase would include road maintenance, SGP-related traffic, borrow areas, and road decommissioning of the Burnt Log Road-Thunder Mountain Road Connector.

Road Maintenance

Road maintenance activity and equipment are assumed to be the same as during the operation phase. The estimated total average hourly noise levels from road maintenance activity on the Burntlog Route would range from 88 dBA L_{EQ} at the reference distance of 50 feet during the summer months to 90.2 dBA L_{EQ} during the winter months when snow removal is required. Noise from access road summer maintenance would attenuate to the threshold of 55 dBA approximately 0.42 mile from the source of activity based on distance alone and noise from access road winter maintenance would attenuate to the threshold of 55 dBA approximately 0.54 mile from the source of activity. Accounting for ground absorption and atmospheric absorption, noise from summer access road maintenance would attenuate to 55 dBA approximately 0.22 mile and noise from winter access road maintenance would attenuate to 55 dBA approximately 0.27 mile from the source of activity. Access road maintenance and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.).

SGP-Related Traffic During the Access Road Closure Phase

During the closure phase, SGP-related traffic would continue to utilize the Burntlog Route. Traffic volumes would be lower than during the operation phase. Total average annual daily traffic is estimated at 26 AADT (versus 68 ADDT during the operation phase). Heavy vehicle volumes are estimated to be 14 AADT (versus 49 ADDT during the operation phase) and light vehicle volumes are estimated to be 12 AADT (versus 19 AADT during the operation phase) (Midas Gold 2016). Assuming 10 percent of AADT at peak hour and vehicle speeds of 25 mph, traffic noise levels 50 feet from the mine access road would be 43 dBA L_{EQ}, 5 dBA lower than during the operations phase, primarily due to the substantially lower volume of heavy vehicles on the roadway.

Borrow Areas

Activity, equipment, and noise levels at borrow areas are expected to be similar to the construction and operations phases. It is unknown which borrow areas would be active within each SGP phase.

Road Decommissioning

Decommissioning the Burnt Log Road-Thunder Mountain Road Connector section of the Burntlog Route would likely involve the same or similar set of equipment as construction, and would generate similar noise levels, 91 dBA L_{EQ} at the reference distance of 50 feet. Noise from access road decommissioning activity would attenuate to the threshold of 55 dBA approximately 0.57 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from access road decommissioning would attenuate to 55 dBA approximately 0.28 mile from the source of activity. However, road decommissioning activity would be limited to just this section of the mine access road.

4.6.2.1.3.3 Utilities

After closure of the mine site, when the need for substantial on-site electrical power requirements has ceased, the transmission line from the Johnson Creek substation to mine site would be disassembled. **Table 4.6-15** lists noise levels for construction equipment that would likely be used at the transmission line during the closure phase. In the absence of a detailed schedule of equipment operated at the transmission line during closure, it was assumed that equipment during this phase would be similar to equipment detailed in environmental documents for other transmission line projects. The estimate of total average hourly noise levels is considered conservative, assuming the simultaneous operation of all the equipment listed in **Table 4.6-15**.

Table 4.6-12 Major Noise Sources and Estimated Maximum Noise Levels from Disassembly of the Johnson Creek Substation to Mine Site Transmission Line During the Closure Phase

Equipment[1]	Total Number of Units (max)[2]	Acoustical Usage Factor (%)[3]	Maximum Noise Levels per Unit, L_{MAX} at 50 feet (dBA)[4]	Predicted Total Noise Level, L_{EQ} at 50 feet (dBA)[5]
Reel truck	1	40	76	72
Boom crane	2	16	81	76
Flatbed supply trucks	2	40	74	73
Crew vans	2	40	75	74
Pickup trucks	2	40	75	74
Total Average Hourly Noise Level				**81**

Table Source: AECOM 2020

Table Notes:

1 Equipment list based on similar transmission line projects.

2 The total number of equipment units represents an estimated total number of units that would be operating at the mine site during different stages of construction.

3 The acoustical usage factor is used to estimate the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during equipment operation. Acoustical usage factor provided in the table are equivalent to default values in FHWA RCNM version 1.1.

4 The noise levels listed represent L_{MAX} (per equivalent specifications provide in FHWA RCNM version 1.1, except as noted) measured at 50 feet from the equipment.

5 Estimated total noise levels emitted by multiple units of the same type, using the equation in Section 4.6.1 for adding equal sound pressure levels.

The estimated total average hourly noise levels generated from the transmission line decommissioning would be 81 dBA L_{EQ} at the reference distance of 50 feet, slightly lower than noise levels generated during the construction phase. Noise from transmission line decommissioning would attenuate to the threshold of 55 dBA approximately 0.19 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from transmission line decommissioning would attenuate to 55 dBA approximately 0.11 mile from the source of activity.

4.6.2.1.3.4 Off-Site Facilities

The sound sources associated with the closure and reclamation of the Landmark Maintenance Facility was conservatively assumed to be similar to those associated with construction activities, as listed in **Table 4.6-5**. There would be no reclamation-related noise associated with the SGLF. The facility has a post-mining land designated as light industry, where it would remain un-reclaimed after mining operations and transferred to a third-party for light industrial uses.

4.6.2.1.3.5 Noise Impacts

Table 4.6-16 provides estimated noise levels at noise receiver locations during the closure and reclamation phase under Alternative 1, followed by a discussion of estimated noise levels and impact at Site 5.

Table 4.6-13 Alternative 1 - SGP-Attributed Noise Levels at Analysis Locations During the Closure and Reclamation Phase

ID	Name	Ambient Background Noise Level (dBA L_{EQ})	Ambient Background Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	6	4
Site 3	Meadow Creek Lookout	45	N/A	41	39
Site 5	Forest Service Camp at Landmark	N/A	34	**56**[1]	54
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	18	16
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	18	16
Site 8	Granite Excavation Shop in Cascade	N/A	61	<1	<1
Site 9	Southern Pines Plantation Property	N/A	51	<1	<1
Site 10	Yellow Pine	N/A	50	54	52

ID	Name	Ambient Background Noise Level (dBA L_{EQ})	Ambient Background Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	38	36
Site 12	Mule Hill Trailhead	40	N/A	40	38

Table Source: AECOM 2020

Table Notes:

1 Temporary Short-term exceedance of the recommended noise level.

2 Short-term exceedance of the recommended noise level.

3 Long-term, periodic or intermittent exceedance of the recommended noise level.

4 Long-term, continuous exceedance of the recommended noise level.

N/A = not available.

Site 5. Forest Service Camp at Landmark

Access road decommissioning work on the Burntlog Route and facilities decommissioning at the Landmark Maintenance Facility would be the greatest contributors of SGP noise at Site 5 during the closure phase. Noise from all SGP-related activities combined would attenuate to approximately 56 dBA at Site 5, resulting in a temporary increase in noise levels above the 55-dBA threshold.

Alternative 1 would have a temporary impact on the noise environment at Site 5 during the closure phase while access road decommissioning and facilities decommissioning work is occurring in the immediate vicinity.

4.6.2.2 Alternative 2

4.6.2.2.1 CONSTRUCTION

4.6.2.2.1.1 Mine Site

Construction activities, equipment, and associated noise levels from the mine site would be the same as Alternative 1. Distances from the assumed acoustical center of activity at the mine to noise receivers would be the same as Alternative 1.

4.6.2.2.1.2 Access Roads

Construction activities, equipment and associated noise levels from access road work would be the same as Alternative 1, except that a 5.3-mile segment of the Burntlog Route would be re-routed. The re-route would move the segment of roadway eastward, which would increase the distance to Site 2 (26,136 feet for Alternative 1 vs. 27,157 for Alternative 2), Site 3 (5,069 feet vs. 5,100 feet), and Site 11 (30,360 feet vs. 33,638 feet), but decrease the distance to the FCRNRW (up to 1 mile closer). Traffic volumes on access roads would be the same as Alternative 1.

Borrow sites along the Burntlog Route, borrow sites activities, and associated noise levels from borrow sites would be the same as Alternative 1.

4.6.2.2.1.3 Utilities

Construction activities, equipment, and associated noise levels from transmission line work and the construction of utility access roads would be the same as Alternative 1. However, under Alternative 2, the Cascade Switching Station would be closer to Site 8 (1,217 feet vs.1,479 feet under Alternative 1), affecting estimated noise levels at the site. Additionally, approximately 1 mile east of Cascade Alternative 2 includes the Thunder Mountain Estates Bypass as part of the upgraded transmission line, which would relocate a 5.4-mile segment of the transmission line to avoid the Thunder Mountain Estates Subdivision.

4.6.2.2.1.4 Off-Site Facilities

The location of the SGLF would be the same as for Alternative 1; however, the maintenance facility would be located along Burntlog Route, approximately 4.4 miles east of the junction of Johnson Creek Road and Warm Lake Road, approximately midway between Sites 4 and 5.

4.6.2.2.1.5 Noise Impacts

Under Alternative 2, the Cascade switching station would be moved to the west, closer to Site 8. Average hourly daytime noise levels at Site 8 are estimated at 51 dBA during the construction phase, compared to 49 dBA under Alternative 1. However, noise levels at Site 8 would still be well below the 55-dBA threshold and background ambient noise levels.

While a 5.3-mile segment of the Burntlog Route increases the distance between access road construction work and Site 2, Site 3, and Site 11, the difference has no effect on SGP-related levels or overall noise impacts at these receivers during the construction phase. **Table 4.6-17** provides estimated noise levels at noise receiver locations during the construction phase under Alternative 2.

Alternative 2 would have temporary impacts on the noise environment at Site 2, Site 9, and Site 11 during transmission line work, including utility access roads, in the immediate vicinity, and at Site 5 during access road and facilities construction.

Table 4.6-14 Alternative 2 - SGP-Attributed Noise Level at Analysis Locations During the Construction Phase

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})[1]	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	**84 / 84** [2]	**82 / 82**[2]
Site 3	Meadow Creek Lookout	45	N/A	41 / 25	39 / 23
Site 5	Forest Service Camp at Landmark	N/A	34	**52/51**[2]	50/49
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	21 / 21	19 / 19
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	21 / 21	19 / 19
Site 8	Granite Excavation Shop in Cascade	N/A	61	51 / 51	49 /49
Site 9	Southern Pines Plantation Property	N/A	51	**64 / 64**[2]	**62 / 62**[2]
Site 10	Yellow Pine	N/A	50	33 / 6	31 / 4
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	**63 / 63**[2]	**61 / 61**[2]
Site 12	Mule Hill Trailhead	40	N/A	40 /31	38 / 29

Table Source: AECOM 2020

Table Notes:

1 Noise level with SGP-related traffic on Yellow Pine Route / Burntlog Route.

2 Temporary Short-term exceedance of the recommended noise level.

N/A = not available.

Frank Church-River of No Return Wilderness Areas

The potential noise impacts at dispersed recreational resource areas within the FCRNRW Area would be the same as reported for Alternative 1 (see **Tables 4.6-7, 4.6-8,** and **4.6-9**), provided in terms of predicted noise level and noise level increases over existing at distances between 500 and 8,000 feet. However, the alignment of the 5.3-mile section of the Burntlog Route (Riordan Creek Segment) would be up to 1 mile closer to the FCRNRW in some areas, resulting in the potential for elevated noise levels to extend further into the FCNRNW Area along this segment.

4.6.2.2.2 OPERATIONS

4.6.2.2.2.1 Mine Site

Operations, equipment, and associated noise levels from the mine site would be similar to Alternative 1. Distances from the assumed acoustical center of activity at the mine to noise receivers would be the same as Alternative 1.

4.6.2.2.2.2 Access Roads

Access road maintenance activities, SGP-related traffic and associated noise levels from the access road would be the same as Alternative 1, except that a 5.3-mile segment of the Burntlog Route would be re-routed. The re-route would move the segment of roadway eastward, which would increase the distance to Site 2, Site 3, and Site 11, but decrease the distance to the FCRNRW

Borrow site locations, activities, and associated noise levels from borrow sites would be the same as Alternative 1.

4.6.2.2.2.3 Utilities

Operations, equipment, and associated noise levels from transmission lines, substations, and utility access roads would be the same as Alternative 1. However, under Alternative 2, the Cascade Switching Station west of the station would be closer to Site 8.

4.6.2.2.2.4 Off-Site Facilities

The location of the SGLF would be the same as for Alternative 1; however, the maintenance facility would be located along Burntlog Route, approximately 4.4 miles east of the junction of Johnson Creek Road and Warm Lake Road approximately midway between Sites 4 and 5.

4.6.2.2.2.5 Noise Impacts

Under Alternative 2, the Cascade Switching Station would be closer to Site 8 than under Alternative 1 (1,242 feet for Alternative 2 vs. 6,970 feet for Alternative 1). The average hourly daytime noise level at Site 8 is estimated to be 46 dBA under Alternative 2. However, this is still well below the 55-dBA threshold and background ambient noise levels at the site. The estimated noise levels at all other noise receivers would be the same as Alternative 1. **Table 4.6-18** provides estimated noise levels at noise receiver locations during the operations phase under Alternative 2.

Table 4.6-15 Alternative 2 - SGP-Attributed Noise Levels at Analysis Locations During the Operations Phase

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	14	12
Site 3	Meadow Creek Lookout	45	N/A	40	38
Site 5	Forest Service Camp at Landmark	N/A	34	**51 / 51**[1]	**49**
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	<1	<1
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	5	3
Site 8	Granite Excavation Shop in Cascade	N/A	61	46	44
Site 9	Southern Pines Plantation Property	N/A	51	25	23
Site 10	Yellow Pine	N/A	50	0	7
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	35	33
Site 12	Mule Hill Trailhead	40	N/A	33	31

Table Source: AECOM 2020

Table Note:

1 Long-term, periodic or intermittent exceedance of the recommended noise level.

N/A = not available.

Frank Church-River of No Return Wilderness Areas

The potential noise impacts at dispersed recreational resource areas within the FCRNRW Area would be the same as reported for Alternative 1 (see **Tables 4.6-13** and **4.6-14**), provided in terms of predicted noise level and noise level increases over existing at distances between 500 and 8,000 feet. However, the alignment of the 5.3-mile section of the Burntlog Route (Riordan Creek Segment) would be up to 1 mile closer to the FCRNRW, resulting in the potential for elevated noise levels to extend further into the FCNRNW Area along this segment.

4.6.2.2.3 CLOSURE AND RECLAMATION

4.6.2.2.3.1 Mine Site

Operations, equipment, and associated noise levels from the mine site would be similar to Alternative 1. Distances from the assumed acoustical center of activity at the mine to noise receivers would be the same as Alternative 1.

4.6.2.2.3.2 Access Roads

Access road decommissioning activities, SGP-related traffic and associated noise levels from the access road would be the same as Alternative 1, except that a 5.3-mile segment of the Burntlog Route would be along a different alignment and would be farther from Site 2, Site 3, and Site 11 (as discussed in Section 4.6.2.2.2.2 and reported in **Table 4.6-19**), affecting estimated SGP-attributed noise levels at these sites during the decommissioning phase. Borrow site locations, activities, and associated noise levels from borrow site would be the same as Alternative 1.

4.6.2.2.3.3 Utilities

Under Alternative 2 the new transmission line into the mine site would not be decommissioned and reclaimed, as this facility would remain in perpetuity to provide power to the Centralized Water Treatment Plant at the mine site as part of the post-closure Water Quality Management Plan. Continued noise associated with the retained transmission line would be the same as described under Alternative 1 for operations: audible corona noise from the transmission line would likely not increase ambient levels beyond the transmission line ROW.

4.6.2.2.3.4 Off-Site Facilities

The maintenance facility would be located along Burntlog Route, approximately 4.4 miles east of the junction of Johnson Creek Road and Warm Lake Road approximately midway between Sites 4 and 5.

4.6.2.2.3.5 Noise Impacts

Table 4.6-19 provides estimated noise levels at noise receiver locations during the closure and reclamation phase under Alternative 2.

Alternative 2 would have temporary impacts on the noise environment at Site 5 during access road and facilities decommissioning.

Table 4.6-16 Alternative 2 - SGP-Attributed Noise Levels at Analysis Locations During the Closure and Reclamation Phase

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	6	4
Site 3	Meadow Creek Lookout	45	N/A	41	39
Site 5	Forest Service Camp at Landmark	N/A	34	**47** [1]	45
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	18	16
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	18	16
Site 8	Granite Excavation Shop in Cascade	N/A	61	<1	<1
Site 9	Southern Pines Plantation Property	N/A	51	<1	<1
Site 10	Yellow Pine	N/A	50	54	52
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	38	36
Site 12	Mule Hill Trailhead	40	N/A	40	38

Table Source: AECOM 2020

Table Notes:

1 Temporary Short-term exceedance of the recommended noise level.

N/A = not available.

4.6.2.3 Alternative 3

4.6.2.3.1 CONSTRUCTION

4.6.2.3.1.1 Mine Site

Construction activities, equipment, and associated noise levels from the mine site would be the same as Alternative 1. Despite mine site configuration changes, the distances from the assumed acoustical center of activity at the mine to noise receivers would remain the same as Alternative 1.

4.6.2.3.1.2 Access Roads

Construction activities, equipment and associated noise levels from access road work would be similar to Alternative 1, except that a section of the Burntlog Route (approach into the mine site) would be re-routed through Blowout Creek valley. This would increase the distance between Burntlog Route access road construction work and Site 12 (5,597 feet for Alternative 1 vs. 12,776 feet for Alternative 3), reducing estimated noise levels at Site 12. Traffic volumes on access road would be the same as Alternative 1. However, Alternative 3 also includes public access around the mine site by improving Meadow Creek Lookout Road (FR 51290) to provide public access from Burntlog Route to Monumental Summit and Thunder Mountain Road. This would involve constructing improvements along approximately 7.6 miles of Meadow Creek Lookout Road, including at Site 12.

4.6.2.3.1.3 Utilities

Construction activities, equipment, and associated noise levels from transmission line work and the construction of utility access roads would be the same as Alternative 1.

4.6.2.3.1.4 Off-Site Facilities

Off-site facilities and equipment used to construct off-site facilities would be the same as Alternative 1.

4.6.2.3.1.5 Noise Impacts

Under Alternative 3, estimated noise levels at Site 12 would be substantially higher than under Alternative 1 due to the improvements to Meadow Creek Lookout Road (FR 51290) to provide public access from Burntlog Route to Monumental Summit and Thunder Mountain Road. **Table 4.6-20** provides estimated noise levels at noise receiver locations during the construction phase under Alternative 3, including the noise level of public access road construction within approximately 100 feet of Site 12.

Alternative 3 would have temporary impacts on the noise environment at Site 2, Site 9, and Site 11 during transmission line work in the immediate vicinity, at Site 5 during access road and facilities construction work in the immediate vicinity, and at Site 12 during access road construction along Meadow Creek Lookout Road.

Table 4.6-17 Alternative 3 – SGP-Attributed Noise Level at Analysis Locations During the Construction Phase

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	**84**	**82**
Site 3	Meadow Creek Lookout	45	N/A	41	39
Site 5	Forest Service Camp at Landmark	N/A	34	**53**[1]	51
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	21	19
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	21	19
Site 8	Granite Excavation Shop in Cascade	N/A	61	48	46
Site 9	Southern Pines Plantation Property	N/A	51	**64**[1]	**62**[1]
Site 10	Yellow Pine	N/A	50	33	31
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	**63**[1]	**61**[1]
Site 12	Mule Hill Trailhead	40	N/A	**85**[1]	**83**[1]

Table Source: AECOM 2020

Table Notes:

1 Temporary Short-term exceedance of the recommended noise level.

N/A = not available.

Frank Church-River of No Return Wilderness Areas

The potential noise impacts at dispersed recreational resource areas within the FCRNRW Area would be the same as reported for Alternative 1 (see **Tables 4.6-7, 4.6-8,** and **4.6-9**), provided in terms of predicted noise level and noise level increases over existing at distances between 500 and 8,000 feet. The differences being that for Alternative 3, the approach of the Burntlog Route into the mine site would be routed through Blowout Creek drainage, further east and away from the FCRNRW than if routed through the EFSFSR drainage. However, the public access improvements along approximately 7.6 miles of Meadow Creek Lookout Road would occur along the border of the FCRNRW, bringing construction noise much closer to the area, and thus extending further in to the FCRNRW.

4.6.2.3.2 OPERATIONS

4.6.2.3.2.1 Mine Site

Operations, equipment, and associated noise levels from the mine site would be similar to Alternative 1. Distances from the assumed acoustical center of activity at the mine to noise receivers would be the same as Alternative 1.

4.6.2.3.2.2 Access Roads

Access road maintenance activities, SGP-related traffic, and associated noise levels from the access road would be the same as Alternative 1, except that traffic noise from the Burntlog Route would be lower, resulting in lower SGP traffic-related noise levels at Site 12.

4.6.2.3.2.3 Utilities

Operations, equipment, and associated noise levels from transmission lines, substations, and utility access roads would be the same as Alternative 1. While the transmission line is closer to Site 2 than under Alternative 1, it does not affect noise levels at this site during the operations phase.

4.6.2.3.2.4 Off-Site Facilities

Operation of off-site facilities would be the same as Alternative 1.

4.6.2.3.2.5 Noise Impacts

Under Alternative 3, the nearest borrow site would be farther from Site 12 than under Alternative 1 (6,230 feet for Alternative 1 vs. 16,590 feet for Alternative 3). The average hourly daytime noise level at Site 12 is estimated to be 27 dBA under Alternative 3. This is well below the 55-dBA threshold and background ambient noise levels at the site. The estimated noise levels and noise impacts at all other noise receivers would be the same as Alternative 1. **Table 4.6-21** provides estimated noise levels at noise receiver locations during the operations phase under Alternative 3.

Table 4.6-18 Alternative 3 – SGP-Attributed Noise Levels at Analysis Locations During the Operations Phase

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	14	12
Site 3	Meadow Creek Lookout	45	N/A	40	38
Site 5	Forest Service Camp at Landmark	N/A	34	**51**	**49**

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	<1	<1
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	5	3
Site 8	Granite Excavation Shop in Cascade	N/A	61	25	23
Site 9	Southern Pines Plantation Property	N/A	51	25	23
Site 10	Yellow Pine	N/A	50	<1	<1
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	35	33
Site 12	Mule Hill Trailhead	40	N/A	27	25

Table Source: AECOM 2020

Table Notes:

N/A = not available.

4.6.2.3.3 CLOSURE AND RECLAMATION

4.6.2.3.3.1 Mine Site

Equipment and associated noise levels from the mine site would be similar to Alternative 1. Distances from the assumed acoustical center of activity at the mine to noise receivers would be the same as Alternative 1.

4.6.2.3.3.2 Access Roads

Access road decommissioning activities, SGP-related traffic, and associated noise levels from the access road would be the same as Alternative 1, except for the decommissioning of public access improvements to Meadow Creek Lookout Road (FR 51290), which would substantially increase the noise levels at Site 12 similar to as during construction.

4.6.2.3.3.3 Utilities

Decommissioning activities, equipment, and associated noise levels from transmission line work and the decommissioning of utility access roads would be the same as Alternative 1.

4.6.2.3.3.4 Off-Site Facilities

Off-site facilities and equipment used to decommission off-site facilities would be the same as Alternative 1.

4.6.2.3.3.5 Noise Impacts

Table 4.6-22 provides estimated noise levels at noise receiver locations during the closure and reclamation phase under Alternative 3.

Alternative 3 would have temporary impacts on the noise environment at Site 2 while transmission line decommissioning work is occurring in the immediate vicinity, and at Sites 5 and 12 during access road and facilities decommissioning.

Table 4.6-19 Alternative 3 – SGP-Attributed Noise Levels at Analysis Locations During the Closure and Reclamation Phase

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	6	4
Site 3	Meadow Creek Lookout	45	N/A	41	39
Site 5	Forest Service Camp at Landmark	N/A	34	**56** [1]	54
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	18	16
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	18	16
Site 8	Granite Excavation Shop in Cascade	N/A	61	<1	<1
Site 9	Southern Pines Plantation Property	N/A	51	<1	<1
Site 10	Yellow Pine	N/A	50	54	52
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	38	36
Site 12	Mule Hill Trailhead	40	N/A	**85**[1]	**83**[1]

Table Source: AECOM 2020

Table Notes:

1 Temporary Short-term exceedance of the recommended noise level.

N/A = not available.

4.6.2.4 Alternative 4

4.6.2.4.1 CONSTRUCTION

4.6.2.4.1.1 Noise Impacts

Under Alternative 4, the Burntlog Route would not be constructed or used to access the mine site and no road improvements or road construction would take place in that area. The Yellow Pine Route would be improved and used to access the mine site through construction operations, and closure and reclamation. Road widening and straightening, along with drainage and bridge improvements would be required for the Johnson Creek Road (CR 10-413) portion of the Yellow Pine Route. The Stibnite Road (CR 50-412) portion would be improved by straightening curves, constructing retaining walls, and installing culverts. During the construction phase, SGP-related traffic volumes on the Yellow Pine Route access road is estimated at 65 AADT. Heavy vehicles are estimated at 45 AADT and light vehicles at 20 AADT (Midas Gold 2016). Vehicles per peak hour were assumed to be 10 percent of AADT (Washington State Department of Transportation 2017). Based on the estimated traffic volumes and vehicle mix, and typical vehicle speeds of 25 mph, estimated average hourly noise levels from SGP-related traffic on the mine access route during the construction phase would be 48 dBA L_{EQ} at a distance of 50 feet from the roadway. This is well below the impact threshold level of 55 dBA.

Table 4.6-23 provides estimated noise levels at noise receiver locations during the construction phase under Alternative 4.

Alternative 4 would have temporary impacts on the noise environment at Site 2, Site 9, Site 10, and Site 11 during transmission line work in the immediate vicinity.

Table 4.6-20 Alternative 4 – SGP-Attributed Noise Level at Analysis Locations During the Construction Phase

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	**84[1]**	**82[1]**
Site 3	Meadow Creek Lookout	45	N/A	24	22
Site 5	Forest Service Camp at Landmark	N/A	34	**48**	**46**
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	21	19
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	21	18

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 8	Granite Excavation Shop in Cascade	N/A	61	48	46
Site 9	Southern Pines Plantation Property	N/A	51	**64**[1]	**62**[1]
Site 10	Yellow Pine	N/A	50	**64**[1]	**62**[1]
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	**63**[1]	**61**[1]
Site 12	Mule Hill Trailhead	40	N/A	20	18

Table Source: AECOM 2020

Table Notes:

1 Temporary Short-term exceedance of the recommended noise level.

N/A = not available.

Frank Church-River of No Return Wilderness Areas

The potential noise impacts at dispersed recreational resource areas within the FCRNRW Area would be the same as reported for Alternative 1 (see **Tables 4.6-7, 4.6-8,** and **4.6-9**), provided in terms of predicted noise level and noise level increases over existing at distances between 500 and 8,000 feet. The difference for Alternative 4 is that the primary access road would access the mine site from the north along the existing Stibnite Road (CR 50-412) and would approach close to the FCRNRW area for a very limited distance about midway between the mine site and Yellow Pine, which would represent a much more limited exposure than under Alternatives 1, 2, or 3.

4.6.2.4.2 OPERATIONS

4.6.2.4.2.1 Noise Impacts

Under Alternative 4, SGP-related traffic and road maintenance activities would occur along the Yellow Pine Route instead of the Burntlog Route. SGP-related traffic would not substantially contribute to noise levels during the operations phase. However, road maintenance activities would temporarily increase daytime noise levels at Site 2, Site 5, Site 10, and Site 11 as high as 75 to 84 dBA.

Alternative 4 would have periodic impacts on the noise environment at Site 2, Site 5, and Site 11 during road maintenance throughout the operations phase. The estimated noise levels and noise impacts at all other noise receivers would be the same as Alternative 1.

Table 4.6-24 provides estimated noise levels at noise receiver locations during the construction phase under Alternative 4.

Table 4.6-21 Alternative 4 – SGP-Attributed Noise Levels at Analysis Locations During the Operations Phase

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	**78**[1]	**76**[1]
Site 3	Meadow Creek Lookout	45	N/A	40	38
Site 5	Forest Service Camp at Landmark	N/A	34	**75**[1]	**73**[1]
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	<1	<1
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	6	4
Site 8	Granite Excavation Shop in Cascade	N/A	61	25	23
Site 9	Southern Pines Plantation Property	N/A	51	25	23
Site 10	Yellow Pine	N/A	50	**61**[1]	**59**[1]
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	**84**[1]	**82**[1]
Site 12	Mule Hill Trailhead	40	N/A	27	25

Table Source: AECOM 2020

Table Notes:

1 Temporary Short-term exceedance of the recommended noise level.

N/A = not available.

4.6.2.4.3 CLOSURE AND RECLAMATION

4.6.2.4.3.1 Noise Impacts

Table 4.6-25 provides estimated noise levels at noise receiver locations during the closure and reclamation phase under Alternative 4. The Yellow Pine Route would not be decommissioned and would remain as built under Alternative 4.

Table 4.6-22 Alternative 4 – SGP-Attributed Noise Levels at Analysis Locations During the Closure and Reclamation Phase

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	37	35
Site 3	Meadow Creek Lookout	45	N/A	21	19
Site 5	Forest Service Camp at Landmark	N/A	34	54	52
Site 6	Forest Service Summer Camp/Warm Lake Recreation Areas	N/A	34	18	16
Site 7	Warm Lake Road/Warm Lake Camp	N/A	47	18	16
Site 8	Granite Excavation Shop in Cascade	N/A	61	<1	<1
Site 9	Southern Pines Plantation Property	N/A	51	<1	<1
Site 10	Yellow Pine	N/A	50	54	52
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	42	40
Site 12	Mule Hill Trailhead	40	N/A	20	17

Table Source: AECOM 2020

Table Notes:

N/A = not available.

4.6.2.5 Alternative 5

Under Alternative 5, there would be no large-scale mining operations by Midas Gold, and existing noise from currently permitted Midas Gold drilling activities for exploration would continue. Midas Gold would continue to implement surface exploration and associated activities that have been previously approved on National Forest System lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project Environmental Assessment (Forest Service 2015). These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads), and drilling on both National Forest System and private lands at and in the vicinity of the mine site. The continuation of approved exploration activities at the mine site by Midas Gold would result in the continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip.

4.6.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.6.4 Cumulative Effects

Cumulative noise impacts typically occur when sensitive receivers are exposed to multiple noise sources at approximately the same time, such as cumulative noise from residential uses, industrial and commercial activities, agriculture, forestry, mining activities, highway traffic, and construction traffic and activities. The mine site, access roads, utilities (transmission lines), and off-site facilities would each contribute to the noise environment at varying levels, durations, and locations during each SGP phase.

Reasonably foreseeable future projects in the vicinity of the SGP area that could affect the noise environment are described in **Tables 4.6-26** and **4.6-27**. These include road projects, mining projects, and forestry projects. Each of these activities would contribute to noise levels in the area. Construction projects would likely contribute noise levels similar to the SGP but over discrete and likely short timeframes. The spatial distance between cumulative SGP sites would make it less likely that noise would be detectable at a given point from more than one reasonably foreseeable future action; the impacts from noise are not expected to be additive because the SPG would not occur in the same place or the same time as most reasonably foreseeable future actions.

The SGP has the greatest potential to contribute to cumulative noise impacts in the vicinity of the FCRNRW. However, given the mountainous topography, cumulative impacts would likely only occur if other ongoing or future actions in the general area occur within the same mountain valley or on nearby ridgelines.

Table 4.6-23 Foreseeable Activities Considered Regarding Cumulative Noise Emissions – Specific Planned Projects

Project Type	Project Names/Description	Nature of Noise Contribution to Cumulative Effects
Exploratory Drilling for Mineral Resources	• **Morgan Ridge Exploratory Drilling Plan of Operations Environmental Assessment** Project involves exploratory drilling for locatable minerals from remote drill pads approximately 10 miles north of the mine site. Project is reportedly on hold.	Local noise from drilling equipment (e.g., compressor engines), and vehicles.
Forest Maintenance and Fire Risk Reduction	• **Big Creek fuels reduction project,** approximately 10 miles north of mine site • **South Fork Restoration and Access Management Plan Environmental Assessment,** 25 miles southwest of mine site • **East Fork Salmon River Restoration and Access Management Plan,** approximately 5 miles northwest of mine site Projects to reduce wildfire risk and fire severity/intensity on National Forest System lands and private property using commercial timber harvest, understory treatment, and prescribed burning.	Local noise generation from portable generators equipment (e.g., compressor engines), and vehicles.

Table 4.6-24 Foreseeable Activities Considered Regarding Cumulative Noise Emissions – Ongoing Projects and Foreseeable Emission Sources

Project Type	Project Names/Description	Nature of Noise Contribution to Cumulative Effects
Construction Projects	• **Creek restoration** • **Trail construction and maintenance** • **Bridge and culvert replacement projects,** generally located more than 10 miles north of SGP area • **Hydroelectric projects: small residential projects for power generation** • **Road maintenance**	Short-term noise emissions during construction with no long-term noise impacts that would overlap with impacts related to the SGP.
Mining Activities	**Ongoing mining activities on patented land** Mineral exploration and mining have occurred in several locations around the SGP area. Exploration activities area ongoing for potential future mining development.	Local noise from drilling equipment (e.g., compressor engines), and vehicles. Known mining operations are of small size (50 tons per day or less) or are inactive.
Recreation and tourism	**Recreation and Tourist activities:** • Sport hunting, fishing, trapping • Snowmobile trails • Traffic on unpaved roads • Boating and river recreation • Camping, hiking, backpacking • Outfitter/Guide Operations	Collectively substantial noise from vehicles on unpaved roads and trails, boats, and generators.

Project Type	Project Names/Description	Nature of Noise Contribution to Cumulative Effects
	• Tourist Services – Big Creek Lodge • OHV use • Tourist Services – e.g., Big Creek Lodge	

4.6.5 Irreversible and Irretrievable Commitments of Public Resources

The SGP would not contribute to irretrievable and irreversible commitment of public resources as it relates to the ambient noise environment. All noise sources and noise impacts associated with the SGP would cease upon final closure of the SGP and noise levels would return to ambient conditions without acoustical contribution of the SGP. The future non-SGP ambient sound environment is likely to be similar to the reported baseline, adjusted only by changes in non-SGP acoustical contributors such as roadway traffic flows and the potential for new residential, commercial, and industrial development in the SGP vicinity.

Under Alternative 5, the SGP would not be undertaken. Consequently, there would be no irretrievable and irreversible commitment of public resources as it relates to the ambient noise environment.

4.6.6 Short-term Uses versus Long-term Productivity

Modeled noise levels did not rise beyond threshold of concern under most conditions, and the noise related to mining and associated activities would be short term (during the estimated 20-year life of the mine between construction and reclamation) and are expected to end with mine reclamation.

Under Alternative 5, the SGP would not be undertaken. Consequently, there would be no short-term use that would affect the ambient noise environment, and no effect on long-term productivity.

4.6.7 Summary

Table 4.6-28 provides a summary comparison of noise impacts by issues and indicators for each alternative. All four action alternatives would create some short-term periodic impacts to up to four NSRs during SGP mine site, access road, and transmission line construction. Construction of access roads (Burntlog Route and Yellow Pine Route) for all four alternatives also would impact areas of the FCRNRW Area – noise would gradually attenuate to not noticeable up to 8,000 feet into the wilderness. Differing impacts to the FCRNRW Area are due to the distance of the access road to the wilderness boundary – Alternative 2 is the closest for the longest length and Alternative 4 is closest for the shortest length.

Impacts to NSRs during operations would be long term and periodic for all four action alternatives due mainly to road maintenance activities. Alternative 2 would impact the least number of NSRs and Alternative 4 would impact the most. Access road traffic and maintenance for all action alternatives would impact some areas of the FCRNRW Area, with impacts diminishing with distance from the wilderness boundary. Impacts from operations would not extend as far into the wilderness area as they would during construction.

During closure activities, there would be short-term impacts from transmission line and access road decommissioning to one or two NSRs, depending on the alternative. There would be no irreversible impacts; all noise would cease upon final closure and reclamation.

This page intentionally left blank

Table 4.6-25 Comparison of Noise Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may cause disturbance to NSRs (such as occupied residences and campgrounds).	Area affected by noise that exceeds Outdoor Ambient Sound Level and U.S. Environmental Protection Agency Indoor and Outdoor Standards.	Baseline Ambient sound levels vary by location and range between 34 and 64 dBA, L_{DN} over the 12 identified NSRs as summarized **Tables 3.6-2,** and **3.6-3**.	Construction: Temporary impacts at Site 2, Site 5, Site 9, and Site 11 while transmission line work is within approximately 800-850 feet. Temporary impact at Site 5 while access road work is within approximately 0.5 mile. Operations: Long-term, periodic impacts at Site 5 during road maintenance activity. Closure: Temporary impact at Site 5 while access road decommissioning and facilities decommissioning work is within approximately 0.5 mile.	Construction: Impacts would be similar to Alternative 1, except for slightly reduced noise at Site 5 due to relocation of maintenance facility and some increase at some parts of FCRNRW Area due to Burntlog Route re-alignment. Operations: Long-term, periodic impacts at Site 5 during road maintenance activity. Impacts would be similar to Alternative 1, except for reduced noise at Site 5 due to relocation of maintenance facility. Closure: Impacts would be similar to Alternative 1, except for reduced noise at Site 5 due to relocation of maintenance facility. No decommissioning-related noise of the transmission line into the mine site.	Construction: Impacts would be similar to Alternative 1 but noise increase at Site 12 due to public access road along Meadow Creek Lookout Road (FR 51290), and in FCRNRW Area along Meadow Creek Lookout Road upgrades. Operations: Impacts would be same as Alternative 1. Closure: Impacts would be similar to Alternative 1, except for access road decommissioning noise at Site 12 and along FCRNRW.	Construction: Impacts would be similar to Alternative 1, but with some noise increase at Site 10 and some parts of FCRNRW Area due to Yellow Pine Route construction. Operations: Long-term, periodic impacts at Site 2, Site 5, Site 10, and Site 11 during road maintenance activity due to use of Yellow Pine Route. Closure: No impacts above recommended noise level. Yellow Pine Route would not be decommissioned and would remain as built.	No impacts

This page intentionally left blank

4.7 HAZARDOUS MATERIALS

4.7.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of potential effects from hazardous materials includes the following issue and indicators:

Issue: The Stibnite Gold Project (SGP) may cause accidental releases of hazardous materials or wastes, including diesel fuel, gasoline, lubricants, antifreeze, chemical reagents and reactants (including sodium cyanide and sulfuric acid), antimony concentrate, mercury containing residuals, lime, explosives and other substances during their transport, use, storage, or disposal.

Indicators:

- Volumes and types of hazardous materials and hazardous wastes transported, used, and stored during site operation.
- Practices for storage and use on site including primary/secondary/tertiary containment types and volumes and material handling practices;
- Amount of vehicular transport of hazardous materials during construction, operations and closure and reclamation; and
- Travel routes and road conditions (e.g. terrain, proximity to water bodies, geohazard risk, etc.)

The assessment considers the measures identified by the U.S. Forest Service (Forest Service) or Midas Gold Idaho, Inc. (Midas Gold), as listed in **Appendix D**, Mitigation Measures and Environmental Commitments, to avoid or reduce impacts such as:

- Methods for transporting and safely storing such materials;
- Methods and ability to respond to potential spill events; and
- Methods and plan for waste disposal.

Use and transport of hazardous materials is currently occurring at the site associated with exploration activities as described in Section 3.7, Hazardous Materials. The existing conditions are compared to the increased use and transport of hazardous materials anticipated under the proposed mining activities (Midas Gold 2016). In addition, the analysis considers modifications to existing and new access routes and proposed support facilities.

4.7.2 Direct and Indirect Effects

The following analysis of effects associated with hazardous materials is considered in the overall context of direct impacts caused by accidental releases or spills to localized areas, as well as potential impacts to outlying areas associated with releases to groundwater or nearby drainages/streams/surface waters. Elements of this context include:

- Amount, type, and location of storage, use, or disposal of hazardous materials and the potential for release to the environment;
- Transportation of hazardous materials to or from the mine site, and the potential for accidental release to the environment; and
- Fate and transport (i.e., where the hazardous material may go in the environment) of hazardous materials that have entered the environment.

Impacts associated with the storage, use, and disposal of hazardous materials are measured quantitatively by the amount, type, and location of use. Impacts to the environment in the event of an accidental release are assessed qualitatively, based on the type and amount of hazardous material, handling techniques, location of use and contingency plans, risk of accidental release, and exposure pathway to potential sensitive receptors.

The operation of the SGP would involve the use of various materials in order to mine, process, and extract the metals from the ore and conduct related activities. A list of major consumables to be used at the proposed mine site is presented in **Table 2.3-6** and Section 2.3.5.18, Materials, Supplies, Chemical Reagents and Wastes. **Table 4.7-1** provides a list of the hazardous materials to be used.

A release event could range from a minor spill of up to a few gallons (for which on-site cleanup would be readily available) to a large, reportable spill (e.g., over 25 gallons of fuel). Some hazardous chemicals could have immediate adverse impact on soils and vegetation, and potentially degrade aquatic resources and water quality if they enter surface water. Spills of hazardous materials also could potentially seep into the ground and contaminate the groundwater system over the long term. The risk and potential transport to the environment exists for all hazardous materials.

Spills of hazardous materials could adversely affect soils, vegetation, water quality, wildlife and fish, including lower trophic level aquatic organisms (e.g., bacteria and algae). Impacts could include degraded soil and water quality, fish and wildlife habitat contamination, and toxicity, injury or mortality to fish and other aquatic organisms, depending on the type and volume of material released, location, proximity to streams, timing, spill response, etc.

Impacts could occur at the mine site, off-site facilities, along access routes, or in downstream watersheds. The geographic extent of any impacts would depend on the location and size of the spill and the effectiveness of the response. For most spills the extent would likely be limited to the immediate vicinity of the spill due to the response and cleanup measures that would be in place, but if a spill were to occur into a stream, impacts could extend downstream.

The potential for impacts would perist for the life of the mine. More details regarding the effects of accidental release of hazardous materials to fish and aquatic resources are addressed in Section 4.12, Fish Resources and Fish Habitat.

Local, state, and federal laws regulate the storage, use, recycling, disposal, and transportation of hazardous materials, wastes, and fuels. A Spill Prevention, Control, and Countermeasure (SPCC) Plan would be developed prior to SGP construction and operations, providing direction for preventing and controlling spills and describing Best Management Practices to minimize the potential for releases of hazardous materials. In the event of a spill or release of hazardous materials or wastes, standard spill response and cleanup practices would be implemented to mitigate potential impacts, as outlined below.

4.7.2.1 Spill Risk from Truck Transport

4.7.2.1.1 HIGHWAYS

Trucks would be used to transport hazardous materials to the mine site and off-site facilities. Based on the proposed hazardous materials, supplies, reagents, and wastes being transported to and from the mine site, the greatest concern would be a release of any hazardous material from a transportation accident resulting in a high potential impact to the environment. Data from the Federal Motor Carrier Safety Administration (Federal Motor Carrier Safety Administration 2018) show very low rates of large truck accidents resulting in spills of hazardous material, as addressed below. Strict regulatory controls and SGP emergency response procedures would be expected to limit the extent of any such incidents. The duration of spill risk would be long-term because it would exist throughout the life of the SGP. The impacted area would include the site of the spill and potentially downstream areas as far as the point of dilution. The East Fork South Fork Salmon River (EFSFSR) and associated tributaries, including streams within 0.5 mile of access routes, are the major surface waterbodies that could be impacted by accidental releases.

To evaluate the potential impact of the transport of hazardous materials to and from the mine site, the risk of a transportation accident resulting in the release of hazardous materials was estimated. Accident and incident rates were derived from national statistics for truck accidents that involve hazardous materials as published by the Federal Motor Carrier Safety Administration (2018). Records show that the number of large trucks (gross vehicle weight of more than 10,000 pounds) on national highways from 2013 to 2016 ranged from over 10.59 million to 11.49 million; with large trucks traveling between 275.01 billion miles to 287.89 billion miles annually. Over that same time frame, large truck crashes involving hazardous materials cargo (with no release) ranged from 2,420 to 2,475, while large truck accidents with release of hazardous materials cargo ranged from 385 to 552. The statistical rate of large-truck accidents involving hazardous cargo for miles traveled ranged from approximately 1 accident for every 714 million miles traveled in 2013 to approximately 1 accident for every 522 million miles traveled in 2016. Therefore, statistically, the rate of accidents on the nation’s highways involving crashes or spills of hazardous material cargo by large trucks is very low (Federal Motor Carrier Safety Administration 2018).

In 2019 there were a total of 38 spills of hazardous materials reported in the state of Idaho. None of these spills appear to be associated with a mine site or hauling of materials from a mine site. Most of the sillsed were from freight haulers and delivery services such as Fed Ex or United Parcel Service (accessed at https://portal.phmsa.dot.gov/analytics/saw.dll?Dashboard).

While national highways would be used to transport materials to the SGP area as far as Cascade, Idaho, secondary roads would be used to make delivery into, or transport materials out of, the mine site and to the off-site facilities. Statistics for haul truck accidents on county roads and/or in mountainous terrain are very limited. Transportation on local access roads would be at lower speeds and with less traffic than highways, and would likely be safer than highway travel.

4.7.2.2 Regulatory or Permit Requirements

Regulatory or permit requirements in relation to hazardous materials would include:

- The SGP would be required to comply with all federal and state regulations pertaining to the transport, handling, storage, use, and response to releases.
- Storage tanks would be located within a secondary containment designed to comply with federal and state SPCC regulations. Containment design would include, but not be limited to, bedding, impermeable lining, and regulatory-required containment volume for maximum volume release scenarios and local precipitation. For example, minimum secondary containment requirements mandated by federal regulations include a requirement for containment of 100 percent of the largest tank volume plus freeboard which is typically interpreted as 110 percent secondary containment capacity of the largest tank volume. Routine inspection and maintenance of storage vessels, containment, and preventative infrastructure (e.g., cathodic protection, alarms) would be conducted at prescribed intervals per planning documents.
- Used oils would be managed in accordance with the Used Oil Standards 40 Code of Federal Regulations 279 in closed containers labeled as “used oil” and sent off site for recycling, reclamation, fuel blending and or energy recovery.
- A SPCC Plan for the SGP would be maintained as required by 40 Code of Federal Regulations 112 regulations. The SPCC Plan would address site-specific spill prevention measures, fuel haul guidelines, fuel uploading procedures, inspections, secondary containment of all on-site fuel storage tanks, and staff training.
- A 90-day capacity hazardous waste storage facility and appropriate satellite storage facilities would be constructed to store any generated hazardous wastes as required by U.S. Environmental Protection Agency and State of Idaho regulations. All hazardous waste stored at the facility would be transported to an U.S. Environmental Protection Agency-approved off-site disposal facility within 90 days of collection.
- A solid waste management plan would be developed to assist with the storage, handling and disposal of solid and hazardous waste streams, including recyclables. This plan would be developed in accordance with state and federal regulations pertinent to waste. The solid waste management plan establishes procedures to identify hazardous waste and protocols to track, collect, and dispose of hazardous materials in accordance with

state and federal regulations. The plan also outlines methods to minimize the generation of hazardous waste (e.g., using industrial soaps in place of solvents wherever possible). Hazardous materials would be characterized for proper off-site disposal.

4.7.2.3 Standards of Practice Under the International Cyanide Management Code

The International Cyanide Management Code (ICMC) is a voluntary initiative for the gold and silver mining industries and the producers and transporters of cyanide used in gold and silver mining. It is intended to complement a mining operation's existing regulatory requirements. The ICMC focuses exclusively on the safe management of cyanide that is produced, transported, and used for the recovery of gold and silver, and on mill tailings and leach solutions. Standards of practice specific to cyanide transport, handling, storage, and emergency response under the ICMC include:

- Establish clear lines of responsibility for safety, security, release prevention, training, and emergency response in written agreements with producers, distributors, and transporters.
- Require that cyanide transporters implement appropriate emergency response plans and capabilities and employ adequate measures for cyanide management.
- Design and construct unloading, storage, and mixing facilities consistent with sound, accepted engineering practices and quality control and quality assurance procedures, as well as spill prevention and spill containment measures.
- Operate unloading, storage, and mixing facilities to incorporate inspections, preventive maintenance, and contingency plans to prevent or contain releases and control and respond to worker exposures.
- Prepare detailed emergency response plans for potential cyanide releases.
- Involve site personnel and stakeholders in the planning process.
- Designate appropriate personnel and commit necessary equipment and resources for emergency response.
- Develop procedures for internal and external emergency notification and reporting.
- Incorporate into response plans monitoring elements and remediation measures that account for the additional hazards of using cyanide treatment chemicals.
- Periodically evaluate response procedures and capabilities and revise them as needed.

The combination of Midas Gold's proposed management practices, conformance with the ICMC standards of practice, and the state and federal regulatory requirements described in the above measures, would minimize and/or mitigate the risk of accidental release during the transportation, storage, management, and use of cyanide and other hazardous materials. In addition, the management practices under the ICMC code anticipated to be exercised by Midas

Gold would minimize the generation of hazardous waste, which could reduce the risk of accidental release.

Additional Forest Service mitigation measures and Midas Gold design features are listed in **Appendix D**, Mitigation Measures and Environmental Commitments. These measures are incorporated into the analysis for each alternative.

4.7.2.4 Alternative 1

Under Alternative 1, the volume and types of hazardous materials transported, stored, and used at the mine site and off-site facilities would increase from the current conditions of the permitted exploration operations. Substantial quantities of fuels, lubricants, and chemicals would be transported annually via large truck, and would be stored in aboveground storage tanks, bins, totes, and drums, within the required secondary containment designed to prevent spill releases to the environment. **Table 2.3-6** in Chapter 2, Alternatives Including the Proposed Action, lists the major materials, supplies, and chemical reagents to be potentially used at the mine site and off-site facilities, including fuel, explosives, and ore processing reagents.

Table 4.7-1 provides a list of the hazardous materials to be used as part of the SGP under Alternative 1. While a waste management plan has not been prepared for the SGP at this time, estimates of the wastes likely to be generated can be made based on the volume of materials proposed to be used.

Table 4.7-1 List of Hazardous Materials

Name	Units	Annual Usage/ Transport	On-site storage capacity	Amount of Waste Likely to be Generated
Diesel fuel	Gallon	5,800,000	200,000	0 (fully consumed)
Lubricants	Gallon	296,000	30,000	148,000 (50% consumed)[1] Off-site disposal.
Gasoline	Gallon	500,000	10,000	0 (fully consumed)
Antifreeze	Gallon	40,000	4,000	0 (assumed fully consumed but small amounts could require disposal if radiator is flushed)
Propane	Gallon	560,000	30,000	0 (fully consumed)
Antimony Concentrate	Truckloads of up to 20 suoersacs of 2 tons each	365-730	---	All concentrate transported off-site
Ammonium nitrate	Tons	7,300	200	0 (fully consumed)
Explosives	Tons	100	20	0 (fully consumed)
Grinding metals (steel balls for mill)	Tons	10,000	200	0 (fully consumed)
Crusher liners	Tons	3,200	50	0 (fully consumed)

Name	Units	Annual Usage/ Transport	On-site storage capacity	Amount of Waste Likely to be Generated
Sodium cyanide	Tons	3,900	300	Unknown quantity mixed with tailings, neutralized and discharged to the TSF[3]
Lime	Tons	70,000	4,000	0 (fully consumed in process, mixed with tailings as calcium carbonate)
Activated carbon	Tons	470	50	0 (recycled and re-activated)[2]
Copper sulfate	Tons	2,500	100	0 (consumed as a reagent)
Lead nitrate	Tons	700	25	0 (consumed as a reagent)
Aerophine 3418A	Gallon	10,000	300	0 (consumed as a reagent)
Methyl isobutyl carbonyl	Gallon	55,000	6,000	0 (consumed as a reagent)
Flocculant	Tons	600	15	0 (consumed as a reagent)
Sodium metabisulfite	Tons	14,000	500	0 (consumed as a reagent)
Potassium amyl xanthate	Tons	1,700	40	0 (consumed as a reagent)
Sodium hydroxide	Tons	300	20	0 (consumed as a reagent)
Nitric acid	Gallon	115,000	6,000	0 (consumed as a reagent)
Scale control reagents	Gallon	5,000	500	0 (consumed as a reagent)
Hydrogen peroxide	Gallon	30,000	8,000	0 (consumed as a reagent)
Magnesium chloride	Gallon	250,000	20,000	Partially consumed as water treatment, partially utilized on road surfaces
Solvents	Gallon	1,000	1,000	Most would be consumed, a portion of unknown quantity would become waste for off-site disposal
Wastes containing mercury from ore processing (carbon canisters, filter packs, gas condensers)	---	Not quantified	---	Not quantified. Waste would be disposed off-site in permitted facilities.

Table Source: Midas Gold 2016

Table Notes:

1 https://ec.europa.eu/environment/waste/oil_index.htm.

2 Some amount of carbon per ton of ore leached is likely lost to attrition. This lost material would likely end up in the tailings.

3 Waste would be in the form of cyanide mixed with tailings and would be sent to fully contained TSF for disposal. Cyanide levels would be reduced to less than 10 parts per million weak acid dissociable cyanide.

TSF = tailings storage facility.

Specific components proposed under Alternative 1 that would have hazardous materials include the mine site and off-site facilities. The maintenance workshop with truck wash (petroleum products and chemical storage, oil water separator); worker housing facility (with sanitary and solid waste); and fuel and explosives storage at the mine site.

Transportation access to the mine site would be provided by upgrades and/or improvements to Yellow Pine Route and construction of the Burntlog Route, as well as additional haul and service roads at the mine site. The access roads used under Alternative 1 would cross 71 different named and unnamed streams, as inventoried in Section 4.9, Surface Water and Groundwater Quality (see **Table 4.9-13**). New and upgraded utilities would be constructed including: transmission lines (42 miles of existing 69-kilovolt line and 21.5 miles of existing 12.5-kilovolt line upgraded to 138-kilovolt line, and 8.5 miles of new 138-kilovolt line from Johnson Creek Substation to the mine site), three new electrical substations, and upgrades to two existing substations (Lake Fork and Warm Lake substations). In addition, the following off-site facilities would be constructed: Stibnite Gold Logistics Facility (SGLF) (with sanitary and solid waste, warehouse storage, laydown yards, and assay laboratory) and the Landmark Maintenance Facility (with equipment maintenance activities, fuel storage, and sanitary and solid waste).

4.7.2.4.1 CONSTRUCTION

During the construction phase (approximately 2 to 3 years), the mine site would be accessed via the Yellow Pine Route until the Burntlog Route is completed. The Yellow Pine Route crosses 43 of the streams listed in **Table 4.9-13**. The largest volume of hazardous material or petroleum transferred to the mine site during construction would be diesel fuel. It is estimated that on average, two daily round trips to deliver fuel and miscellaneous supplies would occur (**Table 2.3-2** provides the projected construction traffic for supply and haulage of materials to the mine site). Although transportation of hazardous materials presents the greatest risk of impacts from spills and releases to the environment, all deliveries of fuel and hazardous loads would be escorted by pilot vehicles. Hazardous materials would be transported to the mine site in U.S. Department of Transportation (USDOT) certified containers and by USDOT registered transporters (Midas Gold 2016).

4.7.2.4.2 OPERATIONS

During the mining and ore processing operations phase (approximately 12 years), the mine site would be accessed via the Burntlog Route, which would cross 37 of the streams listed in **Table 4.9-13**. Hazardous materials such as diesel, gasoline, propane, lubricants, hydraulic oil, antifreeze, explosives, antimony concentrate, and other ore processing reagents (e.g., corrosive acids and bases) would be transported, stored, and used at the mine site, and potentially at off-site facilities (**Table 4.7-1**). Shipments would be transported by truck (heavy vehicle) along the Burntlog Route access road in USDOT approved containers (totes) or bulk tanker trucks, depending on the oil type and vendor. It is estimated that on average, 23 daily round trips to transport ore processing supplies, fuel, concentrate, and other materials would occur during operation (**Table 2.3-7** provides projected traffic during mining and ore processing operations for supply and haulage of materials to the mine site).

The majority of hazardous materials used on site would be spent or consumed during operations (**Table 4.7-1**). Materials that are not spent or consumed (e.g., lubricants) would be recycled, to the extent practical, or disposed off-site in an approved depository in accordance with applicable federal and state laws (Midas Gold 2016). Antimony concentrate produced at the mine site would be transported off-site for processing.

4.7.2.4.2.1 Wastes Containing Mercury

Multiple mine processes have the potential to generate mercury, including gold and silver leaching and carbon adsorption, and gold and silver electrowinning and refining. In the gold and silver leaching process, sodium cyanide would be used to leach gold and create a gold-cyanide complex that would be adsorbed to activated carbon. The gold would then be stripped from the activated carbon by washing the carbon with an acid solution to remove impurities, rinsing with fresh water, and stripping under pressure at high temperature using a hot alkaline caustic stripping solution. During the carbon stripping process, a small amount of mercury may not desorb from the activated carbon. This residual mercury would volatilize in the carbon reactivation kiln. Release of mercury to the atmosphere would be prevented by installing a venturi scrubber and sulfur-impregnated carbon columns in the kiln off-gas stream. Solid waste from this process (i.e., the carbon canisters and filter packs) would be disposed off-site in a permitted solid waste disposal facility.

For the gold and silver electrowinning and refining, a gold- and silver-bearing solution would be passed through electrowinning cells where the gold and silver would be precipitated onto stainless steel mesh. The gold and silver-plated mesh would be washed to produce a metal-bearing sludge that would be filtered and placed into a furnace to dry the material and volatilize any remaining impurities, such as mercury. The gas from the furnace would then be passed through a chilled condenser, where mercury would be converted to its liquid metallic state and then securely stored prior to shipment to a Resource Conservation and Recovery Act certified hazardous waste disposal facility. To ensure that it is free of mercury, the remaining gas would be passed through a bed of sulfur-impregnated carbon before being released into the atmosphere. The furnace gas condensers would be disposed in a landfill or waste repository permitted to accept this type of waste material.

Produced antimony concentrate also would contain trace amounts of mercury.

4.7.2.4.2.2 Dust

Dust from baghouses at ore crushing/ore reclaim facilities, etc. would be collected and disposed as appropriate. If dust has elevated metals levels, it would be disposed with the tailings.

4.7.2.4.2.3 Oils

Alternative 1 includes the operation of three new substations and upgrades to two existing substations, which would require large quantities of oils (i.e., mineral oils). However, oils would be contained within the substation equipment and as per the site-specific SPCC plans, design of the substation yards would prevent discharges to navigable waters of the U.S. in the event of a release.

4.7.2.4.2.4 Spills at Mine Site and Off-Site Facilities

A large volume release to the environment at the mine site or off-site facilities (SGLF, Landmark Maintenance Facility) is not likely to occur based on the planned infrastructure specifically designed for the storage and management of hazardous materials and use of secondary containment. There was a reportable spill at the mine site from a plane crash in February of 2012 that resulted in a diesel spill.There have been no reportable spills since then.

In the event a release was to occur, it would be relatively small in volume based on estimated container volumes and would be promptly addressed by stopping the source of the spill, using absorbent material or barriers to prevent further migration of the spilled material, and removing, characterizing, and properly disposing of any impacted soil per implementation of the prescribed SPCC Plan and/or Emergency Response Plan recovery efforts. The bulk fuel storage facilities would be constructed with appropriate, redundant, and legally required protection systems in place. The fuel tanks would be aboveground and located within a concrete-lined secondary containment facility that would be capable of holding a minimum of 110 percent of the largest tank volume present within the containment (Midas Gold 2016). For these reasons, possible spill-related impacts to surface water and other physical resources would be low to negligible. Any effects would be temporary in duration, assuming proper spill response measures, but the low risk of spills would be throughout the life of the SGP (long-term). Spills would be limited to the immediate area of release and would therefore be local in geographic extent. The effects would be localized, though spills to flowing water could spread contaminants downstream. Some materials that are highly toxic (e.g. cyanide) could result in greater impacts to a localized area.

For these reasons, the overall direct and indirect effects of hazardous materials and other substances would likely be minor but the effects could increase depending on the location where a spill occurs and the amount and type of material released.

4.7.2.4.2.5 Spills on Access Roads

During operations, all fuel would be trucked to the mine site via the Burntlog Route from a bulk fuel storage farm on Warm Lake Road (SGLF). During operations, one to two truckloads of antimony concentrate would be transported from the mine site each day. There is no past incidence of spills (since 2016) while transporting fuel and consumables to the mine site (Midas Gold 2016).

The most probable release scenario associated with truck transport would be relatively small (for example, less than 25 gallons of fuel) and attributed to mechanical failure or human error. Under this scenario, immediate cleanup actions would typically include deployment of containment and spill recovery materials, and removal of impacted roadbed material. Material spilled to soils/roadbed could likely be contained and recovered, while material which enters waterways may be difficult or impossible to fully recover. Response actions would include notification to the appropriate regulatory agencies.

Most small volume release scenarios would be temporary due to prompt response and cleanup actions; however, higher volume/lower probability spill scenarios could result in longer-term remedial actions and impacts. The risk of spills would last throughout the life of the SGP (long-term). Effects would generally be local and in close proximity to the release source in most scenarios; however, if surface or groundwater were to be impacted with fuels or other hazardous materials, the potential for migration beyond the local area could occur.

A low probability fuel release of up to 10,000 gallons or large spill of concentrate could potentially occur assuming the complete failure of a bulk tanker truck or truck rollover or accident. Under this scenario, spilled material would be released to the immediate roadbed area, and potentially to nearby surface water depending on the topography and location. Spill response and recovery measures such as containment, deployment of absorbent materials, removal of impacted roadbed material and vegetation, and deployment of water-based spill recovery equipment (as needed) may help to limit impacts. Impacts to physical resources and ecological receptors (e.g., vegetation or wildlife) could be greater depending on the location of the spill.

4.7.2.4.3 CLOSURE AND RECLAMATION

Hazardous materials present at the mine site and off-site facilities during closure and reclamation would be similar in comparison to the construction phase of the SGP. However, most of the final closure and reclamation would be concentrated during May through November to avoid winter conditions (Midas Gold 2016). It is estimated that on average, one daily round trip to deliver fuel and miscellaneous supplies would occur during closure and reclamation. **Table 2.3-8** provides projected traffic during closure and reclamation for supply and haulage of materials to the mine site. The risk of spills or releases would diminish throughout the closure and reclamation phase as fuel and other hazardous materials demands progressively diminish.

4.7.2.4.4 ACCESS ROUTE HAZARDS

Under Alternative 1 the Yellow Pine Route would be used for site access during the first 1 to 2 years of construction. The Burntlog Route would be used during operations.

All access routes could present occasionally adverse road conditions that are common on remote mountain roads, especially due to ice and snow conditions during winter months. Road conditions on high mountain passes such as Warm Lake, Landmark and and Big Creek Summit may be particularly challenging in the winter. Both the Burntlog and Yellow Pine routes have segments with steep grades (above 6 percent), and no emergency truck ramps are present or planned on the routes. Switchbanks and reduced turning radius also may be a challenge for large trucks operating on these roads. Any additional transport of hazardous materials under the action alternatives would increase the spill risk compared to the No Action Alternative.

Both the Burntlog and Yellow Pine access routes have segments that are susceptible to geohazards, including avalanches, landslides and rockfalls. See Sections 3.2 and 4.2, Geologic Resources and Geotechnical Hazards, for additional information on geohazards relevant to the SGP. These geohazards present along the road corridors could increase the potential for truck accidents resulting in spills of hazardous materials.

No geologic hazard assessment, including field reconnaissance, has been conducted to date for the Yellow Pine Route. Therefore, as part of preparation of the Environmental Impact Statement and to enable a general comparison of identified hazards between the Yellow Pine and Burntlog routes, a desktop study of both corridors was conducted (**Appendix E**). The details of the desktop study are provided in **Appendix E** and identified geohazards are depicted on **Figure 3.2-6** (see Section 3.2.3.7.3, Summary of Geohazards – Access Routes). Regarding the potential for avalanches, the desktop study focused on larger avalanches (Class 3 and above) that could be capable of burying or overturning a vehicle. Smaller avalanches (Class 1 or 2) could result in temporary road closures, but would be unlikely to increase the risk of a truck accident.

- Along the Burntlog Route, the desktop study identified 6 landslides and 20 rockfalls. No avalanche paths were identified along the Burntlog Route, although the existing Burnt Log Road (National Forest System Road [FR] 447) is known to experience small avalanches. The Burntlog Route is closer to avalanche “starting zones” such that it may have frequent but small avalanches (Class 1 or 2) that would be unlikely to impact vehicles.
- Along the Yellow Pine Route, 26 landslides, 19 rockfalls, and 12 avalanche paths were identified. Stibnite Road in particular is at the base of several large avalanche paths, and the route is known to have significant avalanches that disrupt traffic periodically.

Avalanches also can happen outside of existing avalanche paths, especially along road cuts and in areas that have undergone burning.

The Yellow Pine Route has increased potential for trucking accidents and greater spill risk from these geohazards compared to the Burntlog Route. See Section 3.2.3.7.2, Access Roads for the complete background information on geohazards across the two access routes.

Road conditions for transport routes beyond Landmark also would include occasionally adverse road conditions as noted above, as well as avalanche hazards at Warm Springs (see **Figure 3.2-6**). Occasional “slides” on Big Creek Summit in the last 20 years have caused temporary road closures, and Warm Lake Summit often has avalanche debris areas (Valley County Road Department 2020). These conditions are generally associated with road cuts. Road hazards past Landmark could increase spill risk for all action alternatives compared to the No Action Alternative.

4.7.2.4.5 Impacts to Waterways

Close proximity of access roads to surface water resources increases the potential for spilled material to enter water, thus increasing the potential consequences of a spill. The Burntlog

Route crosses 37 of the 71 streams listed in **Table 4.9-13** and includes 9 miles of road that are within 0.5 mile of surface water resources. The Yellow Pine Route crosses 43 different streams (**Table 4.9-13**) and includes 27 miles of road that are within 0.5 mile of surface water resources, including several miles that parallel the fish-bearing EFSFSR and Johnson Creek waterways. Though the Burntlog Route includes a greater number of stream crossings, the Yellow Pine Route includes significantly greater proximity to water resources. The potential consequences from trucking spills would thus be greater along the Yellow Pine Route.

4.7.2.4.6 Spill Risk Throughout SGP Phases

The location of the spill risk would change as the SGP progresses. Johnson Creek and the portion of the EFSFSR between the town of Yellow Pine and the mine site would be at risk during the first 1 to 2 years of the SGP when the Yellow Pine Route would be used as the access route while the Burntlog Route is being constructed. For the remainder of the mine life, the waterbodies adjacent to the Burntlog Route would be at risk. Mine transport begins on Warm Lake Road (County Road [CR] 10-579) where the risk of spills would be lower, as it is paved and maintained by Valley County and has overall gentler grades. At the intersection of Warm Lake Road and Johnson Creek Road (CR 10-413) the two mine access routes begin, with the Yellow Pine Route north along Johnson Creek Road (CR 10-413) and the Burntlog Route east onto Burnt Log Road (FR 447). The hauling of fuel and other materials along both routes puts the environment and resources in these adjacent waterways at risk.

4.7.2.4.7 Conclusion

The combination of Midas Gold's proposed management practices, committed mitigation measures, and Forest Service-required mitigation measures detailed in **Appendix D**, and the state and federal regulatory requirements described in Section 4.7.2.2 and practices of the ICMC in Section 4.7.2.3 above, would minimize and/or mitigate the risk of accidental release during the transportation, storage, management, and use of hazardous materials. In addition, management practices exercised by Midas Gold could minimize the overall amounts of generated hazardous waste, which could reduce the risk of accidental release.

4.7.2.5 Alternative 2

The access roads used under Alternative 2 would cross 69 different named and unnamed streams, as inventoried in **Table 4.9-20**. The Burntlog Route Riordan Creek segment would avoid crossing two unnamed streams, therefore reducing the potential for hazardous materials to impact these streams during mine operations and reclamation.

Aside from the change in stream crossings, hazardous materials impacts would generally be similar to those described for construction, operations, and closure and reclamation phases in Alternative 1. Under Alternative 2, an on-site limestone crushing plant and associated lime generation equipment is proposed and would require additional hazardous materials present at the mine site (i.e., diesel for associated trucking and propane to fuel the lime kiln). Producing lime from an on-site source of limestone as opposed to hauling lime from off-site sources would result in an estimated average 13 daily round trips to transport ore processing supplies, fuel, concentrate, and other materials during operation for Alternative 2 (**Table 2.4-3** provides projected traffic during mining and ore processing operations for supply and haulage of materials to the mine site) (M3 2018).

Alternative 2 also would require water treatment chemicals at the Centralized water treatment plant. Water treatment during operations would require hazardous chemicals as listed in **Table 4.7-2** in addition to those listed in **Table 4.7-1**. Water treatment chemical transport would require approximately 40 trips annually. Water treatment could result in sludges which would be transported to the tailings storage facility for disposal with tailings during operations.

Table 4.7-2 Alternative 2 – Operational Water Treatment Chemicals

Name	Units	Operational Annual Usage/ Transport	Post closure Annual Usage/ Transport	On-site storage capacity	Amount of Waste Likely to be Generated
Sodium hypochlorite	Gallons	5,500	2,600	1,000	0 (consumed as water treatment, any precipitants or sludge would be disposed in the TSF)
Ferric sulfate	Gallons	65,000	44,800	To Be Determined	0 (consumed as water treatment, any precipitants or sludge would be disposed in the TSF)
Sulfuric acid	Gallons	1,700	870	To Be Determined	0 (consumed as water treatment, any precipitants or sludge would be disposed in the TSF)

Table Source: Brown and Caldwell 2020

Water treatment at the water treatment plant would continue post closure and would require ongoing transport of chemicals to the site. The expected amount of chemicals needed post closure are listed on **Table 4.7-2**. In addition, an unknown number of trips would be required to transport any residual treatment sludges and wastes from the site, since these wastes would no longer be able to be disposed of in the TSF.

The in-perpetuity treatment would result in approximately 20 truck trips annually to delivery water treatment chemicals and an unknown number of trips to haul sludges and wastes from the treatment plant off-site for disposal. Transport would occur during the spring through fall with chemicals stockpiled in the fall to avoid winter transport.

4.7.2.6 Alternative 3

Hazardous materials impacts would generally be the same as those described for construction, operations, and closure and reclamation phases in Alternative 1. The number of stream crossings by access roads also would be the same.

4.7.2.7 Alternative 4

The use, storage, and disposal of hazardous materials during the construction, operations, and closure and reclamation phases would generally be similar to those described in Alternative 1. However, the Yellow Pine Route would be used as primary access to the mine site, including transport of hazardous materials and supplies. The Yellow Pine Route under Alternative 4 has both a higher spill risk than the Burntlog Route due to increased presence of landslides, rockfalls, and avalanche paths, and higher potential consequences from a spill due to the route's close proximity to surface water resources, as discussed above under Alternative 1.

Under Alternative 4, no improvements or construction of new segments for the Burntlog Route would be completed. Therefore, potential impacts from hazardous materials due to road construction for Burntlog Route or use of the Burntlog Route as an access route would not occur.

4.7.2.8 Alternative 5

Alternative 5 assumes that the mine site would remain as is. Exploration activities would continue, because these activities have been previously approved by the Forest Service. Existing use of petroleum products (fuels, lubricants, and hydraulic and motor oils), cleaning agents, batteries, tires, and other routine materials used for drill rig support equipment, such as generators, water pumps, vehicles, and helicopters, and other exploration-related operations would be ongoing. Alternative 5 would not address legacy mining impacts. This includes proposed reclamation of multiple open pits, development of rock dumps, tailings deposits, heap leach pads, and spent heap leach ore piles, in addition to legacy infrastructure. It is possible that hazardous substances associated with previous mining activities at the mine site remain beneath tailings and sediments. These substances could include cyanide, mercury, petroleum hydrocarbons, and solid waste.

There would be no direct or indirect effects on hazardous materials associated with Alternative 5. With no direct or indirect effects, this alternative also would not contribute to cumulative effects from hazardous materials. No additional use, storage, transport, or disposal of hazardous materials or solid waste would occur beyond what is currently ongoing at the mine site. The risk of accidental spill or release would not be any greater over what is currently occurring at the mine site. Assuming the current exploration activities continue, the potential for spills or releases from exploration operations would remain low, based on the single recordable release (2012 airplane crash) during the 6 years of exploration work in the mine site area.

4.7.3 Mitigation Measures and Effectiveness

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final Environmental Impact Statement.

4.7.4 Cumulative Effects

The cumulative effects analysis area for hazardous materials is bound by the bordering transportation routes that would provide access to the mine site: Warm Lake Road (CR 10-579) (from Cascade, Idaho), bound by South Fork Road (FR 474 and 50674) to the west; the East Fork Road portion of McCall – Stibnite Road and the Stibnite Road portion of McCall - Stibnite Road (CR 50-412) to the north (from Yellow Pine, Idaho); and Burnt Log Road (FR 447) to the East.

Cumulative effects associated with the SGP consider the range of existing and foreseeable activities and their potential effects with respect to hazardous materials. Past and present actions that have, or are currently, affecting hazardous materials include the following (from the complete listing presented in Section 4.1, Introduction):

- Midas Gold Operations and Exploratory Drilling from 2016 to 2019. The SGP has included transportation of approximately 141,000 gallons of fuel (diesel, gasoline, and jet fuel) per calendar year to the fuel storage facility on private land at the mine site. This activity occurs on existing County and Forest Service roads.
- Mine Closure and Reclamation of Hecla and Stibnite Mine, Inc. mining and processing facilities occurred between 1993 and 2000. These activities were conducted near the headwaters of EFSFSR and Sugar Creek.
- Comprehensive Environmental Response Compensation and Liability Act Actions. Several Comprehensive Environmental Response Compensation and Liability Act removal actions were conducted by the Forest Service, U.S. Environmental Protection Agency, and Exxon-Mobil Corporation. These activities were conducted near the headwaters of EFSFSR and Sugar Creek.

Each of these projects represents past and present actions that have occurred around or near the historic Stibnite Mining District.

Some of the reasonably foreseeable future actions (RFFAs) presented in Section 4.1, Introduction, have the potential to use some of the same roads as the SGP for access (e.g., Warm Lake Road, Johnson Creek Road, Stibnite Road). Although there is insufficient information about the nature of the RFFAs to assess specific hazardous materials usage, these reasonably foreseeable future actions projects would similarly be required to comply with state and federal regulations regarding transport and use of hazardous materials. Furthermore, available information for the RFFAs that could potentially use some of the same roads as the SGP and incrementally contribute to traffic (including heavy vehicle traffic involving transport of hazardous materials) suggests a nominal amount of cumulative traffic. For example, the Big Creek Hazardous Fuels Reduction Project in the Edwardsburg area north of Yellow Pine could be accessed via McCall - Stibnite Road; however, this project would involve 10,600 acres of treatment over a short period of time, such that the contribution of the action alternatives combined with this, and other similar projects would result in negligible changes to the overall traffic volume. The SGP when added to other past, present, and RFFAs could slightly increase the impact from hazardous materials in the cumulative impact analysis area.

4.7.5 Irreversible and Irretrievable Commitments of Public Resources

Under all alternatives, no irreversible or irretrievable commitment of public resources or impacts are anticipated. However, if a spill were to affect a sensitive resource, an irretrievable impact could occur pending the recovery of the resource (i.e., soil, water, vegetation, or wildlife).

4.7.6 Short-term Uses versus Long-term Productivity

Development of the SGP would result in potential short-term impacts to resources from the presence of hazardous materials in the area. Small spills would likely occur but would be cleaned up and managed in accordance with state and federal regulations. Residual contamination from previous mining and exploration efforts in the area would be addressed as they are encountered during the SGP. Potential hazardous materials would be characterized for proper off-site disposal. Long-term positive impacts due to removal and proper disposal of residual and SGP hazardous materials, habitat reclamation and post- mining reclamation are anticipated to provide an overall long-term environmental benefit and improve the long-term productivity.

4.7.7 Summary

All action alternatives would include the use, storage, and transport of hazardous materials which, if spilled, could potentially affect human health, water quality, wildlife, and vegetation. Hazardous materials to be used would include diesel fuel, gasoline, lubricants, antifreeze, other petroleum products, chemical reagents and reactants (including sodium cyanide and sulfuric acid), antimony concentrate, mercury containing residuals, lime, explosives and other substances (see **Table 4.7-1** for a list of hazardous materials to be used for the SGP).

Potential direct adverse impacts to soil and waterways could result from accidental releases or spills of hazardous materials. Spills also could result in indirect impacts to outlying areas from releases to tributaries of the nearby watersheds or groundwater.

Duration of spill risk for all action alternatives would be long-term as it would last throughout the life of the SGP. The extent of potential impacts would include the site of the spill and any downstream areas, as far as the point of containment or the point where dilution and/or dispersion mitigate the impacts naturally.

State and federal regulations, project controls and emergency response procedures would be in place to reduce spill risk and the extent of potential spill impacts.

4.7.7.1 Storage and Use of Hazardous Materials

Across all alternatives, storage and use of hazardous materials would occur at the mine site and at the SGLF and off-site maintenance facility during construction and operations. The probability of small volume/low impact spills is high, while the probability of large volume/high impact spills is relatively low. Designs utilizing areas with secondary containment for storage and grading to direct spills that could escape secondary containment into catchment areas, as well as spill prevention, containment and response measures incorporated into the SPCC Plan would reduce the probability of hazardous material spills and the extent of impacts in the event of a spill.

Use, volumes, and storage of fuels, lubricants, and chemicals at the mine site and off-site facilities (SGLF and the off-site maintenance facility) would be the same or similar across all action alternatives, with the exception of Alternative 2, which would include an on-site limestone crushing plant and associated lime generation equipment. This would require an additional 1,463,000 gallons of propane annually to fuel the lime kiln, and would require additional propane storage. Alternative 2 would have a somewhat elevated spill risk of these materials over other alternatives during storage and use at the mine site.

4.7.7.2 Transport of Hazardous Materials

Transport of hazardous materials would occur for all alternatives. The volume and frequency of hazardous material transport by truck would be the same or similar for Alternatives 1, 3, and 4, but the volume and frequency would change under Alternative 2, with on-site lime generation. Under Alternative 2, fewer truck trips would occur during an operational year. The reduced truck trips would be related to reduction of 2,032 truck trips each year for shipment of lime for use at the site and an increase of 133 propane delivery trucks each year for an overall net decrease of 1,889 truck trips each year of operations (an average annual daily traffic reduction from 49 trips per day to 33 trips per day. The overall risk of a spill would be reduced with reduced truck trips.

The mine access road corridors utilized for operations would vary across alternatives. The Burntlog Route would be used under Alternatives 1, 2, and 3, while the Yellow Pine Route would be the only route used under Alternative 4. Under Alternatives 2 and 3 there would be variations in the Burntlog Route corridor alignment, which would result in only slight changes to the spill risks.

In general, the potential for a release of hazardous material from a truck accident can be reduced for both the Burntlog and Yellow Pine Routes with the use of appropriate management practices such as pilot vehicles, speed restrictions and requiring appropriate spill kits in trucks hauling hazardous materials and in pilot vehicles.

Both the Burntlog and Yellow Pine Routes have segments with steep grades (greater than 6 percent), and no emergency truck ramps are present on the routes. Both routes have segments that are susceptible to landslides, rockfalls and avalanches These geohazards present along the road corridors could increase the potential for truck accidents resulting in spills of hazardous materials. Along the Burntlog Route, 6 landslides and 20 rockfalls were identified. No avalanche paths were identified along the Burntlog Route. Along the Yellow Pine Route, 26 landslides, 19 rockfalls and 12 avalanche paths were identified. The Yellow Pine Route thus may have higher potential for increased trucking accidents and greater spill risk from these geohazards.

Close proximity to surface water resources increases the potential consequences of a spill along the access routes. The Burntlog Route crosses 37 of the 71 streams listed in **Table 4.9-13** and includes 9 total miles that are within 0.5 mile of surface water resources. The Yellow Pine Route crosses 43 different streams (**Table 4.9-13**) and includes 27 miles that are within 0.5 mile of surface water resources, including several miles which parallel the fish-bearing EFSFSR and Johnson Creek waterways. Though the Burntlog Route includes a greater number of stream crossings, the Yellow Pine Route includes greater proximity to water resources. The potential consequences from trucking spills would thus be greater along the Yellow Pine Route.

Table 4.7-3 provides a summary comparison of hazardous materials impacts by issue and indicators for each alternative.

This page intentionally left blank

Table 4.7-3 Comparison of Hazardous Materials Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may cause accidental release of hazardous materials or wastes, including milling reagents and reaction products, during the transport, use, storage, and disposal of materials.	Volumes and types of hazardous materials and hazardous wastes transported, used, and stored during site operation.	Petroleum products are currently stored at exploration-related facilities for activities associated with the exploration activities. In total approximately 63,885 gallons of petroleum products are used, stored and transported annually.	Hazardous materials and petroleum products storage would be stored at the following locations: SGLF; Landmark Maintenance Facility; Worker Housing Facility; Fuel and Explosive Storage. Approximate hazardous materials annual use and transport volumes would include: fuels and lubricants (6.6 million gallons); antifreeze (40,000 gallons); propane (560,000 gallons); antimony concentrate (365 to 730 truckloads); sodium cyanide (3,900 tons); copper sulfate (2,500 tons); nitric acid (115,000 gallons); solvents (1,000 gallons) along with numerous other chemicals as listed in **Table 4.7-1**.	Same as Alternative 1 except additional propane supply and storage volume would be required for the on-site lime kiln facility. This additional propane storage would slightly elevate the risk of a spill during hazardous materials transport and storage. Additional chemicals would be required for water treatment during operations and in-perpetuity. Chemicals include sodium hypochlorite, ferris sulfate, and sulfuric acid.	Same as Alternative 1.	Same as Alternative 1.	Same as Baseline Conditions.
	Practices for storage and use on site including primary and secondary containment types and volumes and material handling practices.	Hazardous materials are used and stored on site in accordance with applicable regulations including secondary containment for fuels and other hazardous materials. Midas Gold has developed documents for use and storage including a SPCC Plan and a Solid Waste Management Plan, which addresses management of hazardous materials.	Hazardous materials would be are used and stored on site in accordance with applicable regulations including secondary, and in some cases tertiary, containment for fuels and other hazardous materials. Midas Gold would develop documents for use and storage including a SPCC Plan and a Solid and Hazardous Materials Handling and Emergency Response Plan, which addresses management of hazardous materials Following regulatory requirements and plans for spill containment, control, and response would reduce the potential for spills and for impacts associated with those spills.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Baseline Conditions.
	Hazardous materials transport traffic volumes during construction, operations and closure and reclamation.	Petroleum products are transported to the site on an as-needed basis.	Overall heavy vehicle traffic, of which hazardous materials transport will be a part, would be approximately 45 trips per day as an average annual daily traffic (AADT) count for construction; for operations the AADT would be 49 daily trips; and for closure and reclamation the AADT would be 13 daily trips. These trips represent the	Net truck traffic and associated risk of a traffic accident would be reduced over Alternative 1 by an AADT count of 16 daily trips to a total AADT of 33. A reduction in traffic volumes would represent a reduced risk for a spill of hazardous materials. Trips for operational delivery of water treatment chemicals	Same as Alternative 1.	Same as Alternative 1.	Same as Baseline Conditions.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
			risk of a traffic accident.	would continue in-perpetuity and would represent approximately 40 trips annually with an unknown number of trips to haul water treatment sludges and wastes off-site for disposal.Post closure delivery of chemicals would be approximately 20 trips annualy and would not occur during winter months.			
	Travel route road hazards	The existing routes are a combination of paved routes (Warm Lake Road) and existing native surface roads. There are potential road hazards along the routes used for delivery of supplies for the exploration project including landslide and rockslide areas, avalanche paths and routes close to streams. These hazards would represent a potential for hazard for accidents and spills.	Yellow Pine Route has potential road hazards, including landslide areas, rockfall areas, and avalanche paths. Twenty-seven miles of the route have streams within 0.5 mile of the travel way. Burntlog Route which would be used for most of the life of the mine has fewer landslide and rockslide areas and no mapped avalanche paths. Nine miles of the travel way have streams within 0.5 mile. Short-term use of the Yellow Pine Route would have a higher risk for accidents due to potential road hazards resulting in spills than the longer-term use of Burntlog Route. Yellow Pine Route also has more road length with waterways close to the road which could increase the transport of any spilled materials.	Same as Alternative 1.	Same as Alternative 1.	Major road improvements would occur for use of the Yellow Pine Route. Burntlog Route would not be constructed. The Yellow Pine would represent a higher risk for road hazards that could result in an accident and spill of hazardous materials, and the route's greater proximity to waterways could increase the consequences of a spill.	Same as Baseline Conditions.

4.8 Surface Water and Groundwater Quantity

This section addresses potential effects to surface water quantity, groundwater quantity, and water rights that could result from implementation of the Stibnite Gold Project (SGP). It specifically addresses potential change in volumes of water within the analysis area from water management and use. Effects upon the habitat provided by surface water features are outside of the scope of this analysis and are addressed separately in Section 4.11, Wetlands and Riparian Resources, and Section 4.12, Fish Resources and Fish Habitat.

4.8.1 Effects Analysis Indicators and Methodology of Analysis

Analysis of surface water and groundwater quantity effects is guided by the following issues and indicators:

Issue: The SGP may cause changes in the quantity of surface water and groundwater in all drainages within the analysis area.

Indicators:

- Stream flow characteristics (daily, seasonal, annual).
- The extent, magnitude, and duration of changes in groundwater levels.

Issue: The SGP may affect water rights.

Indicators:

- Change in water rights availability in the SGP area.
- New water rights needed.

The surface water and groundwater quantity effects analysis primarily used information provided in the modeling reports prepared for the SGP by Midas Gold Idaho, Inc. (Midas Gold), or their contractors, but also included scientific literature.

The analysis for water rights was performed by gathering existing pertinent data related to surface water and groundwater resources; and existing and proposed water rights in the analysis area. The analysis then considered the timing, place of use, and impact of the proposed new water rights. At the time of new water right application, the Idaho Department of Water Resources (IDWR) would determine if the proposed water rights would impact downstream senior rights.

4.8.1.1 Surface Water and Groundwater Modeling

A hydrologic model was the principal tool used to evaluate the potential effects to surface water and groundwater quantity that could result from implementation of the action alternatives. An independent, critical evaluation of the surface water and groundwater modeling approach and its assumptions is summarized in Section 4.8.8, Uncertainty Associated with Model Predictions; additionally, Environmental Resource Management completed a more thorough, independent review of the contents of the model reports (Environmental Resource Management 2019). That review did not include the model auditing, which would involve opening the model files, inspecting model inputs, running verification simulations, and several other tasks.

Environmental consequences related to surface water and groundwater quantity are evaluated by comparing the effects of Alternatives 1 through 4 to the existing conditions (summarized in Section 3.8), using indicators listed above. Evaluation of Alternative 5 takes into account historical mining impacts already present at the mine site. Likely legacy water quantity impacts are associated with the following historical mining structures:

- Underground mine workings;
- Multiple open pits;
- Development rock dumps, piles, and tailing deposits;
- Spent ore disposal areas, including heap leach pads and spent heap leach ore piles;
- Mill and smelter facilities;
- A ruptured Blowout Creek (also known as East Fork Meadow Creek) water dam; and
- An abandoned water diversion tunnel.

Brown and Caldwell developed general versions of the model for simulating surface water flow in the analysis area: one for representing existing conditions (Brown and Caldwell 2018a), and the other for simulating the effects on surface water as a result of Alternative 1 (Brown and Caldwell 2018b), and the various action alternatives with different mine site configurations (i.e., Alternatives 2 and 3) (Brown and Caldwell 2019a,b). Brown and Caldwell also completed a separate model sensitivity analysis to evaluate the response of varying selected input parameters on the model results (Brown and Caldwell 2019c).

Note that the model does not represent underground mine workings, exploration drilling, or faults. The workings occupy a limited area and space and their presence was judged to exert only a limited influence upon the groundwater system. The effects of exploration drilling upon the groundwater system are likely much smaller and more local than the effects of the presence of unabandoned mine workings.

Implications of not representing the faults in the model are discussed in Sections 4.8.1.1.1 (Existing Conditions Hydrologic Model), in Section 4.8.2 (Direct and Indirect Effects) and in Section 4.8.8, (Uncertainty Associated with Model Predictions, sub-section 4.8.8.2 “Main Sources of Predictive Uncertainty for the Proposed Action Hydrologic Model”).

4.8.1.1.1 EXISTING CONDITIONS HYDROLOGIC MODEL

The existing conditions model was developed by combining a spreadsheet-based long-term meteoric water balance (that tracks precipitation, snow accumulation, and melt) with a numerical groundwater/surface water flow model developed using MODFLOW-NWT.

The principal climate data used to develop the meteoric water balance were precipitation, temperature, and evapotranspiration. Midas Gold has been collecting meteorological data in the analysis area, including air temperature, barometric pressure, wind speed, and precipitation, since August 2011. However, climate data collected at the site is only representative of the last few years and is not sufficient for assessing long-term statistics or trends. To address that limitation, the Water Resources Summary Report (Brown and Caldwell 2017) presents an analysis of long-term regional climate parameters developed using the Parameter-Elevation Regressions on Independent Slopes Model (PRISM). The PRISM interpolates a database of climate records onto a spatial grid covering the U.S. Next, it calculates a climate elevation regression for each grid location, using data from nearby climate stations (where long-term records are available) and a digital elevation model. Factors considered in the regression used for interpolation of climate parameters include: location, elevation, coastal proximity, topographic facet orientation, vertical atmospheric layer, topographic position, and orographic effectiveness of the terrain.

Simulation of surface water flows and interactions between surface water and groundwater was one of the primary objectives of the model analysis. Stream flow data were collected from U.S. Geological Survey (USGS) gages. A primary goal of the model calibration was to simulate both peak stream flow events (from runoff estimates developed in turn from the meteoric water balance model) and stream base flows (from simulated groundwater/surface water interactions).

Simulation of groundwater elevations and flow was another principal objective for the hydrologic model. The model was set up using available geological, geophysical, and hydrogeological data collected at the proposed mine site. Midas Gold has been systematically measuring groundwater levels at monitoring points within the mine site water modeling boundary since November 2011 (see Section 3.8.3.2.2, Groundwater Levels, Gradients, and Flow Directions). Midas Gold also completed an assessment of the thickness of the soil, colluvial, and alluvial overburden (to be represented in the model, along with bedrock, as the model layers and “property zones”) utilizing geologic logging and surface geophysical data. The model does not explicitly represent the faults present in the SGP area – discussion of model predictive uncertainties associated with such lack of representation is provided in Section 4.8.8, Uncertainty Associated with Model Predictions.

The model was set up to simulate monthly stress periods, which were considered sufficient for capturing variations in groundwater flow conditions and stream base flows in response to long-term changes in recharge and surface runoff. Model simulations initially followed monthly time steps for the 122-year (1895 through 2016) historical period, including the 2011 through 2016 calibration period. Once general calibration was achieved, the model simulation focused on the period between 1985 and 2016. The 1985 through 2016 model was used for fine-tuning the model calibration.

The model setup included: 1) discretization of the model domain into a three-dimensional grid, 2) setting boundary conditions that control the addition and removal of water to and from the model domain, and 3) setting hydraulic parameters that control the flow of water within the model domain.

The model grid consists of 224 rows, 145 columns, and 3 vertical layers (**Figures 4.8-1** and **4.8-2**). Layer 1 represents the alluvial aquifer and overburden, Layer 2 represents fractured near-surface bedrock, and Layer 3 represents less fractured (and therefore less permeable) bedrock at depth. The lateral extent of the grid coincides with the “analysis area” defined in Section 3.8.1.1.1, Analysis Area. Horizontal grid spacing ranges from a minimum of 30 feet (around the Hangar Flats pit) to a maximum of approximately 330 feet in other parts of the model domain. The adopted design of the grid considered limitations of the software used to build the model. Professional experience shows that such design limits the size of the model, which improves computational efficiency (this is an important aim for large models), and increases precision of the model predictions for the area with the greatest concentration of SGP-related impacts.

Water is simulated to enter the model domain primarily through surface recharge (see **Figure 4.8-3** showing recharge zones set in the model) and exit the model domain via discharges to surface streams. Water consumed by evapotranspiration is accounted for in the meteoric water balance described above and is not directly simulated in the model. Monthly recharge rates from the meteoric water balance are added to the model using the MODFLOW Recharge Package. Flows in surface streams and creeks are simulated using the MODFLOW Surface Flow Routing package.

The modelers developed hydraulic conductivity estimates using available data to represent regional-scale and SGP site-specific aquifer conditions. **Figures 4.8-4** and **4.8-5** show hydraulic conductivity zones as set in the model. For flow in unconfined model layers (Layer 1 and, seasonally, Layer 2), MODFLOW-NWT uses a “total” storage approach, adding confined (specific) storage to the specific yield. For confined flow, the model uses specific storage only. The model uses constant values of specific yield (0.15, based on model calibration) and specific storage (1×10^{7} ft^{-1}) for Layer 1. Less fractured bedrock represented by Layer 2 in upland areas is assigned a specific yield value of 0.001, while model domain parts representing a more weathered and fractured bedrock underneath valleys and stream courses use a higher specific yield of 0.01. Specific storage for all bedrock layers (Layers 2 and 3) is set to a value of 1×10^{7} ft^{-1}. All final values of aquifer parameters were developed through model calibration.

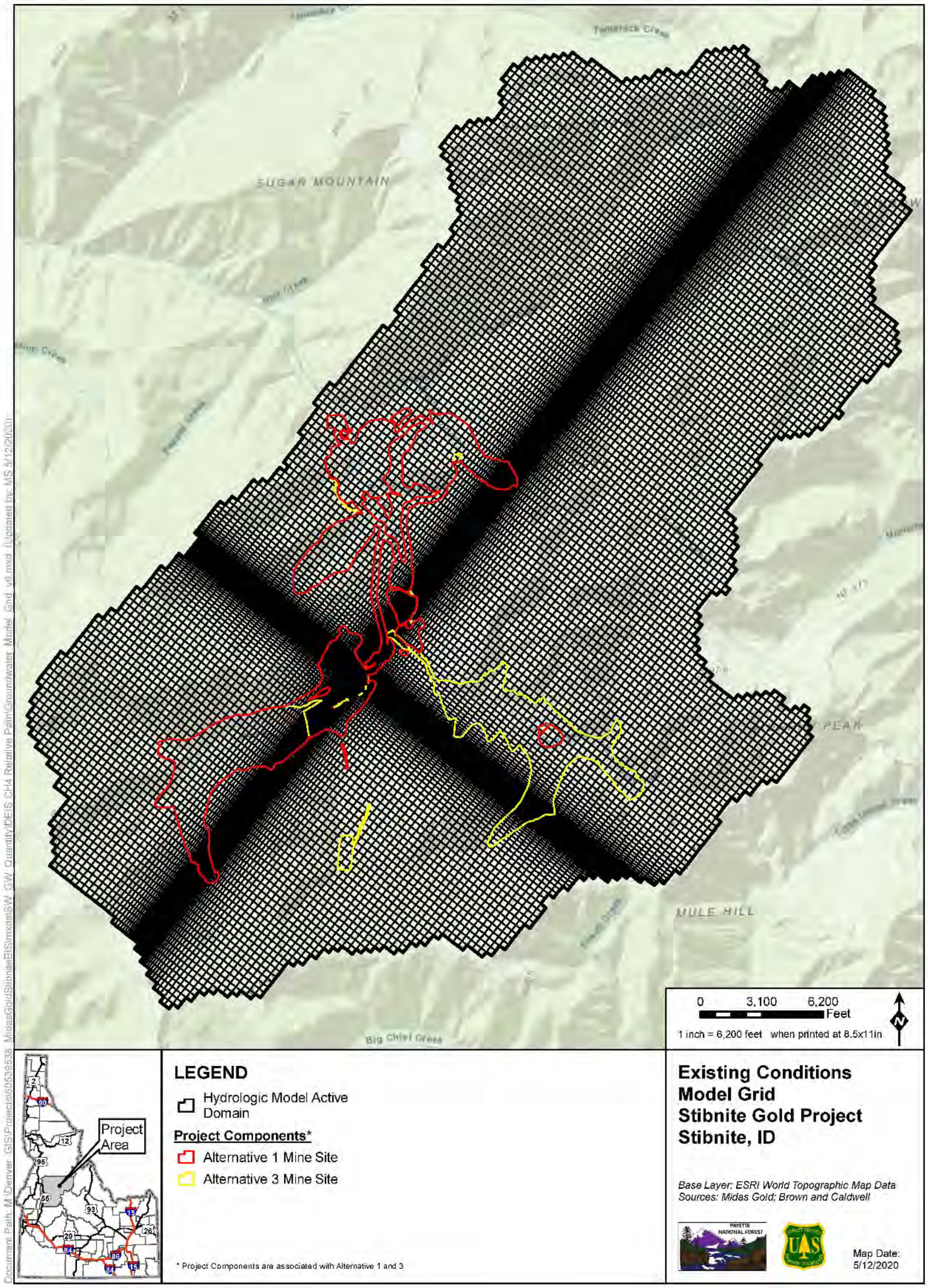


Figure Source: Brown and Caldwell 2018a Figure 4-2

Figure 4.8-1 Existing Conditions Model Grid

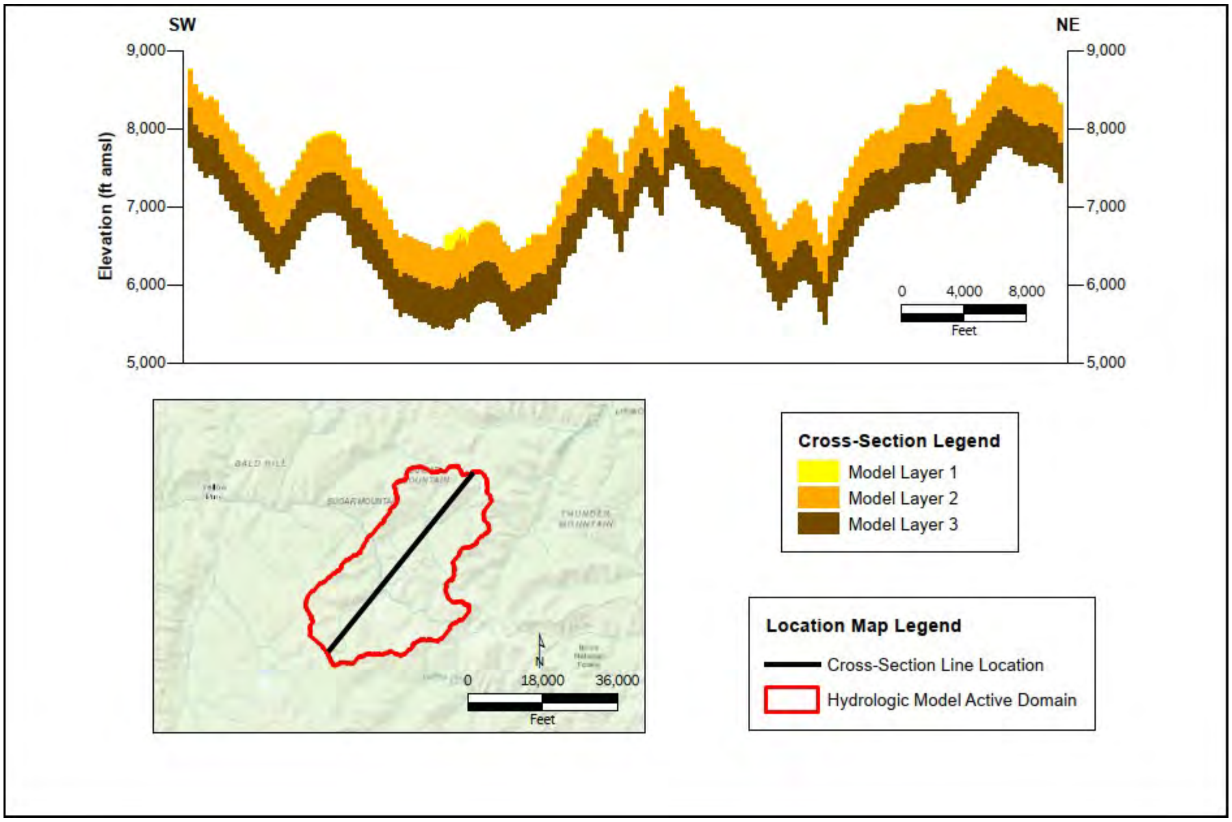


Figure Source: Brown and Caldwell 2018a, Figure 4-5

Figure 4.8-2 Groundwater Model Grid - Cross Section through Model Column 60

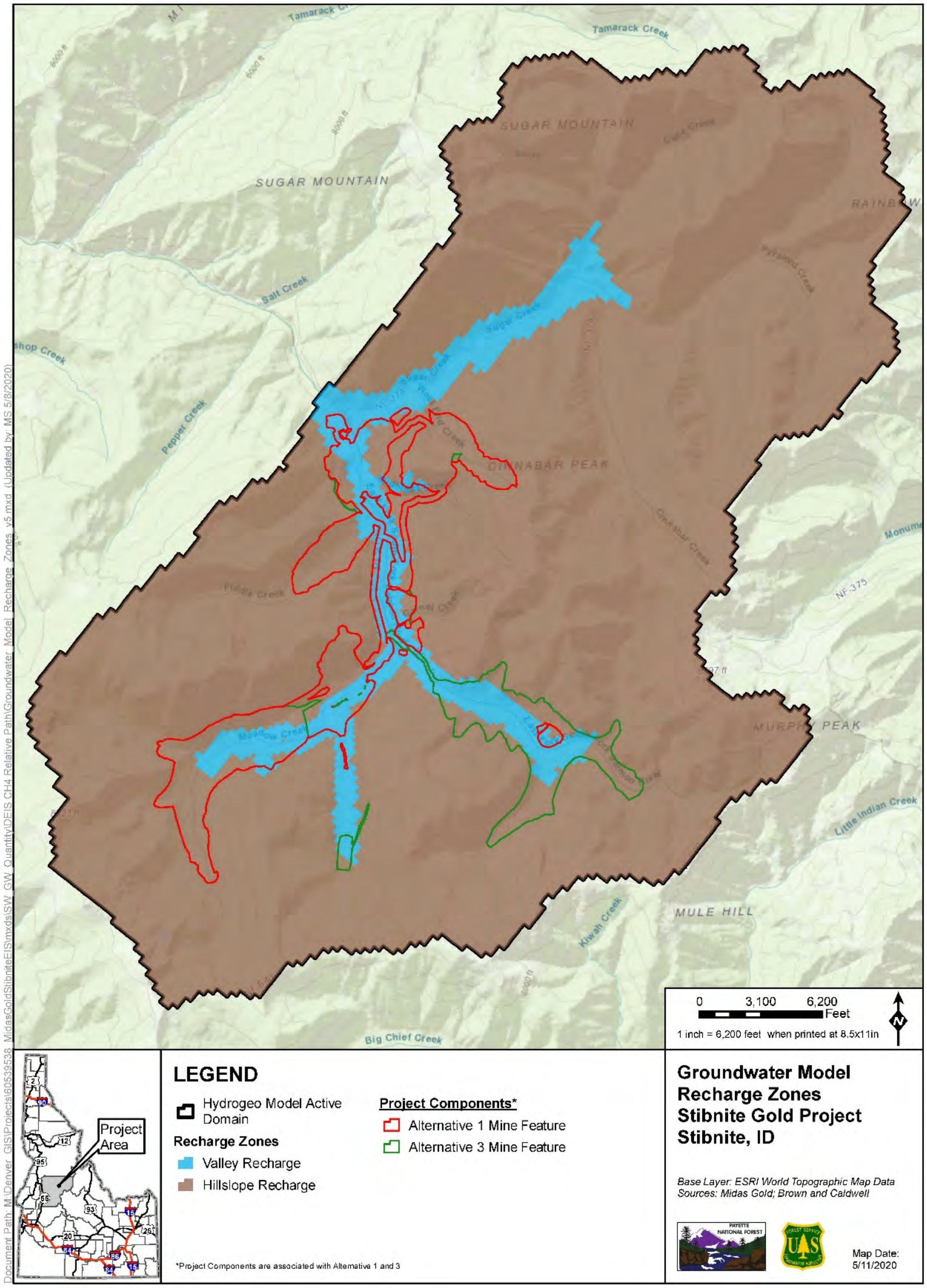


Figure Source: Brown and Caldwell 2018a, Figure 3-2

Figure 4.8-3 Groundwater Model Recharge Zones

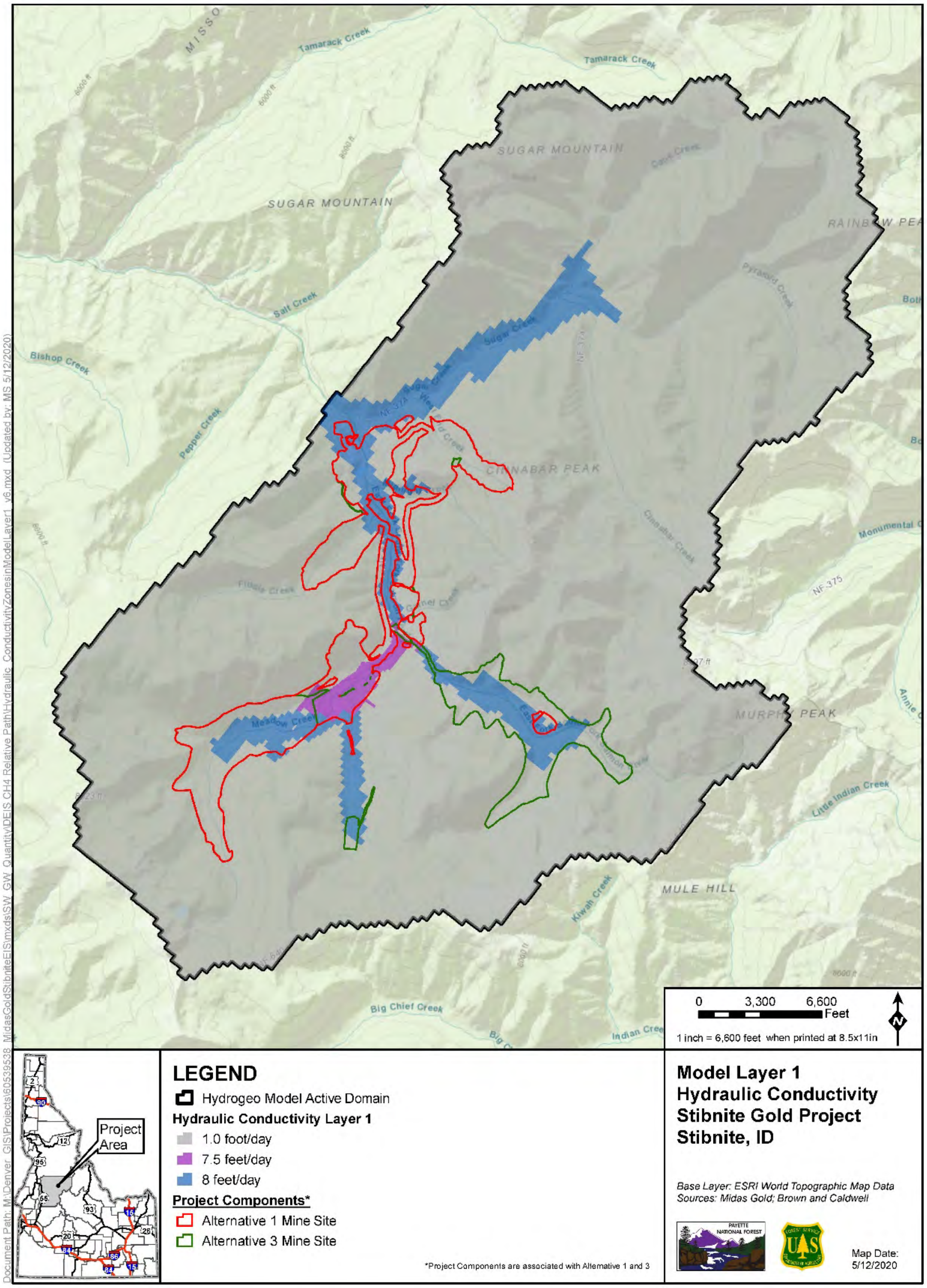


Figure Source: Brown and Caldwell 2018a, Figure 4.7

Figure 4.8-4 Model Layer 1 Hydraulic Conductivity

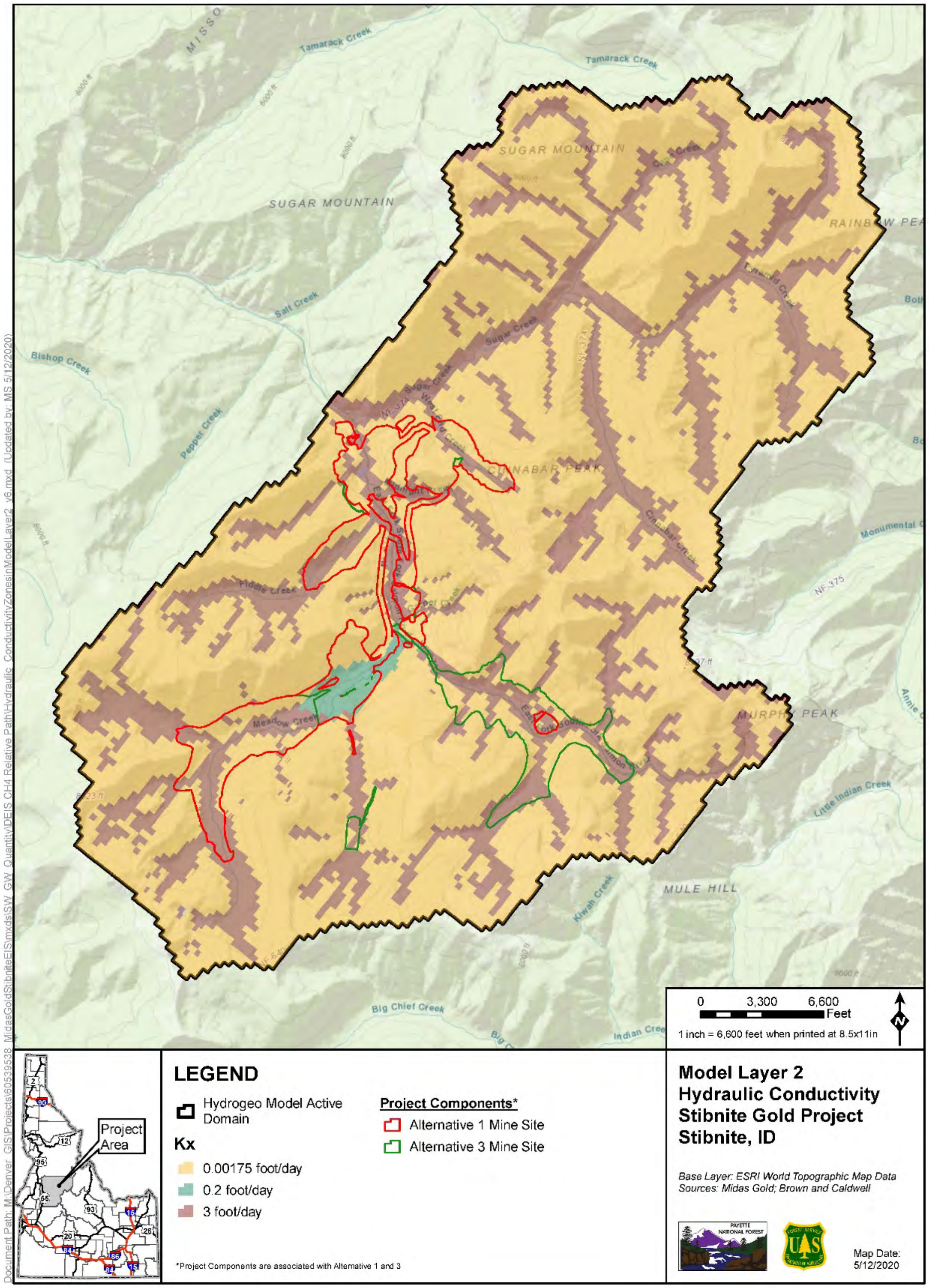


Figure Source: Brown and Caldwell 2018a, Figure 4-8

Figure 4.8-5 Model Layer 2 Hydraulic Conductivity

The model was calibrated to groundwater levels and surface water flow data collected within the analysis area. Model calibration concentrated on accomplishing the following:

- Reasonably accurate simulation of seasonal wetting and drying of upland overburden during annual snowmelt periods;
- Reasonably accurate simulation of observed groundwater elevations; and
- Reasonably accurate simulation of observed stream flow conditions, focusing on late-season base flow conditions.

Among the data used for the model calibration was the information collected during a 31-day-long Gestrin Airstrip well aquifer test. The Gestrin well was completed in alluvium but monitoring wells used to collect groundwater level data during the aquifer test of the well were completed in both alluvium (four wells) and shallow bedrock (three wells).

The following parameter groups were adjusted during the model calibration: 1) meteoric water balance parameters, 2) aquifer physical parameters, 3) streambed conductivity, and 4) application of recharge. The final calibration represents a balance between the set calibration objectives (Brown and Caldwell 2018a).

As part of the existing conditions model calibration, the model also was used to simulate the Gestrin well test performed in December 2013. Graphs 5-13 and 5-14 provided in the Brown and Caldwell's Existing Conditions Report (Brown and Caldwell 2018a) show a close correspondence between the model-simulated changes in groundwater levels (in response to pump test) and groundwater levels measured in the wells (monitored during that test).

4.8.1.1.2 PROPOSED ACTION HYDROLOGIC MODEL

The existing conditions hydrologic model (Brown and Caldwell 2018a) was adjusted to assess changes in hydrologic conditions within the analysis area that would occur when implementing Alternative 1 (Brown and Caldwell 2018b). Additional model versions also were created to simulate conditions considered under the other action alternatives (Brown and Caldwell 2019a,b). The final output from the existing conditions model was the starting point for simulations of future conditions that include the proposed SGP-related activities.

The existing conditions model was modified to simulate changes in the hydrologic system during mining operations and during the reclamation/post closure periods. Two separate groundwater flow model sub-versions were developed for Alternatives 1, 2, and 3: one for the mine operational period (mine years -2 through 12), and one for post closure conditions (from mine year 13 through 112). The Brown and Caldwell modeling reports construction as negative years (-3, -2, and -1) counting down to when operations began at the site. This use of timing is repeated throughout this discussion of the modeling results below. The mine timeline based on the start of construction is presented in **Figure 2.3-3**.

Adjustments to the model to simulate hydrologic changes that would occur during the mine operational period included: 1) representations of mine dewatering, 2) changes in recharge around the tailings storage facility (TSF) and development rock storage facilities (DRSFs), and 3) rerouting of streams around mine facilities. The model input files also were adjusted to simulate the annual sequence of proposed mine activities and the timing of facility development. The model analysis assessed climatic variation by simulating precipitation sequences from the meteoric water balance representing: 1) historical average, 2) historical above average, and 3) historical below average periods (with regard to precipitation).

Similar to the existing conditions model, the mine operational period was simulated using 168 monthly stress periods over the 14-year simulation. Each stress period included 10 simulated time steps. Simulated groundwater level (head) conditions at the end of the existing conditions calibration period served as initial head conditions for the mine operational period model.

To simulate the rate of groundwater inflow into the pits during the mine operations, the average topographic elevation was first calculated for each model cell representing part of a proposed mine pit, and then a drain package cell was assigned with a reference elevation placed ten feet below the average topographic elevation of the pit bottom. The modelers updated drain reference elevations for each year of the model simulation to reflect the advancing mine pit.

Because mine operations would result in changes to surface conditions and affect recharge to groundwater, the modelers evaluated those changes for different SGP-related elements, and adjusted values of recharge. Those adjustments included simulations of the TSF, DRSFs, and rapid infiltration basins (RIBs).

Surface water management during mine operations would include a number of stream diversions. Where the streams are proposed to be diverted and/or lined, it was assumed that the streams would no longer interact with underlying groundwater, but rather surface flows would be fully routed from the upstream to downstream portion of the lined section. This lack of interaction was represented in the model by setting the stream width parameter to an arbitrarily small value of 1×10^{-6} ft., leading to a near zero value of conductance.

Separate model versions were developed for Alternatives 1, 2, and 3 to simulate changes in the hydrologic system that would occur after mining has ceased. The post closure model versions were used to simulate development of pit lakes, long-term changes in surface recharge, and restoration of streams. The modelers developed a post closure model to simulate a 100-year period utilizing historical climate data, representing mine year 13 through mine year 112. The 100-year period was chosen to include climate variations observed in the historical record. Like the existing conditions and mine operational period model versions, the post closure model versions simulate monthly stress periods using surface runoff and recharge to groundwater estimates developed from the long-term PRISM dataset in the meteoric water balance model. The 100-year post closure simulation utilized the previous 100 years of PRISM data, representing 1918 through 2017. That period encompasses: 1) the average, 2) above average (wet), and 3) below average (dry) climate condition sequences.

The modelers utilized the Lake package linked to the MODFLOW-NWT model to simulate: 1) the effects of seepage between the pit lakes and surrounding groundwater system, 2) interactions between local streams and the pit lakes, and 3) the overall lake water budgets during and after filling of the pit lakes. The post closure model versions were developed from the mine operations model versions by adding the pit lakes and adjusting recharge to various areas that would be subject to reclamation, modification, and changing stream routing.

4.8.2 Direct and Indirect Effects

The following analysis of direct and indirect effects associated with surface water and groundwater quantity are considered in the overall context of the local and regional hydrological and hydrogeological conditions of the affected environment. The following are the main characteristics of those conditions:

- The mine site and surrounding area (i.e., the analysis area) consists of mountainous terrain dissected by narrow valleys with steep slopes.
- The hydrology of the analysis area is strongly influenced by seasonal patterns of snow accumulation during the winter, and snowmelt in the spring and early summer.
- Water entering the analysis area as precipitation migrates as surface runoff and shallow groundwater down the mountain slopes and along the valley bottoms in an alluvial aquifer formed by unconsolidated Quaternary deposits. The alluvial aquifer is documented to be the most groundwater-transmissive formation in the analysis area; it is typically more than 50 feet thick (reaching a thickness of 250 feet at some locations), and is represented in the model by Layer 1.
- Groundwater in the alluvial aquifer eventually discharges to surface streams. However, at some locations, surface water recharges shallow groundwater during periods of high stream stage.
- Groundwater supports many seep-, spring- and wetland ecosystems referred to as groundwater dependent ecosystems (GDEs).
- A portion of groundwater flow occurs through a network of fractures in shallow bedrock and through fracture zones (encountered in boreholes) and faults (interpreted to be present from the results of geophysical surveys – Brown and Caldwell 2017) in deeper bedrock. Shallow bedrock is documented to be less transmissive than the alluvial aquifer, but more fractured and transmissive than deeper bedrock, particularly along the main surface drainages and underneath overburden material on hillslopes. This shallow bedrock is represented in the model as Layer 2; model Layer 3 represents nearly impermeable bedrock at depth. Faults are not implicitly represented in the model (see discussion provided in Section 4.8.8, Uncertainty Associated with Model Predictions).
- There are four existing water rights held by Midas Gold in the vicinity of the mine site that are related to historical mining use, but there are no immediate downstream consumptive-use water rights on the East Fork South Fork Salmon River (EFSFSR).

The analysis in this section focuses on elements of the alternatives that have the potential to affect: 1) stream flow characteristics; 2) groundwater levels; and 3) water rights and availability of water resources subject to such rights.

4.8.2.1 Alternative 1

The Alternative 1 model was used to assess the direct and indirect effects of Alternative 1 on surface water and groundwater quantity. Two separate versions of the model were developed to simulate Alternative 1: 1) the mine operational period model, covering a 14-year period representing mine construction and operations (mine years -2 through 12); and 2) the post-closure model (mine years 13 through 112) (based on the Brown and Caldwell timing using negative numbers for construction years) to simulate conditions during reclamation and post closure (Brown and Caldwell 2018b). These model versions also were used to simulate three precipitation conditions representing the average, above average, and below average climate periods. The results of predictive simulations generated by the Alternative 1 model also were used to inform water quality modeling, as described in Section 4.9, Surface Water and Groundwater Quality.

4.8.2.1.1 SURFACE WATER QUANTITY

4.8.2.1.1.1 Changes in Stream Flow Characteristics (Daily, Seasonal, Annual)

The changes in surface water flow described in this section for Alternative 1 are compared to those of the simulated existing conditions. Changes in surface water flows in the analysis area are expected to result primarily from the proposed development of three open pits (Yellow Pine, Hangar Flats, and West End), which would require dewatering during mining operations.

Groundwater drawdown associated with dewatering of the pits would result in decreasing surface water flow, impacting downgradient surface water resources. Additionally, further reductions in surface water flow could result from lining additional lengths of rerouted stream segments, thus preventing groundwater discharge to the lined streams. The primary focus of the effects analysis is on predicted stream flows in Meadow Creek between the TSF and Hangar Flats pit; Meadow Creek downstream of the Hangar Flats diversion but upstream of the confluence with the EFSFSR; the EFSFSR at USGS Gaging Stations 13310800, 13311000, and 13311250; the EFSFSR downstream of Sugar Creek; and Sugar Creek at the USGS Gaging Station 13311450.

Construction and Operations

The model version developed to simulate the mine construction and operational period was used to simulate three precipitation conditions representing average, above average, and below average climate periods (Brown and Caldwell 2018b). These model simulations resulted in similar streamflow predictions for the three climate periods; therefore, the analysis here focuses on the average climatic condition. Streamflow simulations were performed for various locations potentially affected by mining operations, including locations of the USGS gaging stations in the analysis area (**Figure 3.8-2**).

In Meadow Creek, the model predicts reductions in late-season average monthly low flows between the TSF and Hangar Flats pit (**Figure 4.8-6**). This section of Meadow Creek is simulated as lined, preventing groundwater from discharging to the creek. Monthly average seasonal low flows under the No Action scenario average 2.7 cubic feet per second (cfs), compared to 2.3 cfs for the Alternative 1 scenario simulated by the mine operational period model (Brown and Caldwell 2018b). This represents a 15 percent reduction in monthly average seasonal low flows.

Effects to both seasonal monthly average peak and low flows are noted for Meadow Creek below the Hangar Flats diversion, but above the EFSFSR (**Figure 4.8-7**). These model-simulated effects are a result of dewatering the Hangar Flats pit. Between mine years 7 and 10, simulated seasonal low flows at that location are predicted to average 3.8 cfs for the No Action conditions, versus 2.1 cfs for the Alternative 1 scenario (45 percent reduction). The maximum simulated base flow reduction impact would occur at mine year 10, with a predicted flow reduction of 1.9 cfs. Simulated seasonal monthly average peak flows also would be impacted, primarily between mine years 7 and 10. Average peak flows for these years are predicted to be approximately 57 cfs for the No Action scenario, versus 53 cfs for the Alternative 1 scenario. The simulated reductions in average peak and low flows are caused by water table depression in the direct vicinity of the Hangar Flats pit, which reduces base flow and increases stream losses in Meadow Creek directly downstream of the lined diversion (Brown and Caldwell 2018b).

Late-season stream flow decreases also would occur under average climate conditions during the mine operational period in areas beyond the RIB influence. Such impacts are predicted at USGS Gaging Station 13311250 (EFSFSR above Sugar Creek) (**Figure 4.8-8**), with simulated seasonal monthly average low flows for the No Action Alternative scenario averaging 10.9 cfs, compared to 8.9 cfs for the Alternative 1 scenario. The maximum difference in late-season monthly average low flows at this station would occur during mine year 3, with a difference of approximately 3.4 cfs. These simulated late-season flow reductions are attributed to lower groundwater rates of discharge into the river, and/or increased stream seepage as a result of dewatering the Yellow Pine pit (Brown and Caldwell 2018b).

Simulated impacts to monthly average seasonal low flows in the EFSFSR downstream of the Sugar Creek confluence (**Figure 4.8-9**) are generally similar to those at USGS Gaging Station 13311250. Under the No Action scenario, the simulated monthly average seasonal low flows are predicted to average 19.2 cfs, versus 16.9 cfs for Alternative 1, a 12 percent reduction. The maximum difference in late-season low flows would occur during mine year 5, with a difference of approximately 3.5 cfs between the No Action and Alternative 1 simulations (Brown and Caldwell 2018b).

Simulations for other USGS Gaging Stations (13310800, 13311000, and 13311450) indicate minimal impact to streamflow at these locations as a result of mine dewatering (**Figures 4.8-10** through **4.8-12**).

In summary, the mine operational period model version results indicate that implementing Alternative 1 would impact stream flows. The simulated flows vary from no predicted change or minimal change (USGS Gaging Stations 13310800, 13311000, and 13311450) to a 45 percent reduction in low flows (Meadow Creek below the Hangar Flats diversion), depending on the stream location and the mine year. These impacts would occur during the 14-year mine operational period, and extend through post closure (discussed in the Closure and Reclamation section below). The extent of the predicted impacts to peak/base flows is expected to be mainly localized around the pits where dewatering indirectly effects downgradient surface water flow through groundwater drawdown. Modeling results also indicate that the impacts would extend to the downgradient limits of the analysis area, with an average of 12 percent reduction in annual low flows at EFSFSR downstream of Sugar Creek. Reductions in the EFSFSR base flow farther downstream (of Sugar Creek) are expected to be less pronounced due to inflows of additional surface water and groundwater.

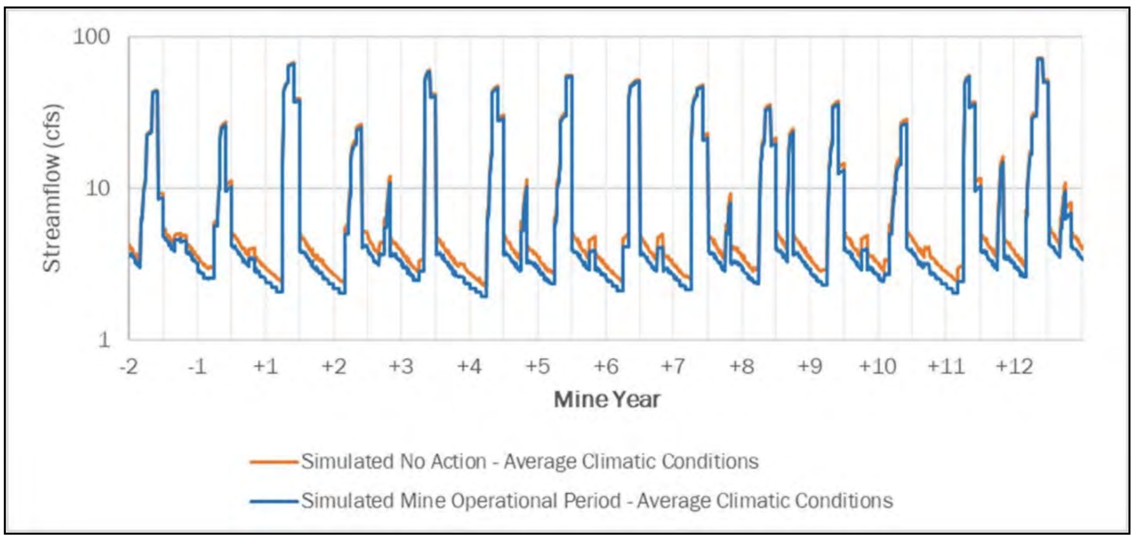


Figure Source: Brown and Caldwell 2018b, Graph 4-27

Figure Notes:

Existing conditions are represented as *Simulated No Action – Average Climate Conditions* on the graph. *Alternative 1* conditions are represented as *Simulated Mine Operational Period – Average Climate Conditions* on the graph.

Figure 4.8-6 Simulated Flow at Meadow Creek Between TSF and Hangar Flats Pit (Logarithmic) for the Mine Operational Period

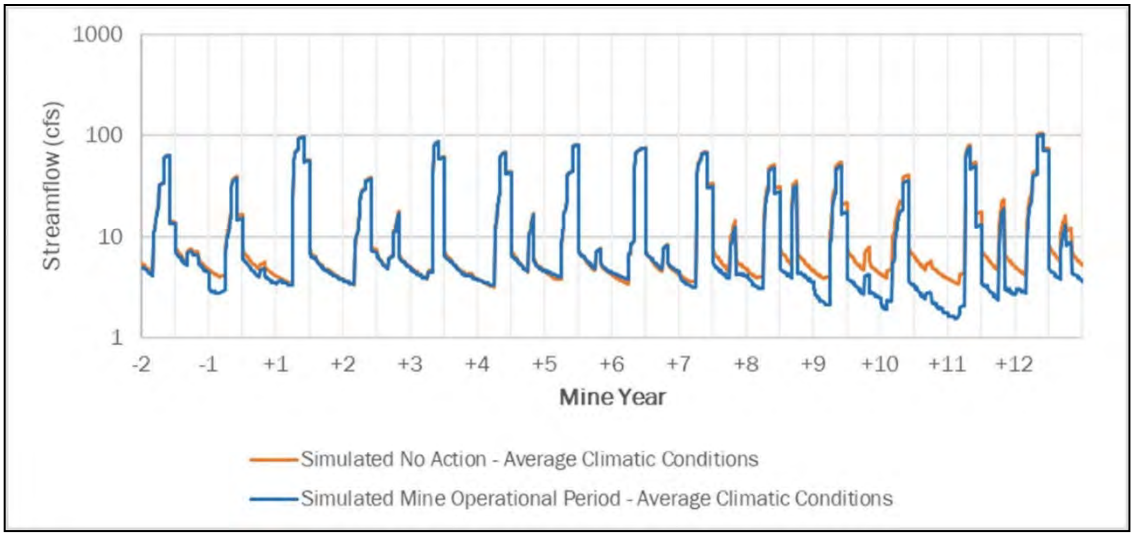


Figure Source: Brown and Caldwell 2018b, Graph 4-29

Figure Notes:

Existing conditions are represented as *Simulated No Action – Average Climate Conditions* on the graph. *Alternative 1* conditions are represented as *Simulated Mine Operational Period – Average Climate Conditions* on the graph.

Figure 4.8-7 Simulated Flow at Meadow Creek Downstream of the Hangar Flats Diversion but Upstream of the Confluence with EFSFSR (Logarithmic) for the Mine Operational Period

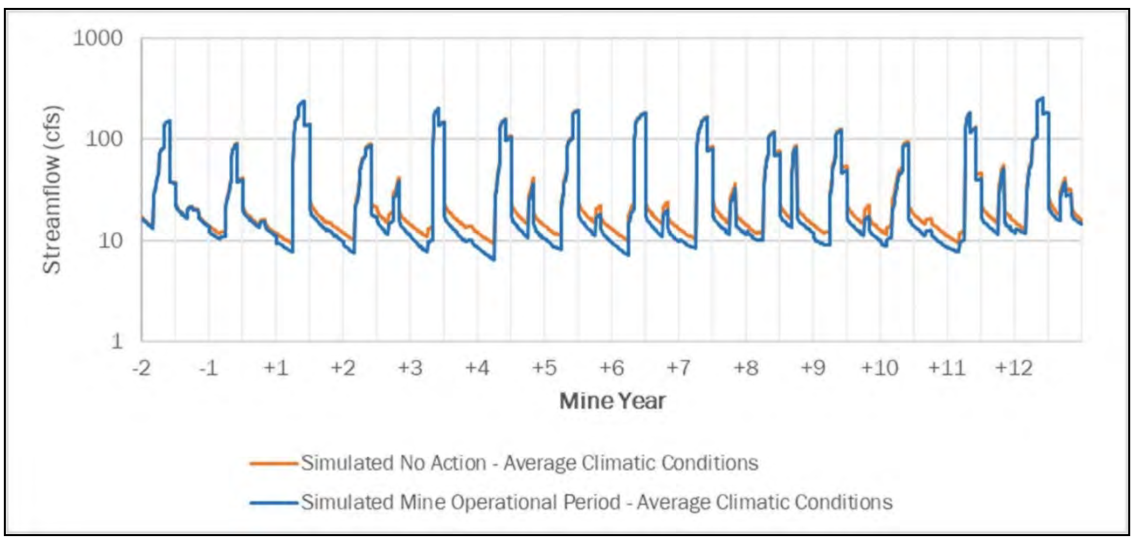


Figure Source: Brown and Caldwell 2018b, Graph 4-23

Figure Notes:

Existing conditions are represented as *Simulated No Action – Average Climate Conditions* on the graph. *Alternative 1* conditions are represented as *Simulated Mine Operational Period – Average Climate Conditions* on the graph.

Figure 4.8-8 Simulated Flow at USGS Gaging Station 13311250, EFSFSR above Sugar Creek (Logarithmic) for the Mine Operation Period

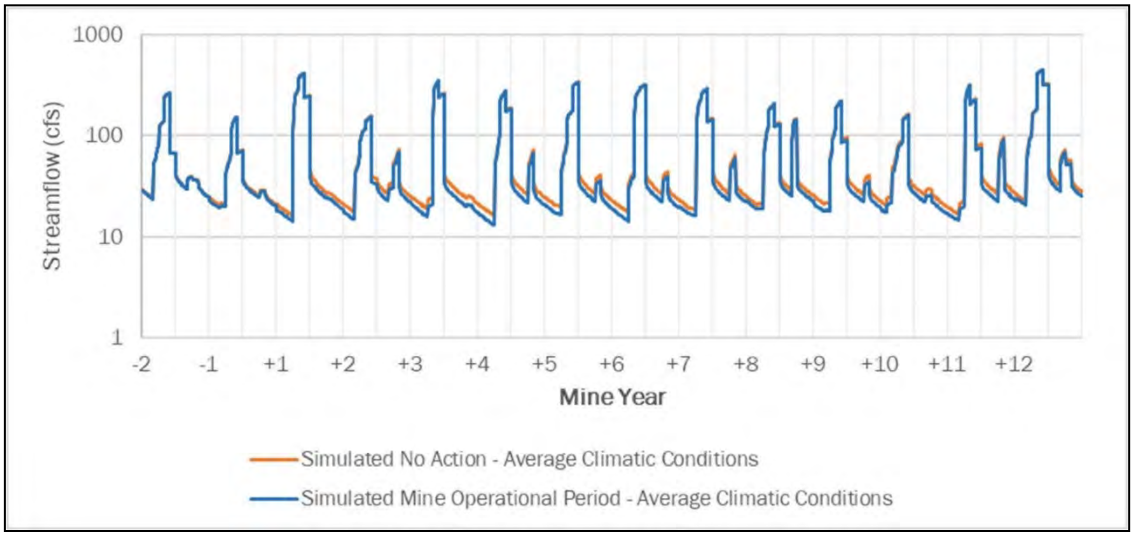


Figure Source: Brown and Caldwell 2018b, Graph 4-31

Figure Notes:

Existing conditions are represented as *Simulated No Action – Average Climate Conditions* on the graph. *Alternative 1* conditions are represented as *Simulated Mine Operational Period – Average Climate Conditions* on the graph.

Figure 4.8-9 Simulated Flow at EFSFSR Downstream of Sugar Creek (Logarithmic) for the Mine Operation Period

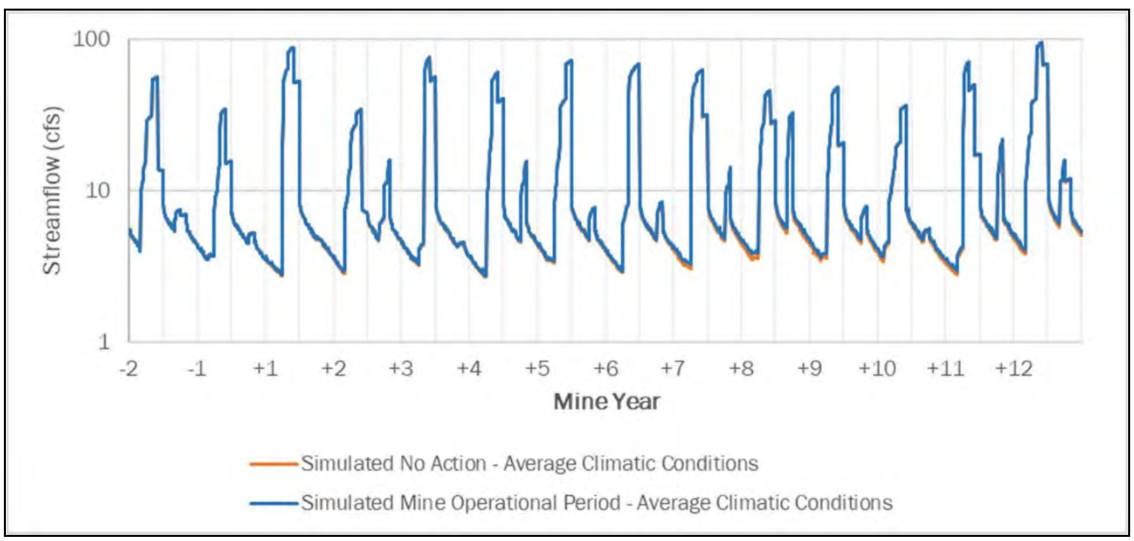


Figure Source: Brown and Caldwell 2018b, Graph 4-19

Figure Notes:

Existing conditions are represented as *Simulated No Action – Average Climate Conditions* on the graph. *Alternative 1* conditions are represented as *Simulated Mine Operational Period – Average Climate Conditions* on the graph.

Figure 4.8-10 Simulated Flow at USGS Gaging Station 13310800, EFSFSR above Meadow Creek (Logarithmic) for the Mine Operation Period

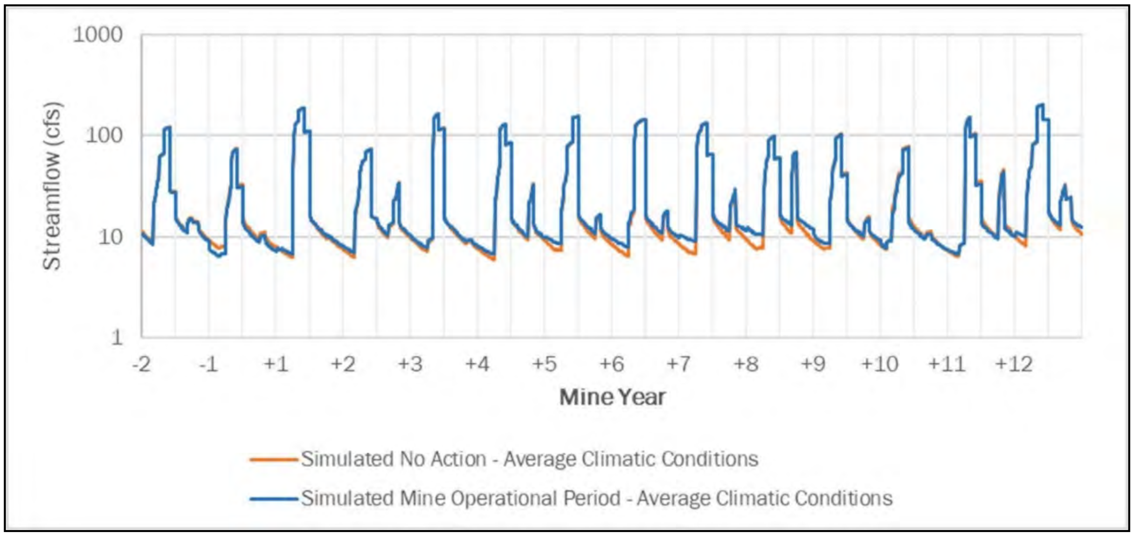


Figure Source: Brown and Caldwell 2018b, Graph 4-21

Figure Notes:

Existing conditions are represented as *Simulated No Action – Average Climate Conditions* on the graph. *Alternative 1* conditions are represented as *Simulated Mine Operational Period – Average Climate Conditions* on the graph.

Figure 4.8-11 Simulated Flow at USGS Gaging Station 13311000, EFSFSR at Stibnite (Logarithmic) for the Mine Operation Period

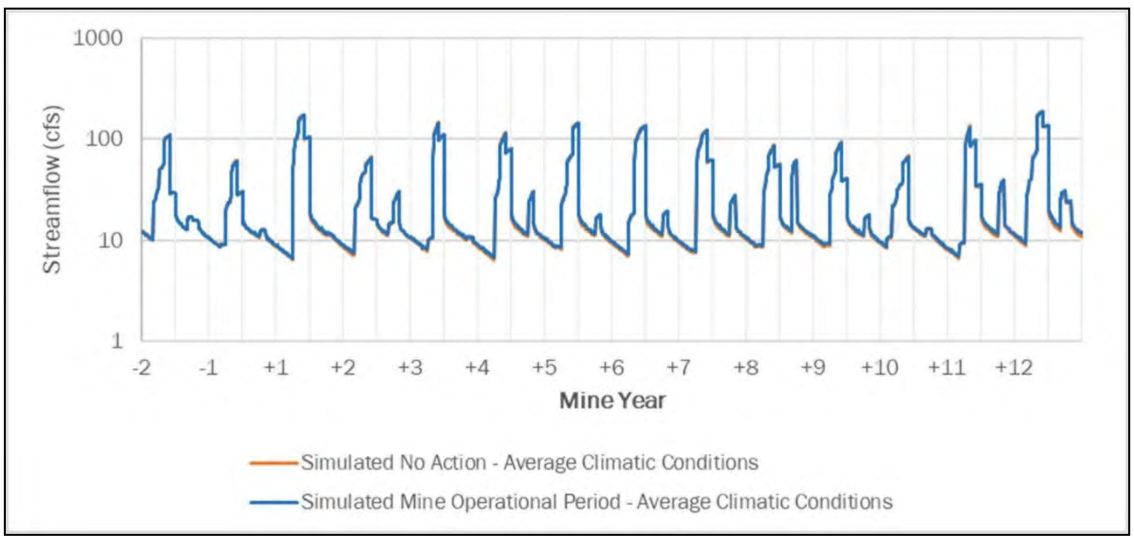


Figure Source: Brown and Caldwell 2018b, Graph 4-25

Figure Notes:

Existing conditions are represented as *Simulated No Action – Average Climate Conditions* on the graph. *Alternative 1* conditions are represented as *Simulated Mine Operational Period – Average Climate Conditions* on the graph.

Figure 4.8-12 Simulated Flow at USGS Gaging Station 13311450, Sugar Creek near Stibnite (Logarithmic) for the Mine Operation Period

The relative increase in flow along the EFSESR at different points of the river is illustrated by the flow statistics presented in **Table 3.8-2**. The mean flow at USGS Gaging Station 13311500 (EFSFSR approximately at the downgradient limit of the modeling boundary) was 50.39 cfs for the 13-year period from 1928 to 1941, and the mean flow at the USGS Gaging Station 13312000 (EFSFSR approximately 8 miles downstream of the downgradient limit of the modeling boundary) was 142.40 cfs over the same 13-year period. The minimum flows for the same stations and time period were 10.00 cfs and 28.00 cfs respectively (Brown and Caldwell 2017). This represents an approximate 180 percent increase in mean flow and minimum flow over the monitored points along an 8-mile distance of the river.

The EFSFSR is gradually gaining flow as a result of discharge of tributary streams and of groundwater, contributions of surface water runoff and of direct precipitation. The model simulations indicate an average of 12 percent reduction in annual low flows at EFSFSR downstream of Sugar Creek – which is the most downgradient point of the EFSFSR within the analysis area (which embraces the SGP area). Consequently, the percentage of flow reduction outside of the analysis area would be less than 12 percent.

Note that the model simulations do not take into account surface water discharge via Idaho Pollutant Discharge Elimination System (IPDES) permitted surface water outfalls, which would have a minor mitigating effect to surface water quantity by compensating for surface water reductions due to dewatering. This includes discharge associated with the Alternative 1 water treatment plant at the ore processing area and domestic wastewater treatment discharge from the worker housing facility to the EFSFSR.

Comparison of Stream Flow Characteristics for the Construction and Operations Period between Average, Below Average and Above Average Climate Conditions

The above discussion summarizes the results of the model simulations assuming average climate conditions. The model simulations of stream flows assuming the above average (wet) and below average (dry) climate conditions showed that “In general, there is little variation (between climate conditions) during seasonal low flows at any of the gages, with some lower monthly seasonal low flows simulated during mine year -1. Variation in simulated surface flows are evident during monthly average seasonal peak flow periods, as expected, given that most precipitation differences (between climate conditions) occur as variations in snowpack contributing to spring runoff. r example, monthly average flows at gage 13311000 (EFSFSR at Stibnite) for mine year 5 are predicted to peak at approximately 33 cfs for the below average period, 155 cfs for the average period, and 186 cfs for the above average period. Variations in peak flows are noted throughout the mining period at all gages because of variations in the simulated climate sequences” (Brown and Caldwell 2018b). Graphs 4-32 through 4-35 of the Brown and Caldwell Hydrologic Model Proposed Action Report (2018b) present a comparison of flows from the average, above average, and below average periods at the principal USGS gaging stations (within the analysis area), while Appendix D of that report provides the simulated monthly average stream flows for all climate conditions. Similar pattern of differences is expected for all the action alternatives.

Closure and Reclamation

The post closure period model version was used to assess potential changes in surface flows after mining activities cease (Brown and Caldwell 2018b). The model simulated the flow conditions for 100 years after cessation of mining activities (equivalent to mine years 13 through 112). The principal objective of closure model simulations was to estimate the rate and timing of groundwater and surface water flows around the three principal locations where pit lakes would develop (Hangar Flats, West End, and Midnight Area). The model also was designed to assess the return of long-term surface water and groundwater flows back to a stable seasonal pattern, similar to pre-mining conditions.

The lined segment of Meadow Creek upstream of the Hangar Flats diversion would be restored in post closure year 6 to route surface flows into the Hangar Flats pit lake once the lake fills with water. After the creek segment is routed into the pit lake, the seasonal flow pattern for this segment is predicted to be similar to existing conditions for the remainder of the post closure period (**Figure 4.8-13**). Downstream of the Hangar Flats diversion, but upstream of the confluence with the EFSFSR, flow reductions are predicted to persist during the post closure period, with the stream simulated as being nearly dry during seasonal low-flow periods for the first 3 years after mining. The predicted stream flows generally begin to approximate existing conditions after post closure year 10, and thereafter remain in a long-term, stable seasonal pattern (**Figure 4.8-14**).

For the EFSFSR upstream of Sugar Creek, late-season low flows also are predicted to be lower at USGS Gaging Station 13311250 during the first decade of the post closure period as groundwater levels recover from pit dewatering. After post closure year 10, the stream flows are predicted to return to a stable long-term seasonal pattern similar to existing conditions (**Figure 4.8-15**).

Similar reductions in average monthly flows are predicted to persist for the first decade of the post closure period downstream of Sugar Creek (**Figure 4.8-16**), as groundwater levels recover from dewatering and backfilling of the Yellow Pine pit. The stream flows and groundwater levels are predicted to recover by post closure year 10, to approximate existing conditions. The flows would thereafter exhibit a long-term, stable seasonal pattern. Above Meadow Creek, the EFSFSR (USGS Gaging Station 13310800) model simulations indicate that very little impact is expected to streamflow at this location, with simulated seasonal peak and low flows covering a range similar to those for the existing conditions model (**Figure 4.8-17**). Simulated flows for the EFSFSR at USGS Gaging Station 13311000 are generally lower in the early years of the post closure period.

Both seasonal peak and low flows are predicted to be reduced in post closure years 0 through 7 before recovering to a stable seasonal pattern similar to existing conditions (**Figure 4.8-18**).

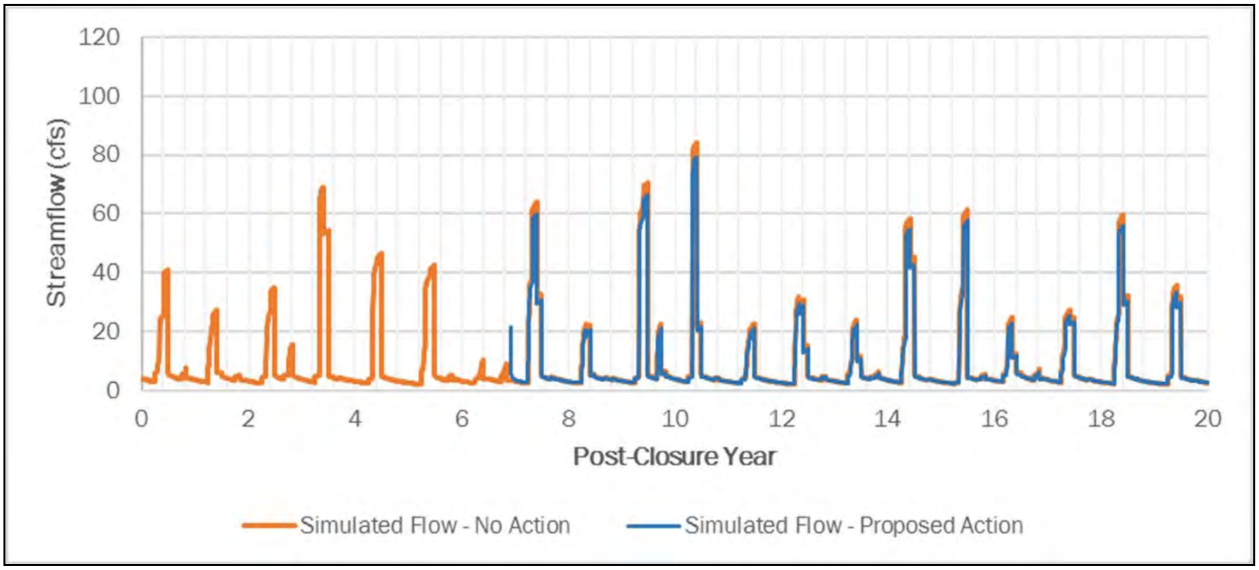


Figure Source: Brown and Caldwell 2018b, Graph 5-24

Figure Notes:

Existing conditions are represented as *Simulated Flow - No Action* on the graph. *Alternative 1* conditions are represented as *Simulated Flow – Proposed Action* on the graph.

Figure 4.8-13 Simulated Flow at Meadow Creek Upstream of Hangar Flats Diversion (Logarithmic) for the First 20 Years of Post Closure

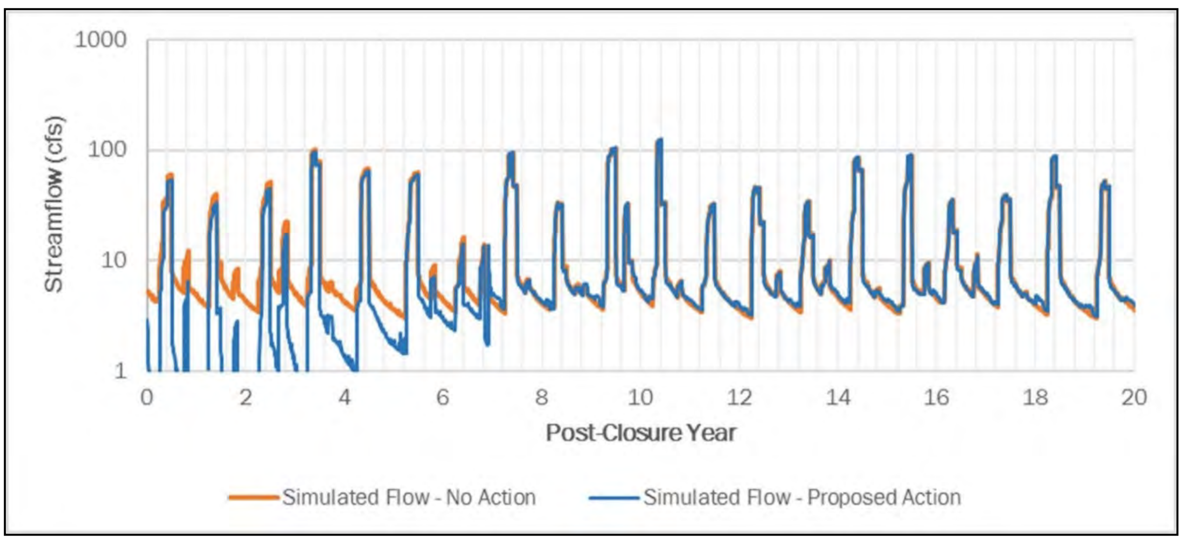


Figure Source: Brown and Caldwell 2018b, Graph 5-28

Figure Notes:

Existing conditions are represented as *Simulated Flow - No Action* on the graph. *Alternative 1* conditions are represented as *Simulated Flow – Proposed Action* on the graph.

Figure 4.8-14 Simulated Flow at Meadow Creek Upstream of EFSFSR (Logarithmic) for the First 20 Years of Post Closure

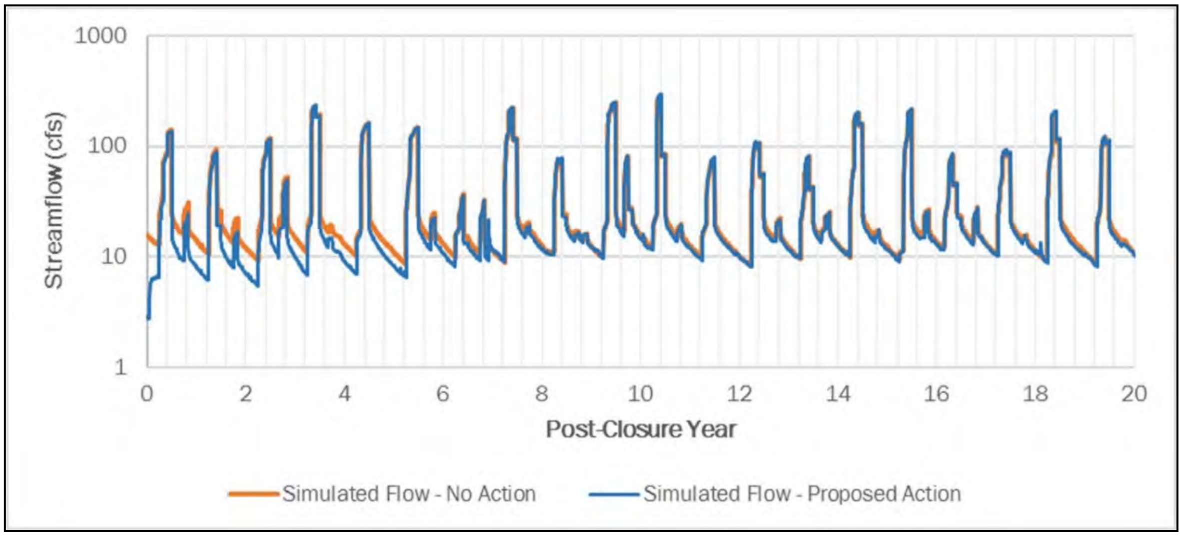


Figure Source: Brown and Caldwell 2018b, Graph 5-16

Figure Notes:

Existing conditions are represented as *Simulated Flow - No Action* on the graph. *Alternative 1* conditions are represented as *Simulated Flow – Proposed Action* on the graph.

Figure 4.8-15 Simulated Flow at USGS Gaging Station 13311250, EFSFSR above Sugar Creek (Logarithmic) for the First 20 Years of Post Closure

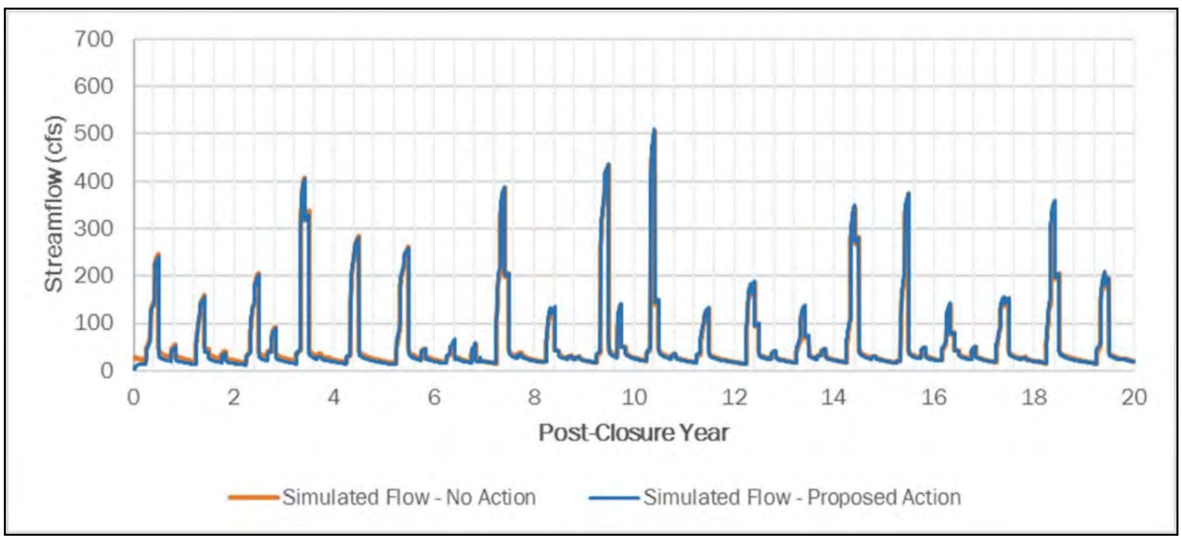


Figure Source: Brown and Caldwell 2018b, Graph 5-32

Figure Notes:

Existing conditions are represented as *Simulated Flow - No Action* on the graph. *Alternative 1* conditions are represented as *Simulated Flow – Proposed Action* on the graph.

Figure 4.8-16 Simulated Flow at EFSFSR Downstream of Sugar Creek (Logarithmic) for the First 20 Years of Post Closure

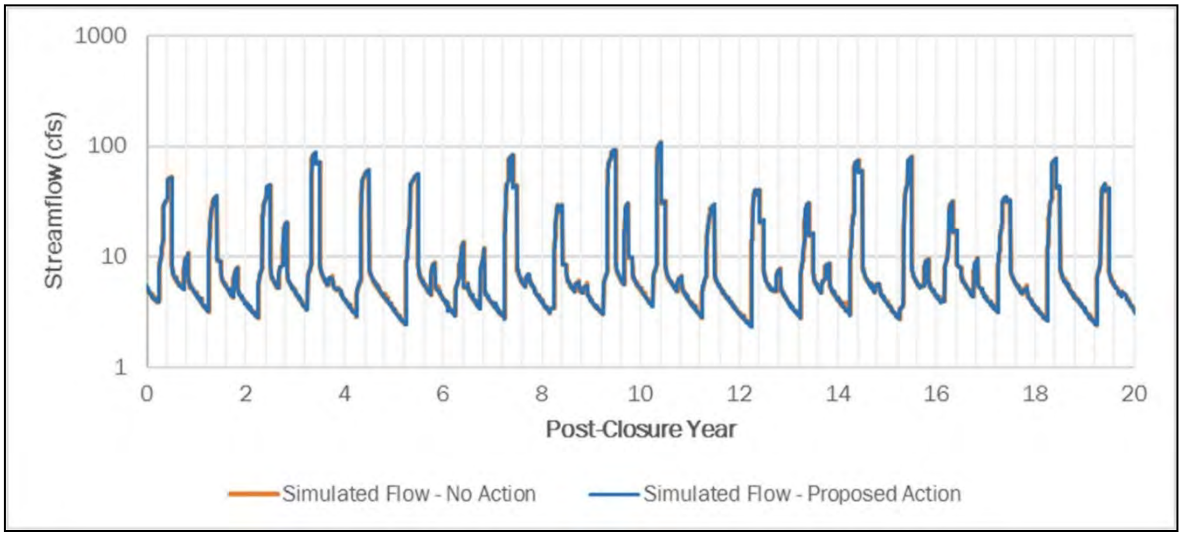


Figure Source: Brown and Caldwell 2018b, Graph 5-8

Figure Notes:

Existing conditions are represented as *Simulated Flow - No Action* on the graph. *Alternative 1* conditions are represented as *Simulated Flow – Proposed Action* on the graph.

Figure 4.8-17 Simulated Flow at USGS Gaging Station 13310800, EFSFSR above Meadow Creek (Logarithmic) for the First 20 Years of Post Closure

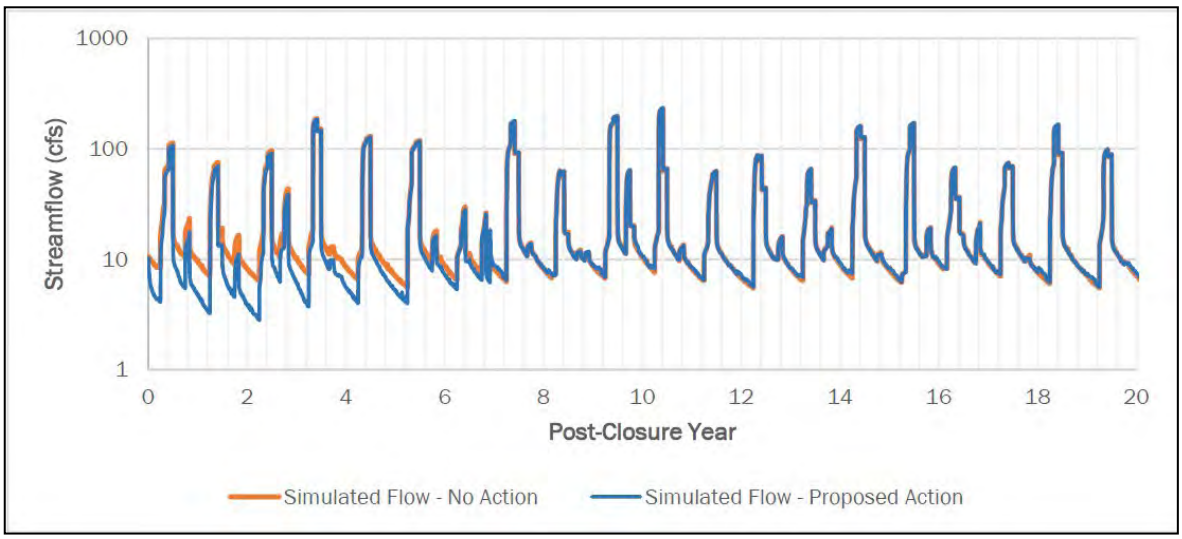


Figure Source: Brown and Caldwell 2018b, Graph 5-12

Figure Notes:

Existing conditions are represented as *Simulated Flow - No Action* on the graph. *Alternative 1* conditions are represented as *Simulated Flow – Proposed Action* on the graph.

Figure 4.8-18 Simulated Flow at USGS Gaging Station 13311000, EFSFSR at Stibnite (Logarithmic) for the First 20 Years of Post Closure

For Sugar Creek above the EFSFSR (USGS Gaging Station 13311450), model simulations indicate that very little impact is expected to streamflow at this location, with simulated seasonal peak and low flows for Alternative 1 covering a range similar to those of existing conditions (**Figure 4.8-19**).

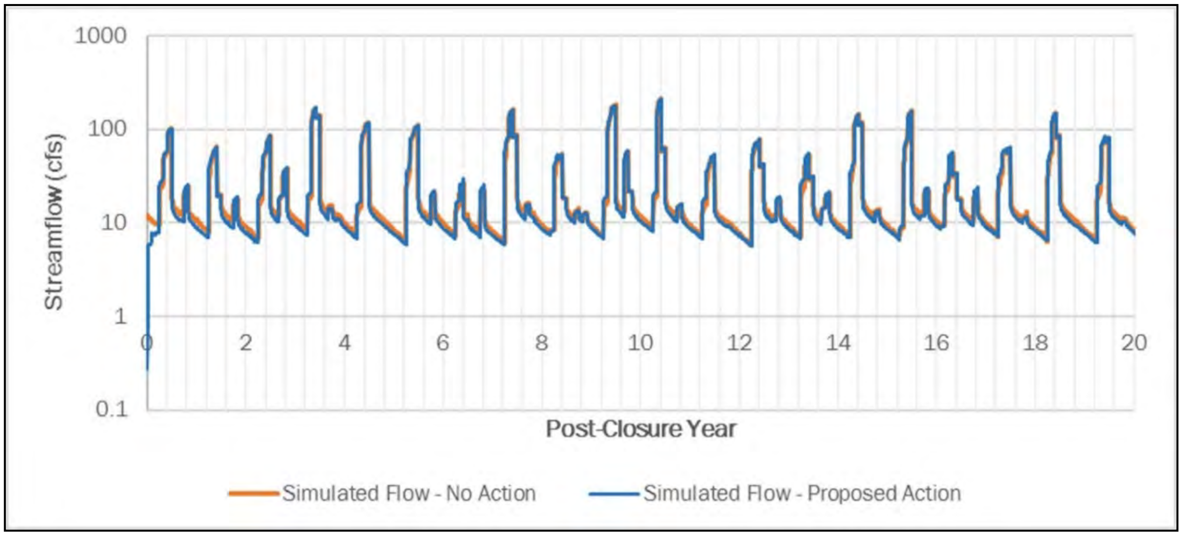


Figure Source: Brown and Caldwell 2018b, Graph 5-20

Figure Notes:

Existing conditions are represented as *Simulated Flow - No Action* on the graph. *Alternative 1* conditions are represented as *Simulated Flow – Proposed Action* on the graph.

Figure 4.8-19 Simulated Flow at USGS Gaging Station 13311450, Sugar Creek near Stibnite (Logarithmic) for the First 20 Years of Post Closure

In summary, the model simulations indicate that implementation of Alternative 1 would result in some impacts to the post closure stream flow. The simulated flows vary from minimal to no predicted change at USGS Gaging Stations 13310800 and 13311450, to a 100 percent reduction (dry) in Meadow Creek upstream of the EFSFSR, depending on the stream and the mine year.

Surface flows are generally predicted to recover to the existing pre-mine conditions within approximately 10 years after mining operations have ceased. The predicted impacts to peak/base flows are expected to be limited to areas around the pits. Modeling simulations indicate that notable impacts would be limited to the analysis area. Farther downstream, base flow reductions are expected to be smaller due to incremental inflows of surface water and groundwater along the run of the river.

4.8.2.1.2 GROUNDWATER QUANTITY

The model was the main tool used to assess the effects of implementing Alternative 1 on groundwater quantity (Brown and Caldwell 2018b). Groundwater quantity effects are defined here as changes to the groundwater flow system. The effects analysis is focused on assessing the extent, magnitude, and duration of groundwater level changes. Changes to the groundwater system also could affect the surface water system, as groundwater supplies water to surface water streams (see discussion provided above in Section 4.8.2.1.1, Surface Water Quantity).

4.8.2.1.2.1 Construction and Operations

Three model simulations were completed to assess potential changes to the groundwater and surface water flow systems during the mine operational period for Alternative 1. Those simulations were completed for the 14-year average, above average, and below average climate condition periods. The primary objectives for the mine operational period model were to quantify dewatering rates required to develop the open pits, assess local effects of dewatering on groundwater levels and stream flows, and evaluate ranges of surface water and groundwater flows at different locations and for different SGP facility footprints. The results of those model simulations also were used to evaluate potential impacts upon GDEs (see sub-section Groundwater-Dependent-Ecosystems Potentially Affected by Drawdown below).

Although in practice pumping wells would be used to dewater all the mine pits, Brown and Caldwell (2018b) used model drain cells to estimate average pit dewatering rates, which is a standard practice in groundwater modeling.

Yellow Pine Pit

The model-simulated dewatering rates for the Yellow Pine pit for average climatic conditions (called “climate periods” in the modeling report; Brown and Caldwell 2018b) are shown on **Figure 4.8-20**. Most dewatering flows produced from the Yellow Pine pit beginning in mine year 1 would be derived from fractured bedrock on the valley floor, with minor contributions from overlying alluvium, uplands overburden, and un-fractured rock. Dewatering flows for the Yellow Pine pit would reach a peak rate of approximately 1,800 gallons per minute (gpm) in mine year 7. After mine year 7, backfilling of the Yellow Pine pit would be initiated, and simulated dewatering rates would be substantially reduced by mine year 10 as a result of the backfill. The years presented are based on the Brown and Caldwell model which assumes construction years as -3, -2, and -1 and Year 1 is the start of mining.

The rates of dewatering simulated for above- (wet) and below-average (dry) climatic conditions are similar to the simulated average conditions. Similarity between average and above-average conditions is explained by the fact that higher precipitation years generally result in high spring snowpack. Because the maximum recharge rate to groundwater is limited by the hydraulic conductivity of surface material, higher snowpack results primarily in greater surface runoff, not additional recharge to groundwater.

The below-average climate period does result in some reductions in simulated dewatering flows for the Yellow Pine pit. For example, the model-computed total dewatering rates are approximately 200 to 250 gpm lower for the below average climate simulation for mine year 4 and mine year 6, suggesting that snowmelt in those years was insufficient to fully refill the groundwater system. Years with sufficient snowpack to produce the maximum recharge rates to groundwater show generally similar dewatering rates for all three climate conditions (Brown and Caldwell 2018b).

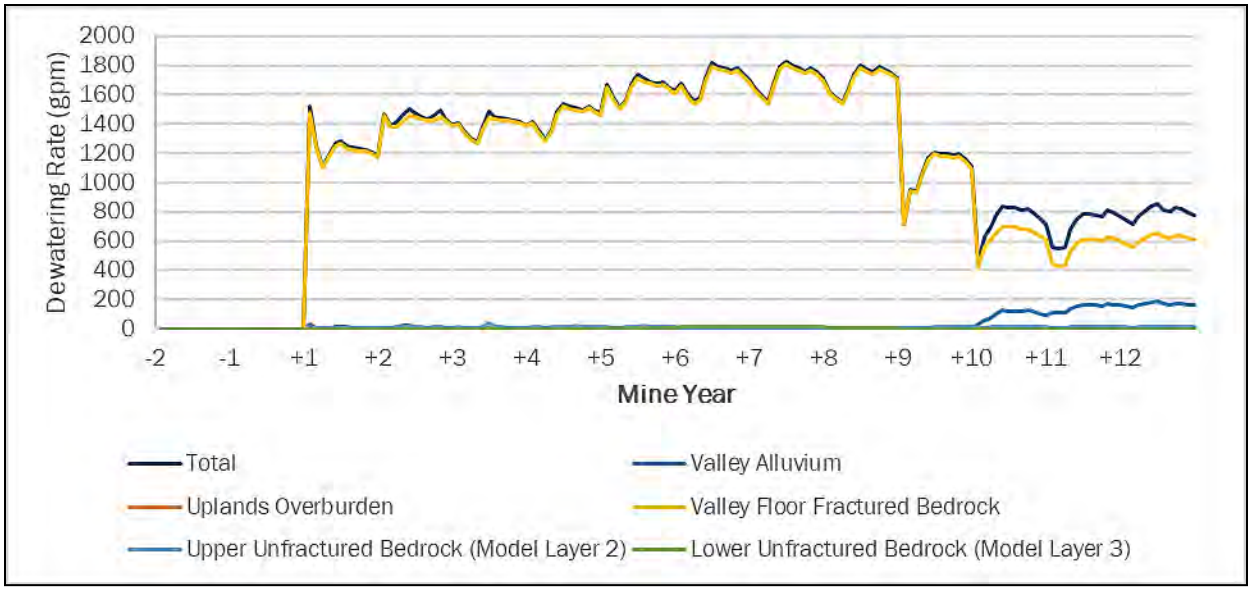


Figure Source: Brown and Caldwell 2018b, Graph 4-1

Figure 4.8-20 Simulated Dewatering Rates for the Yellow Pine Pit—Average Climate Conditions

Hangar Flats Pit

The model-simulated dewatering rates for the Hangar Flats pit for average climate condition periods are shown on **Figure 4.8-21**. Most simulated dewatering flows are produced beginning in mine year 7 (based on the years as presented by Brown and Caldwell), as mining progresses below the local alluvial water table. Hangar Flats pit dewatering flows are derived primarily from valley alluvium (up to 70 percent), with some flow (up to 30 percent) derived from fractured bedrock on the valley floor underlying the alluvium. Minor flows (less than 1 percent) are derived from unfractured bedrock and upland overburden.

Spikes in simulated dewatering rates occur at the beginning of mine years 7 and 8, with total rates above 2,800 gpm occurring in mine year 8. These spikes can be interpreted to represent worst-case predictions, and are an artifact of instantaneous, step wise changes in drain elevations set in the model to represent changes in planned end of year topography of the pit. This step wise change results in a model simulating increased groundwater inflows into the drains due to steep hydraulic gradients – gradients that would not exist in the real system in which the pit bottom elevations would be changing gradually throughout the period of mining. A more likely estimate of peak dewatering flows from Hangar Flats pit is approximately 2,100 gpm during mine year 8 (Brown and Caldwell 2018b).

For the Hangar Flats pit dewatering, there is very little variation simulated between the average, wet, and dry climate conditions. Like in the case of Yellow Pine pit, this is because most of the precipitation variation occurs as snowpack contributing to changes in surface runoff, not groundwater recharge (Brown and Caldwell 2018b).

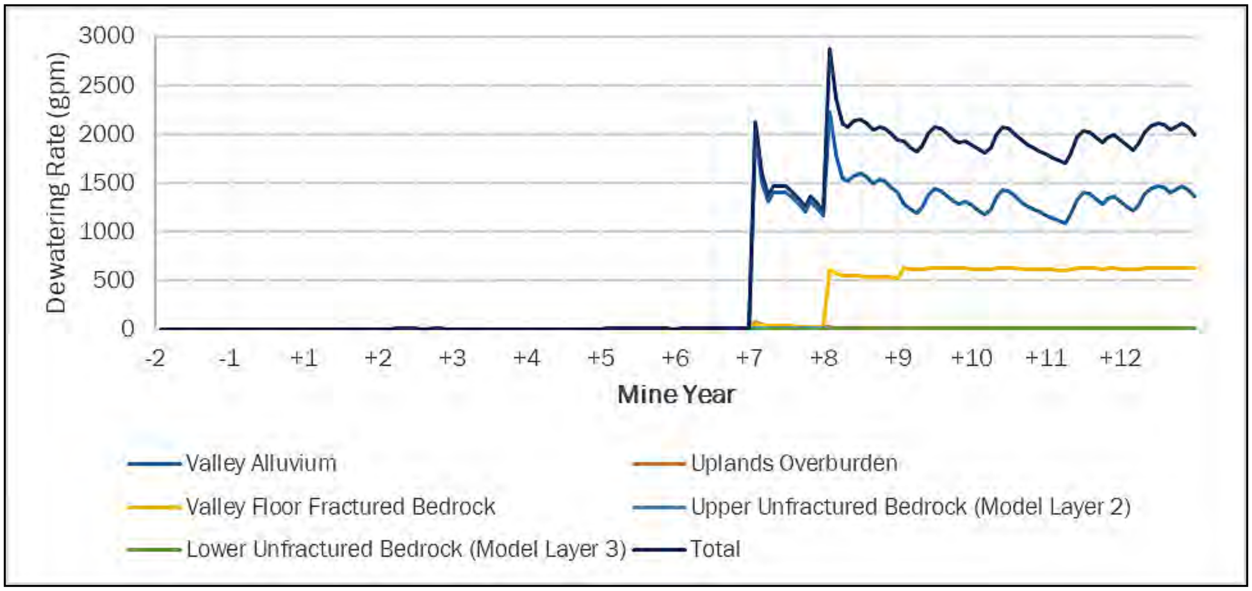


Figure Source: Brown and Caldwell 2018b, Graph 4-5

Figure 4.8-21 Simulated Dewatering Rates for the Hangar Flats Pit—Average Climate Conditions

West End Pit

Simulated dewatering rates for the West End pit for average climatic conditions are shown on **Figure 4.8-22**. The model-simulated dewatering flows do not begin until mine year 10 (based on mine years as presented by Brown and Caldwell), when the proposed pit topography would extend below the current elevation of West End Creek, encountering groundwater along the stream valley. As shown on **Figure 4.8-22**, total dewatering flows peak at approximately 440 gpm in mine year 12. Dewatering flows at West End pit are primarily derived from fractured bedrock underlying West End Creek, with minor flows from unfractured bedrock.

As in the case of Yellow Pine pit and Hangar Flats pit, the model-simulated dewatering rates are similar for the above average and average climatic conditions. However, when simulating dry climatic conditions, the peak dewatering rates are approximately 100 gpm lower than the other climate scenarios in mine year 12, while producing similar results during most other periods (Brown and Caldwell 2018b).

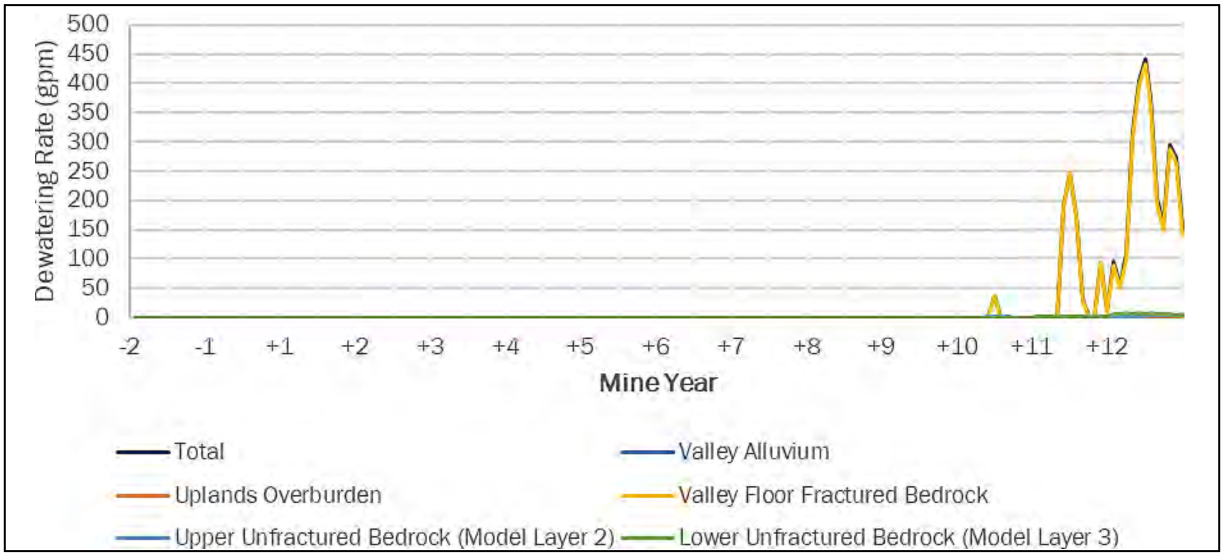


Figure Source: Brown and Caldwell 2018b, Graph 4-9

Figure 4.8-22 Simulated Dewatering Rates for the West End Pit—Average Climate Conditions

Drawdown

Drawdown refers to a decline in groundwater elevation due to pumping and removal of groundwater faster than the rate of natural replenishment. When groundwater levels are lowered, even for a short period of time, it may indirectly impact other resources that are sustained by groundwater discharge, such as surface water flows, springs, seeps and wetlands, which may potentially support GDEs – see discussion below under the sub-section Groundwater-Dependent-Ecosystems Potentially Affected by Drawdown.

The Alternative 1 mine operational period model version was developed to simulate the depression of the water table in response to dewatering of the three proposed open pits. **Figures 4.8-23, 4.8-24,** and **4.8-25** show drawdown in model Layer 1 (representing valley alluvium plus thin upland overburden) at the end of mine years 6, 7, and 12, respectively (mine years as presented in the modeling report). These years were chosen as generally representative of the maximum drawdowns associated with each pit, based on a review of simulated water levels throughout the mine operational period.

The contours show the extent of simulated drawdowns greater than 5 feet (in model Layer 1) for the average climate period model. Drawdowns less than 5 feet are within the natural variation of seasonal water table fluctuations, and are therefore not considered a potential impact on the local hydrologic system.

The maximum extent of alluvial drawdown in the Yellow Pine pit area is predicted to occur at the end of mine year 6 (**Figure 4.8-23**). The cone of depression induced by dewatering of the

Yellow Pine pit (and defined by drawdown greater than or equal to 5 feet) would extend approximately 2,100 feet north of the pit and approximately 1,700 feet to the southeast in the Midnight Creek valley.

Alluvial drawdown near the West End pit along West End Creek would result from rerouting the creek around the pit. The maximum extent of drawdown from the stream rerouting would occur at the end of mine year 12, with an elliptical cone of depression approximately 3,000 feet long that would parallel the original West End Creek valley (**Figure 4.8-25**). A separate spur of the cone of depression also would extend to the northeast into the valley of Sugar Creek.

The maximum alluvial drawdown near the Hangar Flats pit would occur at the end of mine year 10, when mining at that pit would end. Although graphical drawdown results are not available for that year in the Brown and Caldwell (2018b) report, the simulated groundwater contours for mine year 12, depicted on **Figure 4.8-25**, provide the closest approximation of the maximum predicted drawdowns for the pit. As shown on that figure, the cone of depression during mine year 12 would extend beyond the western, southern, and eastern pit boundaries. Downstream of the pit, the extent of drawdown would be limited by infiltration from the RIBs, which would maintain high groundwater levels along Meadow Creek and at the confluence of Meadow Creek with the EFSFSR. The maximum drawdown in mine year 12 is predicted to occur beneath the southeastern part of Hangar Flats pit, and would be as much as 200 feet below the static water table surface. The cone of depression is predicted to extend approximately 5,700 feet along the Meadow Creek Valley, and would be as much as 3,700 feet wide.

The predicted drawdown in model layer 2 (representing valley floor fractured bedrock and un-fractured bedrock below) for the average climate period is presented on **Figures 4.8-26**, **4.8-27**, and **4.8-28** for the end of mine years 6, 7, and 12, respectively. Drawdown in the bedrock is expected to be greater than in the overlying alluvium, as the pits are proposed to be mined hundreds of feet into bedrock. As shown on the figures, the effects of dewatering would create one continuous cone of depression around the Yellow Pine and West End pits. At the end of mine year 7 (**Figure 4.8-27**), the simulated drawdown associated with the Yellow Pine and West End pits is predicted to extend approximately 1,400 feet to the west of the pits beneath areas of high topographic relief, approximately 3,300 feet to the south beneath the EFSFSR, and approximately 2,000 feet east of the West End pit. By mine year 12 (**Figure 4.8-28**), the simulated drawdown also would extend approximately 3,000 feet to the north across Sugar Creek. The timing of the maximum predicted drawdown would generally coincide with the end of mining in each pit. For example, maximum bedrock drawdowns are predicted to exceed 500 feet beneath the Yellow Pine pit after mine year 7 (drawdown is defined as a difference between groundwater levels simulated by the model calibrated to existing conditions, and groundwater levels simulated by the model predictive simulations), and may exceed 600 feet beneath the West End pit after Mine Year 12 (Brown and Caldwell 2018b).

The maximum bedrock drawdown associated with Hangar Flats pit also would occur around the end of mine year 12, when drawdowns in the central pit area are predicted to exceed 500 feet (**Figure 4.8-28**). At that time, the cone of depression around the pit would extend approximately 1,600 feet to the west beneath areas of high topographic relief, approximately 1,600 feet to the southwest towards the Hangar Flats DRSF and TSF, and approximately 1,000 feet to the north beneath areas of high topographic relief. The extent of bedrock drawdown to the northeast and east of the pit would be controlled to some extent by infiltration into the RIBs and by rerouting of streamflow to the north side of the pit.

Groundwater Dependent Ecosystems Potentially Affected by Drawdown

Dewatering of the mine pits could potentially affect nearby seeps, springs, and wetlands, and the GDEs they support. **Figure 4.8-29** shows which of those features (as catalogued during the hydrology field survey completed by HydroGeo in 2012) are within the model-computed areas of water table drawdown larger than 5 feet. The 5-foot drawdown contour is represented on **Figure 4.8-29** by the blue contour lines. Section 3.10, Vegetation, and Section 3.11, Wetlands and Riparian Habitat, of this environmental impact statement (EIS) provide a discussion of the plant species, animal species and ecosystems that could be affected by lowering groundwater levels. Using the 5-foot drawdown contour for delineating the areas of potential dewatering impacts upon the GDEs is justified because: 1) groundwater levels seasonally fluctuate within the analysis area from approximately 2 to 20 feet (Section 3.8.3.2.2, Groundwater Levels, Gradients, and Flow Directions), and 2) most of the seeps, springs and wetlands are likely not dependent upon groundwater only. Other sources of water that potentially support the GDEs include surface runoff and water migrating at shallow depths above the water table, such as interflow and through-flow. Finally, it would be difficult to attempt using a regional-scale groundwater model (simulating this dynamic, seasonally fluctuating system) to reliably estimate water table drawdowns smaller than 5-feet. Groundwater level data show that water table elevations fluctuate seasonally from two to 20 feet. Lowering water table less than five feet would likely impact the GDEs only part of the year, thus limiting impacts to those types of ecosystems.

All the limitations of and uncertainties associated with the model simulations and available measurement data point out to the possibility that the area within which GDEs could be potentially impacted by the Proposed Action may by somewhat larger than presented on **Figure 4.8-29**. GDEs near the pits should be subject to long-term monitoring.

Figure 4.8-29 illustrates that only a small fraction of the GDEs catalogued to be present within the analysis area are at risk of dewatering impact. Such impacts would occur only in cases where the hydrology of the seeps, springs, and wetlands affected is dominated, or largely influenced by groundwater discharge. However, since hydrology of the GDEs has not been characterized, the GDEs at risk should be subject to monitoring requirements

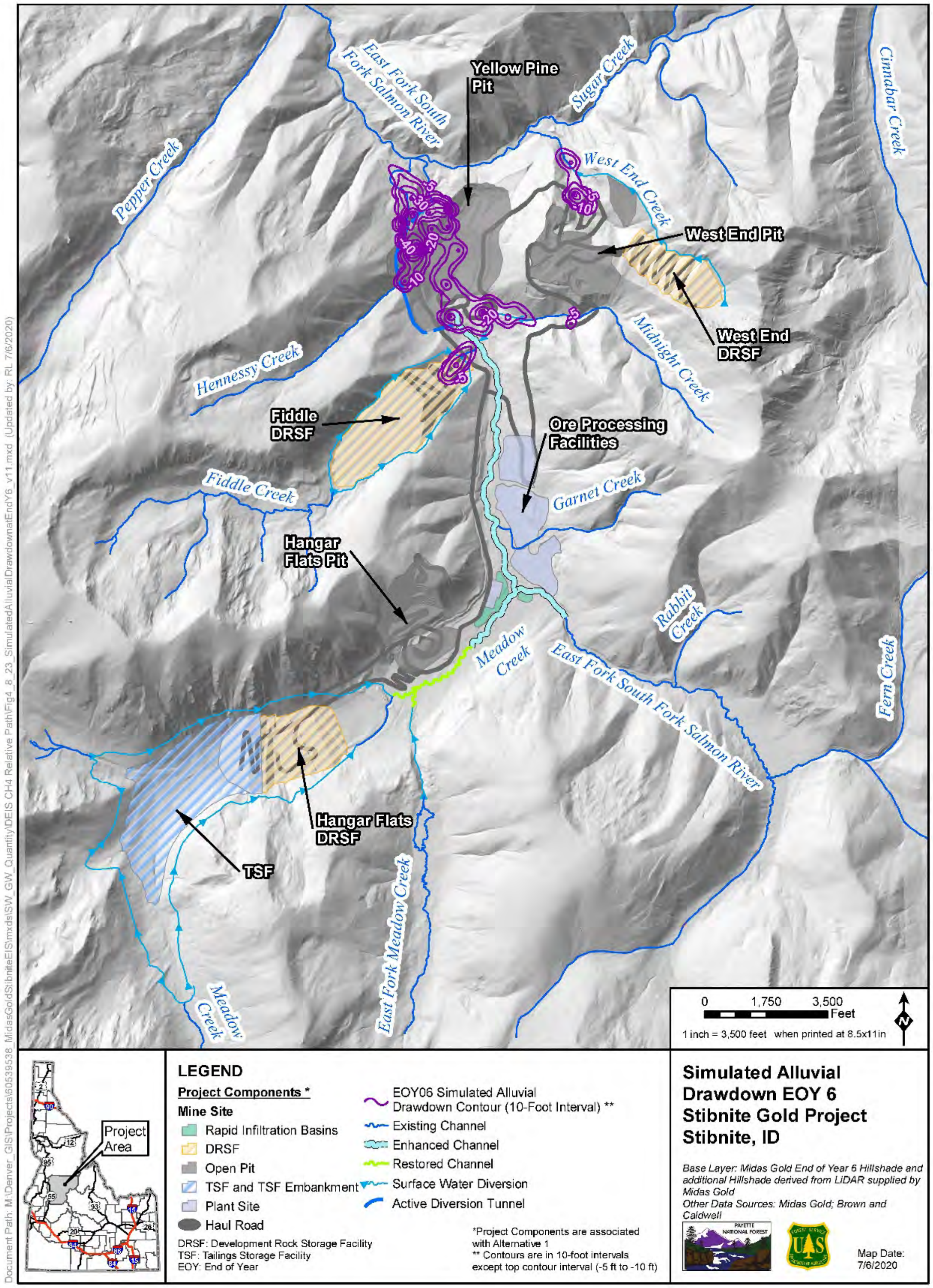


Figure Source: Brown and Caldwell 2018b, Figure 4-4

Figure 4.8-23 Simulated Alluvial Drawdown End of Year (EOY) 6

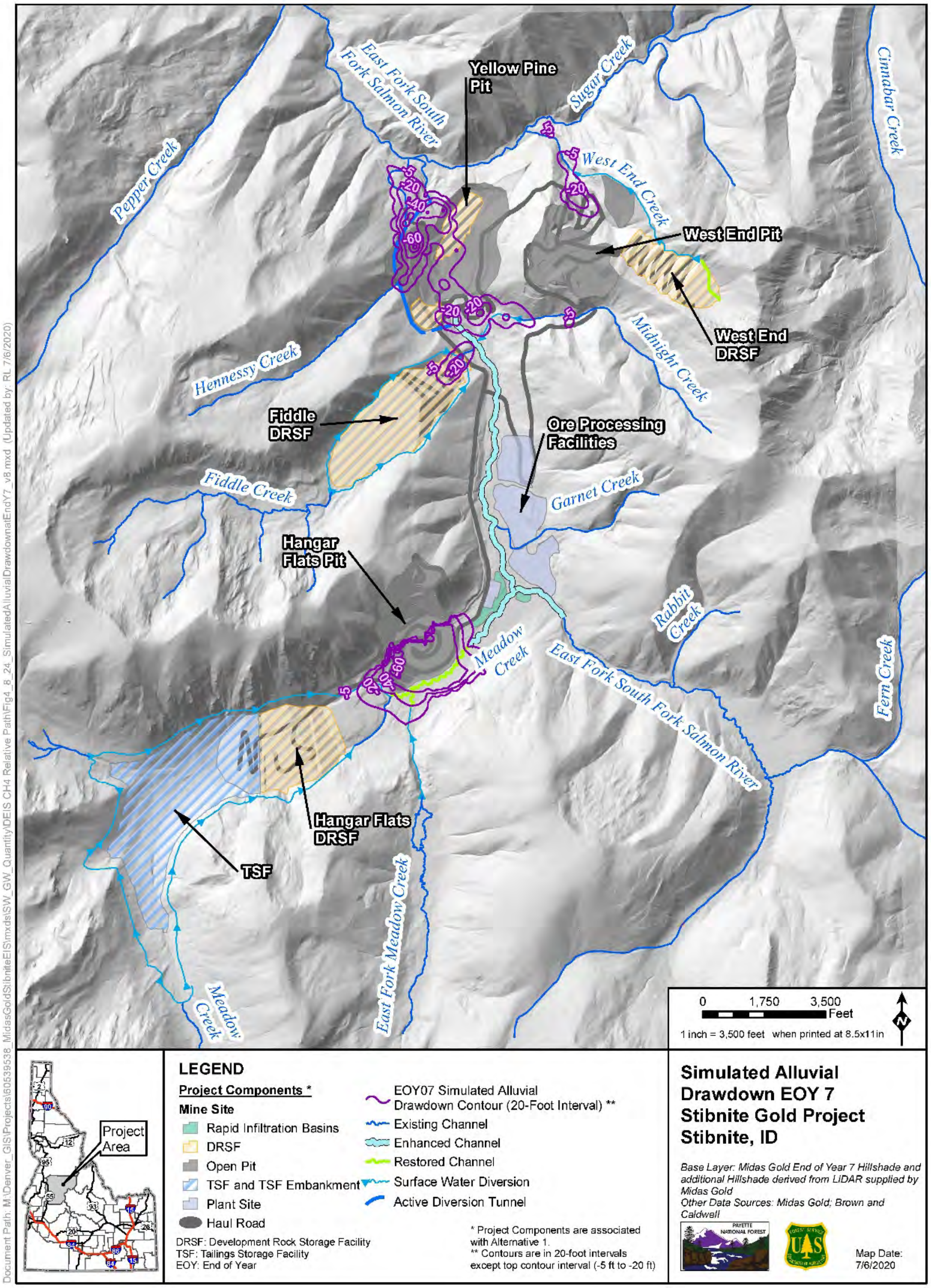


Figure Source: Brown and Caldwell 2018b, Figure 4-5

Figure 4.8-24 Simulated Alluvial Drawdown EOY 7

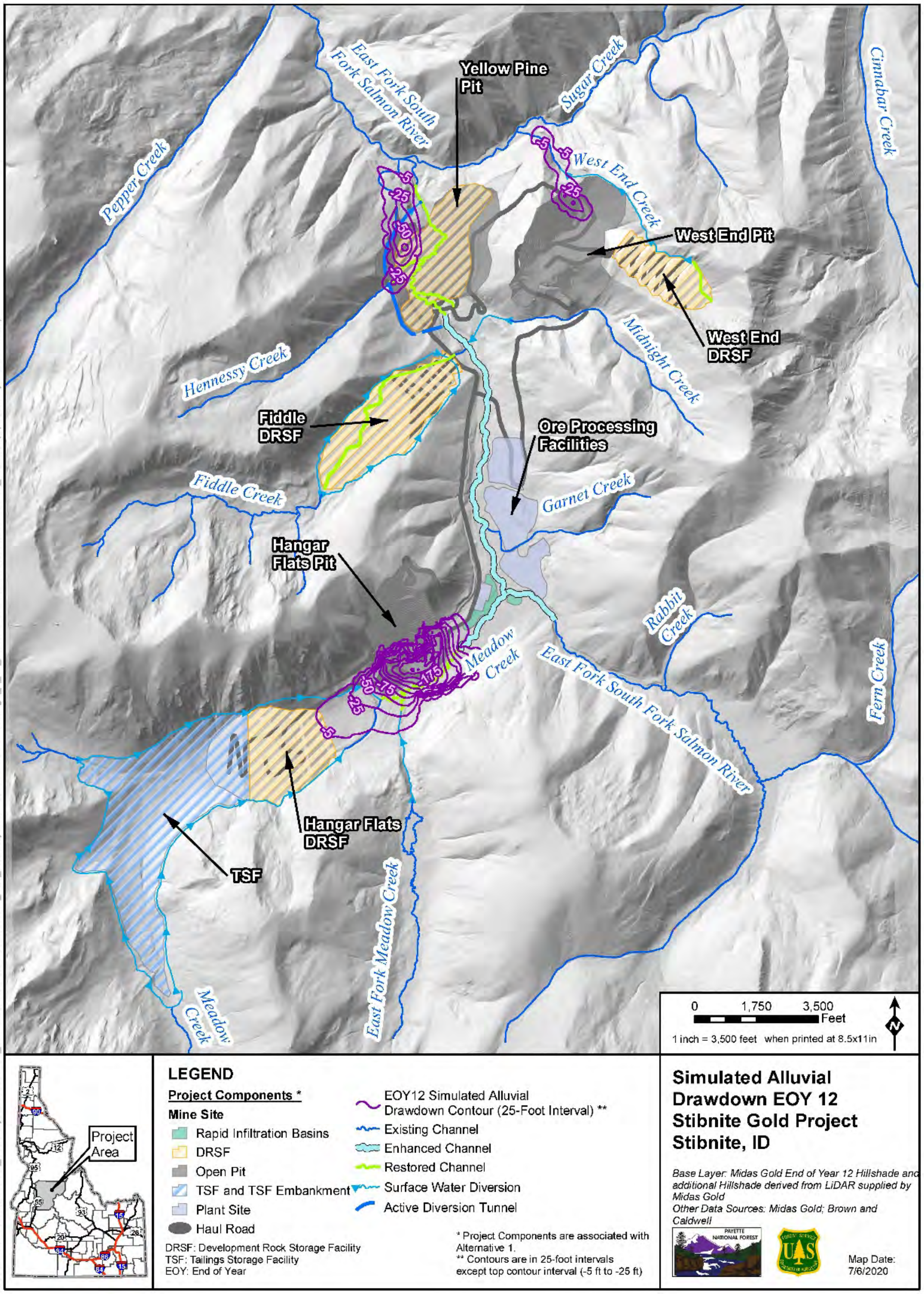


Figure Source: Brown and Caldwell 2018b, Figure 4-6

Figure 4.8-25 Simulated Alluvial Drawdown EOY 12

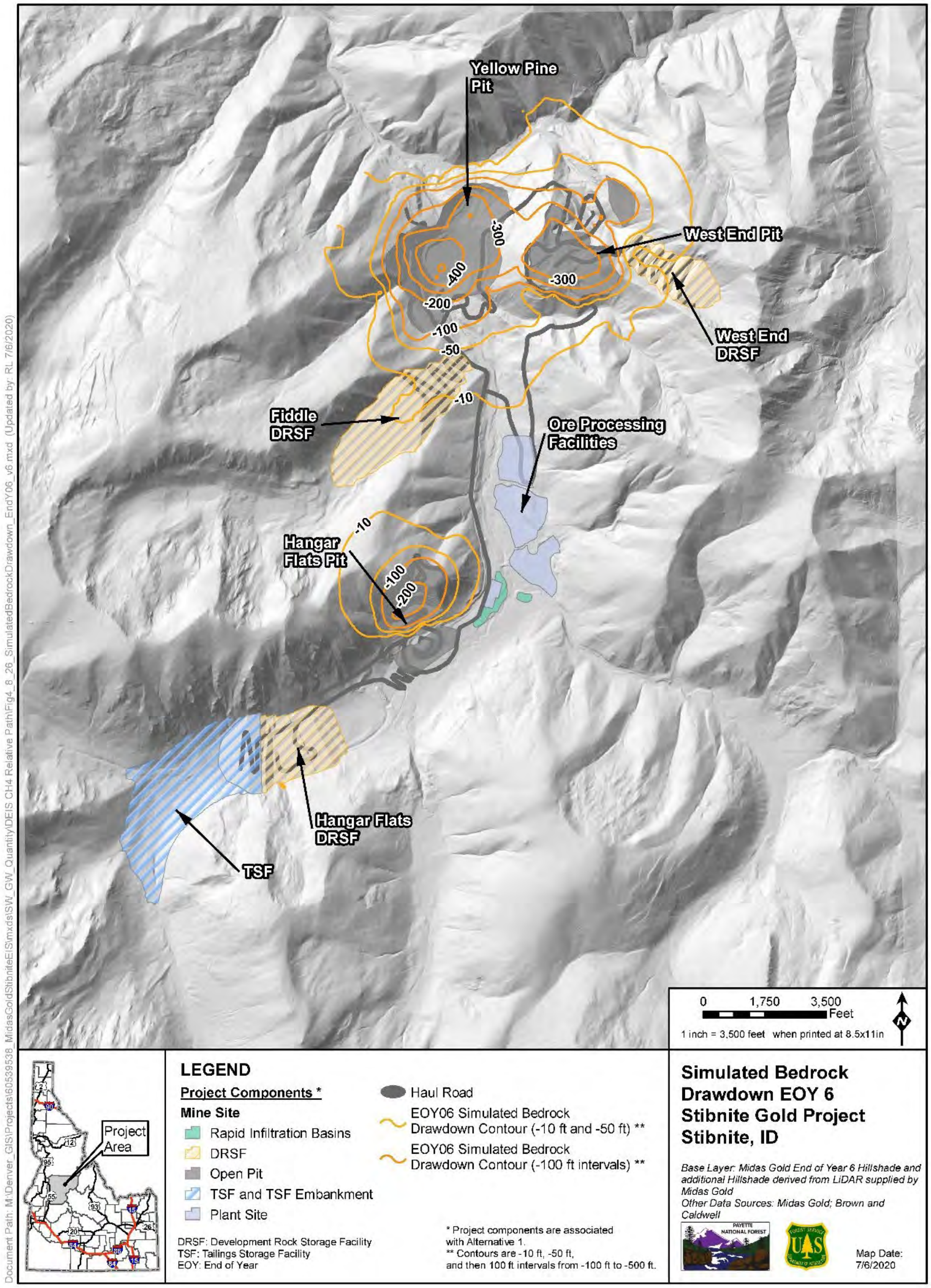


Figure Source: Brown and Caldwell 2018b, Figure 4-7

Figure 4.8-26 Simulated Bedrock Drawdown EOY 6

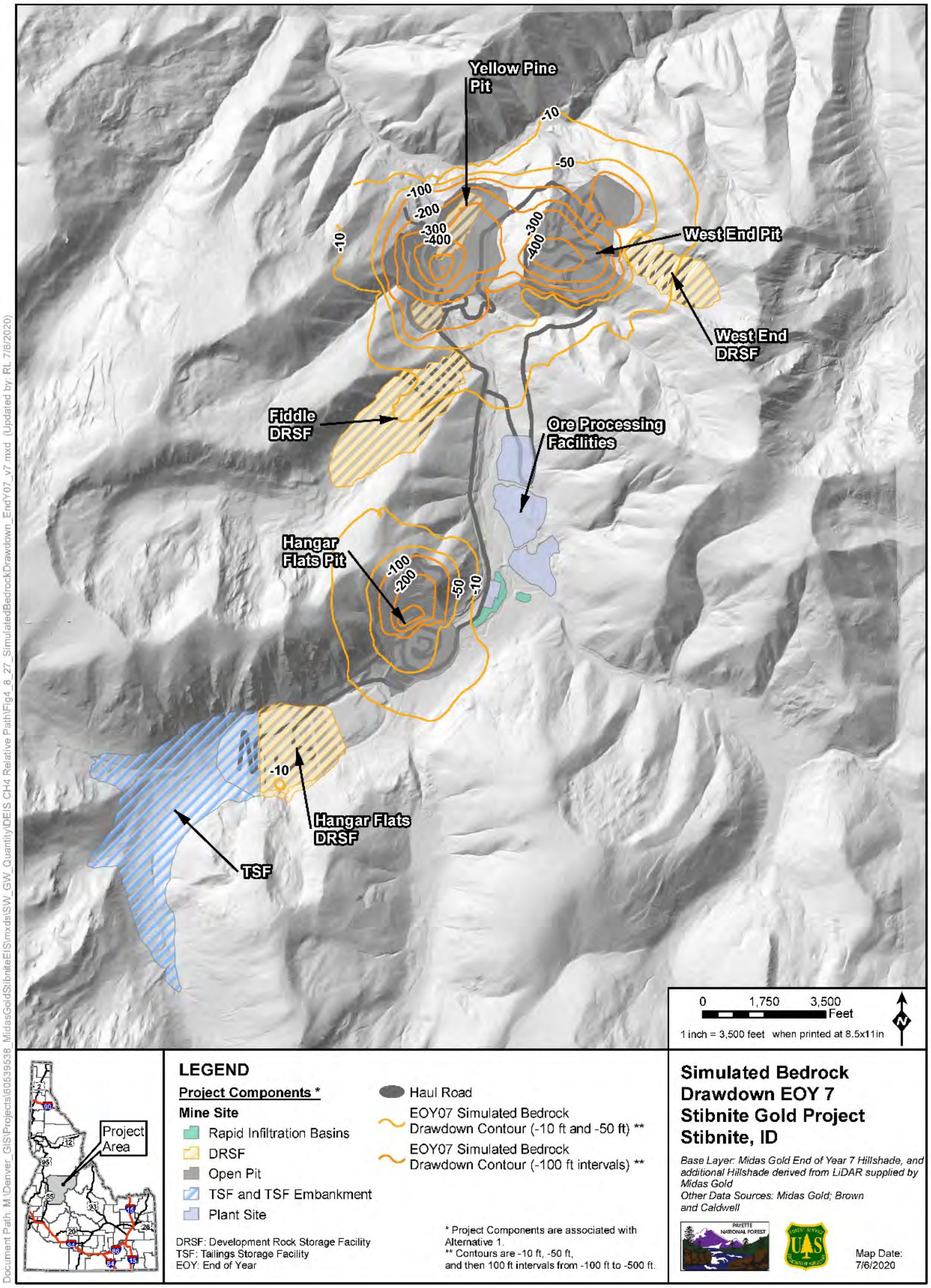


Figure Source: Brown and Caldwell 2018b, Figure 4-8

Figure 4.8-27 Simulated Bedrock Drawdown EOY 7

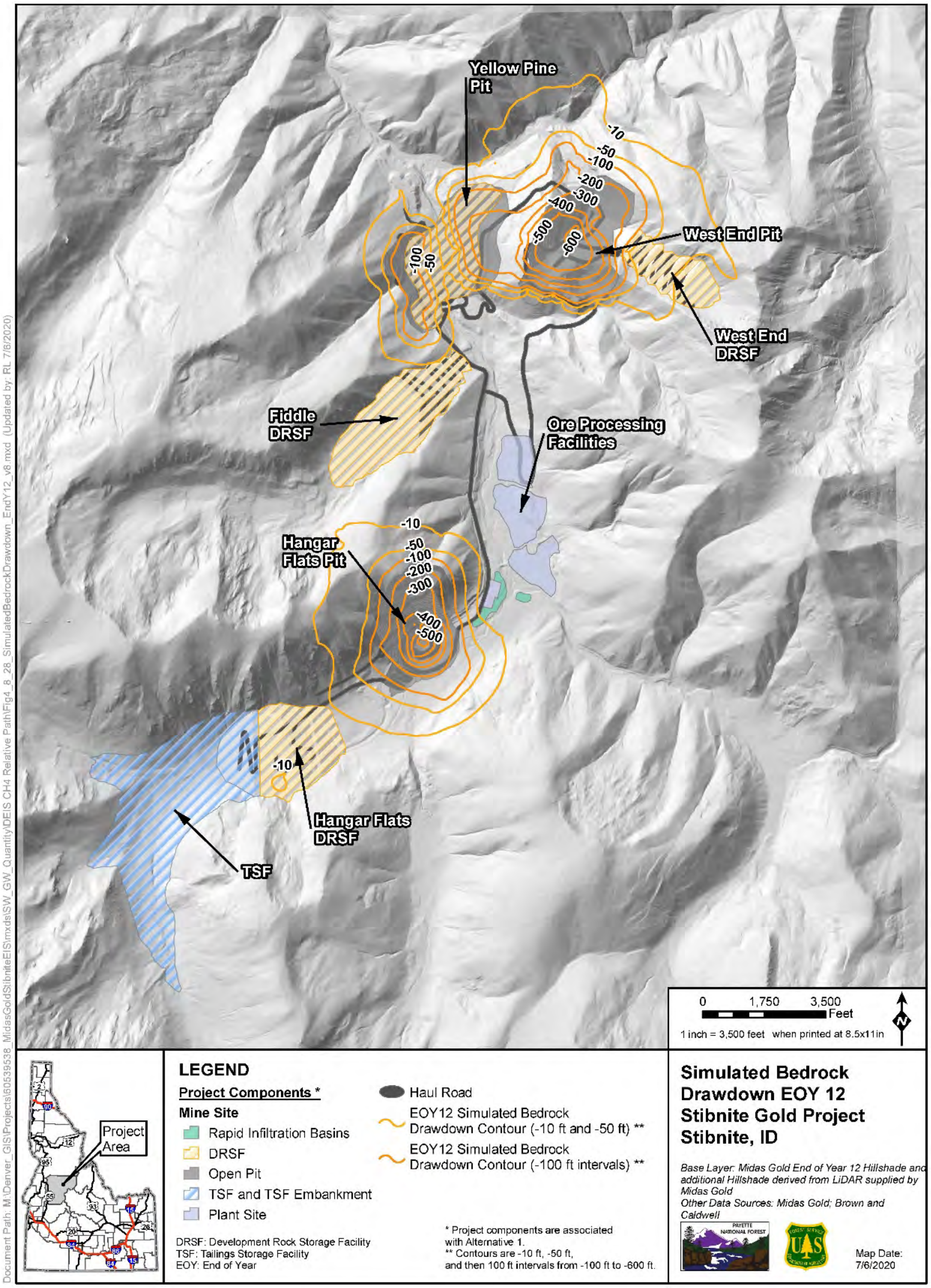


Figure Source: Brown and Caldwell 2018b, Figure 4-9

Figure 4.8-28 Simulated Bedrock Drawdown EOY 12

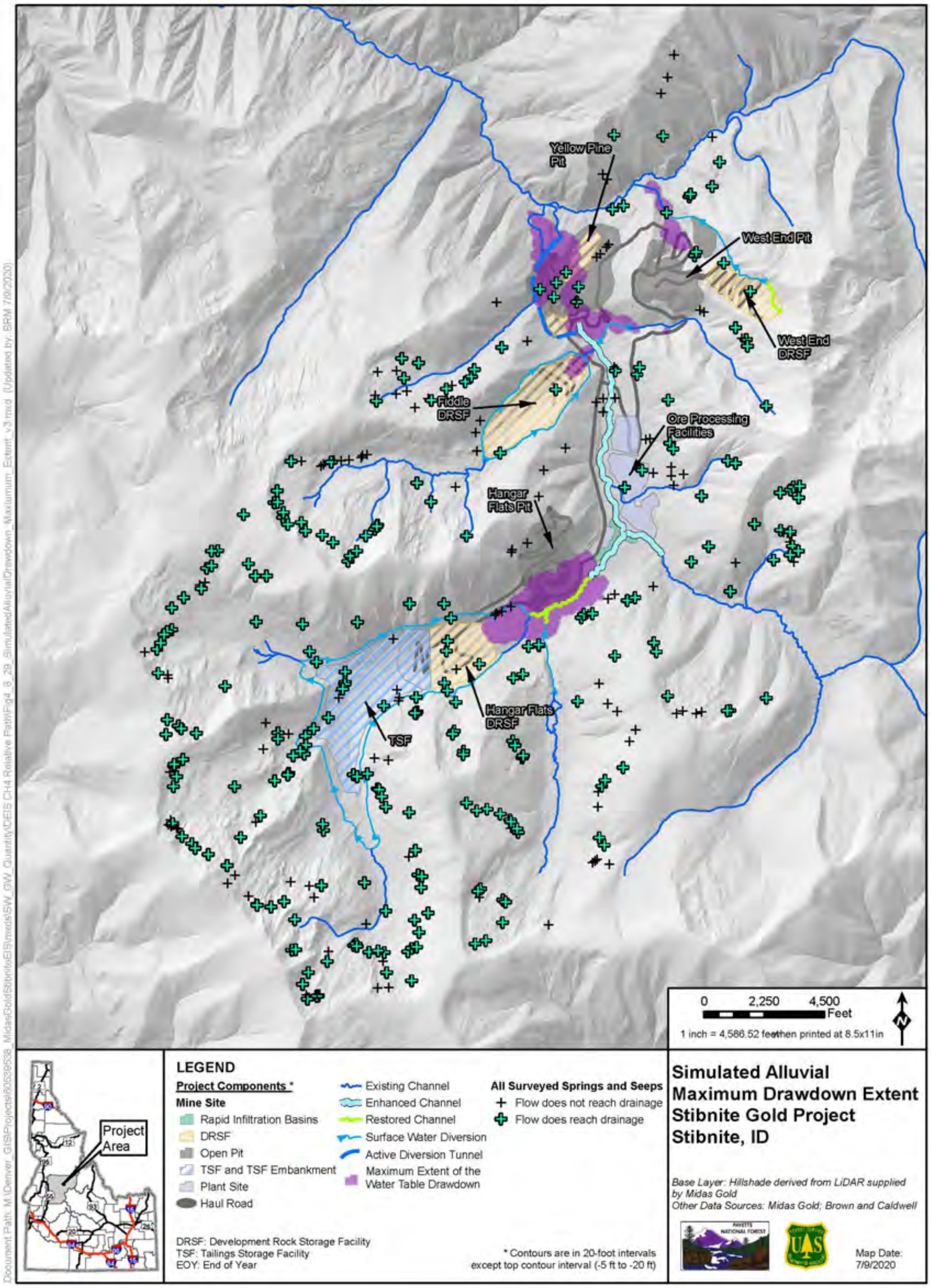


Figure Source: AECOM 2020, modified from HydroGeo 2012a, Figure 1-3

Figure 4.8-29 GDEs Potentially Affected by Drawdown

Underdrain Flow

Fiddle DRSF and West End DRSF are designed with systems to collect and convey any groundwater underneath the facilities. The TSF design includes a drain system underneath the liner, while each DRSF includes a drain system to be placed in the surface channels prior to placement of overlying development rock. The mine operational period model included drain cells to simulate flows from these underdrains.

Figures 4.8-30 and **4.8-31** show simulated flows from the TSF and Fiddle DRSF underdrains for the average, above average, and below average periods. Simulated flow from the West End DRSF underdrain was zero for all simulated periods. Simulated flows from the TSF underdrain (**Figure 4.8-30**) follow a seasonal pattern and range from approximately 900 to 1,300 gpm (roughly 2 to 3 cfs, similar to observed natural base flow conditions in Meadow Creek prior to mining). These flows are simulated as freely draining into Meadow Creek downstream of the TSF. Only minor (less than 5 percent) variations in simulated flow from the TSF are noted between the average, above average, and below average climate periods.

Simulated flow from the Fiddle DRSF underdrain (**Figure 4.8-31**) is initiated in mine year 2 and also follows a seasonal pattern, ranging from approximately 200 to 600 gpm (roughly 0.5 to 1.5 cfs). These flows are assumed to be collected in the DRSF toe drain and are removed from the simulated groundwater system (Brown and Caldwell 2018b). Like in the case of the TSF, only minor (less than 5 percent) variations in simulated flow are noted between the average, above average, and below average periods (Brown and Caldwell 2018b).

Placement of underdrains would most likely result in lowering groundwater levels around the drains. The contents of model-generated figures of drawdown (**Figures 4.8-23** through **4.8-28**) indicate that such drawdowns would be less than 5 feet.

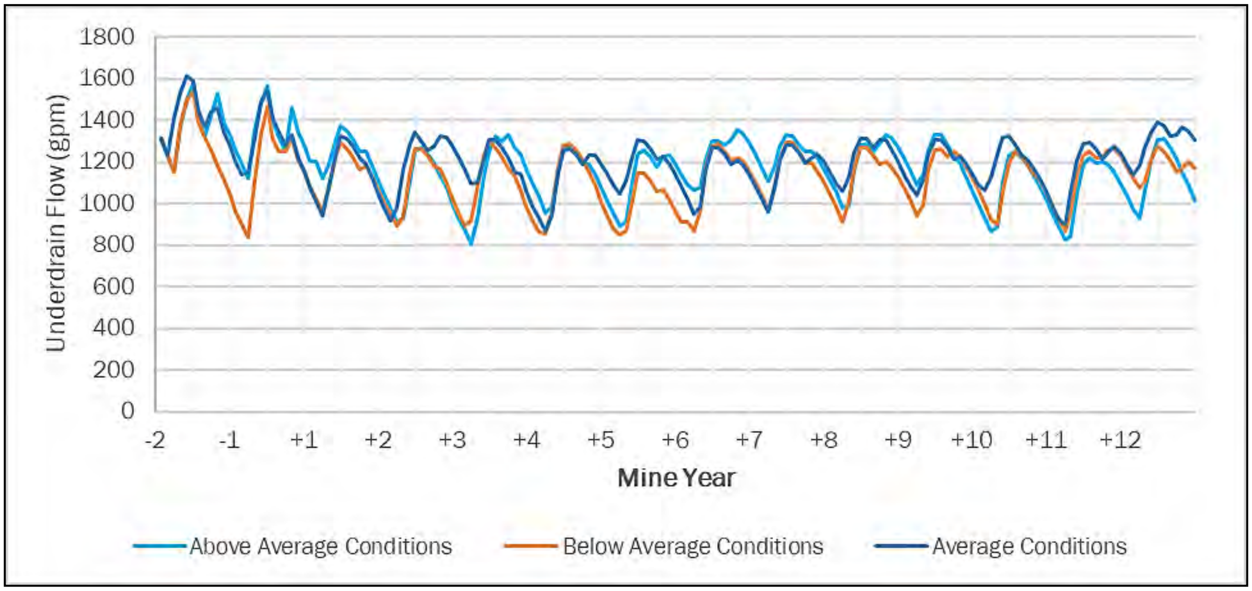


Figure Source: Brown and Caldwell 2018b, Graph 4-39

Figure 4.8-30 Simulated TSF Underdrain Flow for Average, Above Average, and Below Average Climate Conditions

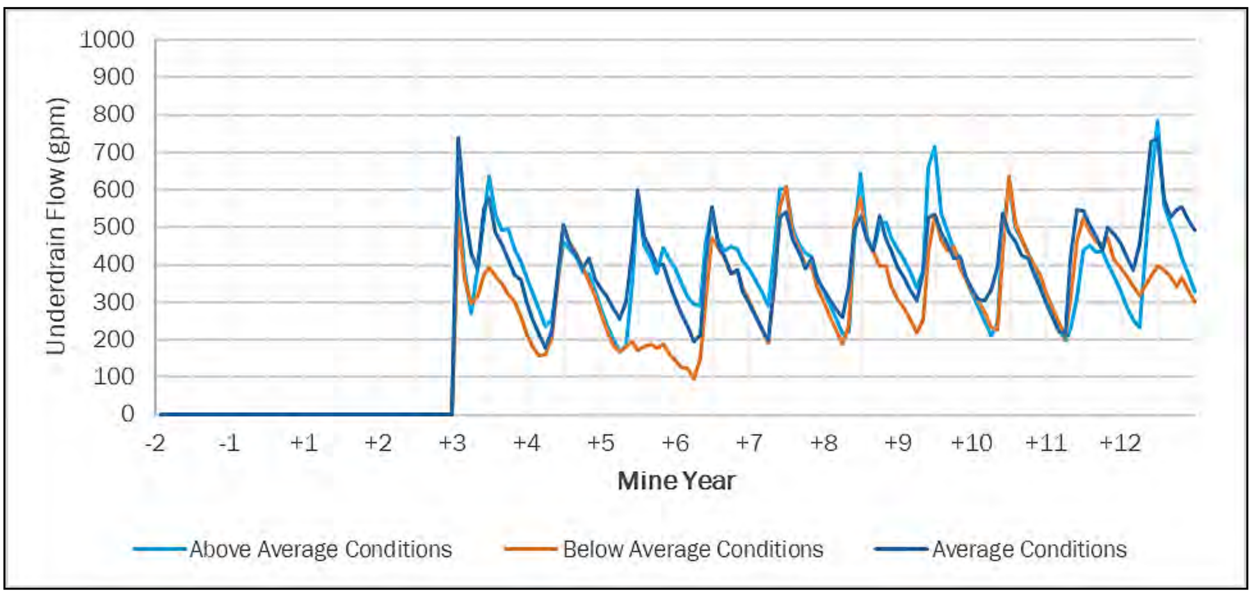


Figure Source: Brown and Caldwell 2018b, Graph 4-40

Figure 4.8-31 Simulated Fiddle DRSF Underdrain Flow for Average, Above Average, and Below Average Climate Conditions

Summary of Alternative Groundwater Quantity Effects During Construction and Operation

Figure 4.8-32 presents the total simulated dewatering rates from all three open pits during the mine operational period for average climate conditions. The model-simulated dewatering rates for below average and above average climate conditions are very similar to the rates calculated by the model simulating average climate conditions. Dewatering of the Yellow Pine pit provides all flows between mine years 1 and 6, with dewatering at the Hangar Flats pit providing the most flows during the rest of the mine operational period. Spikes in simulated dewatering rates occur at the beginning of mine years 7 and 8, with total rates of approximately 4,500 gpm occurring in mine year 8. These spikes can be interpreted to represent worst-case predictions, and are an artifact of instantaneous, step wise changes in drain elevations set in the model to represent changes in planned end of year topography of the pit. In reality, the pit bottom elevations would change gradually throughout the period of mining. A more likely estimate of peak dewatering flows is approximately 3,900 gpm in mine year 8 (Brown and Caldwell 2018b).

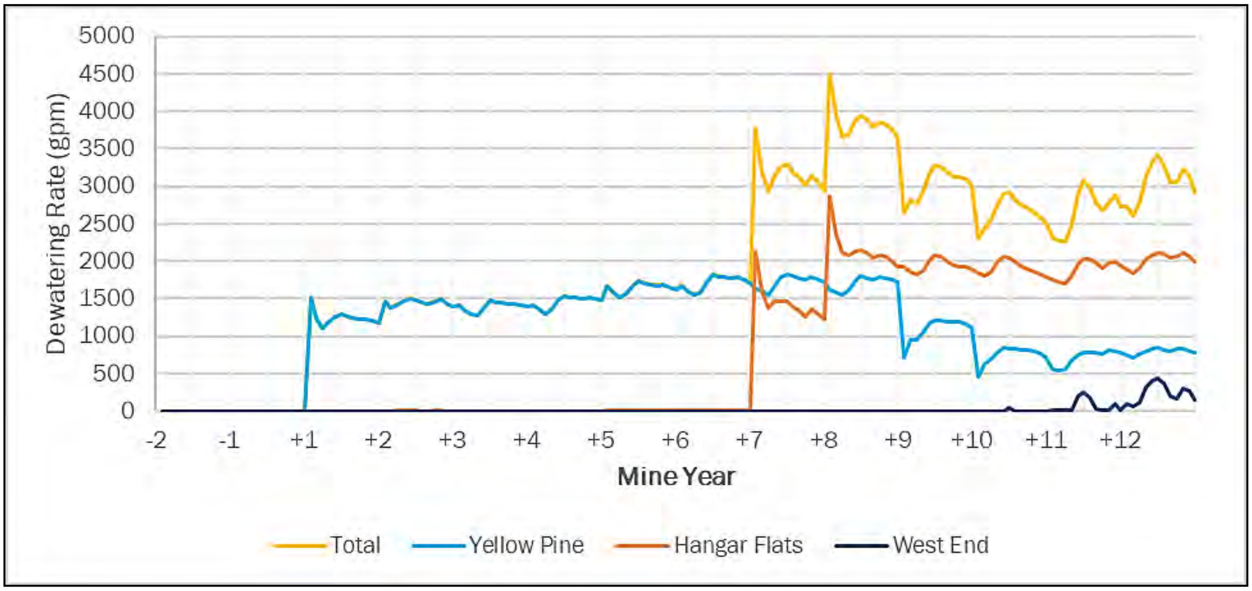


Figure Source: Brown and Caldwell 2018b, Graph 4-13

Figure 4.8-32 Total Simulated Dewatering Rates—All Pits—Average Climate Condition

Dewatering of the pits would lower groundwater levels in the alluvial and bedrock formations during the mining period, and would subsequently reduce flows in surface water streams that receive groundwater discharge. The maximum extent of alluvial drawdown in the Yellow Pine pit area would occur at the end of mine year 6, with the cone of depression extending approximately 2,100 feet north of the pit and approximately 1,700 feet to the southeast. The maximum extent of drawdown associated with the West End pit would occur at the end of mine year 12, with an elliptical cone of depression approximately 3,000 feet long paralleling the West End Creek valley. Finally, the maximum alluvial drawdown associated with Hangar Flats pit would occur at the end of mine year 10, when the drawdown in the southeastern part of the pit would exceed 200 feet, and the cone of depression would be more than 5,700 feet long by 3,700 feet wide.

Drawdown in the bedrock aquifer is expected to be greater than in the overlying alluvium, as the pits are proposed to be mined hundreds of feet into the bedrock formations. At the end of mine year 7, the simulated bedrock drawdown associated with the Yellow Pine and West End pits is predicted to extend approximately 1,400 feet to the west of the pits beneath areas of high topographic relief, approximately 3,300 feet to the south beneath the EFSFSR, and approximately 2,000 feet to the east. By mine year 12, the simulated drawdown also would extend approximately 3,000 feet to the north across Sugar Creek. At Hangar Flats pit, the bedrock cone of depression in mine year 12 would extend approximately 1,600 feet to the west beneath areas of high topographic relief, 1,600 feet to the southwest towards the Hangar Flats DRSF and TSF, and approximately 1,000 feet to the north. The timing of the maximum predicted drawdown would generally coincide with the end of mining in each pit.

The drawdown caused by pit dewatering is predicted to reduce surface flows during the mine operational period in Meadow Creek and the EFSFSR to its confluence with Sugar Creek (Brown and Caldwell 2019b). Simulations of the average climate period model version indicate that the pit dewatering caused flow reductions would mainly occur during the seasonal low flow period. Exceptions include stream segments such as the EFSFSR just below the Meadow Creek confluence, where return flow from the RIBs would help maintain (or even increase) late season flows. The pit dewatering also could impact springs, seeps, and wetlands (and the GDEs they support) near the pits, as described in the subsection Groundwater Dependent Ecosystems Potentially Affected by Drawdown.

4.8.2.1.2.2 Closure and Reclamation

Te post closure model version was used to run a single predictive simulation of flow conditions for 100 years after cessation of mining activities (equivalent to mine years 13 through 112). The principal objective of the post closure modeling was to simulate the rate and timing of groundwater and surface water flows around the three locations where pit lakes would develop: Hangar Flats, West End, and Midnight Area. The model also was designed to assess the return of long-term surface water and groundwater flows back into a stable seasonal pattern, approaching the pre-mining conditions.

Pit Lake Development

Hangar Flats Pit Lake

The model simulations show that Hangar Flats pit would fully fill to create a lake in 6 years and 10 months after cessation of mining. Water filling the pit would be sourced from groundwater inflows, direct precipitation, and surface water runoff. After the lake is full, surface flows from Meadow Creek and Blowout Creek would be routed into the lake, creating through-flow conditions. The lake was simulated as being stable at the spillover point elevation of 6,540 feet above mean sea level for the rest of the 100-year simulation period.

Net groundwater inflows into the Hangar Flats pit lake were simulated at a high of approximately 2,500 gpm at the initiation of filling, to a long-term seasonal pattern ranging from approximately 500 to 750 gpm. Net inflows would occur primarily from valley alluvium (simulated by model Layer 1), with minor flows from valley floor fractured bedrock (model Layer 2) in the first 2 years of filling. Over the long term, the vast majority of pit inflows would be from valley alluvium (Brown and Caldwell 2018b).

West End Pit Lake

West End pit lake would be situated primarily in bedrock and would not receive substantial groundwater inflows. The primary sources of water filling the lake would be direct precipitation and surface water runoff. The lake is predicted to fill slowly over 41 years, with a seasonal pattern of increased lake stage from spring runoff followed by seasonal declines as water evaporates and flows from the lake back into the local bedrock groundwater system. The model simulated the lake would spill over during short seasonal periods only, between post closure years 42 and 66.

The Midnight pit area of the West End pit would be a small pit located in the southern part of the main West End pit, and is simulated to fill primarily from precipitation and surface runoff. The pit lake would spill over at an elevation of 6,980 feet above mean sea level beginning in post closure year 10. The pit was simulated to spill over into Midnight Creek, with seasonal and longer periods of net loss to evaporation and to the groundwater system. This would result in a seasonal decline in lake stage, with subsequent spill over during spring runoff periods (Brown and Caldwell 2018b).

Formation of these two pit lakes would have a negligible impact on the groundwater system, because the lakes would be fed primarily by direct precipitation and surface water runoff.

Post Closure Groundwater Flow

The investigators used the post closure model version to simulate long-term groundwater flow conditions after mining operations have ceased.

The Hangar Flats pit is predicted to fill with water in 6 years 10 months after the cessation of mining, and the Midnight Area of the West End pit would be fully filled in post closure year 10. The West End pit is predicted to fill more slowly over 41 years because it would be mined primarily into bedrock and would not receive substantial alluvial groundwater inflow (Brown and Caldwell 2018b).

Outside of the mine pit areas, groundwater levels would rebound during the post closure period even more quickly than near the pits (Brown and Caldwell 2018b). **Figures 4.8-33** and **4.8-34** present simulated hydrographs for monitoring wells MWH A-07 (Meadow Creek drainage) and MWH-A10 (EFSFSR drainage).

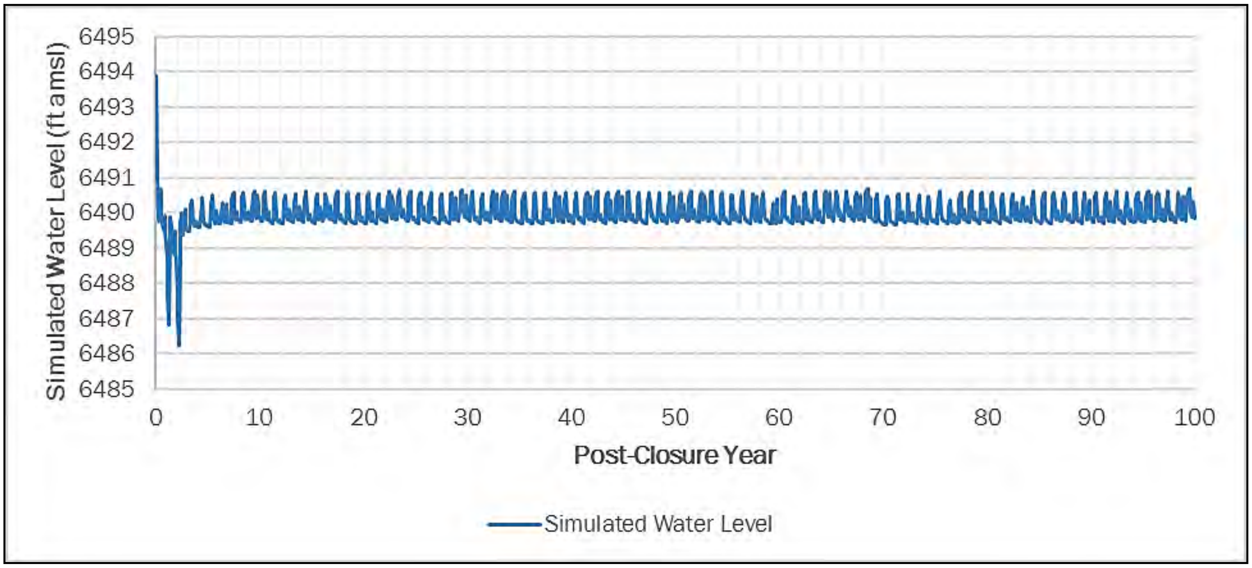


Figure Source: Brown and Caldwell 2018b, Graph 5-36

Figure 4.8-33 Simulated Water Level Hydrograph for Well MWH-A07—Post Closure Years 1 through 100

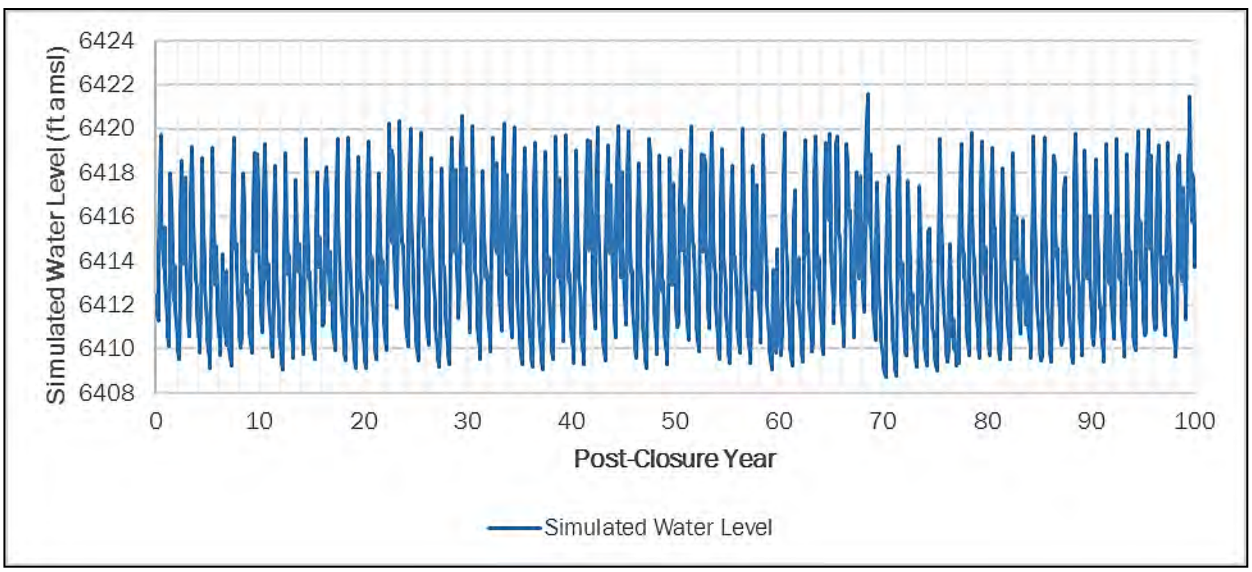


Figure Source: Brown and Caldwell 2018b, Graph 5-37

Figure 4.8-34 Simulated Water Level Hydrograph for Well MWH-A10—Post Closure Years 1 through 100

As shown on **Figure 4.8-33**, groundwater levels in MWH-A07 would initially decline in response to cessation of infiltration into the nearby RIBs, followed by water table recovery from the moment dewatering ends, back to a long-term stable condition. Water levels would be increasing through post closure year 3, and would then reach a stable seasonal pattern with higher water levels after spring recharge, followed by lower water levels late in the winter. This pattern would continue for the remainder of the post closure simulation, returning to approximately pre-mining conditions.

Water levels in MWH-A10 (**Figure 4.8-34**) show a long-term stable pattern similar to the pre-mining condition documented between 2012 and 2017. The pre-mining baseline dataset indicates that the groundwater level at MWH-A10 varies over a range of approximately 13 feet, with an average elevation of around 6,425 feet above mean sea level (Brown and Caldwell 2018a). The average post closure groundwater level simulated in MWH-A10 is 10 feet lower at around 6,415 feet above mean sea level.

Figure 4.8-35 shows the simulated water table elevation contours for July of post closure year 50. The groundwater flow pattern in the figure shows that flow directions are predicted to be only minimally affected by the presence of the pit lakes. Groundwater in areas away from the lakes would return to stable conditions, with seasonal responses to recharge followed by low winter water levels. The simulated groundwater levels and seasonal changes are similar to pre-mining conditions simulated by the existing conditions model.

The presence of DRSFs and the TSF would alter groundwater levels more permanently, as these structures would reduce or eliminate groundwater recharge across the areas of their footprints and lower groundwater levels. In addition, the TSF and DRSF underdrains would locally lower groundwater levels beneath these facilities, further altering hydraulic gradients near the drains. The presence of pit lakes would also result in long-term changes (relative to existing conditions) to water table elevations and reduction of horizontal hydraulic gradients around the lakes. Such changes would occur as a result of implementation of any of the action alternatives.

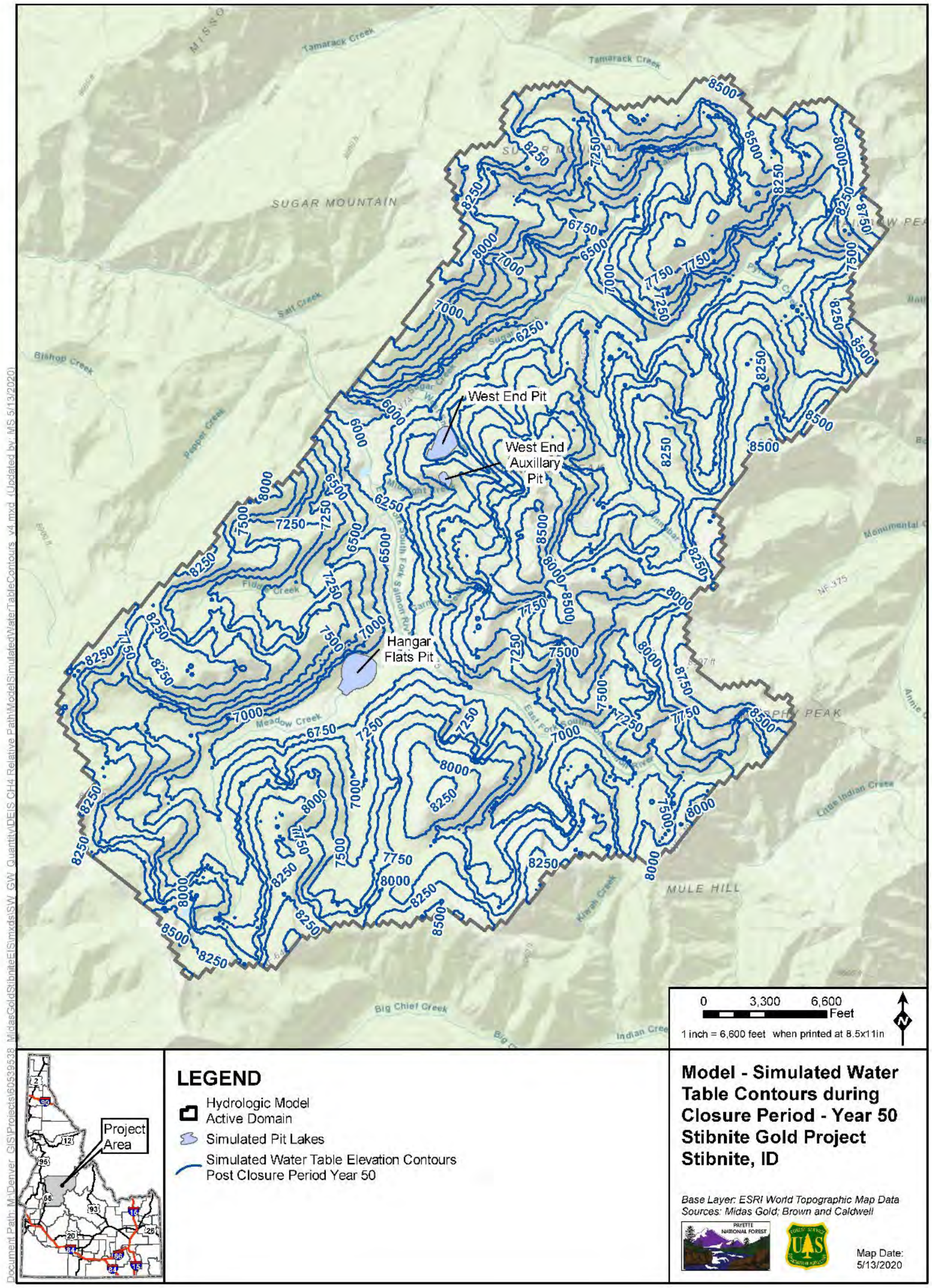


Figure Source: Brown and Caldwell 2018b, Figure 5-1

Figure 4.8-35 Model - Simulated Water Table Contours during Post Closure Period – Year 50

4.8.2.1.3 WATER RIGHTS

Impacts to water rights would be the same for all action alternatives (1 through 4). The analysis of the action alternatives assumes IDWR will grant the proposed water right applications.

4.8.2.1.3.1 Impacts Common to All Action Alternatives

Additional water rights would be needed for the SGP and are intended to be secured through direct permit application for approval of such rights from the IDWR. Midas Gold currently has 0.7 cfs in existing groundwater rights. Preliminary hydrologic modeling indicates that an estimated additional 2.39 cfs and 1,730 acre-feet of groundwater rights would need to be secured to support ore processing during the life of the SGP (approximately 15 years of ore processing). Under certain conditions (prolonged severe drought occurring early in operations), an estimated temporary seasonal withdrawal of up to 5.63 cfs over the present water right may be required to maintain ore processing operations. Such peak withdrawals would be uncommon and limited in duration.

Midas Gold plans to apply for a permit seeking a maximum diversion rate of approximately 5.63 cfs from groundwater sources to support mining and ore processing. This maximum diversion rate would be to maintain ore processing operations during prolonged severe drought and withdrawal of the dull 5.63 cfs would be expected to be uncommon and limited in duration. Additionally, Midas Gold plans to submit an application to divert 3.47 cfs of surface (contact) water and store 500 acre-feet. Therefore, applications for permits to appropriate/divert up to 9.1 cfs of groundwater and diffuse runoff (i.e., contact water), to store up to 500 acre-feet of diffuse runoff for industrial use, and to divert the 500 acre-feet of stored water to industrial use would be submitted. The applications would include a mitigation plan to protect existing instream water rights on the South Fork Salmon River and the Salmon River.

The SGP plans to use more of the water pumped from the pits and return less water for infiltration via the RIBs. Graph 4-17 of the Brown and Caldwell Proposed Action modeling report (Brown and Caldwell 2018b) (Simulated Surface Flows at USGS Gaging Station 13311000; with and without RIB Infiltration) shows the model-simulated flows conditions with and without discharge via the RIBs. Not infiltrating water via the RIBs would notably reduce low flows in the EFSFSR. However, such peak withdrawals would be uncommon, limited in duration and most likely lower than 5.63 cfs.

Midas Gold has proposed an approach in which wells currently anticipated for dewatering would be listed on the water right application for industrial purposes. At the time of well construction, Midas Gold can determine whether the constructed well would be used for industrial purposes or for dewatering purposes. The determination would be based on water quality, well location, yield, and other factors.

Groundwater use for potable water supply would require drilling wells at the Landmark Maintenance Facility and Stibnite Gold Logistics Facility. At each facility, a well with a capacity of 18 gpm (0.04 cfs) is proposed. Separate water rights applications would be submitted for each well, seeking a permit to authorize diversion of 0.04 cfs for domestic and industrial purposes at the Landmark Maintenance Facility, and a permit authorizing diversion of 0.04 cfs for domestic and commercial purposes at the Stibnite Gold Logistics Facility.

Domestic water use at the truck shop and mill facilities also would be supplied from a potable water system. Midas Gold anticipates submitting an application for permit seeking 0.06 cfs of groundwater for this use.

Domestic use at the Worker Housing Facility also would be supplied by groundwater. The authorized point of diversion for water right 77-7141 (0.20 cfs and 11.4 acre-feet for domestic use) would be modified for this purpose through an application for transfer. In addition, Midas Gold anticipates submitting an application for permit to appropriate 0.20 cfs of groundwater to supplement the 11.4 acre-feet volume authorized under 77-7141. These additional groundwater appropriations for potable water supply total 0.34 cfs.

After a water right application has been filed, IDWR would perform an analysis to determine if the application would infringe on any existing downstream water rights, or if it would detract from the wild and scenic values of the EFSFSR and instream flows of water rights on the South Fork Salmon River and the Salmon River. Instream rights on the South Fork Salmon River are subordinate to 20.6 cfs; maximum diversions proposed by Midas Gold would be 9.1 cfs.

Minimum instream flow in the Salmon River water rights is 1,200 cfs, over 60 miles downstream from the SGP area. IDWR would be responsible for determining the impacts of the water right application.

It should be noted that no water right with a junior priority date can deplete the water needed to maintain the minimum streamflow water right on the EFSFSR (Water Right 77-14190), unless allowed as a condition of approval of the proposed junior water right. All the existing water rights at the mine site predate the priority date of April 1, 2005 associated with Water Right 77-14190. Any new water rights permits would have a junior priority date, but the minimum stream right (77-14190) on the EFSFSR is subordinate to all future domestic, commercial, municipal, and industrial uses, and up to 8.2 cfs of new non- domestic, commercial, municipal, and industrial uses.

Groundwater Rights

Midas Gold owns all existing groundwater wells and permanent groundwater rights at the mine site. Current water withdrawals from groundwater (0.7 cfs in water rights) in the analysis area or surrounding area do not affect groundwater rights of any other parties and have a negligible impact on surface water flow rates in nearby streams (HDR, Inc. 2017). Midas Gold proposes to request the additional 2.39 cfs and 1,730 acre-feet groundwater right for mining activities, and the additional 0.34 cfs and 10 acre-feet for potable water supply over the present water right. Midas Gold also plans to apply for a permit seeking a maximum diversion rate of approximately 5.63 cfs from groundwater sources to maintain ore processing operations during prolonged severe drought. Such peak withdrawals would be uncommon and limited in duration.

Given that Midas Gold owns all groundwater rights at the mine site, it is unlikely that any current groundwater rights would be affected. Alluvial groundwater systems are connected to surface water resources, and therefore groundwater withdrawals would reduce surface water volumes. The greatest concern regarding downstream water rights would be in times of drought, when groundwater resources are reduced, which is when Midas Gold proposes in the water right application to increase diversions from the local groundwater systems.

As part of the water rights application process, IDWR would perform an analysis to determine if additional groundwater withdrawals associated with the new water rights would infringe on state and federal downstream water rights; specifically, the instream flow right on the EFSFSR, the South Fork Salmon River, and the Salmon River. If IDWR concludes that the new water right would not infringe on downstream water rights, including the wild and scenic nature of the EFSFSR, the South Fork Salmon River, and the Salmon River, IDWR would grant the water right. If, however, IDWR concludes that it may infringe on downstream water rights, the application would be denied. If the agency approves the water right, then IDWR has concluded that there is no impact on downstream water rights.

Surface Water Rights

Base flows in the EFSFSR below Sugar Creek are approximately 17 cfs, and 60 cfs in Johnson Creek. The maximum diversion rate under existing surface water rights is 0.58 cfs, which is approximately 3.4 percent of the base flow in the EFSFSR and 0.8 percent of the combined flows of the EFSFSR and Johnson Creek. Current Midas Gold surface water right diversions are negligible compared to the combined EFSFSR and Johnson Creek flows and would not impact downstream consumptive water rights. Midas Gold also plans to apply for a water right to divert an additional 3.47 cfs of surface (contact) water and to store up to 500 acre-feet for industrial use. Storage of water is not covered under the subordinations of federal water rights 77-11941 and 75-13316 and may require mitigation. During mine operations, the additional diversion of 3.47 cfs would decrease flows in the EFSFSR below Sugar Creek by an average of 12 percent during the seasonal low flow period (Section 4.8.2.1.1.1, Changes in Stream Flow Characteristics). If IDWR determines that this reduction would not impact downstream water rights, they would approve the water rights application. If they find that the additional withdrawals would significantly impact downstream water rights, they would reject the application.

4.8.2.2 Alternative 2

The model used to assess the direct and indirect effects of Alternative 1 on surface water and groundwater quantity was modified to represent the changes proposed under Alternative 2. The following components were incorporated into the hydrologic model to represent Alternative 2:

- Eliminate West End DRSF;
- Backfill Midnight pit;
- Partially backfill Hangar Flats pit;

- Divert Hennessy Creek in an open channel;
- Retain Meadow Creek interim diversion around Hangar Flats pit post closure;
- Extend Meadow Creek liner;
- Divert portion of Meadow Creek flow to accelerate pit lake fill; and
- Extend timing for flow to RIBs until Hangar Flats pit lake is filled.

Results of the modeling are detailed in the Modified Plan of Restoration and Operations Alternative Modeling Report (Brown and Caldwell 2019a). The following sections describe the predicted direct and indirect effects on surface water quantity and groundwater quantity associated with Alternative 2 for the phases of the SGP.

4.8.2.2.1 SURFACE WATER QUANTITY

4.8.2.2.1.1 Changes in Stream Flow Characteristics (Daily, Seasonal, Annual)

The changes in surface water flow described in this section for Alternative 2 are compared to those of the simulated existing conditions (referred to as No Action in graphics below) and to Alternative 1. The effects analysis primarily focusses on predicted stream flows in the EFSFSR at USGS Gaging Stations 13310800, 13311000, and 13311250, Sugar Creek at the USGS Gaging Station 13311450, and on Meadow Creek upstream of the EFSFSR.

Construction and Operations

The monthly average stream flows at the USGS Gaging Station 13310800 (EFSFSR above Meadow Creek) are predicted to be similar to Alternative 1 and to the existing condition (**Figure 4.8-36**). There is a slight increase in flows for Alternative 2, compared to existing conditions, due to additional recharge supplied by the RIBs. Stream flows at USGS Gaging Station 13311000 (EFSFSR at Stibnite), which is downstream of the confluence with Meadow Creek, are simulated as slightly increased for the Alternative 2 scenario relative to Alternative 1 and existing conditions (**Figure 4.8-37**). The increased stream flow predictions for this alternative are primarily a result of the Meadow Creek liner extension. For the EFSFSR above Sugar Creek (USGS Gaging Station 13311250), the simulated stream flows are slightly higher for Alternative 2 than for Alternative 1, but still lower than the existing conditions scenario (**Figure 4.8-38**). Simulated seasonal monthly average low flows were 10.9 cfs for the existing conditions scenario and 9.4 cfs for the Alternative 2 scenario, which is a 14 percent decrease for Alternative 2 relative to the existing conditions. The Alternative 2 simulation predicts higher low-flows than under Alternative 1 for mine years 7 through 12.

Model simulations predict no substantial differences in stream flows at the Sugar Creek USGS Gaging Station 13311450 between Alternative 2 and existing conditions (**Figure 4.8-39**).

The model also was used to estimate stream flows for Meadow Creek downstream of Hangar Flats pit to the confluence with the EFSFSR (**Figure 4.8-40**). Along this reach, predicted stream flows for Alternative 2 are higher than the low flows under Alternative 1 by over a factor of 2 during mine years 7 through 12. Across these years, the average monthly flow reduction relative to the existing conditions was predicted to be 32 percent for Alternative 2 and 47 percent for Alternative 1. These predictions of increased streamflow for Alternative 2 relative to Alternative 1 are a direct result of extending the Meadow Creek liner and supplying additional dewatering flows to the RIBs. Although predicted stream flows for this stream reach are higher under the Alternative 2 scenario compared to Alternative 1, they are still lower than the model-estimated flows under existing conditions during the low-flow season by up to approximately 2.5 cfs.

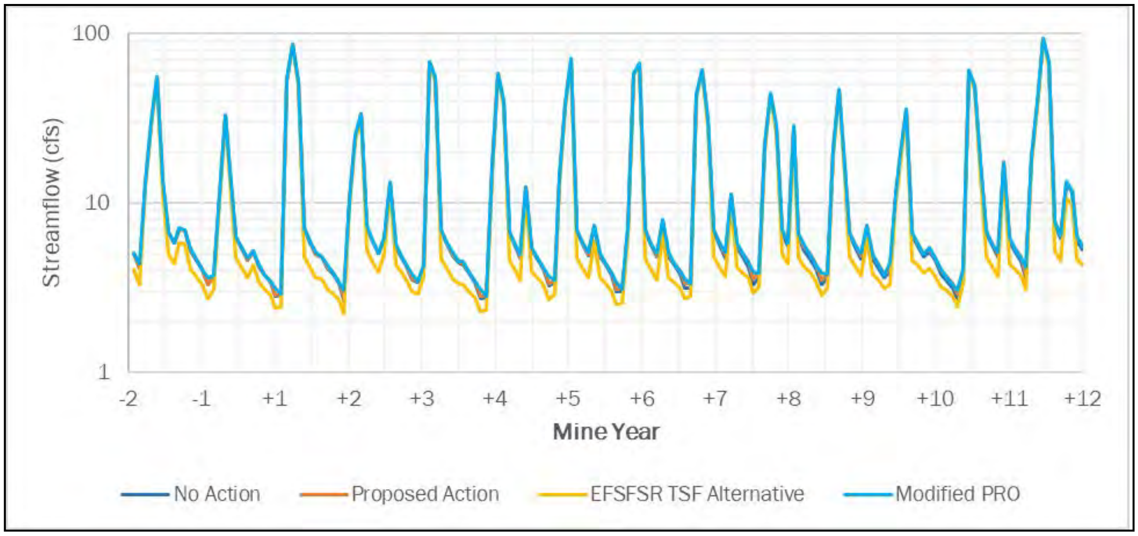


Figure Source: Brown and Caldwell 2019a, Figure 3-5

Figure Notes:

Existing conditions are represented as *No Action* on the graph. Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-36 Simulated Flow at USGS Gaging Station 13310800, EFSFSR above Meadow Creek (Logarithmic) for the Mine Operation Period

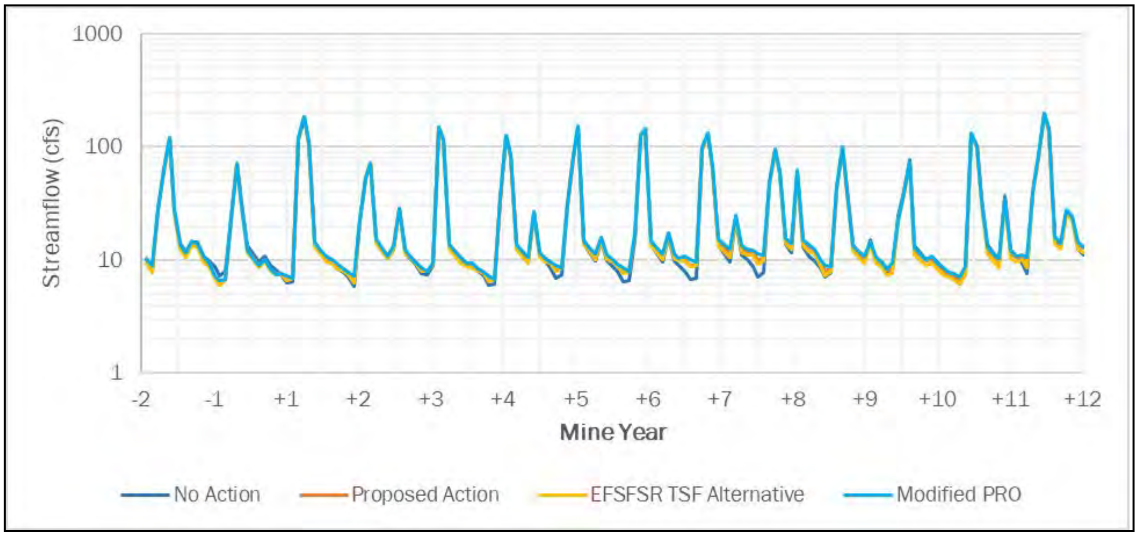


Figure Source: Brown and Caldwell 2019a, Figure 3-6

Figure Notes:

Existing conditions are represented as *No Action* on the graph. Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-37 Simulated Flow at USGS Gaging Station 13311000, EFSFSR at Stibnite (Logarithmic) for the Mine Operation Period

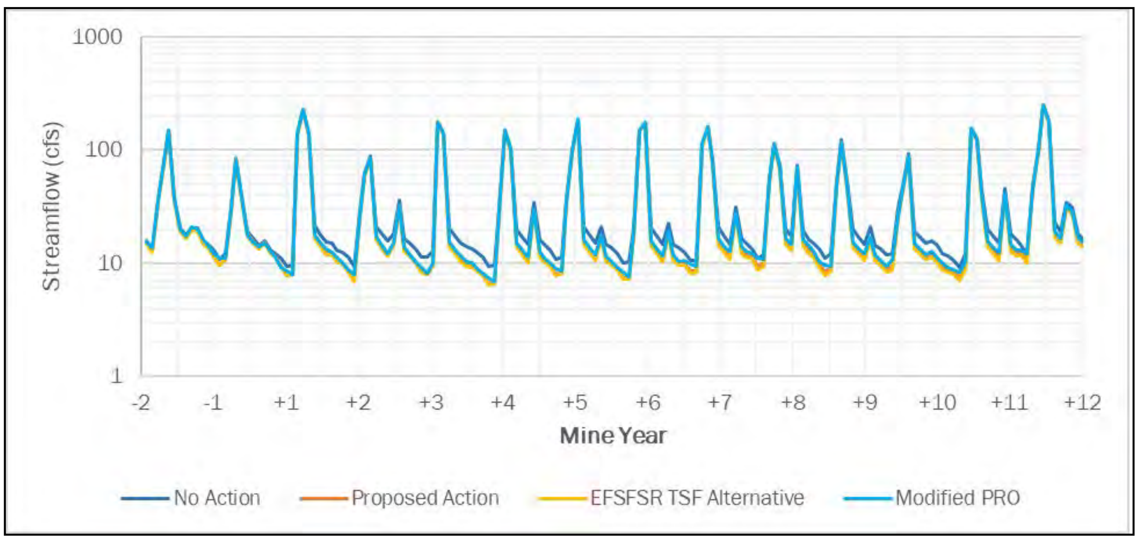


Figure Source: Brown and Caldwell 2019a, Figure 3-7

Figure Notes:

Existing conditions are represented as *No Action* on the graph. Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-38 Simulated Flow at USGS Gaging Station 13311250, EFSFSR above Sugar Creek (Logarithmic) for the Mine Operation Period

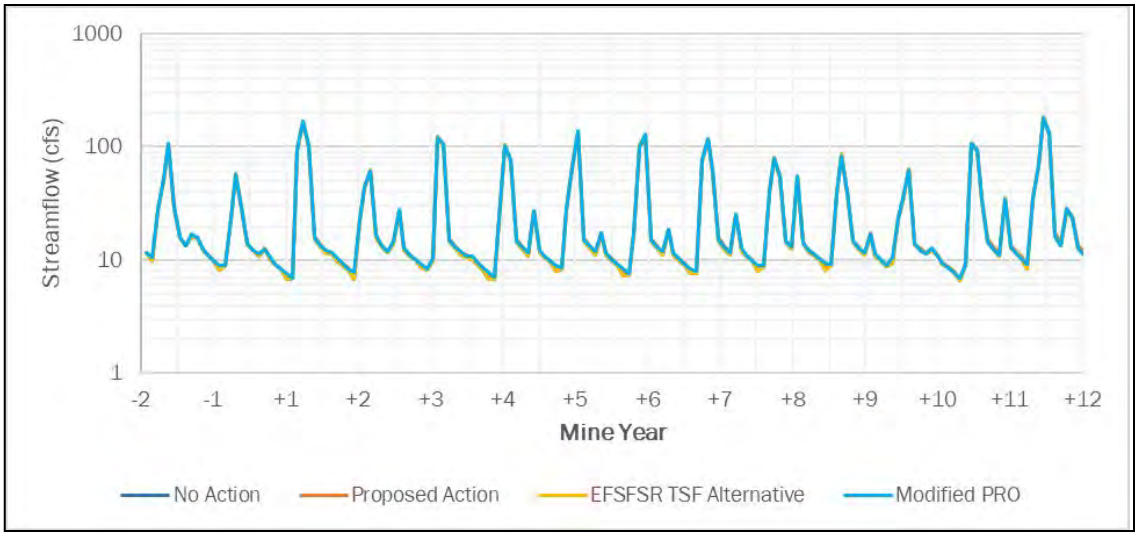


Figure Source: Brown and Caldwell 2019a, Figure 3-8

Figure Notes:

Existing conditions are represented as *No Action* on the graph. Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-39 Simulated Flow at USGS Gaging Station 13311450, Sugar Creek near Stibnite (Logarithmic) for the Mine Operation Period

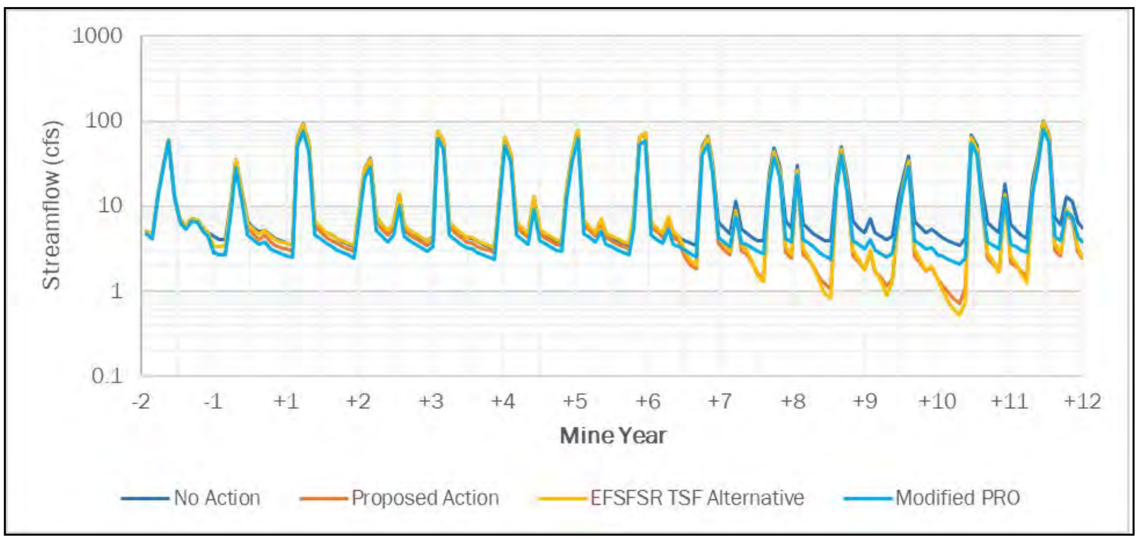


Figure Source: Brown and Caldwell 2019a, Figure 3-9

Figure Notes:

Existing conditions are represented as *No Action* on the graph. Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-40 Simulated Flow for Meadow Creek downstream of Hangar Flats Pit to the Confluence with the EFSFSR (Logarithmic) for the Mine Operation Period

Alternative 2 also would include water treatment applied to limit surface water quality impacts, which would involve temporarily storing mine contact water for active and passive treatment. Storing mine contact water in equalization ponds as proposed in the Water Quality Management Plan (Brown and Caldwell 2020) during the construction and operation periods could result in additional small changes to stream flows that have not been quantified above. The impounded contact water would likely represent a small percentage of the runoff contributing to predicted operational streams flows. It also should be noted that during mine operations, recharge to the RIBs would be the same with or without water treatment because mine pit dewatering water would be routed directly to the water treatment plant with no intermediate storage prior to treatment and after treatment routed to the RIBs. Thus, the segments of Meadow Creek and the EFSFSR influenced by RIB recharge would continue to flow at predicted levels during mine operations (Brown and Caldwell 2020). The only difference in RIB operation between the water treatment and non-treatment scenarios would be the chemistry of the water discharged through the RIBs. Effects of the discharge chemistry changes on surface water quality are discussed in Section 4.9, Surface Water and Groundwater Quality.

In summary, model simulations for Alternative 2 predict a slight increase in streamflow for the EFSFSR at locations above and below Meadow Creek, relative to existing conditions, due to additional recharge supplied by the RIBs. The model-predicted potential effects to streamflow under the Alternative 2 scenario were similar to those predicted for Alternative 1, indicating that implementing Alternative 2 would impact stream flows relative to existing conditions. Above Sugar Creek (USGS Gaging Station 13311250), the simulated stream flows for the EFSFSR are slightly higher for Alternative 2 than for Alternative 1, but still lower than the existing conditions scenario with a simulated 14 percent decrease in seasonal monthly average low flows. A considerable difference between Alternative 2 and Alternative 1 scenarios was estimated for Meadow Creek downstream of Hangar Flats pit to the confluence with the EFSFSR, where predicted stream flows for Alternative 2 would be higher than the low flows under Alternative 1 by over a factor of 2 during mine years 7 through 12. However, it still results in an average monthly flow reduction of 32 percent relative to the existing conditions for the period. The predicted increased streamflow at this location is a direct result of extending the Meadow Creek liner and supplying additional dewatering flows to the RIBs. Although predicted stream flows for Meadow Creek downstream of Hangar Flats pit to the confluence with the EFSFSR would be higher under Alternative 2 than those estimated for Alternative 1, they are still lower than under the existing conditions scenario during the low-flow season by up to approximately 2.5 cfs in the later mine operations period.

Closure and Reclamation

The model-simulated post closure monthly average stream flows at the USGS Gaging Station 13310800 (EFSFSR above Meadow Creek) are predicted to be similar for Alternatives 1, 2, and the existing condition (**Figure 4.8-41**). At USGS Gaging Station 13311000 (located on EFSFSR downstream of the confluence with Meadow Creek), the Alternative 2 simulation predicts lower high flows than for existing conditions and Alternative 1 for mine years 13 and 14 (**Figure 4.8-42**). This is attributed to diversion of Meadow Creek streamflow to the Hangar Flats pit lake during periods of high streamflow to accelerate the pit lake filling.

Modeling of Alternative 2 predicts similar low flows to existing conditions in mine years 13 through 19, with higher predicted low flows than Alternative 1. This indicates that the Meadow Creek liner extension, additional RIB recharge, and accelerated pit lake filling would reduce streamflow reductions predicted under Alternative 1. Predicted flows for Alternatives 1, 2, and existing conditions are similar from mine year 19 onward. For the EFSFSR above Sugar Creek (USGS Gaging Station 13311250), the simulated stream flows for mine years 13 through 19 are similar for Alternative 2 and existing conditions (**Figure 4.8-43**).

In Sugar Creek at USGS Gaging Station 13311450, model simulations predict no substantial differences in stream flows under Alternative 2 compared to existing conditions (**Figure 4.8-44**).

Predicted low flows in Meadow Creek downstream of Hangar Flats pit to the confluence with the EFSFSR are higher under Alternative 2 than Alternative 1, but slightly lower than existing conditions (**Figure 4.8-45**). Alternative 2 is predicted to increase streamflow relative to Alternative 1 during mine years 13 and 14, and would increase streamflow to near the existing condition from mine year 15 onward. The minimum predicted streamflow under Alternative 2 in mine years 13 and 14 is approximately 3 cfs, which is a 26 percent flow reduction relative to the existing conditions. The Modified Plan of Restoration and Operations Alternative Modeling Report (Brown and Caldwell 2019a) suggests that the higher stream flows simulated for Alternative 2 are primarily due to the Meadow Creek liner extension; additional infiltration from the RIBs; diversion of Meadow Creek peak flows to the pit lake during high runoff periods; and the partial backfill of Hangar Flats pit. The partial backfill would significantly reduce the time it takes to fill the Hangar Flats pit lake.

The Water Quality Management Plan (Brown and Caldwell 2020) identifies five mine contact water sources that are expected to require treatment during the post closure period: TSF supernatant pond water, TSF consolidation water, Fiddle DRSF toe seepage, Hangar Flats pit lake overflow, and West End pit lake overflow. Midas Gold proposes to treat these contact water sources using a mixture of active and passive treatment technologies. Overall, water treatment would not alter the magnitude of flows in the EFSFSR, Fiddle Creek, or West End Creek, because outflows from the treatment systems would be the same as inflows. However, the timing of flows in streams receiving treated water effluent could be altered depending on the time that contact water is in each treatment system. Any lag in flows resulting from water treatment would likely be on the order of hours to days. Analysis by Brown and Caldwell (2020) suggests that average monthly flow rates in the EFSFSR with water treatment would essentially be the same as ambient conditions.

It is possible that the proposed active treatment of the Hangar Flats pit lake water could affect downstream flows in Meadow Creek by diverting the pit lake overflow to the active water treatment plant located in the EFSFSR drainage. The rate of diversion from the pit lake during the maximum weekly summer condition (corresponding to late season baseflow) is estimated to be 1.23 cfs (Brown and Caldwell 2020). Assuming this entire diversion volume would have otherwise reported directly to Meadow Creek, the pit lake diversion for water treatment could reduce late season flows in Meadow Creek by up to third, based on average predicted seasonal low flows of 3.8 cfs for the No Action scenario. Midas Gold has mitigated for the potential for reductions in Meadow Creek by proposing to pump and treat water from the Hangar Flats pit lake and discharge the treated water back into the pit lake at or near the point of pit lake overflow so that the overflow water would be primarily comprised of treated water and potential impacts to flow rates in Meadow Creek would be minimized.

In summary, the model simulations indicate that implementation of Alternative 2 would result in some impacts to the post closure stream flow. The simulated flows vary from no predicted change at USGS Gaging Station 13310800, to a moderate reduction in streamflow (26 percent reduction of the minimum monthly streamflow) relative to existing conditions at Meadow Creek downstream of the Hangar Flats pit, depending on the stream and the post closure year.

Surface flows are generally predicted to recover to the existing pre-mine conditions by approximately mine year 15. Model simulations indicate that streamflow under the Alternative 2 scenario would be higher than that predicted for Alternative 1, especially for the EFSFSR downstream of Meadow Creek and for Meadow Creek downstream of Hangar Flats pit to the confluence with the EFSFSR during the early post closure years. This is attributed to: 1) diversion of Meadow Creek peak flow to the Hangar Flats pit lake during periods of high runoff (proposed to accelerate pit lake filling); 2) extending the Meadow Creek liner; 3) extending the duration of RIB infiltration; and 4) partially backfilling the Hangar Flats pit (which would reduce the time for the pit lake to form).

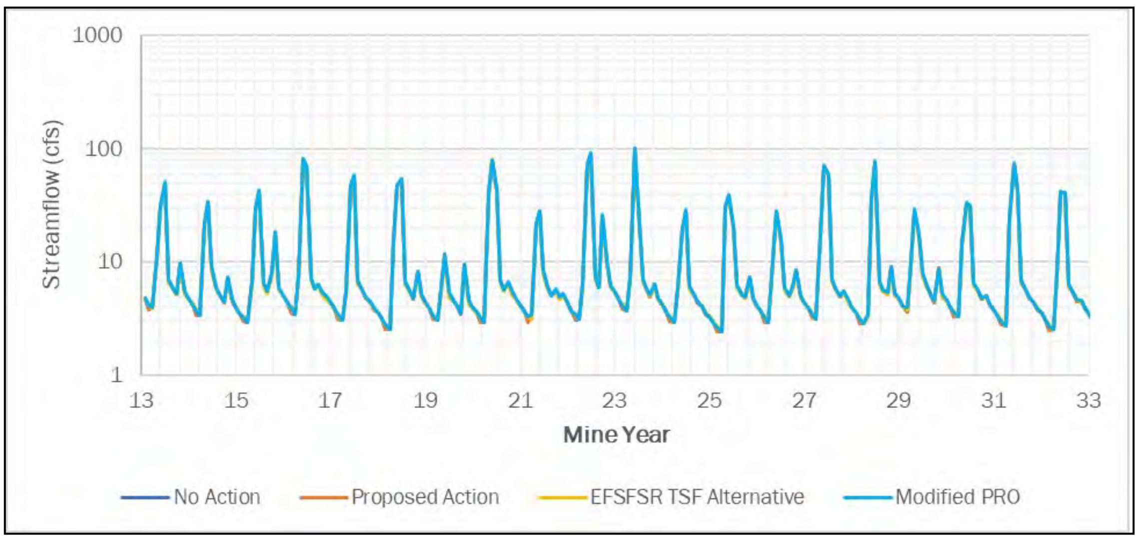


Figure Source: Brown and Caldwell 2019a, Figure 3-12

Figure Notes:

Existing conditions are represented as *No Action* on the graph. Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-41 Simulated Flow at USGS Gaging Station 13310800, EFSFSR above Meadow Creek (Logarithmic) for the First 20 Years of Post Closure

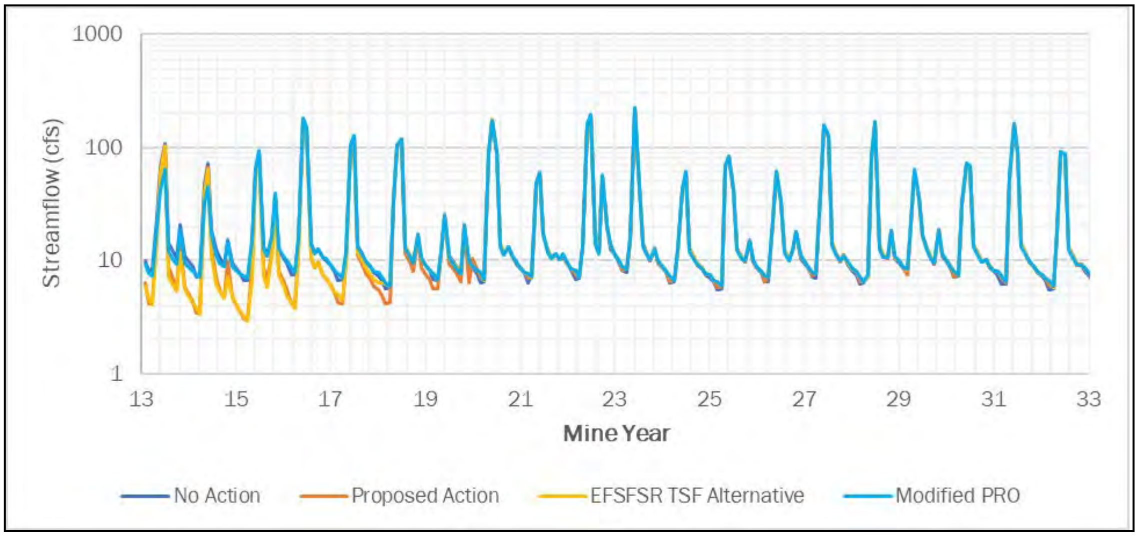


Figure Source: Brown and Caldwell 2019, Figure 3-13

Figure Notes:

Existing conditions are represented as *No Action* on the graph. Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-42 Simulated Flow at USGS Gaging Station 13311000, EFSFSR at Stibnite (Logarithmic) for the First 20 Years of Post Closure

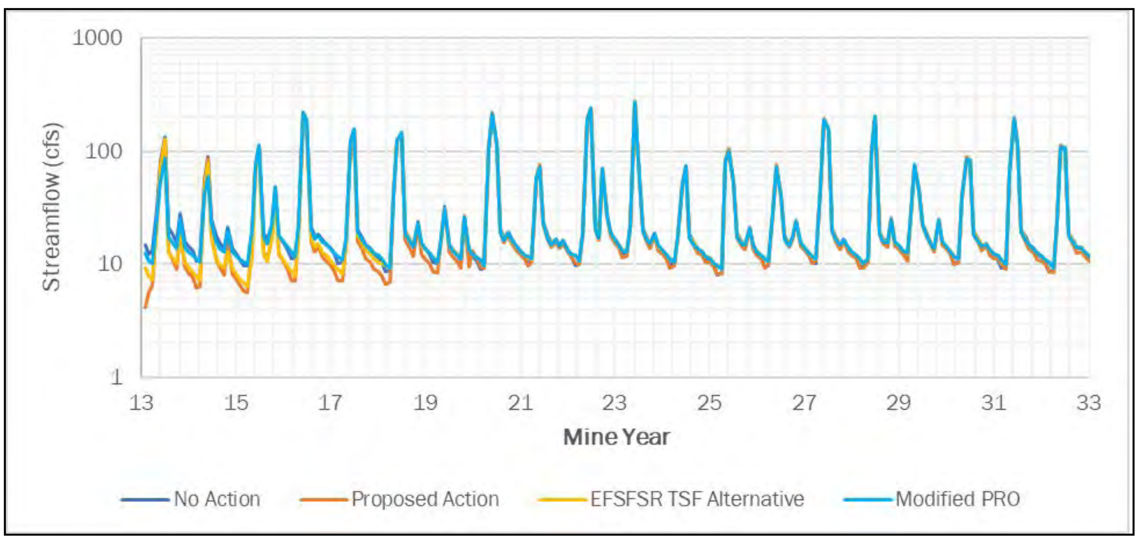


Figure Source: Brown and Caldwell 2019a, Figure 3-14

Figure Notes:

Existing conditions are represented as *No Action* on the graph. Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-43 Simulated Flow at USGS Gaging Station 13311250, EFSFSR above Sugar Creek (Logarithmic) for the First 20 Years of Post Closure

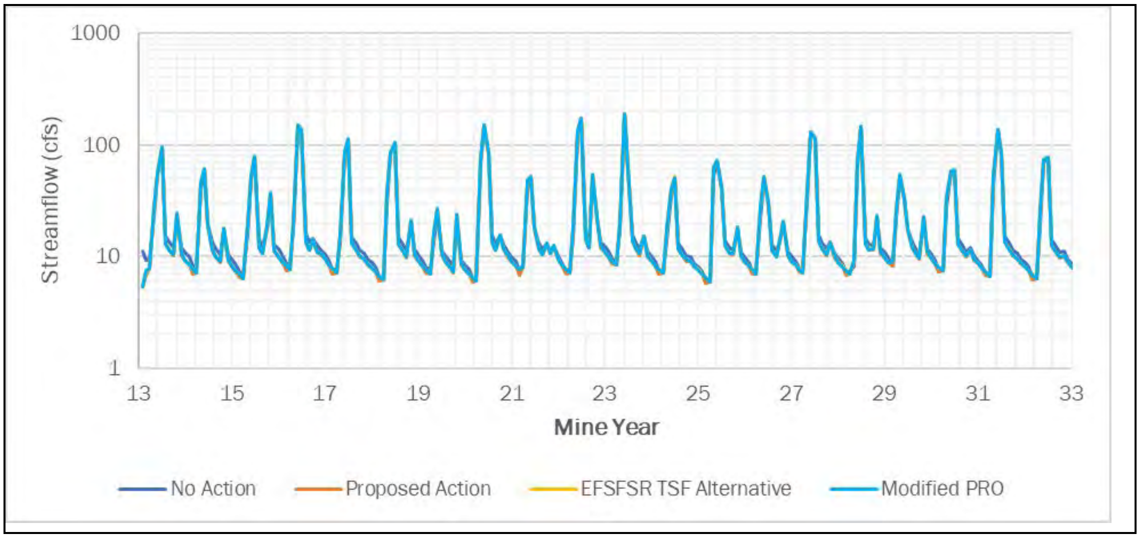


Figure Source: Brown and Caldwell 2019a, Figure 3-15

Figure Notes:

Existing conditions are represented as *No Action* on the graph. Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-44 Simulated Flow at USGS Gaging Station 13311450, Sugar Creek near Stibnite (Logarithmic) for the First 20 Years of Post Closure

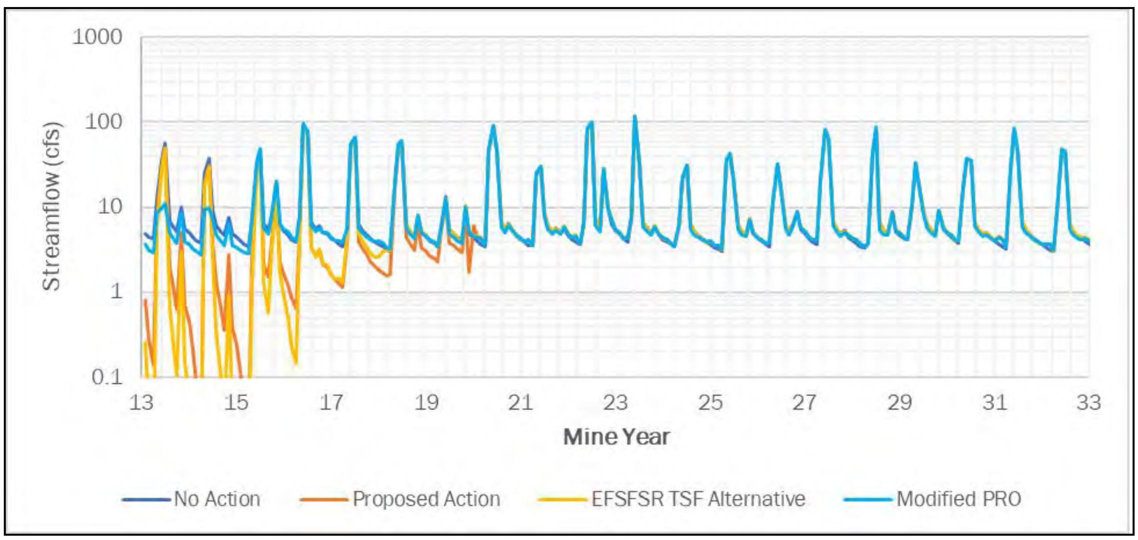


Figure Source: Brown and Caldwell 2019a, Figure 3-16

Figure Notes:

Existing conditions are represented as *No Action* on the graph. Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-45 Simulated Flow for Meadow Creek downstream of Hangar Flats Pit to the Confluence with the EFSFSR (Logarithmic) for the First 20 Years of Post Closure

4.8.2.2.2 GROUNDWATER QUANTITY

Similar to the above changes in surface water flow for Alternative 2, the model-predicted groundwater conditions that would result from implementation of Alternative 2 are compared to the conditions simulated for existing conditions and Alternative 1.

4.8.2.2.2.1 Construction and Operations

The extended channel liner would reduce stream loss from Meadow Creek near the Hangar Flats pit during dewatering, which in turn would reduce the pit dewatering rates (Brown and Caldwell 2019). Those reduced dewatering rates are shown in **Figure 4.8-46**. The two sharp dewatering declines in mine years 11 and 12 are caused by the partial backfill of Hangar Flats pit. **Figure 4.8-46** shows that reducing stream loss from Meadow Creek (by lining extended portions of it) would reduce the rate of groundwater inflow into the Hangar Flats pit by more than one-third (compared to Alternative 1). This reduction is explained by the close proximity of Meadow Creek to the pit, with the creek serving as a major source of water for the pit under Alternative 1; that source would be substantially reduced as a result of extending the liner under Alternative 2.

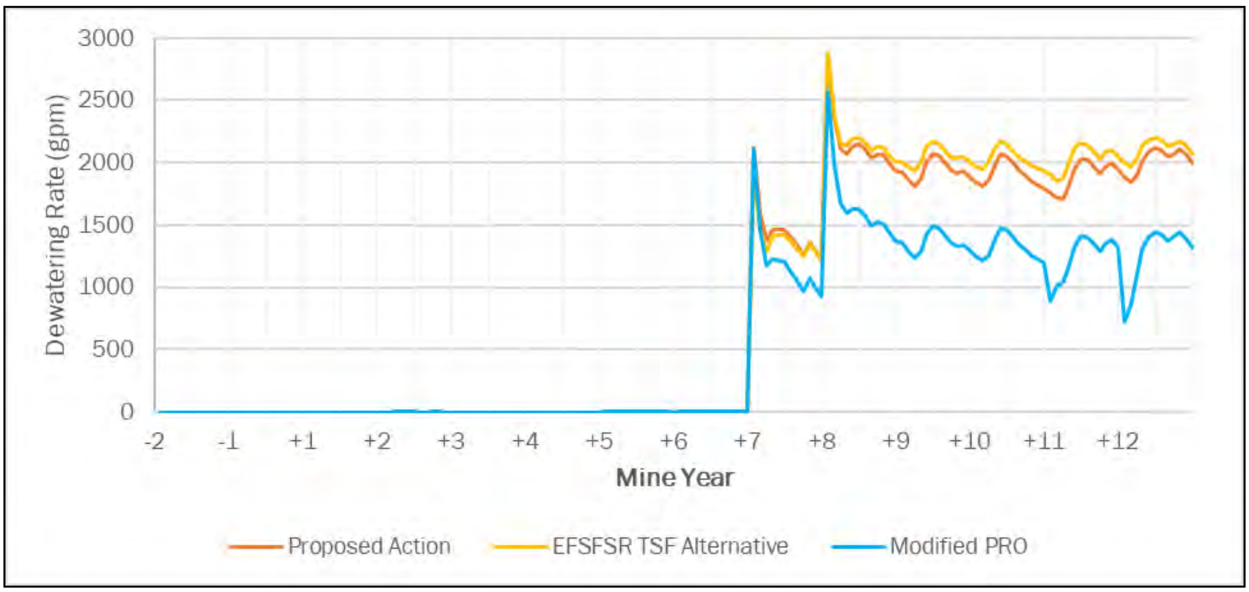


Figure Source: Brown and Caldwell 2019a, Figure 3-10

Figure Notes:

Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-46 Predicted Hangar Flats Pit Dewatering Rates

The simulated reduction in the Hangar Flats dewatering rates would reduce the amount of water supplied to the RIBs (**Figure 4.8-47**). The average reduction in RIB infiltration rates would be approximately 450 gpm for mine years 7 through 12 (Brown and Caldwell 2019a). Increasing or decreasing the RIB infiltration rates would affect groundwater levels between the RIBs and EFSFSR, as well as the rate of groundwater discharge to surface water.

Figure Source: Brown and Caldwell 2019a, Figure 3-11

Figure Notes:

Alternative 1 conditions are represented as *Proposed Action* on the graph. Alternative 2 conditions are represented as *Modified PRO* on the graph. Alternative 3 conditions are represented as *EFSFSR TSF Alternative* on the graph.

Figure 4.8-47 Predicted Infiltration Rates for the RIBs

4.8.2.2.2.2 Closure and Reclamation

Partial backfill of Hangar Flats pit with West End Development Rock and diversion of Meadow Creek peak flow to the pit lake during high runoff periods would notably reduce the time to fill the pit with water (to form the Hangar Flats pit lake). **Figure 4.8-48** shows that the Hangar Flats pit lake would completely fill in mine year 14 under Alternative 2, as opposed to mine year 19 under Alternative 1. Speeding up the rate of pit lake formation also would speed up the rate of recovery of groundwater levels around the lake.

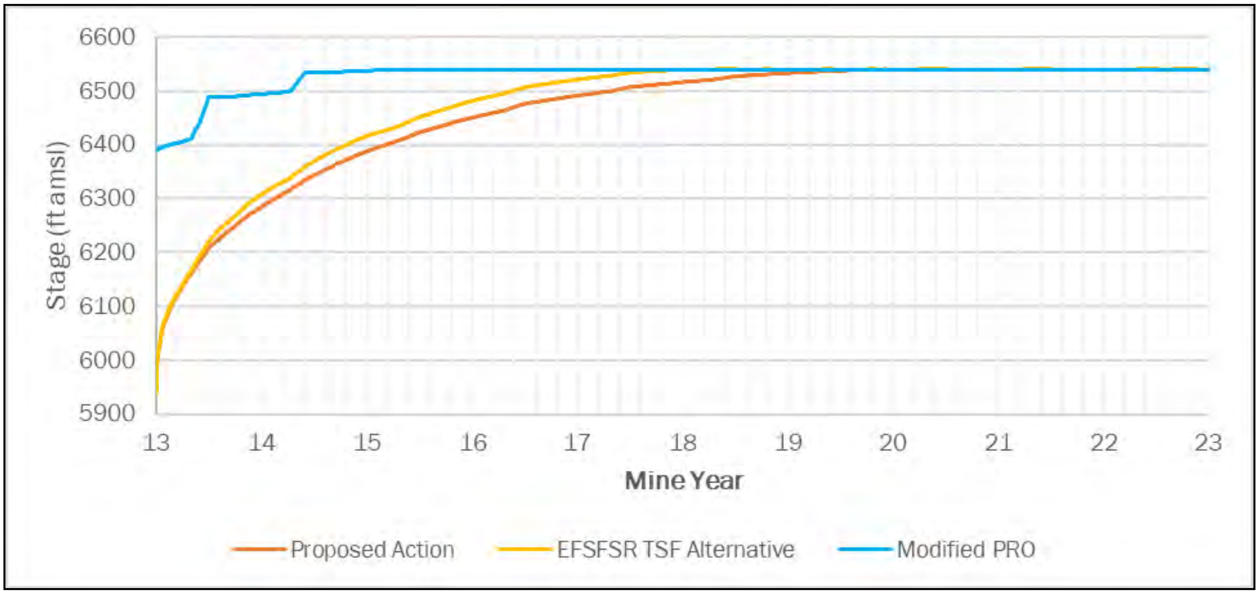


Figure Source: Brown and Caldwell 2019a, Figure 3-17

Figure 4.8-48 Predicted Hangar Flats Pit Lake Filling Curves – First 10 Years of Post Closure Period

4.8.2.3 Alternative 3

The hydrologic model used to assess the direct and indirect effects of Alternative 1 on surface water and groundwater quantity was modified with the changes proposed in Alternative 3. The two selected components that were modified in the Alternative 3 model version are:

- Move TSF to the EFSFSR drainage; and
- Move Hangar Flats DRSF to the EFSFSR drainage.

Results of the modeling are detailed in the EFSFSR TSF/DRSF Alternative Modeling Report (Brown and Caldwell 2019b). The following sections describe the predicted direct and indirect effects of implementing Alternative 3 on surface water quantity and groundwater quantity.

4.8.2.3.1 Surface Water Quantity

4.8.2.3.1.1 Changes in Stream Flow Characteristics (Daily, Seasonal, Annual)

The changes in surface water flow described in this section for Alternative 3 are compared to those simulated for the existing conditions and other proposed alternatives. The primary focus of the analysis is on areas with the largest model-predicted effects, such as flows in the EFSFSR at USGS Gaging Stations 13310800, 13311000, and 13311250; Sugar Creek at the USGS Gaging Station 13311450; and on Meadow Creek upstream of the EFSFSR.

Construction and Operations

Base flows at the USGS Gaging Station 13310800 (EFSFSR above Meadow Creek) are predicted to be lower under Alternative 3 than predicted for the existing conditions and other proposed alternatives (**Figure 4.8-36**). Predicted base flow reductions at this location would result from reductions in groundwater discharge to the EFSFSR beneath the TSF and DRSF. The model-simulated stream flows at USGS Gaging Station 13311000 (EFSFSR at Stibnite), which is downstream of the confluence with Meadow Creek, are similar for Alternatives 3 and 1, which are higher than the existing conditions simulation (**Figure 4.8-37**). For the EFSFSR above Sugar Creek (USGS Gaging Station 13311250), the simulated stream flows are lower for Alternative 3 relative to existing conditions and all other alternatives (**Figure 4.8-38**).

The Alternative 3 model-simulated stream flows for Sugar Creek at USGS Gaging Station 13311450 are similar to existing conditions (**Figure 4.8-39**).

Stream flows were predicted for Meadow Creek downstream of Hangar Flats pit to the confluence with the EFSFSR (**Figure 4.8-40**). Predicted stream flows for Alternative 3 are generally lower than all other scenarios with an average monthly flow reduction of 44 percent for mine years 7 through 12. Base flows are predicted to be very low relative to the existing conditions and Alternative 2 during mine years 7 through 12. January through March, low flows in mine years 7 through 12 show a 53 percent reduction relative to the existing conditions. The simulated reductions in flows are caused by water table depression in the direct vicinity of the Hangar Flats pit, which increases stream losses in Meadow Creek directly downstream of the lined diversion (Brown and Caldwell 2018b).

In summary, the model simulations predict that implementation of Alternative 3 would result in some impacts to stream flows in the area of analysis. The simulated flows for Alternative 3 are similar to those predicted for Alternative 1 (i.e., vary from no predicted change to greater than a 45 percent reduction in low flows, depending on the stream and the mine year). The greatest impacts for Alternative 3 are predicted for Meadow Creek downstream of the Hangar Flats pit to the confluence with the EFSFSR where January through March low flows show an average of 53 percent reduction in mine years 7 through 12.

Closure and Reclamation

Average stream flows for the post closure period at the USGS Gaging Station 13310800 (EFSFSR above Meadow Creek) are predicted to be the same for alternatives 1, 2, and 3, and the existing conditions (**Figure 4.8-41**). Stream flows at USGS Gaging Station 13311000, which is downstream of the confluence with Meadow Creek, are predicted to be similar for Alternatives 3 and 1, but lower than under Alternative 2 and existing conditions. However, peak flows would be higher (compared to Alternative 2 and existing conditions) during mine years 13 and 14. Base flows would remain low until mine year 19, when they would return to seasonal patterns similar to existing conditions (**Figure 4.8-42**). Similar trends are predicted for the EFSFSR above Sugar Creek (USGS Gaging Station 13311250), where the simulated base flows are lower for Alternative 3 relative to existing conditions and Alternative 2 (**Figure 4.8-43**).

In Sugar Creek at USGS Gaging Station 13311450, model simulations predict similar stream flows for Alternative 3 relative to existing conditions and the other action alternatives (**Figure 4.8-44**).

Stream flows were predicted for Meadow Creek downstream of Hangar Flats pit to the confluence with the EFSFSR (**Figure 4.8-45**). Predicted base flows for Alternative 3 are generally lower than all other scenarios for mine years 13 through 16, before gradually returning to the seasonal baseline pattern by mine year 19. Simulated seasonal base flows indicate that this section of Meadow Creek would go dry during the first three years of closure (mine years 13 through 15) before beginning to gradually recover by mine year 19.

In summary, the Alternative 3 model simulations for the post closure period indicate that stream flow would be impacted to some degree in the area of analysis. The simulated flows for Alternative 3 are similar to those predicted for Alternative 1, with reduced base flow for sections of the EFSFSR below Meadow Creek, as well as Meadow Creek in the vicinity of the Hangar Flats pit. Impacts vary from no predicted change on the EFSFSR above Meadow Creek and Sugar Creek to a 100 percent reduction (dry) in low flows on Meadow Creek downstream of the Hangar Flats pit in the early post closure period. Stream flows predicted for Alternative 3 generally return to baseline seasonal stream flow patterns by mine year 19.

4.8.2.3.2 GROUNDWATER QUANTITY

The model-predicted groundwater conditions that would result from implementation of Alternative 3 are compared to the conditions simulated for Alternative 1 and to existing conditions.

4.8.2.3.2.1 Construction and Operations

Locating and developing the DRSF and TSF in the EFSFSR valley upstream of the Meadow Creek confluence would shift the location of groundwater level impacts relative to Alternatives 1 and 2.

Groundwater levels within the footprint of the relocated DRSF and TSF facilities would be somewhat lower than existing conditions due to reduced rates of groundwater recharge.

The model-predicted Hangar Flats pit dewatering rates would be somewhat higher under Alternative 3 compared to Alternative 1 (see **Figure 4.8-46**). The higher dewatering rates can be explained by higher groundwater recharge, because the TSF would no longer be located in the Meadow Creek valley, leading to higher groundwater levels and steeper hydraulic gradients around the Hangar Flats pit. Because dewatering rates from the Hangar Flats pit would be higher, the model-predicted infiltration rates for the RIBs also would be slightly higher compared to Alternative 1 (see **Figure 4.8-47**).

Placement of the TSF and Hangar Flats DRSF in the EFSFSR valley upstream of the Meadow Creek confluence, instead of the Meadow Creek valley, would cause reduction of groundwater recharge beneath these facilities in the upper EFSFSR valley, but at the same time would affect a smaller number of springs and seeps, compared to other action alternatives. **Figure 4.8-29** shows a much smaller number of springs and seeps near the axis of the EFSFSR valley upstream of the Meadow Creek confluence, compared to the axis of Meadow Creek valley.

4.8.2.3.2.2 Closure and Reclamation

The higher model-predicted dewatering rates for the Hangar Flats pit under Alternative 3 compared to Alternative 1 (see **Figure 4.8-46**) would correspondingly result in a somewhat shorter time of filling that pit with water after mine closure. The absence of the TSF in the Meadow Creek Valley directly upgradient of the pit would result in higher groundwater levels in that area and steeper hydraulic gradients, both during dewatering of the pit and during pit lake formation. As **Figure 4.8-48** shows, the pit lake would reach its final stage by mine year 17 under Alternative 3, as opposed to mine year 19 under the Alternative 1 scenario (5 years after mining and ore processing cease versus 7 years after mining and ore processing cease).

4.8.2.4 Alternative 4

Model predictions suggest that potential impacts on surface water and groundwater quantity for Alternative 4 would generally be the same as Alternative 1. The model used to assess the direct and indirect effects of Alternative 1 on surface water and groundwater quantity can be used for evaluating Alternative 4. This is because the major mine components incorporated into the model are the same for both alternatives.

However, one change in surface water management under Alternative 4 that could affect streamflow would be the use of a pipeline to divert Meadow Creek around Hangar Flats pit during operations. The stream segment in the piped section would not receive surface runoff from snowmelt or precipitation, but also would not be subject to evaporative losses. As such, piping this segment of Meadow Creek could have a minor effect on the timing and magnitude of surface water flows downstream. The potential effect of piping this segment has not been quantified but is expected to be minor relative to the impacts from other mine features that are quantified in the modeling studies. This is because of the relatively short length of the pipeline, compared to the entire run of Meadow Creek upstream of the piped section, and that surface water runoff occurring over the length of the pipeline would be returned to the Creek at a location down-gradient of the pipe.

4.8.2.5 Alternative 5

Under Alternative 5, none of the action alternatives would be approved, and therefore no activities proposed on National Forest System lands would be approved. This scenario would not preclude Midas Gold from submitting another plan of operations in the future.

Under Alternative 5, there would be no surface (open-pit) mining or ore processing to extract gold, silver, and antimony, and no SGP-related underground exploration, sampling, or related operations and facilities on the National Forest System lands. Midas Gold would continue to implement surface exploration and associated activities that have been previously approved on the National Forest System lands as part of the Golden Meadows Exploration Project, per the

Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project Environmental Assessment (Forest Service 2015).

Midas Gold would be required to continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and Environmental Assessment. Those commitments would include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices, and monitoring, to ensure that sediment and stormwater best management practices are in place and effective, so that soil erosion and other potential resource impacts are avoided or minimized. Additionally, Midas Gold could continue information collecting activities at the mine site and vicinity such as groundwater and surface water monitoring and reporting (pursuant to development of another plan of operations). Such reporting is required as part of the Golden Meadows Exploration Environmental Assessment. Other requirements include care and maintenance of stormwater best management practices at over 140 historical mining impact locations, and monitoring stream flow measurements from stream gages installed in creeks.

Alternative 5 would result in no changes to existing surface water or groundwater quantity conditions as summarized above. Stream flow characteristics and groundwater hydraulic gradients, levels, flow directions, hydraulic properties of water-bearing materials, and productivity of the groundwater system would remain unchanged.

4.8.2.5.1 WATER RIGHTS

Alternative 5 would result in no additional water rights being filed with IDWR. Therefore, there would be no change from baseline conditions for groundwater and surface water resources, and no direct or indirect effects on existing water rights.

4.8.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.8.4 Cumulative Effects

4.8.4.1 Common to all Alternatives

The cumulative effects analysis area for surface water and groundwater quantity that could be directly or indirectly affected by the SGP consists of the area where activities associated with the action alternatives could affect stream flows and/or the quantity of groundwater in storage, groundwater levels, and groundwater transmission. The analysis area is described in Section 3.8.1.1, Scope of Analysis, and shown on **Figure 3.8-1**.

Cumulative effects associated with the SGP consider the range of existing and foreseeable activities and their potential effects with respect to surface water and groundwater quantity. Past and present actions that may have impacted water quantity through short-term water use include historical mining and reclamation activities in the area, as well as the Golden Meadows Exploration Project, which requires water for borehole drilling and other purposes.

The active Valley County Quarry (located near the village of Yellow Pine and about 7 miles to the west of the SGP area) also may require some degree of groundwater consumption, but since the quarry is located in a different subwatershed from the mine site that is outside the analysis area, it would not contribute to cumulative groundwater quantity impacts.

There are no reasonably foreseeable future actions that have or would affect surface water and groundwater quantity in the analysis area. In making this determination, a number of other nearby projects that have the potential to affect surface water and groundwater quantity were considered. These include Big Creek area's small-scale hydroelectric projects and Morgan Ridge Exploration. Although these projects could affect the surface water and groundwater systems within their respective watersheds, they are located within a different subwatershed from the analysis area and the mine site, and lack direct communication via waterways to combine and result in cumulative water quantity effects.

4.8.5 Irreversible and Irretrievable Commitments of Public Resources

4.8.5.1 Common to All Action Alternatives

4.8.5.1.1 SURFACE WATER QUANTITY

Surface water, in terms of its flow rate characteristics, is a renewable resource, and therefore the action alternatives are not expected to have irreversible flow impacts. The duration of the predicted impacts on streamflow include the mine operational period (including the construction period), and another 10 years through the post closure period, before returning to a stable, long-term seasonal pattern similar to existing conditions. An exception to this would be the accelerated return to a stable, long-term seasonal flow pattern during post- closure under Alternative 2. The modeled streams surrounding the Hangar Flats pit (EFSFSR and Meadow Creek) are expected to return to similar patterns as the existing conditions up to approximately

4 years sooner for Alternative 2, relative to Alternatives 1 and 3. The accelerated recovery of streamflow to the existing condition is a direct result of the Meadow Creek liner extension, partial backfilling of the Hangar Flats pit, and acceleration of Hangar Flats pit lake filling. Changes to the drainage network would occur as a series and sequence of stream diversions of varied duration, with predicted impact durations ranging from approximately eight to twenty years.

However, the SGP would irreversibly alter the mine site by the development of the TSF, by eliminating the existing Yellow Pine pit lake (and reconstructing the EFSFSR through its present location), and creating three lakes in the Hangar Flats, West End, and Midnight area pits. The degree of irreversible effects would be lower under Alternative 2 due to backfill of the Midnight area pit.

4.8.5.1.2 GROUNDWATER QUANTITY

The SGP would result in some irreversible changes to the groundwater system. Mining of ore would result in the formation of mine pits, which would fill during a post closure period, forming pit lakes. The Yellow Pine pit would be backfilled with development rock to facilitate reclamation of the EFSFSR. Mining of the pits and filling the Yellow Pine pit with rock would result in the most substantial changes to the groundwater system.

Over the long term, the vast majority of Hangar Flats pit lake inflows would occur from groundwater. West End pit lake would be situated primarily in bedrock and therefore would not receive substantial groundwater inflows (The model simulations show that the primary sources of water for filling the lake are direct precipitation and surface water runoff. The lake is predicted to fill slowly over 41 years, with a seasonal pattern of increased lake stage from spring runoff followed by seasonal declines as water evaporates and flows from the lake back into local bedrock groundwater). The small Midnight pit would be relatively isolated, receiving water from precipitation and minor groundwater contributions, with no surface water contributions (Brown and Caldwell 2018b).

Long-term, groundwater levels would be locally affected by the DRSFs and TSF, which would permanently alter groundwater recharge rates over the areas occupied by these structures.

Underdrains installed under the DRSFs also would modify groundwater flow beneath the development rock facilities. However, the post closure groundwater model simulations show a flow pattern that is similar to existing conditions with only small localized effects arising from the presence of the pit lakes, DRSFs, and TSF (Brown and Caldwell 2018b). Those effects would include altering hydraulic gradients and lowering the water table around the SGP components.

4.8.5.2 Alternative 5

Under the No Action Alternative, no mining would take place. Consequently, no change would occur in the current surface water and groundwater conditions in the analysis area, and no change to the current commitment of resources would occur. Therefore, there would be no irreversible or irretrievable commitments of water resources beyond those already realized as a consequence of historical mining activities conducted within the analysis area.

4.8.6 Short-term Uses versus Long-term Productivity

4.8.6.1 Common to All Action Alternatives

4.8.6.1.1 Surface Water Quantity

Implementation of Alternatives 1 through 4 would result in short-term impacts to surface water quantity at the mine site through groundwater withdrawal and stream diversions. The duration of predicted impacts on streamflow include the 1mine operational period, and the post closure period. After that period, the system would return to a stable, long-term seasonal pattern similar to existing conditions. An exception to this would be the accelerated return to a stable, long-term seasonal pattern during post closure under Alternative 2. The modeled streams surrounding the Hangar Flats pit (EFSFSR and Meadow Creak) are expected to return to similar patterns as the existing conditions up to approximately 4 years sooner for Alternative 2 relative to Alternatives 1 and 3. The accelerated recovery of streamflow to existing conditions is a direct result of the Meadow Creek liner extension, partial backfilling of the Hangar Flats pit, and acceleration of Hangar Flats pit lake filling.

4.8.6.1.2 Groundwater Quantity

Apart from triggering some changes in groundwater quality characteristics (see Section 4.9, Surface Water and Groundwater Quality), implementation of the action alternatives would not result in any substantial changes to short-term or long-term groundwater productivity. Post-mining, groundwater wells could still be installed within the SGP area (except in the footprints of the TSF, DRSF, and pit lakes), and used to produce groundwater at rates similar to those under existing conditions. Saturated thickness of alluvial deposits and their groundwater transmissive properties would remain similar to baseline conditions.

4.8.6.2 Alternative 5

4.8.6.2.1 Surface Water and Groundwater Quantity

Under Alternative 5, SGP activities would not be implemented. Consequently, no short-term use would occur that would affect surface water or groundwater quantity, and no change in long-term productivity would occur.

4.8.7 Summary

The SGP would result in stream flow impacts under all alternatives except Alternative 5. Low flow would be reduced at some locations during some periods of the SGP operations up to 18 percent in EFSFSR (at USGS Gaging Station 13311250) and up to 45 percent in Meadow Creek (downstream of the Hangar Flats diversion but upstream of the confluence with EFSFSR due to water table depression from dewatering of the Hangar Flats pit).

The impacts to Meadow Creek in the vicinity of the Hangar Flats pit would be partially mitigated under Alternative 2, compared to other alternatives, due to extension of the lined portion of the Meadow Creek diversion. The model-predicted stream flows for Alternative 2 are higher than the low flows under other alternatives by over a factor of two during mine years 7 through 12.

Dewatering of the pits under Alternatives 1 through 4 would lower groundwater levels in the alluvial and bedrock formations during the mining and post closure periods, and would reduce flows in surface water streams that receive groundwater discharge. The extended liner proposed under Alternative 2 would reduce stream loss from Meadow Creek near the Hangar Flats pit during its dewatering, which in turn would reduce the pit dewatering rates. Compared to other alternatives, under Alternative 2 the partial backfill of Hangar Flats pit with West End development rock and diversion of Meadow Creek high flows to the pit lake during runoff periods would notably reduce the time of filling the Hangar Flats pit with water.

The TSF and Hangar Flats DRSF proposed to be located in the Meadow Creek valley under Alternatives 1, 2, and 4, would be constructed in the EFSFSR drainage under Alternative 3. These facilities, under Alternatives 1, 2, and 4 would lower groundwater levels and permanently remove a limited number of GDEs present within the footprint of the TSF and DRSF. Implementation of Alternative 3 would result in removing a smaller number of GDEs, compared to other action alternatives. Hangar Flats pit dewatering rates and the rate of water infiltrating via the RIBs would be somewhat higher under Alternative 3, compared to Alternatives 1, 2, and 4.

Table 4.8-1 provides a comparison of surface water and groundwater quantity impacts estimated to result from implementation of the various alternatives.

Table 4.8-1 Comparison of SGP's Surface Water and Groundwater Quantity Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may cause changes in quantity of surface water and groundwater in all drainages within the analysis area.	Stream flow characteristics (daily, seasonal, annual).	Surface waters include: the EFSFSR, Rabbit Creek, Meadow Creek, East Fork Meadow Creek (also known as Blowout Creek), Garnet Creek, Fiddle Creek, Midnight Creek, Hennessy Creek, West End Creek, and Sugar Creek. Monthly average seasonal low flows: Meadow Creek between TSF and Hangar Flats pit = 2.7 cfs Meadow Creek below the diversion and above EFSFSR (mine years 7-10) = 3.8 cfs	Meadow Creek monthly average low flow during operations = 2.3 cfs (15% reduction from baseline conditions). The primary predicted impact: reduction in streamflow along Meadow Creek near the Hangar Flats pit and pit lake close to the end of the mine operation and early post closure. Simulated flows vary from no predicted change to a 45% reduction in low flows during the mine operational period. Flows vary from no predicted change to a 100% reduction during the early post-closure period. In most areas, groundwater in the alluvial aquifers recover within 10 years after the cessation of mining. Large areas of the bedrock aquifer are also expected to recover. However, there is less confidence about overall long-term recovery of the bedrock aquifer.	Stream flow impacts partially mitigated for Meadow Creek in the vicinity of the Hangar Flats pit and pit lake relative to Alternative 1. Predicted stream low flows for Alternative 2 two times higher than the low flows under Alternative 1 during mine years 7 through 12. Across these years, the average monthly flow reduction relative to the existing conditions was predicted to be 32% for Alternative 2 and 47% for Alternative 1. In early post closure when the section of Meadow Creek is predicted to go dry under Alternative 1, predictions for Alternative 2 are a 26% reduction in the average monthly flow. Surface flows are generally predicted to recover to pre-mine conditions by approximately mine year 15 (3 years after operations cease)	Stream flow would be impacted by Alternative 3 within the analysis area. Simulated flows are similar to Alternative 1.	Stream flow would be impacted by Alternative 4 within the analysis area. Simulated flows are similar to Alternative 1.	Alternative 5 would result in no changes to existing stream flow characteristics.
	The extent, magnitude, and duration of groundwater level changes.	Groundwater flow in the analysis area occurs primarily in the Quaternary unconsolidated deposits filling the valleys and through the unconsolidated deposits covering the mountainsides.	Dewatering of the pits lowers groundwater levels in the alluvial and bedrock formations during the mining and post closure periods, and reduces flows in surface water streams that receive groundwater discharge. In most areas, groundwater in the alluvial aquifers recover within 10 years after the cessation of mining. Large areas of the bedrock aquifer are also expected to recover. However, there is less confidence about overall long-term recovery of the bedrock aquifer. Development of DRSFs and TSF within Meadow Creek valley would result in lowering water table levels by more than ten feet in some areas within their footprint, and in areas close around, during production and post closure periods.	The extended liner reduces stream loss from Meadow Creek near the Hangar Flats pit, and reduces that pit's dewatering rates by more than 25%. Partial backfill of Hangar Flats pit with West End Development Rock and diversion of Meadow Creek high flow to the pit lake reduces the time of filling the pit with water from the Hangar Flats pit lake.	The TSF and Hangar Flats DRSF constructed in the EFSFSR valley would lower groundwater levels within their footprint. Hangar Flats pit dewatering rates and the rate of water infiltrating via the RIBs somewhat higher compared to Alternative 1. Hangar Flats pit fills with water somewhat quicker.	The extent, magnitude, and duration of groundwater level changes would be similar to Alternative 1.	Alternative 5 would result in no changes to existing (baseline) groundwater flow conditions.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may affect water rights.	Change in water rights availability in the SGP area.	Four existing water rights at the mine site owned by Midas Gold.	No changes in water rights availability in the SGP area. May affect downstream water rights.	No changes in water rights availability in the SGP area. May affect downstream water rights.	No changes in water rights availability in the SGP area. May affect downstream water rights.	No changes in water rights availability in the SGP area. May affect downstream water rights.	No changes in water rights availability.
	New water rights needed.	Existing water rights held by Midas Gold: 77-7285 - Groundwater right for storage and mining with diversion of 0.5 cfs for a maximum total usage of 39.2 acre-feet 77-7141 – Groundwater right for domestic with diversion of 0.2 cfs for a maximum total usage of 11.4 acre-feet 77-7293 – Surface water right for storage and mining for diversion of 0.25 cfs and a maximum total usage of 20 acre-feet. 77-7122 – Surface water right for storage and mining for diversion of 0.33 cfs for a maximum total usage of 7.1 acre-feet.	An additional 2.39 cfs and 1,730 acre-feet of groundwater rights needed to support ore processing. An additional 0.34 cfs and 10 acre-feet of groundwater rights needed for potable water supply. During drought conditions, temporary seasonal withdrawal of up to 5.63 cfs from groundwater. An additional water right for 3.47 cfs diversion of surface would be needed.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No new water rights required.

4.8.8 Uncertainty Associated with Model Predictions

4.8.8.1 Sources of Uncertainty and Approaches to Evaluate such Uncertainties in Hydrologic Models

Predictions generated by groundwater and hydrologic models are associated with a degree of uncertainty, and can be limited in their predictive power. General sources of model uncertainty are attributed to a variety of factors, including:

- Insufficient data for characterizing hydraulic properties (over a large enough area), or the hydrologic system's response to changes or stressors on which the model predictions depend;
- Inaccurate conceptual models or model assumptions;
- Inadequate geometrical representation of a complex system and its heterogeneities;
- Random error resulting from spatial interpolations;
- Random errors in field measurements;
- Poor data collection designs and inadequate interpretation of the collected data;
- Not representing relevant processes that affect the hydrologic system;
- General limitations of the models and numerical methods used; and
- Unpredictable natural and human factors.

Uncertainties associated with model predictions can be evaluated and assessed using a variety of approaches, including:

- Sensitivity analysis;
- "Bayesian model averaging" applied to multiple conceptual models and multiple parameter estimation methods;
- Parallel testing of several viable conceptual models, combined with parametric uncertainty analysis carried out for each conceptual model;
- The use of "pilot points" in conjunction with nonlinear parameter estimation software that incorporates advanced regularization functionality;
- "Calibration-Constrained Monte-Carlo," also called "Null Space Monte Carlo"; and/or
- "Subspace Monte Carlo" that allows calibration-constrained random heterogeneity.

Sensitivity analysis is deemed an important part of model uncertainty analysis. Most often such analysis is limited to varying model parameters and noting how such changes affect the model calibration. However, sensitivity analysis alone is not always adequate if the altered model is used for making predictions. This is because varying the values of model parameters often results in a significant model “de-calibration,” and de-calibrated models should not be used for predictive simulations.

ASTM International Standard Guide for Conducting Sensitivity Analysis for a Groundwater Flow Model Application (ASTM International 2008) provides the following clear instructions: “For each value of each group of inputs, rerun the calibration and prediction runs [emphasis added] of the model with the new value of the calibrated value” – this means that after varying the value of a given parameter, one needs to calibrate the altered model, before using it for making predictions. This is seldom accomplished with the models developed for industrial applications – completing such systematic analysis would require large budgets and a significant level of effort that many projects cannot support.

Many of the other, more sophisticated approaches listed above for evaluating model uncertainty can be quite involved and, due to limitations of software and hardware, combined with the budgetary and time constraints of most projects, are still not practical outside of the realm of research (Rzepecki 2012).

4.8.8.2 Main Sources of Predictive Uncertainty for the Proposed Action Hydrologic Model

An independent review of the Proposed Action Hydrologic Model noted the following limitations that result in model predictive uncertainties (Environmental Resource Management 2019):

- The number of hydraulically tested wells and boreholes;
- Limitations of the data derived from the completed hydraulic testing related to the scale of the tests;
- Uncertainty as to if any of the fault zones near the proposed pits were hydraulically tested; and
- Not evaluating model predictive sensitivity to various possible degrees of hydraulic transmissivity of fault zones, which have not been represented in the model.
- Spatial distribution of wells with measured groundwater level.

4.8.8.2.1 DISCUSSION

The following paragraphs provide a discussion of each of those noted limitations put in a broader context of standard modeling practice.

4.8.8.2.1.1 Number of Hydraulically Tested Wells and Boreholes

For the Existing Conditions and Proposed Action hydrologic models, setting the values of hydraulic property parameters was guided by the results of slug tests, packer tests, and aquifer tests completed within the area of analysis over several years (Brown and Caldwell 2017).

Brown and Caldwell (2018a) developed average values for each of the main identified hydrogeological units, including the alluvium, overburden, and non-fractured- or moderately fractured- bedrock.

The Water Resources Summary Report (Brown and Caldwell 2017) indicates that hydraulic properties for the analysis area were obtained from:

- Twenty-one slug tests of wells completed in alluvium and 12 wells/boreholes completed in bedrock;
- Seventy packer tests completed in 12 bedrock boreholes – of those, 56 tests were considered successful; and
- Six alluvial aquifer tests performed on the Camp well, Stibnite's Hooterville and main camp domestic wells, Hecla Mining Company's Pioneer well, the Stibnite Plant utility well, and the Stibnite Gestrin Airstrip Well – water levels during this test were observed in four alluvial and three bedrock wells.

The Brown and Caldwell reports (2017, 2018a) do not provide a summary of differences between hydraulic properties of different rock types present within the analysis area. However, hydraulic properties of crystalline rock are often driven primarily by the density and interconnectedness of fractures, not the rock type itself. Site-specific data show that the fractured bedrock is more permeable than non-fractured bedrock, regardless of the rock type. This difference is reflected in the model by different values of hydraulic conductivity assigned to the model layers representing shallower fractured bedrock and the deeper, less fractured bedrock.

The wells and boreholes subject to hydraulic testing are located within or near the bottom of mountain valleys, which is common for projects located in mountainous regions. Since the valley bottoms contain the most permeable formations, the network of test points cover the most important parts of the analysis area with regard to water balance and interaction of the SGP infrastructure with the environment.

Overall, the number of hydraulically tested wells and boreholes is within the standard practice for characterizing similar-sized projects subject to the EIS process. The quantity of hydraulic data used to develop the model was adequate and does not result in an unreasonable degree of model-uncertainty. The following sections discuss the uncertainties associated with the collected data and model predictive sensitivity analysis addressing those uncertainties.

4.8.8.2.1.2 Limitations of the Completed Hydraulic Testing

Hydraulic stresses induced by slug and packer testing affect only a small volume of the formation around the tested well or borehole. As such, even a large number of such tests completed on a large number of wells/boreholes may fall short of detecting the presence of highly transmissive bedrock fractures, faults, or sedimentary structures within unconsolidated deposits. Such structures provide preferential pathways for groundwater flow. This phenomenon is referred to as a problem of scale of the test. Without specifically characterizing these heterogeneities, their effects become averaged into the hydraulic conductivity zones defined during model calibration. The result may be underestimating (or oversimplifying) the transmissive capacity of a larger volume of rock or sediment.

The results of aquifer pump tests are considered among the most reliable for estimating hydraulic properties of larger volumes of groundwater-hosting formations. The results derived from the data collected during a 31-day Gestrin Airstrip alluvial Well aquifer test are more reliable than the results of slug tests. However, it is important to note that the results obtained from the Gestrin well test are within the range of results obtained for alluvium from slug tests.

Bedrock boreholes are typically tested using packers, as packers allow isolation of the most fractured- and potentially most hydraulically prolific sections of a borehole. Conducting a packer test for a prolonged time, longer than a day (to stress a larger volume of rock) is expensive, often not practical, and seldom practiced. Long-term pumping bedrock aquifer testing was conducted in late 2019; however, the results were not available to be included in the EIS at this time. The new data will likely improve characterization of hydraulic properties of the bedrock formations. In case the new estimates of those properties notably diverge from what was assumed in the hydrologic model, it is unlikely that the divergence would be greater than what was evaluated as part of the model sensitivity analysis summarized in Section 4.8.8.2.2, Hydrologic Model Sensitivity Analysis below.

Overall, the slug test and pump test data collected are sufficient to define hydraulic conductivity values in the model for zones representing alluvial sediments; moreover, results obtained from these tests likely approach the real properties of the alluvium. Additionally, the model is calibrated not only to groundwater levels but also to the rates of discharge measured in the mine site streams. The degree of model calibration described in Brown and Caldwell's report (2018a) could not have been achieved if the hydraulic conductivity of the alluvial sediments was significantly underestimated.

4.8.8.2.1.3 Uncertainty as to Hydraulic Testing of Fault Zones near the Proposed Pits

The ore deposits in the analysis area are cut by several major local- to regional-scale fault zones (Brown and Caldwell 2017). The bedrock also is fractured and faulted within the analysis area, primarily by north and northeast trending faults. The most prominent structure is the Meadow Creek Fault Zone, a steeply dipping northerly trending structure extending down the East Fork of Meadow Creek, through the Hangar Flats and Yellow Pine pit locations, and eventually trending to the northeast along Sugar Creek (SPF Consulting and Associates 2017).

Descriptions provided in Table 5-2 of the Water Resources Summary Report (Brown and Caldwell 2017) indicate that many of these faults are “poorly exposed” or “not exposed,” “not a single fault but a braided network of structural zones,” and that locations of many faults are interpreted from “geophysical surveys and soil and rock sampling.”

It is uncertain if any of the boreholes subjected to packer and/or slug testing intercepted these fault zones. Several of the packer tests were targeting fractured bedrock, but it is not clear if the fractures were associated with any of the faults mapped in the analysis area.

The consequences of such uncertainty to the model predictive accuracy also are difficult to estimate. This is because faults can serve as either (1) conduits for groundwater flow, or (2) barriers to flow. In addition, such transmissive or barrier properties are often changing from place to place. Many borehole logs presented by SPF Consulting and Associates (2017) document the presence of “fault gouge” which has a potential to decrease transmissive properties of a fault, compared to a fault which does not contain gouge material. However, that fault gouge does not necessarily prevent preferential groundwater flow through a network of fractures associated with and around the faults, even if such faults are filled with a gouge.

In conclusion, it is not certain if subjecting many more boreholes to packer testing would have better characterized the hydraulic properties of local faults. Characterizing the hydraulic properties of a fault system presents a difficult problem and such characterization is seldom achieved in groundwater studies.

4.8.8.2.1.4 Lack of Model Sensitivity Analysis for Hydraulic Transmissivity of Faults

As discussed above, it is uncertain if any of the hydraulically tested boreholes intercept a fault zone. As such, no definitive data is available characterizing hydraulic properties of the faults. Consequently, simulating such faults by the model would have to be based on alternative conceptual models.

Building alternative numerical models based on such alternative conceptual models would represent a substantial modeling effort. This is because each such model would need to be calibrated, before running any model predictive simulations. And if there is not enough data available to develop or support such alternative models, the predictive power of the alternative model would likely be no better (and perhaps substantially worse) than the Existing Conditions and Proposed Action (Alternative 1) hydrologic models developed by Brown and Caldwell.

Any calibrated groundwater model developed for research or predictive purposes realistically represents one of a large number of possible calibrated models that could be constructed using a given set of calibration data. This fact points to a problem of non-uniqueness of the solution, which in turn leads to “parametric uncertainty.”

It is likely, however, that, if Brown and Caldwell developed several versions of the calibrated model, the model predictions obtained using those various versions would not be substantially different. This is because calibrating the model not only to measured groundwater levels but also to stream discharges (measured during different seasons) helps to significantly constrain the calibration process. The more the model is constrained by various types of calibration data, the less the possibility of developing model versions of markedly different predictive capacities.

4.8.8.2.1.5 Spatial Distribution of Wells with Measured Groundwater Level Data

Investigators carrying out environmental studies for mining projects in the mountainous regions typically install most of the monitoring wells and collect groundwater level data mainly for the areas within the mountain valleys. Mountain slopes are often inaccessible or difficult to access for drilling and installation operations. Groundwater models developed for such projects are properly calibrated only for the areas of the valleys. Such models can be appropriate tools for predictive simulations provided that: (1) most of the project’s infrastructure is located within the valleys; and (2) the valleys are filled with sediments more transmissive than the underlying bedrock. Such is the case for the SGP. However, there is less confidence in the groundwater model’s predictive abilities outside of the valleys.

4.8.8.2.2 Hydrologic Model Sensitivity Analysis

Brown and Caldwell completed sensitivity analyses for the hydrologic models simulating existing conditions, No Action, and Alternative 1. The analyses involved varying either hydraulic conductivity (K) or specific yield (Sy) values, and quantifying the resulting differences in the model-simulated groundwater levels, stream flows, pit dewatering flow rates, and rates of excess water disposal through RIB infiltration (Brown and Caldwell 2019c).

Sensitivity analysis typically completed for modeling programs evaluates how changes in the model input parameters result in model de-calibration. De-calibrated models should not be used for generating predictions. Brown and Caldwell acknowledge this; however, also reported that the changes to model parameters (made during the completed sensitivity analysis) did not result in a substantial de-calibration of the analyzed models.

The most relevant results of the completed sensitivity analyses are the following:

- Changing the K values (without major model de-calibration) results in model-predicted rates of pit dewatering ranging from up to two times higher than or two to three times lower than the rates predicted by the “base case” model versions. The “base case” models are referred to as all the models Brown and Caldwell developed during 2018 and 2019 that were used for predicting the effects of the various action alternatives.
- Lowering the K values results in lowering stream flows during low flow conditions (when stream flow approaches a baseflow) by a factor of two to three times. Predicted stream high flows are not affected by such changes in K.
- Increasing the K values results in increasing the rates of water disposal through RIB infiltration of up to two times.
- Changing the K values does not change the model-computed lateral extents of the cone of depressions around the pits (subject to dewatering). One exception is the area of Hangar Flats pit, where increasing the K of the alluvium results in an expanded cone of depression around that pit. On the other hand, decreasing the K results in smaller model-predicted lateral extents of cones of depression around the pits.

4.8.8.2.3 CONCLUSIONS

Groundwater modeling requires simplifying assumptions to represent a complex subsurface hydrologic regime.

As a result of data limitations and simplifying assumptions, all predictive models, no matter how well constructed and calibrated, contain uncertainty. The main sources of uncertainty for the Brown and Caldwell model are:

- Limited number of hydraulically tested wells and boreholes;
- Typical limitations of data derived from hydraulic tests;
- Uncertainty as to if any of the fault zones near the proposed pits were hydraulically tested; and
- Not evaluating model predictive sensitivity to various possible degrees of hydraulic transmissivity of the fault zones, which have not been represented in the model; and.
- Lack of a long-term bedrock aquifer test. Future documents will be updated with the results of the 2019 test when available.

Despite those sources of uncertainty, the modeling approach and data used by Brown and Caldwell are within the typical scope of modeling work done for similar projects.

Although alternative conceptual and numerical models likely could be developed, an undertaking of this magnitude is not realistic, and in any case, would have been unlikely to produce significantly different predictive results or to significantly reduce the uncertainties associated with the model predictions.

This page intentionally left blank

4.9 Surface Water and Groundwater Quality

This section describes potential impacts of the Stibnite Gold Project (SGP) on geochemistry, surface water quality, and groundwater quality within the analysis areas. The surface water quality analysis area spans the 22 subwatersheds that encompass the proposed mine site, access roads, transmission lines, and off-site facilities (**Figure 3.9-1**). The analysis area for groundwater quality includes the Sugar Creek and Headwaters East Fork South Fork Salmon River (EFSFSR) subwatersheds (**Figure 3.8-1**), which together encompass the proposed mine site infrastructure that is most likely to influence groundwater quality.

Water quality and stream temperature impacts evaluated in this section could potentially originate from:

- Open pit mining, including exposed rock faces and material used to backfill open pits.
- Tailings and development rock storage.
- Tailings consolidation water and runoff from the proposed tailings storage facility (TSF).
- Mine pit dewatering and surface water diversions.
- Permitted discharges from the sanitary wastewater treatment plant and the Centralized Water Treatment Plant (WTP) that would be used to treat mine contact water under Alternative 2.
- Ground disturbance and potential erosion.
- Fugitive dust from vehicles driving on mine haul roads and SGP access roads.
- Treated sanitary wastewater discharge from the Worker Housing Facility.
- Accidental spills of fuels and hazardous chemicals.
- New access road and utility corridor stream crossings.
- Artificial groundwater recharge using rapid infiltration basins (RIBs).

Information regarding impacts to surface water flow, surface water and groundwater occurrence, and water rights is provided in Section 4.8, Surface Water and Groundwater Quantity.

4.9.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to surface water and groundwater quality includes the following issues and indicators:

Issue: The SGP may affect water resources through acid rock drainage and/or metals leaching from mineralized rock in the mine pits, development rock storage facilities (DRSFs), and the TSF.

Indicators:

- Volume and disposition of mineralized waste generated.
- Lithologic composition of final pit walls and exposure of potentially acid-generating material.
- Removal of legacy mine tailings and waste rock.
- Predicted leachate chemistry of development rock and tailings.

Issue: The SGP may cause changes in surface water and groundwater quality.

Indicators:

- Surface water quality parameters (e.g., pH, temperature, major ions, total dissolved solids (TDS), metals, sediment content, and organic carbon).
- Groundwater quality parameters (e.g., pH, major ions, TDS, and dissolved metals).

Issue: The SGP may cause increased mercury methylation in adjacent waterbodies through SGP-related activities and discharges.

Indicator:

- Predicted impact on methylmercury production.

Surface water and groundwater quality were primarily analyzed using baseline water quality data, geochemical characteristics of development rock and tailings produced by mining, water quality predictions from modeling studies completed by Midas Gold Idaho, Inc. (Midas Gold) and their consultants for the SGP, and the Stibnite Gold Project Water Quality Management Plan (Brown and Caldwell 2020). Other sources consulted include scientific literature and governmental agency documents that identify impaired stream segments and applicable water quality standards. For a list of specific references used in the water quality analysis, the reader is referred to Chapter 8, References Cited.

Several models were developed by the proponent to support the water quality analysis, including an existing conditions hydrologic model, a proposed action hydrologic model, an existing conditions site-wide water chemistry (SWWC) model, a proposed action SWWC model, and the Stream and Pit Lake Network Temperature (SPLNT) model. These models were independently reviewed by AECOM for technical adequacy as discussed in Section 4.9.8, Model Uncertainty, and Section 4.8.8, Uncertainty Associated with Model Predictions. The methodology used to develop and calibrate the existing conditions and proposed action hydrologic models are outlined in Section 4.9.1.1, Surface Water and Groundwater Modeling. Summaries of the existing conditions SWWC model, the proposed action SWWC model, and the SPLNT model are provided below.

4.9.1.1 Existing Conditions SWWC Model

SRK Consulting (SRK) developed the SWWC model on behalf of Midas Gold Idaho, Inc. (Midas Gold) to simulate and predict surface water quality under existing site conditions. The purpose of the existing conditions model was to:

- Evaluate the effectiveness of the modeling method for simulating existing water chemistry at several of the surface water assessment nodes (HDR, Inc. [HDR] 2017); and
- Identify potential data gaps (e.g., diffuse water quality sources or groundwater flows that are not accounted for in the baseline water quality dataset or the site water balance/ hydrologic model).

The surface water assessment nodes used in the existing conditions SWWC model were established at or near surface water sampling locations monitored during the Surface Water Quality Baseline Study (HDR 2017). The main sources contributing to flow and constituent loading at each of the assessment nodes were identified from the baseline study, the Water Resources Summary Report (Brown and Caldwell 2017), and from an inventory of legacy mining features provided by Midas Gold (SRK 2018a). These sources include upgradient stream flow, flow from seeps and adits in the watershed, loading from legacy mine features, plus any potential sources of groundwater inflow identified from the gain-loss analysis conducted as part of the Water Resources Summary Report (Brown and Caldwell 2017).

The modeling was conducted using a spreadsheet mass balance approach to calculate constituent loads in surface water at each assessment node for comparison to existing measured concentrations at the assessment node locations. The various contributing sources identified for each prediction node were mixed (i.e., mass balanced) in ratios defined by their volumetric flux. According to this method, each contributing source represents a loading term that is calculated as the product of the source flow rate times the average source concentration. The calculation method used in the model is illustrated by the formula below for a hypothetical assessment node that has three identified contributing sources:

$$C_n = \frac{(C_1F_1 + C_2F_2 + C_3F_3)}{F_n}$$

In this formula, C_1, C_2, and C_3 represent the source term concentrations (in units of mass per volume), F_1, F_2, and F_3, represent the source term flow rates (in units of volume per time), F_n represents the measured assessment node flow rate, and C_n represents the predicted concentration at the assessment node. The products of C_1F_1, C_2F_2, and C_3F_3 in this equation represent the individual mass loading source terms and have units of mass per time. Thus, the SWWC existing conditions model is a mass loading-based approach where the loading rates are built into the estimated concentrations at each assessment node. The flow rates and average concentrations used to represent various mass loading sources in the existing conditions model are provided in Tables 4-2 and 4-3 of the Existing Conditions SWWC Report (SRK 2018a).

Many of the source terms contributing to the existing surface water chemistry are derived from seeps and adit seeps. Flow rates and average concentrations were measured at these seep locations as part of the Surface Water Quality Baseline Study (HDR 2017). The average flow rates and concentrations were used to calculate mass loading inputs from the seeps in the SWWC model. Other legacy mine features such as historical waste rock piles also may contribute mass loading to the surface water system that is not easily measured due to the diffuse nature of seepage from these features, or because the seepage reports to shallow groundwater before reaching surface water. In the existing conditions model, SRK derived loading rates for these unquantified source terms using the Arrhenius equation and geochemical test data scaled to field conditions. The source term derivation was a complex process that is described in more detail in Section 4.2 of the Existing Conditions SWWC Report (SRK 2018a). These calculated source terms were incorporated into water quality predictions for assessment nodes YP-SR-6, YP-SR-4, and YP-SR-2. At the other assessment nodes evaluated in the existing conditions model (YP-T-22, YP-SR-10, and YP-SR-8), the source term inputs were obtained from measured flow rates and sampled water quality concentrations, along with model-simulated inputs from the nearest upstream prediction node.

After the various known sources were mass-balanced, SRK compared the model predicted mass balance chemistry to the average measured chemistry at each assessment node by calculating a relative percent difference between the simulated and observed concentrations. The comparison showed that the first pass of model development yielded reasonable calibration results. Seventy-five percent of mass balance concentrations were predicted to be within ±20 percent of measured concentrations, indicating that the primary loading sources affecting the chemistry at each node were accounted for in the calculations. The 20 percent comparison threshold is consistent with acceptable laboratory precision when analyzing duplicate samples (U.S. Environmental Protection Agency 2016). If analytical results for identical duplicate samples may vary by up to 20 percent and still meet precision requirements, a mass balance model calibrated to within ±20 percent of measured concentrations would be considered to exhibit a high degree of accuracy.

The remaining 25 percent of the predicted mass balance concentrations showed greater variability, with the agreement between measured and predicted concentrations generally decreasing downstream in the system. Sulfate, arsenic, and antimony were generally under predicted by the initial mass balance calculations, particularly between assessment nodes YP-SR-8 and YP-SR-2. Concentrations of these constituents were underpredicted by up to 48 percent, 60 percent, and 88 percent for sulfate, arsenic, and antimony, respectively (SRK 2018a). Conversely, initial mercury concentrations varied between over and under predicted, depending on the node. Constituent loads that were initially underpredicted in the model likely arise from “diffuse” sources of mass loading, uncertainty in the source terms developed for the known legacy mining facilities, or seasonal influences that were not accounted for in the model setup. Potential diffuse sources may include:

- Additional legacy mine facilities such as the Bradley Mining Company former man camp, Stibnite Mine, Inc. former crushing site and pilot plant site, and the former septic drain field.

- Mineralized bedrock outcrops within the area.
- Unquantified subsurface groundwater load inputs originating from the gravels intersected in the Monday Tunnel and the Cinnabar Tunnel.

The presence of diffuse loading sources is supported by the findings of Etheridge (2015), who identified sources of arsenic and antimony (in particular from groundwater) in specific reaches along the EFSFSR between the Garnet Creek and Sugar Creek confluences.

To account for these diffuse sources, model loading inputs for arsenic, antimony, and sulfate were calibrated by incorporating additional loading for these constituents. The greatest adjustments to the calibration were typically required between prediction nodes YP-SR-8 and YP-SR-4, owing to the diffuse loading and/or unquantified source loading between these points. Adjustments also were made for constituents that were over-predicted by more than 20 percent in the initial model, such as manganese at YP-SR-4, by reducing the initial mass loading used for these constituents. With these adjustments, SRK was able to achieve a suitable model calibration that allows the existing conditions model to be used as the basis for predicting future water quality concentrations at the site.

4.9.1.2 Proposed Action SWWC Model

Geochemical modeling also was performed by SRK to assess future water quality resulting from the SGP (SRK 2018b). The objective of the modeling was to determine the potential for groundwater and surface water impacts from the proposed open pits, DRSFs, and the TSF. The adopted methodology included development of conceptual models for operational and post-closure phases of the SGP, and numerical geochemical modeling (using the U.S. Geological Survey software PHREEQC). The numerical modeling was completed for: (1) Yellow Pine pit and backfill, (2) Hangar Flats pit, (3) West End pit, (4) Fiddle DRSF, (5) Hangar Flats DRSF, (6) West End DRSF, and (7) the TSF and TSF embankment.

The general modeling approach was to quantify the solute concentrations in water that would potentially seep from the base of those facilities during operations and post closure, and to predict the likely solute concentrations in the underlying groundwater and downgradient surface water.

Data used as input to the geochemical models included:

- Geological and mine planning information, including development rock production schedule and mine design;
- Hydrogeologic and hydrologic water balance information;
- Geochemical data from laboratory static and kinetic tests performed on representative/ materials, scaled to field conditions;
- Precipitation chemistry data from long-term monitoring at the Smiths Ferry meteorological station, Idaho; and

- Surface water chemistry data from the Surface Water Quality Baseline Study (HDR 2017).

Results from the facility geochemical models were then incorporated into the calibrated SWWC model to assess surface water chemistry at a series of prediction nodes downstream of the facilities under high flow and low flow conditions, during both the mine operational and post-closure periods. The same mass balance approach described for the existing conditions model was used in the proposed action SWWC model. The loading sources contributing to predicted concentrations at each surface water assessment node are provided in Tables 8-2 and 8-3 of SRK (2018b) for the mine operational and post closure periods, respectively. Examples of loading sources that affect concentrations during the mine operational period include upstream surface water flows, seep flows, groundwater discharge, and groundwater inflow from the RIBs. During the post closure period, additional mass loading from the TSF, pit lakes, and DRSFs were incorporated into the SWWC model.

4.9.1.3 Stream and Pit Lake Network Temperature Model

The SPLNT model was developed by Brown and Caldwell (2019a) using two separate software packages: QUAL2K for stream temperature modeling, and the General Lake Model for simulating pit lake temperatures. Similar to the SWWC model, an existing conditions SPLNT model was developed to confirm that the modeling approach was capable of reproducing observed stream temperatures. After the existing conditions SPLNT model had been appropriately calibrated, it was used to generate future temperature predictions for the proposed action SPLNT model. The proposed action model was run for three different model timelines: end of mining year 6 (EOY 6), EOY 12, and post closure. EOY 6 is approximately halfway through mining operations, and EOY 12 represents full build-out at the end of active mining. Note that these equate to Year 9 and Year 15 in the Draft Environmental Impact Statement (EIS) which accounts for construction as years 1 through 3 with mining starting in year 4. A post closure timeline also was simulated to represent how the site would function after the mine facilities and permitted discharges have been removed, dewatering and mining have been discontinued, and the channels and vegetation have been fully reclaimed.

The SPLNT model results were integrated with other modeling efforts for the SGP. Outputs from the hydrologic model and the site-wide water balance model became SPLNT inputs to simulate streams and pit lakes for the Proposed Action (Alternative 1). Output from the General Lake Model component of the SPLNT model supported development of the SWWC model by providing temperature and dissolved oxygen profiles for the pit lakes.

4.9.2 Direct and Indirect Effects

The direct and indirect effects associated with surface water and groundwater quality are analyzed within the overall context of the SGP area and the mountainous headwaters watershed where the mine site is located. Elements of this context include:

- Mining and mineral processing, primarily of gold, antimony, and tungsten, have occurred at and in the vicinity of the analysis area intermittently since the early 1900s.

- Historical mining activities have been associated with releases of metals into the aquatic environment and physical disturbances that have adversely affected environmental media.
- Remnants of past physical disturbances at the mine site include underground mine workings, open pits, development rock piles and tailings deposits, spent ore disposal areas (SODA), a ruptured dam on the East Fork of Meadow Creek (also known as Blowout Creek), and an abandoned water diversion tunnel.
- The presence of legacy mine waste materials has led to elevated concentrations of arsenic and antimony in groundwater, and elevated arsenic, antimony, and mercury in surface water and seeps.
- Numerous streams in the mine site and vicinity are classified as impaired waters by the Idaho Department of Environmental Quality (IDEQ) (2018).
- Average precipitation at the mine site is approximately 32 inches per year (Brown and Caldwell 2017). Most precipitation occurs as snowfall in the winter and rainfall during the spring.
- Average annual precipitation is typically higher than average annual evapotranspiration (Brown and Caldwell 2018). As a result, much of the precipitation received at the mine site recharges groundwater or runs off to streams.
- Streamflow at the mine site follows a seasonal pattern with the peak flow observed after spring snowmelt, and baseflow conditions occurring in fall and winter.

4.9.2.1 Alternative 1

Alternative 1 water quality impacts were analyzed using baseline water quality and temperature data, geochemical characteristics of development rock and tailings, water quality predictions from the Stibnite Gold Project Proposed Action SWWC Modeling Report (SRK 2018b), and temperature predictions from the Stibnite Gold Project Stream and Pit Lake Network Temperature Model Proposed Action and Proposed Action with Modifications Report (Brown and Caldwell 2019a).

4.9.2.1.1 GEOCHEMISTRY

Any changes to the mine site geochemistry would directly affect surface water and groundwater quality. Thus, geochemical changes at the mine site that would be caused by mining must be described first in order to fully understand potential water quality changes. This section describes geochemical effects that would occur under Alternative 1. The geochemistry discussion is followed by a summary of predicted surface water and groundwater quality that could result from changes to the mine site geochemistry.

4.9.2.1.1.1 Volume and Disposition of Mineralized Waste

Development Rock – Alternative 1

The types of waste generated by open pit mining and ore processing include development rock and mine tailings material. Development rock is defined as rock that contains no commercial antimony, gold, or silver ore. An estimated 350 million tons (MT) of development rock would be produced during mining operations. A breakdown of development rock placement under Alternative 1 is provided below:

- TSF embankment (61 MT);
- Hangar Flats DRSF and TSF buttress (81 MT);
- Fiddle DRSF (68 MT);
- West End DRSF (25 MT); and
- Yellow Pine pit backfill (111 MT).

These SGP features are depicted on **Figure 2.3-2**. Development rock also would be important as a reclamation material for the following major activities:

- Reconstruction of the valley currently occupied by the Yellow Pine pit; and
- Reconstruction of the EFSFSR to its estimated pre-mining course.

Additional limited amounts of development rock would be used to construct haul roads and pad areas for site facilities. Some development rock also may be crushed and screened for use as road surfacing material or concrete aggregate.

Development rock disposed on-site or used for construction or reclamation material would alter the mine site geochemistry. Generally, the extent, magnitude, and duration of geochemical impacts would depend on how the development rock is handled and placed, the chemical composition of the rock, the amount of oxygen and meteoric water that contacts the development rock material, and the residence time of water within the development rock pore space.

Midas Gold's proposed practices for handling and testing development rock would be outlined in the SGP-specific Development Rock Management Plan (DRMP), which would be developed after a preferred alternative has been identified. The DRMP would include procedures for sampling and testing waste rock during mine operations to support flexible management strategies for the use and placement of development rock material. Additional testing procedures prescribed in the DRMP are anticipated to include geological pit mapping to confirm areas of mineralized development rock and ore, geochemical characterization of cuttings from tightly-spaced blast holes within mineralized areas, and using X-ray fluorescence analyzers to aid in pit mapping and material characterization. The DRMP also would include criteria to designate metal-leaching and non-metal leaching rock, such as lithology, mineralogy (i.e., the presence or absence of carbonate and sulfide minerals, the latter of which are indicative of acid-generating and metal- leaching potential within non-ore grade rock), and geochemical test results (Brown and Caldwell 2019a). Geochemical characterization analyses prescribed in the DRMP would likely include similar methods performed as part of the baseline geochemical characterization study (SRK 2017).

Until the DRMP is available, it is necessary to make assumptions on development rock handling and storage procedures, and how those processes would affect the mine site geochemistry. These assumptions include:

- During mining, active blending of development rock would not occur.
- Rock fragments of each lithology type stored in the DRSFs would have similar characteristics in terms of grain size distribution and fracture density. As such, the development rock deposits in each DRSF would have similar size pore volumes, similar permeability, and a similar proportion of reactive surfaces.
- The composition of development rock placed in each DRSF is assumed to contain at least some potentially acid-generating (PAG) material.

The lithological composition of development rock has been predicted for each DRSF using the Preliminary Feasibility Study (PFS) resource model (M3 2014). The results show the predominant rock types comprising each DRSF and include the overall percentage of PAG material expected within each facility. It should be noted that the projected DRSF compositions represent preliminary estimates derived from existing site characterization data, and may be subject to change as additional information is gathered prior to and during mining.

A site-specific neutralizing potential ratio (NPR) of 1.5 was used to differentiate between PAG and non-PAG development rock material. The 1.5 NPR threshold is based on guidance contained in the Global Acid Rock Drainage Guide (International Network for Acid Prevention 2014). The guidance classifies rock as PAG if the NPR is less than 1, and non-PAG if the NPR is greater than 2. SRK (2018b) selected an NPR cutoff midway between these values (1.5) to categorize the acid generating properties of development rock for modeling purposes. Different development rock lithologies were considered non-PAG by SRK if the material had an NPR greater than 1.5, and PAG if the material had an NPR of 1.5 or less (SRK 2018b). Sensitivity modeling by SRK (2019a) helped justify the 1.5 NPR threshold by showing that the model produced similar concentration results when a higher NPR cutoff was used. The sensitivity analysis results are discussed further in Section 4.9.8, Model Uncertainty, below.

Overall, the Hangar Flats DRSF and TSF buttress would contain 30 MT of development rock sourced from the Yellow Pine pit and 51 MT from the Hangar Flats pit at full buildout (**Table 4.9-1**). Of this total, approximately 64 MT (79 percent) of the rock would be non-PAG intrusive quartz monzonite. PAG material would comprise approximately 5.9 percent of the total DRSF mass, or 4.8 MT.

Table 4.9-1 Alternative 1 Lithological Composition of the Hangar Flats DRSF and TSF Buttress

Source	Material Type	Mass (MT)	Proportion (%)
Yellow Pine pit	Calc-Silicate	0.8	1.0
	Quartzite[1]	1.8	2.2
	Quartzite-Schist	0.2	0.2
	Quartz Monzonite	20.3	25
	Meadow Creek Fault Zone	1.9	2.3
	Hidden Fault Zone	0.7	0.9
	Alaskite-Granite	0.8	1.0
	PAG	3.6	4.4
Hangar Flats Pit	Quartz Monzonite	44.0	54
	Meadow Creek Fault Zone	5.9	7.3
	PAG	1.2	1.5
	Total	**81.2**	**100**

Table Source: Modified from SRK 2018b, Table 4-2

Table Notes:

1 Quartzite includes Upper Quartzite, Lower Quartzite, and Quartzite-Schist in fault.

Development rock placed in the West End DRSF would be derived from the West End pit and Midnight Area pit. The rock types placed in the DRSF are variable (**Table 4.9-2**) and would include 18 percent calc-silicate, 18 percent quartzite schist, 14 percent stibnite stock, and 13 percent each of quartzite and quartz pebble conglomerate. PAG material would be present at a relatively low concentration, comprising less than 1 percent of the total DRSF by mass (i.e., 0.1 MT).

Table 4.9-2 Alternative 1 Lithological Composition of the West End DRSF

Material Type	Mass (MT)	Proportion (%)
Fern Marble	2.3	9.2
Hermes Marble	1.9	7.6
Middle Marble	1.9	7.6
Calc-Silicate	4.4	18
Quartzite[1]	3.3	13
Quartzite-Schist	4.4	18
Quartz Pebble Conglomerate	3.3	13
Stibnite Stock	3.5	14
PAG	0.1	0.4
Total	25.1	100

Table Source: Modified from SRK 2018b, Table 4-3

Table Notes:

1 Quartzite includes Upper Quartzite, Lower Quartzite, and Quartzite-Schist in fault.

As shown in the **Table 4.9-3**, the Fiddle DRSF would be comprised of 63 MT of development rock from the Yellow Pine pit and 5 MT of development rock from the West End Pit. Most of the development rock in the Fiddle DRSF (64 percent) would be intrusive quartz monzonite. Per the PFS resource model, PAG material (9.5 percent) would likely represent the second most abundant lithology and would be derived mostly from the Yellow Pine pit (6.2 MT), with a small contribution from the West End deposit (0.3 MT).

Table 4.9-3 Alternative 1 Lithological Composition of the Fiddle DRSF

Source	Material Type	Mass (MT)	Proportion (%)
Yellow Pine pit	Calc-Silicate	1.6	2.3
	Quartzite[1]	3.9	5.7
	Quartzite-Schist	0.3	0.4
	Quartz Monzonite	43.7	64
	Meadow Creek Fault Zone	4.2	6.2
	Hidden Fault Zone	1.5	2.2
	Alaskite-Granite	1.8	2.6
	PAG	6.2	9.1
West End Pit	Fern Marble	0.4	0.6
	Hermes Marble	0.4	0.6
	Middle Marble	0.4	0.6
	Calc-Silicate	0.8	1.2
	Quartzite[1]	0.6	0.9
	Quartzite-Schist	0.8	1.2
	Quartz Pebble Conglomerate	0.6	0.9
	Stibnite Stock	0.7	1.0
	PAG	0.3	0.4
	Total	**68.2**	**100**

Table Source: Modified from SRK 2018b, Table 4-3

Table Notes:

1 Quartzite includes Upper Quartzite, Lower Quartzite, and Quartzite-Schist in fault.

The lithological composition of development rock used to backfill the Yellow Pine pit is estimated to be a mix of metamorphic rock, calc-silicates, quartz pebble conglomerate, and igneous intrusive rock from the West End pit, along with granite and Meadow Creek fault zone development rock mined from the Hangar Flats pit (**Table 4.9-4**). No rock classified as PAG would be used for the pit backfill.

Table 4.9-4 Alternative 1 Lithological Composition of Yellow Pine Pit Backfill

Source	Material Type	Mass (MT)	Proportion (%)
Hangar Flats Pit	Intrusive granite	10.5	9.4
	Meadow Creek Fault Zone	1.4	1.3
West End Pit	Fern Marble	9.0	8.1
	Hermes Marble	7.5	6.7
	Middle Marble	7.6	6.8
	Calc-Silicate	17.6	16
	Quartzite	13.2	12
	Quartzite-Schist	17.5	16
	Quartz Pebble Conglomerate	13.1	12
	Intrusive	13.9	12
	Total	111.3	100

Table Source: SRK 2018b, Table 7-14

Finally, the TSF embankment adjacent to the Hangar Flats DRSF is predicted to contain 31.4 MT (52 percent) of non-PAG development rock from the Yellow Pine pit, 23.1 MT (38 percent) of non- PAG development rock from the Hangar Flats pit, 0.6 MT of non-PAG development rock from the West End pit (1 percent), and 5.8 MT (9 percent) of non-PAG spent ore from the SODA (SRK 2018b).

Predicted changes to groundwater and surface water quality from the DRSFs are discussed in subsequent sections.

Mine Tailings – Alternative 1

Ore processing creates a fine-grained waste material (tailings) after targeted metals have been extracted. Because of the small particle size, tailings can cause acid rock drainage (ARD) and metals leaching. Mine tailings would be managed though deposition in a fully-lined TSF with an engineered rock-fill dam and development rock buttress. The tailings production rate is anticipated to be approximately 20,000 to 25,000 tons per day during mining (M3 2014). The tailings would be thickened and neutralized prior to placement in the TSF and would contain 45 to 55 percent solids by weight. Approximately 100 MT of tailings solids would be stored in the TSF at the end of mining (Midas Gold 2016).

The tailings have the potential to impact geochemistry and water quality through solute loading and seepage from the base of the TSF, and uncontrolled runoff from the TSF surface. Seepage through the base of the TSF would be controlled through construction of an engineered liner.

The liner system would be augmented by over-drains to collect water that drains to the base of the tailings, which would flow to a sump and be pumped to the tailings supernatant pond for reuse. Underdrains also would be installed beneath the liner to collect groundwater from springs and seeps and convey the water beneath the TSF. Detection of leaks through the liner would be performed by water quality monitoring of the underdrain collection sumps.

Facilities that use cyanide in their mineral extraction process are required to obtain a permit from the IDEQ and follow the Rules for Ore Processing by Cyanidation (Idaho Administrative Procedure Act [IDAPA] 50.01.13). The liner system proposed by Midas Gold does not meet the current regulatory requirements of IDAPA 50.01.13. However, at the request of the Idaho Mining Association, IDEQ has entered into rulemaking on the existing regulations to change the regulatory requirements from prescriptive requirements to performance-based requirements. No schedule has been determined for completion of the rulemaking. Midas Gold has indicated that the TSF liner system would be modified to meet the IDAPA regulatory requirements in effect at the time of facility permitting.

During mine operations, there would be no runoff from the TSF, as any precipitation that falls within the TSF footprint would be contained within the facility and managed within the process circuit. Post closure, the tailings in the TSF would continue to consolidate and release water. Consolidation water would be managed through forced evaporation or treated at the water treatment plant used during mine operations until installation of the TSF cover was completed. After installation of the TSF cover, consolidation water from the tailings would discharge to the tailings surface and mix with meteoric water that has infiltrated the cover, as well as runoff water that flows across the TSF surface. The geochemistry of the consolidation water and infiltration water would be impacted by the tailings; if left untreated, this water could affect downstream water quality as it drains from the TSF. An engineered passive treatment system would be utilized to treat this water post closure.

4.9.2.1.1.2 Lithologic Composition of Final Pit Walls

After ore deposits have been mined, the geochemistry of the open mine pits would largely depend on the rock types that are exposed in the final pit walls. The PFS resource model (M3 2014) was used to calculate the surface area of each lithology that would be exposed in the final pit walls both above and below the pit lake level as the open pits fill with water. The estimated surface areas are summarized in **Tables 4.9-5, 4.9-6,** and **4.9-7** for the Hangar Flats, West End, and Midnight Area pits, respectively. It should be noted that the surface area of each lithology is a preliminary estimate derived from existing site characterization data and may be subject to change as additional information is gathered prior to and during mining. For the wall rock lithologies, the same criterion (NPR cutoff of 1.5) applied to development rock was used to differentiate PAG from non-PAG material.

Data for Hangar Flats pit indicate that non-PAG intrusive igneous rock such as quartz monzonite would be the primary lithology exposed in the pit, comprising 70 percent of the total pit wall surface area. PAG rock would be exposed across approximately 5.1 percent of the pit walls, with the PAG material concentrated in the lower portions of the pit submerged by the Hangar Flats pit lake (**Table 4.9-5**). Submerging the PAG wall rock could help reduce surface water quality impacts by limiting further oxidation of the PAG material after it has been submerged.

Table 4.9-5 Two-Dimensional Surface Areas of Rock Types Exposed in Final Pit Walls for Hangar Flats at Equilibrium (Alternatives 1-4)

Material Type	Total Surface Area (m^2)	Total Proportion	Above Water Level (Exposed) Surface Area (m^2)	Above Water Level (Exposed) Proportion	Below Water Level (Submerged) Surface Area (m^2)	Below Water Level (Submerged) Proportion
Overburden	128,948	17.6%	44,139	11.6%	84,809	24.0%
Intrusive[1]	510,568	69.6%	305,548	80.4%	205,020	58.0%
Meadow Creek Fault Zone	56,940	7.8%	21,838	5.7%	35,102	9.9%
PAG Wall Rock	37,076	5.1%	8,692	2.3%	28,384	8.0%
Total	733,532	100.0%	380,217	100.0%	353,315	100.0%

Table Source: Modified from SRK 2018b, Table 7-2

Table Notes:

1 Intrusive unit includes quartz monzonite and unassigned lithologies.

m^2 = square meters.

The rock types exposed in the West End pit walls would be more variable than Hangar Flats, but would mainly include quartzite (28.9 percent), quartz pebble conglomerate (16.8 percent), calc-silicate (12.7 percent), and quartzite-schist (10.7 percent). PAG rock would comprise only 3,300 square meters (0.4 percent) of the total pit wall surface area, with less than half of the PAG material (1,100 square meters) submerged under the West End pit lake (**Table 4.9-6**).

Table 4.9-6 Two-Dimensional Surface Areas of Rock Types Exposed in Final Pit Walls for West End at Equilibrium (Alternatives 1-4)

Material Type	Total Surface Area (m^2)	Total Proportion	Above Water Level (Exposed) Surface Area (m^2)	Above Water Level (Exposed) Proportion	Below Water Level (Submerged) Surface Area (m^2)	Below Water Level (Submerged) Proportion
Overburden	4,805	0.6%	4,805	0.9%	0	0.0%
Fern Marble	43,176	5.8%	22,388	4.0%	20,788	11.0%
Hermes Marble	33,532	4.5%	26,726	4.8%	6,806	3.6%
Middle Marble	68,324	9.1%	68,324	12.2%	0	0.0%
Calc-Silicate	94,945	12.7%	58,718	10.4%	36,227	19.1%
Quartzite	216,548	28.9%	190,280	33.9%	26,268	13.8%
Quartzite-Schist	80,171	10.7%	35,086	6.2%	48,085	25.3%
Quartz Pebble Conglomerate	125,778	16.8%	102,133	18.2%	23,645	12.5%

Material Type	Total Surface Area (m^2)	Total Proportion	Above Water Level (Exposed) Surface Area (m^2)	Above Water Level (Exposed) Proportion	Below Water Level (Submerged) Surface Area (m^2)	Below Water Level (Submerged) Proportion
Granite	78,185	10.4%	51,351	9.1%	26,834	14.1%
PAG wall rock	3,333	0.4%	2,259	0.4%	1,074	0.6%
Total	748,797	100.0%	562,070	100.0%	189,727	100.0%

Table Source: Modified from SRK 2018b, Table 7-3

Table Notes:

m^2 = square meters.

Mining in the Midnight area pit would expose quartzite (29.4 percent of the final pit wall surface area), quartz pebble conglomerate (17.8 percent), calc-silicate (13.8 percent), Fern marble (13.7 percent), as well as several additional lithologies. PAG wall rock would comprise 0.1 percent of the total pit wall surface area. The exposed PAG rock would be entirely submerged under the Midnight area pit lake in Alternatives 1, 3, and 4 (**Table 4.9-7**).

Table 4.9-7 Two-Dimensional Surface Areas of Rock Types Exposed in Final Pit Walls for Midnight Area Pit at Equilibrium (Alternatives 1-4)

Material Type	Total Surface Area (m^2)	Total Proportion	Above Water Level (Exposed) Surface Area (m^2)	Above Water Level (Exposed) Proportion	Below Water Level (Submerged) Surface Area (m^2)	Below Water Level (Submerged) Proportion
Overburden	2,722	1.0%	1,429	0.8%	1,293	1.7%
Fern Marble	35,435	13.7%	16,912	9.3%	18,523	23.9%
Hermes Marble	2,778	1.1%	2,778	1.5%	0	0.0%
Middle Marble	7,338	2.8%	0	0.0%	7,338	9.5%
Calc-Silicate	35,788	13.8%	15,956	8.8%	19,832	25.6%
Quartzite	76,224	29.4%	60,131	33.0%	16,093	20.8%
Quartzite-Schist	25,283	9.7%	25,283	13.9%	0	0.0%
Quartz Pebble Conglomerate	46,293	17.8%	33,660	18.5%	12,633	16.3%
Granite	27,303	10.5%	25,907	14.2%	1,396	1.8%
PAG wall rock	262	0.1%	0	0.0%	262	0.3%
Total	259,426	100.0%	182,056	100.0%	77,370	100.0%

Table Source: Modified from SRK 2018b, Table 7-4

Table Notes:

m^2 = square meters.

During operations, the pit walls would be exposed to air and water under oxygenated conditions, and would weather to form secondary minerals, including soluble salts. As the exposed wall rock re-saturates post-dewatering, these soluble salts and other weathering products would dissolve into ambient groundwater that flows into the pit. Runoff from the saturated pit high walls also could dissolve secondary minerals to influence the pit lake geochemistry. Other sources of solute loading into the pits include constituents derived from direct precipitation, surface water and groundwater influxes, seepage from the adjacent DRSFs, and mine talus left on the pit benches. Predictions of future pit lake water quality are provided in subsequent sections.

The same types of geochemical impacts associated with the Hangar Flats, West End, and Midnight area pits also would occur for the Yellow Pine pit. However, because the Yellow Pine pit would be completely backfilled with development rock, a pit lake would not form, and the exposed surface area of wall rock would be reduced post closure. Solute loading in the Yellow Pine pit would still occur from direct precipitation and pit wall runoff that enters the pit prior to backfilling, and from groundwater inflows after the cessation of dewatering. Groundwater flowing into the pit also would dissolve additional solutes from fractures in the pit walls and from the fine-grained fraction of the development rock backfill. Groundwater reactions with the development rock backfill are accounted for in the Yellow Pine pit geochemical model.

In order to quantify future groundwater quality impacts within the pit footprint, it is necessary to understand the lithology of development rock planned for backfilling the Yellow Pine pit, and the lithological composition of the final pit walls. The lithology of the backfill material was provided in **Table 4.9-4**. Exposed rock in the final pit walls would predominantly consist of quartz monzonite (**Table 4.9-8**), which would comprise the largest surface area both above and below the long-term groundwater level. PAG wall rock is predicted to occur across approximately 3.9 percent of the pit wall surface area above the water table, and across approximately 14.4 percent of the surface area below the water table.

Predicted groundwater quality changes from mining and backfilling the Yellow Pine pit are provided in Section 4.9.2.1.3, Groundwater Quality.

Table 4.9-8 Two-Dimensional Surface Areas of Rock Types Exposed in Final Pit Walls for Yellow Pine Pit (Alternatives 1-4)

Material Type	Above Water Level (Unsaturated) Surface Area (m^2)	Above Water Level (Unsaturated) Proportion	Below Water Level (Saturated) Surface Area (m^2)	Below Water Level (Saturated) Proportion
Calc-Silicate	28,322	6.7%	29,078	4.0%
Quartzite	46,210	11.0%	23,073	3.2%
Quartzite Schist	6,509	1.5%	5,354	0.7%
Quartz Monzonite	287,292	68.3%	453,045	62.4%
Granite	0	0.0%	53,974	7.4%
Quartz Pebble Conglomerate	3,042	0.7%	0	0.0%

Material Type	Above Water Level (Unsaturated) Surface Area (m^2)	Above Water Level (Unsaturated) Proportion	Below Water Level (Saturated) Surface Area (m^2)	Below Water Level (Saturated) Proportion
Meadow Creek Fault Zone	27,092	6.4%	36,132	5.0%
Hidden Fault Zone	5,934	1.4%	20,863	2.9%
PAG wall rock	16,210	3.9%	104,214	14.4%
Total	420,611	100.0%	725,733	100.0%

Table Source: Modified from SRK 2018b, Table 7-13

Table Notes:

m^2 = square meters.

4.9.2.1.1.3 Removal of Legacy Mine Tailings and Waste Rock

As discussed in Chapter 3 Affected Environment, in Section 3.9, Surface Water and Groundwater Quality, legacy waste materials from historical mining activity influence both groundwater and surface water quality at the mine site. These legacy materials include waste rock, the Bradley tailings, and spent ore in the SODA. Under Alternative 1, 7.5 MT of spent ore would be removed from the SODA that would be excavated and hauled to the TSF for use in construction, if found suitable after further chemical testing of the material under the DRMP. The underlying Bradley tailings would be excavated, reprocessed, and placed in the TSF. The historical Hecla and Stibnite Mine, Inc spent ore heap leach pads also would be excavated and likely used as construction materials for the TSF embankment and potentially in other locations, if found suitable after chemical testing. If additional legacy materials are encountered during construction, they would be removed and hauled off-site, placed in the TSF or a DRSF, or left in place, depending on testing to determine chemical suitability.

By removing, reprocessing, and properly disposing of these legacy waste materials, several existing sources of metals leaching would either be eliminated from the mine site or disposed in an on-site facility (such as the TSF embankment) where further degradation of water quality is less likely. The surface water and groundwater quality of the mine would be altered as a result of these actions. Specific predictions of surface water and groundwater quality changes from removing the legacy waste material are discussed in subsequent sections.

4.9.2.1.1.4 Predicted Leachate Chemistry of Development Rock and Tailings

Development Rock – Common to All Alternatives

The leachate chemistry of the mine waste material was characterized through static and kinetic test work (SRK 2017, 2020). However, only kinetic tests are discussed herein because SRK (2018b) used results from humidity cell kinetic testing to define PAG and non-PAG development rock source terms for geochemical modeling. The humidity cell test (HCT) program was conducted in two different phases.

The Phase I HCT cells were operated for between 144 and 184 weeks to achieve stable effluent chemistry. Leachate from each of the Phase I HCTs was circum-neutral to moderately alkaline, with pH values ranging from 6.5 to 9. The effluent pH also was stable for each of the test cells, indicating that acid generation did not occur, or that the available neutralizing potential was sufficient to offset any acid generation. SRK (2017) also found that the consumption of neutralizing potential was slow in each of the HCT cells, with over 80 percent of the initial neutralizing potential remaining when the cells were terminated. This indicates that significant buffering capacity is still available and/or that acid generation is limited or occurs at a slow rate despite relatively high sulfide concentrations in the tested samples. These results are consistent with observations from the site. Historic waste rock and tailings have been left at the surface for decades, with little evidence of acid rock drainage.

Despite the finding of low acid generation potential, a few metals constituents still proved to be leachable from the HCTs under neutral to alkaline pH conditions. Arsenic, antimony, and aluminum were consistently present in leachate at concentrations above applicable water quality criteria. Manganese, selenium, and sulfate also were occasionally elevated above water quality criterial for some samples.

The Phase 2 HCTs were conducted according to the same methodology used during the Phase I testing. Leachate from the Phase 2 HCTs remained neutral to moderately alkaline through testing, with the effluent pH ranging from 6.7 to 9.1 (SRK 2020). A few constituents are mobile under these neutral to alkaline pH conditions, including arsenic, antimony, aluminum, and manganese, which were frequently leached at concentrations above the strictest potentially applicable surface water quality standard. In addition, sulfate, TDS, copper, cadmium, and zinc were occasionally elevated above the respective water quality criteria. Concentrations of beryllium, bismuth, boron, cadmium, chromium, cobalt, lead, lithium, molybdenum, nickel, selenium, silver, tin, titanium, and vanadium were at or below the strictest potentially applicable water quality criterial in the Phase 2 HCT leachates, indicating a low potential for leaching of these constituents (SRK 2020).

As of late February 2020, three of the Phase 2 HCTs were still active and had been ongoing for 28 to 36 months. Each cell still had at least 80 percent of its original neutralization potential remaining, suggesting that acid generation is inhibited, and there is still significant acid buffering capacity available in the tested materials. It also indicates that the rate of neutralization potential depletion is slow, such that an excess of 800 weeks of humidity cell testing would be required before the neutralization potential is completely consumed in the samples, assuming the weathering rates remain constant through time (SRK 2020).

Steady-state constituent release rates from the HCTs were used to develop leachate source terms for each development rock and wall rock lithology. The source terms were assigned by correlating each rock type to a representative HCT based on the lithology, location, and geochemistry of the HCT sample. The test cell HC-14 from the Phase I testing program was selected to represent PAG development rock and wall rock because this cell had the highest total sulfur and highest sulfate leaching rate, which corresponds to maximum sulfide oxidation and ARD potential. The source terms were then scaled to field conditions to account for differences in reaction rates, temperatures, and liquid-to-solid ratios between laboratory tests and field conditions. (For a more detailed discussion of source term development and the site-specific scaling factors used, the reader is referred to SRK 2018b, Sections 4.5 and 4.6. Tabulated waste rock and wall rock source term data also are provided in Tables 4-6, 7-7, and 7-15 of that report).

The development rock and wall rock source terms were used as inputs in a geochemical model to predict future groundwater and surface water quality resulting from the mine pits and/or DRSFs. Specific water quality predictions are discussed in subsequent sections.

Mine Tailings – Common to All Alternatives

The estimated process water and leachate chemistry of tailings associated with the SGP are summarized in **Table 4.9-9**. The samples shown in this table represent waste streams that will be generated during ore processing, and include chemical adjustments from the flotation and pressure oxidation circuits. Following cyanidation, pressure oxidation tailings will undergo cyanide destruction and be comingled with flotation tailings and thickened prior to deposition in the TSF (SRK 2019b). These processes are reflected in the tailings chemistry shown in the table.

To predict the chemistry of TSF seepage water during mine operations, the process water quality shown in **Table 4.9-9** was proportioned according to the relative contribution of the five tailings streams during each year of mining. For the post closure period, post closure the chemistry of tailings consolidation water was defined based on the process water chemistry of the West End oxide and West End sulfide tailings. These tailings streams would be produced during the latter stages of mining and would therefore comprise the upper portion of the TSF from which most consolidation water would be derived post closure.

4.9.2.1.1.5 Geochemistry Summary

In summary, Alternative 1 would impact the mine site geochemistry through open pit mining, the production and disposal of mine waste material, and the removal and repurposing of legacy mine waste. Impacts to the geochemical environment have been quantified based on the following indicators:

- Volume and disposition of mineralized waste generated.
- Lithologic composition of final pit walls and exposure of potentially acid-generating material.
- Removal of legacy mine tailings and waste rock.
- Predicted leachate chemistry of development rock and tailings.

The volume and disposition of mineralized waste and the lithologic composition of the final pit walls were estimated from the PFS resource model (M3 2014) and from information on Midas Gold’s planned mine sequencing and waste rock handling. The leachate chemistry of development rock, wall rock, and tailings material was defined through geochemical testing.

Geochemical properties of the mine waste were used by SRK (2018b) to develop source terms for each waste material type. These source terms provide the basis for geochemical modeling to predict future surface water and groundwater quality changes at the mine site and downstream. Specific water quality predictions are discussed below in Section 4.9.2.1.2, Surface Water Quality, and Section 4.9.2.1.3, Groundwater Quality.

Table 4.9-9 Estimated Process Water and Leachate Solution Chemistry for West End Sulfide and Oxide Tailings (Alternatives 1-4)

Parameter	Units	Process Water Chemistry					Leachate Chemistry	
		Yellow Pine and Hangar Flats Tailings	Late Yellow Pine Tailings	West End Sulfide Tailings	West End and Hangar Flats Tailings	West End Oxide Tailings	West End Oxide Tailings	West End Sulfide Tailings
Alkalinity	mg/L as $CaCO_3$	170	130	210	190	130	79.0	47
Aluminum	mg/L	<0.45	<0.45	<0.45	<0.45	<0.25	<0.05	<0.05
Antimony	mg/L	0.13	0.16	5.6	4.0	0.1	0.012	0.25
Arsenic	mg/L	6.5	11	11	12	0.042	0.03	0.88
Barium	mg/L	<0.10	0.15	<0.10	<0.10	<0.10	<0.02	<0.02
Beryllium	mg/L	<0.010	<0.010	<0.010	<0.010	<0.0050	<0.001	<0.001
Boron	mg/L	<1.0	<1.0	<1.0	<1.0	<0.50	<0.1	<0.1
Cadmium	mg/L	0.0003	<0.00015	<0.00075	<0.00075	<0.0020	<0.001	<0.0002
Calcium	mg/L	470	580	560	470	200	51.0	150
Chloride	mg/L	<100	13	<100	<100	20	<1.0	<10
Chromium	mg/L	<0.050	<0.050	<0.050	<0.050	<0.025	<0.005	<0.005
Cobalt	mg/L	<0.10	<0.10	<0.10	<0.10	<0.050	<0.01	<0.01
Copper	mg/L	0.29	0.047	0.55	0.39	0.12	<0.01	<0.004
Cyanide, total	mg/L	0.11	0.033	0.090	0.17	0.19	<0.05	0.32
Fluoride	mg/L	<10	2.1	<10	<10	<1.0	0.47	<1
Iron	mg/L	<0.20	<0.20	<0.20	<0.20	<0.10	<0.04	0.15
Lead	mg/L	<0.0020	<0.0010	<0.0050	<0.0050	<0.0025	<0.0025	<0.0007
Magnesium	mg/L	430	120	370	330	26	5.30	7.7
Manganese	mg/L	0.11	0.84	0.18	0.18	0.14	0.0092	<0.005
Mercury	mg/L	0.00096	0.00024	0.097	0.068	0.097	0.000015	0.00015
Molybdenum	mg/L	<0.20	<0.20	<0.20	<0.20	0.15	<0.02	<0.02

Parameter	Units	Process Water Chemistry					Leachate Chemistry	
		Yellow Pine and Hangar Flats Tailings	Late Yellow Pine Tailings	West End Sulfide Tailings	West End and Hangar Flats Tailings	West End Oxide Tailings	West End Oxide Tailings	West End Sulfide Tailings
Nickel	mg/L	<0.30	<0.30	<0.30	<0.30	<0.15	<0.01	<0.01
Nitrate	mg/L as N	<10	<1.0	<10	<10	<1.0	0.11	1
Nitrite	mg/L as N	<5.0	0.9	12	<5.0	<0.50	<0.05	0.25
pH	s.u.	8.38	7.93	8.38	8.50	7.24	7.15	9.30
Phosphorous	mg/L	<5.0	<5.0	<5.0	<5.0	<2.5	<0.5	<0.5
Potassium	mg/L	210	66	71	80	62	5.70	3.6
Selenium	mg/L	0.13	0.014	<0.10	<0.10	<0.010	<0.015	<0.002
Silver	mg/L	0.015	<0.0050	<0.025	<0.025	<0.010	<0.005	<0.006
Sodium	mg/L	5,000	520	6,800	5,700	1,300	34	130
Sulfate	mg/L	12,000	2,600	15,000	13,000	2,400	180	660
TDS	mg/L	15,000	---	20,000	15,000	3,700	290	1,000
Thallium	mg/L	0.0044	<0.0010	<0.0050	<0.0050	<0.0020	<0.001	<0.0004
Vanadium	mg/L	<0.10	<0.10	<0.10	<0.10	<0.050	<0.01	<0.01
Zinc	mg/L	<0.20	<0.20	<0.20	<0.20	<0.10	<0.02	<0.01

Table Source: Modified from SRK 2018b, Table 5-4

Table Notes:

$CaCO_3$ = calcium carbonate.

mg/L = milligrams per liter.

N = nitrogen.

s.u. = standard units.

TDS = total dissolved solids.

4.9.2.1.2 SURFACE WATER QUALITY

4.9.2.1.2.1 Mine Site

General Chemistry (pH, Major Ions, TDS, Metals) – Alternative 1

The mine site is a relatively humid environment where annual precipitation regularly exceeds evapotranspiration. As such, meteoric water that contacts mine tailings or development rock is likely to infiltrate or runoff the waste material, and in doing so, may leach soluble constituents at elevated concentrations that could eventually report to surface water or groundwater. Predicted water quality impacts from these sources have been derived using a SWWC model (SRK 2018b). This model incorporates inputs from individual facility geochemical models (e.g., the TSF, DRSFs) along with solute loading from existing mine site features to provide an overall prediction of future chemistry in the Headwaters EFSFSR and Sugar Creek subwatersheds. Results from the SWWC model have been output at the ten surface water assessment nodes described in Section 3.9, Surface Water and Groundwater Quality. The surface water assessment node locations are shown on **Figure 3.9-3**.

Model predictions from the SWWC model have been made at each assessment node for three different climate scenarios: average precipitation, below average precipitation, and above average precipitation. Unless specifically noted, all water quality results discussed in this chapter are based on the average precipitation scenario. Predicted constituent concentrations for the below average precipitation scenario are often slightly higher, and concentrations for the above average scenario are often slightly lower as a result of more dilute runoff water. However, the list of constituents that is predicted to exceed surface water quality standards is the same for all three scenarios.

Mine Construction and Operation

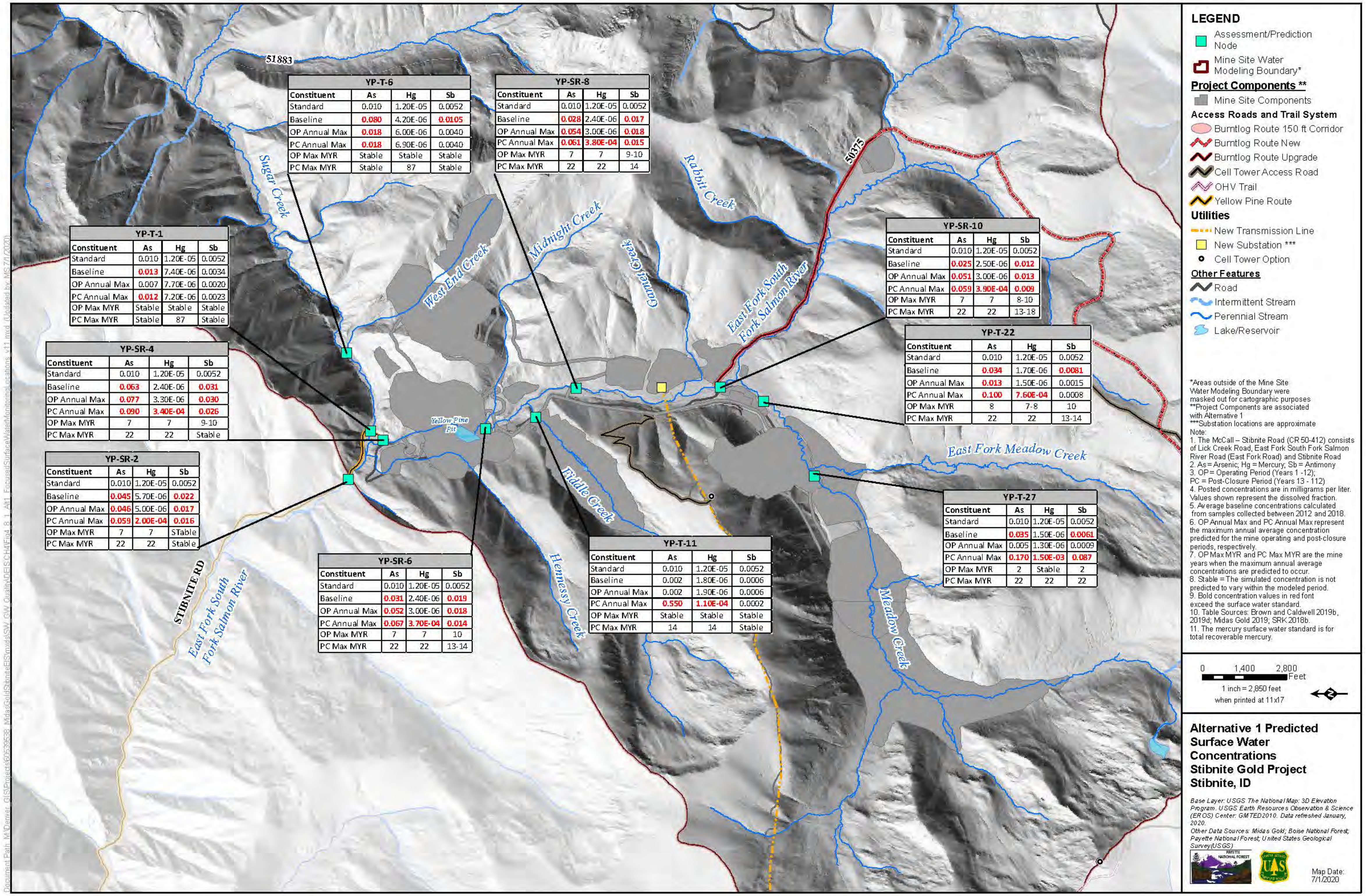
Predictive simulations for the average precipitation scenario indicate that water quality at the SGP assessment nodes would likely be circum-neutral to moderately alkaline, with predicted pH values ranging from 7.2 to 8.4 (SRK 2018b). This suggests that Alternative 1 would not cause ARD during the mine operational period. However, without water treatment, surface water quality impacts from mine contact water or dewatering water recharged through the RIBs would cause the following constituents to be above baseline levels and/or exceed the strictest potentially applicable surface water quality standard. The comparison to water quality standards has been made using average annual concentrations measured during each year of mining operations and does not reflect the full variability in simulated concentrations that may occur throughout the year.

- **Antimony**. Antimony concentrations are predicted to be elevated above the strictest potentially applicable surface water quality standard of 0.0052 mg/L at 5 of the 10 assessment nodes (YP-SR-10, YP-SR-8, YP-SR-6, YP-SR-4, and YP-SR-2), with predicted peak annual average concentrations between 0.013 mg/L and 0.030 mg//L. However, antimony concentrations at these nodes are typically less than average measured baseline (i.e., existing) concentrations (**Figure 4.9-1**), representing a slight improvement in water quality. The only exceptions occur at YP-SR-10 and YP-SR-8 during operational years 8 through 10, when average annual antimony concentrations would be marginally elevated above baseline (**Figure 4.9-1**). The marginally elevated values relate to water from the rapid infiltration basins (RIBs) reaching surface water in the EFSFSR.

- **Arsenic**. Arsenic concentrations are predicted to be elevated above the strictest potentially applicable surface water quality standard of 0.01 mg/L at seven of the ten assessment nodes (YP-T-22 in Meadow Creek, YP-SR-10, YP-SR-8, YP-SR-6, YP-SR-4, and YP-SR-2 in the EFSFSR, and YP-T-6 in West End Creek), with predicted peak annual average concentrations ranging from 0.013 mg/L to 0.077 mg/L. Predicted arsenic concentrations at these nodes are generally less than average measured baseline concentrations (**Figure 4.9-1**) during operational years 1 through 6 and 11 through 12, representing an improvement in water quality during these years. However, arsenic concentrations at YP-SR-10, YP-SR- 8, YP-SR-6, YP-SR-4, and YP-SR-2 are predicted to be elevated above baseline during operational years 7 through 10 due to water from the RIBs reaching surface water in the EFSFSR. During this time, water infiltrating the RIBs would primarily originate from dewatering of the Hangar Flats pit and would include groundwater that has been impacted by legacy mining activities.

Discharge limits for antimony and arsenic would likely be incorporated into the reuse permit or Idaho Pollutant Discharge Elimination System (IPDES) permit issued for the RIBs. The discharge limit concentrations could be met through active treatment of the mine dewatering water. IDAPA 58.01.11.150.03, Ground Water-Surface Water Interactions, requires that contaminants entering groundwater cannot impair surface water bodies. The 2020 Supreme Court decision in County of Maui v. Hawaiʻi Wildlife Fund identified attributes to consider when assessing whether a groundwater discharge requires Clean Water Act coverage, including distance and travel time between the discharge point and nearest surface water body, the discharge concentration, and the degree of contaminant attenuation during transport. Per IDEQ, a determination of whether the RIB discharges would qualify as discharges to waters of the United States would be made during the permitting process.

During mine operations, other constituents simulated by SRK (2018b) are predicted to be below surface water quality standards at the farthest downstream node on the EFSFSR (YP-SR-2), including pH, silver, aluminum, boron, barium, beryllium, cadmium, chloride, chromium, copper, fluoride, iron, mercury, manganese, molybdenum, nickel, lead, selenium, sulfate, thallium, vanadium, zinc, and TDS.



YP-T-6

Constituent	As	Hg	Sb
Standard	0.010	1.20E-05	0.0052
Baseline	**0.080**	4.20E-06	**0.0105**
OP Annual Max	**0.018**	6.00E-06	0.0040
PC Annual Max	**0.018**	6.90E-06	0.0040
OP Max MYR	Stable	Stable	Stable
PC Max MYR	Stable	87	Stable

YP-SR-8

Constituent	As	Hg	Sb
Standard	0.010	1.20E-05	0.0052
Baseline	**0.028**	2.40E-06	**0.017**
OP Annual Max	**0.054**	3.00E-06	**0.018**
PC Annual Max	**0.061**	**3.80E-04**	**0.015**
OP Max MYR	7	7	9-10
PC Max MYR	22	22	14

YP-T-1

Constituent	As	Hg	Sb
Standard	0.010	1.20E-05	0.0052
Baseline	**0.013**	7.40E-06	0.0034
OP Annual Max	0.007	7.70E-06	0.0020
PC Annual Max	**0.012**	7.20E-06	0.0023
OP Max MYR	Stable	Stable	Stable
PC Max MYR	Stable	87	Stable

YP-SR-4

Constituent	As	Hg	Sb
Standard	0.010	1.20E-05	0.0052
Baseline	**0.063**	2.40E-06	**0.031**
OP Annual Max	**0.077**	3.30E-06	**0.030**
PC Annual Max	**0.090**	**3.40E-04**	**0.026**
OP Max MYR	7	7	9-10
PC Max MYR	22	22	Stable

YP-SR-2

Constituent	As	Hg	Sb
Standard	0.010	1.20E-05	0.0052
Baseline	**0.045**	5.70E-06	**0.022**
OP Annual Max	**0.046**	5.00E-06	**0.017**
PC Annual Max	**0.059**	**2.00E-04**	**0.016**
OP Max MYR	7	7	STable
PC Max MYR	22	22	Stable

YP-SR-6

Constituent	As	Hg	Sb
Standard	0.010	1.20E-05	0.0052
Baseline	**0.031**	2.40E-06	**0.019**
OP Annual Max	**0.052**	3.00E-06	**0.018**
PC Annual Max	**0.067**	**3.70E-04**	**0.014**
OP Max MYR	7	7	10
PC Max MYR	22	22	13-14

YP-SR-10

Constituent	As	Hg	Sb
Standard	0.010	1.20E-05	0.0052
Baseline	**0.025**	2.50E-06	**0.012**
OP Annual Max	**0.051**	3.00E-06	**0.013**
PC Annual Max	**0.059**	**3.90E-04**	**0.009**
OP Max MYR	7	7	8-10
PC Max MYR	22	22	13-18

YP-T-22

Constituent	As	Hg	Sb
Standard	0.010	1.20E-05	0.0052
Baseline	**0.034**	1.70E-06	**0.0081**
OP Annual Max	**0.013**	1.50E-06	0.0015
PC Annual Max	**0.100**	**7.60E-04**	0.0008
OP Max MYR	8	7-8	10
PC Max MYR	22	22	13-14

YP-T-11

Constituent	As	Hg	Sb
Standard	0.010	1.20E-05	0.0052
Baseline	0.002	1.80E-06	0.0006
OP Annual Max	0.002	1.90E-06	0.0006
PC Annual Max	**0.550**	**1.10E-04**	0.0002
OP Max MYR	Stable	Stable	Stable
PC Max MYR	14	14	Stable

YP-T-27

Constituent	As	Hg	Sb
Standard	0.010	1.20E-05	0.0052
Baseline	**0.035**	1.50E-06	**0.0061**
OP Annual Max	0.005	1.30E-06	0.0009
PC Annual Max	**0.170**	**1.50E-03**	**0.087**
OP Max MYR	2	Stable	2
PC Max MYR	22	22	22

Figure Source: AECOM 2020

Figure 4.9-1 Alternative 1 Predicted Surface Water Concentrations

This page intentionally left blank

Mine Closure and Reclamation

Results for the post closure pit lakes and SWWC modeling are discussed by drainage in the following sections.

Meadow Creek

During the post closure period, factors that would influence water quality in Meadow Creek include formation of the Hangar Flats pit lake and management of TSF consolidation water. After Hangar Flats pit has been mined and is no longer dewatered, the pit would fill with groundwater, precipitation, and surface runoff to form the Hangar Flats pit lake. The pit lake is predicted to reach hydrologic equilibrium approximately 7 years into the post closure period and would have a long-term lake stage of 6,540 feet. The long-term pH of the pit lake is predicted to be moderately alkaline (8.0 to 8.4), indicating that PAG wall rock would not cause ARD (SRK 2018b). This is due in part to the relatively rapid fill time for the pit, with 75 percent of the PAG material submerged in the first 2 years. The rapid filling would limit the amount of time the PAG is exposed to air and therefore the amount of acidic oxidation products that develop prior to submergence (SRK 2018b).

The Hangar Flats pit lake is expected to have a calcium-bicarbonate major ion signature for the first 5 years post closure based on modeling by SRK (2018b), consistent with the existing chemical signature for Meadow Creek. However, between post closure years 5 and 20, the pit lake is predicted to have a sodium-sulfate signature as a result of runoff from the TSF. Mass loading of arsenic, molybdenum, nickel, and zinc are predicted to occur in the pit lake for the first 5 to 10 years post closure due to dissolution of soluble salts from the pit walls. These effects would be offset and dissipate over time as inflowing groundwater dilutes the solute concentrations.

A second pulse of constituent loading was simulated to occur in the pit lake during post closure years 5 through 30 due to consolidation water runoff from the TSF, assuming the consolidation water would not be treated (details of consolidation water treatment were not known during the Alternative 1 water quality modeling). This second pulse would result in mass loading of arsenic, antimony, chloride, copper, mercury, and sulfate. Arsenic concentrations in the pit lake would increase from 0.039 mg/L during post closure year 5 to a maximum concentration of 0.1 mg/L between post closure years 5 and 20. Concentrations of arsenic are then predicted to decrease and stabilize at around the surface water standard from post closure year 30 onwards (**Figure 4.9-2**). Mercury concentrations (**Figure 4.9-3**) are predicted to exceed the standard during post closure years 10 through 30, with predicted concentrations during this period ranging from 0.00003 mg/L to 0.00076 mg/L (SRK 2018b). After approximately post closure year 40, mercury concentrations are predicted to decrease to less than the standard. Finally, copper concentrations would exceed the chronic aquatic life standard calculated using the Biotic Ligand Model (0.0024 mg/L) during post closure years 10 through 15, with predicted copper concentrations ranging from 0.0033 to 0.0050 mg/L (SRK 2018b).

Besides affecting the Hangar Flats pit lake, uncontrolled runoff from the TSF (if left untreated) would impact arsenic, mercury, and copper concentrations in Meadow Creek. Absent treatment, annual average arsenic concentrations at YP-T-22 (**Figure 4.9-4**) are predicted to be above the surface water quality standard from post closure year five onwards, and above the measured baseline range between post closure years 5 and 20. Annual average mercury concentrations are predicted to be above the surface water quality standard between post closure years 5 and 30, and above the measured baseline range from post closure year 5 onwards (**Figure 4.9-5**). Finally, annual average copper concentrations would exceed the copper criterion during post closure years 10 through 15, and would be above baseline through post closure year 20 (SRK 2018b).

To prevent these predicted surface water quality impacts in Meadow Creek and the Hangar Flats pit lake, Midas Gold would treat the TSF consolidation water runoff with a passive treatment system. The passive treatment system would consist of a biochemical reactor (BCR) followed by aerobic vertical flow wetlands. Treated water from the passive system would be routed to an effluent monitoring station before final discharge. The goal of the BCR and vertical flow wetland would be to reduce constituent concentrations in the consolidation water runoff to meet applicable surface water quality standards. The development of the passive system, including any pilot testing is ongoing. Concentration changes in Meadow Creek from treating the TSF consolidation water runoff have not been modeled for Alternative 1.

Fiddle Creek

Meteoric water infiltrating through the Fiddle DRSF growth media cover would contact the underlying development rock. This infiltration has the potential to impact surface water quality as it mixes with upgradient groundwater and discharges from the DRSF as toe seepage. The SWWC modeling results indicate that toe seepage from the Fiddle DRSF could cause arsenic and mercury concentrations in Fiddle Creek to exceed water quality standards during the post closure period. Post closure arsenic concentrations at YP-T-11 are predicted to be between 0.25 mg/L and 0.55 mg/L compared to the water quality standard of 0.01 mg/L (SRK 2018b). This represents an increase of over 2 orders of magnitude compared to average baseline concentrations. Mercury concentrations at YP-T-11 are predicted to range from 0.00005 mg/L to 0.0001 mg/L, compared to the standard of 0.000012 mg/L.

Additionally, predicted post closure thallium concentrations at YP-T-11 are between 0.00009 mg/L and 0.0002 mg/L compared to the strictest potentially applicable standard of 0.000017 mg/L. These thallium exceedances are an artifact of elevated thallium detection limits in the baseline surface water and geochemical data used for modeling, and are not an indication of future thallium impacts (SRK 2018b).

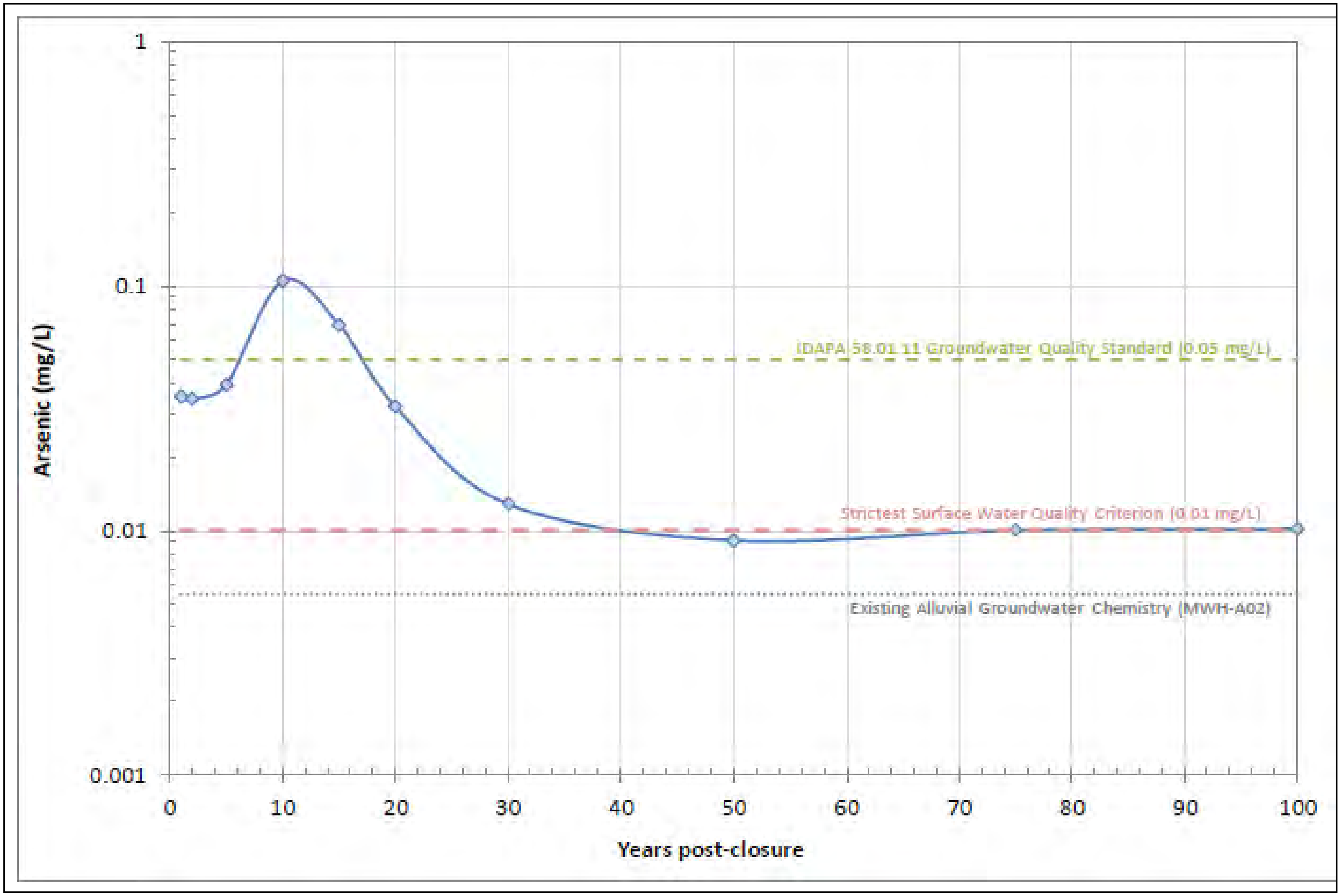


Figure Source: Modified from SRK 2018b, Figure 7-22

Figure 4.9-2 Predicted Dissolved Arsenic Concentrations in Hangar Flats Pit Lake

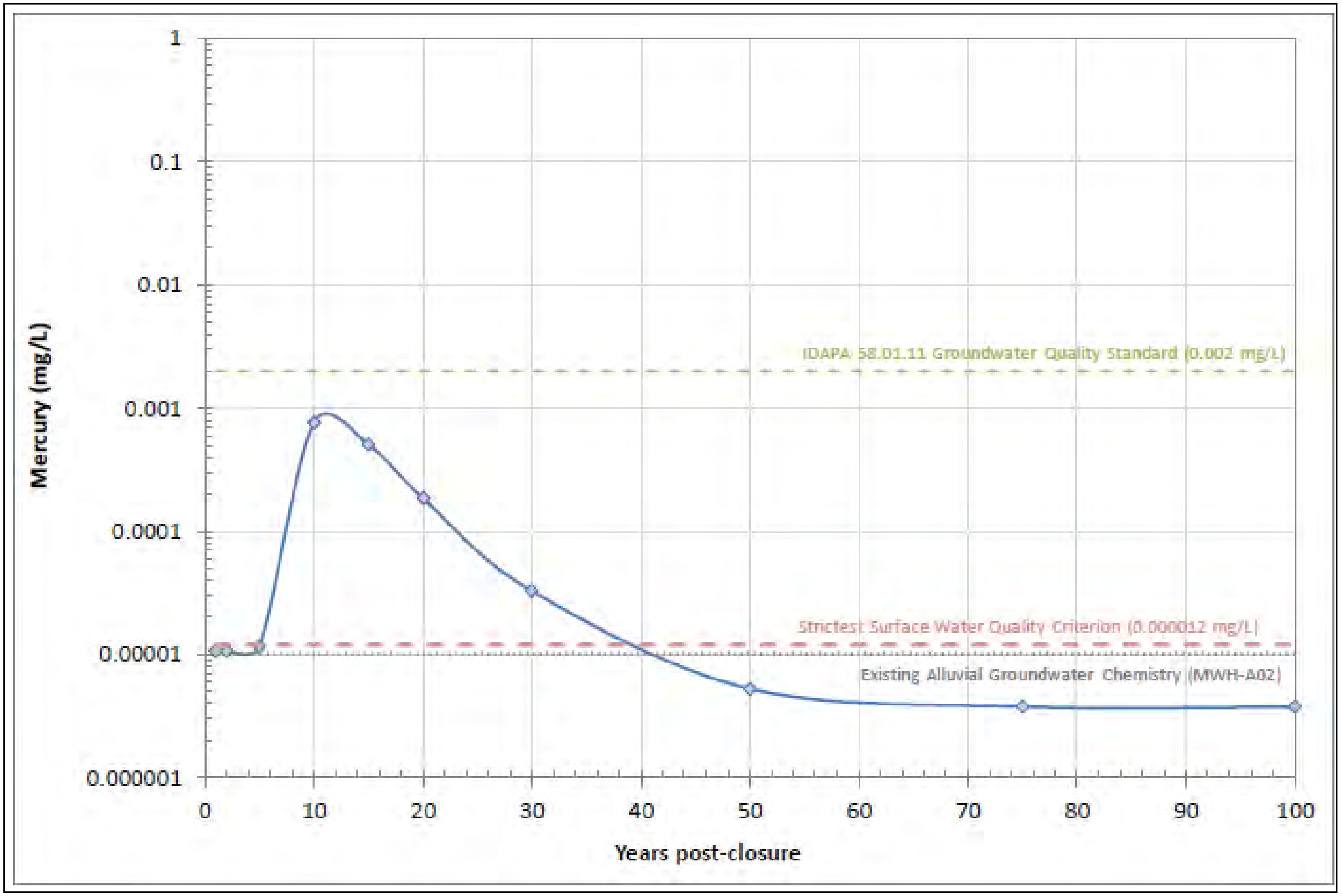


Figure Source: Modified from SRK 2018b, Figure 7-23

Figure 4.9-3 Predicted Dissolved Mercury Concentrations in Hangar Flats Pit Lake

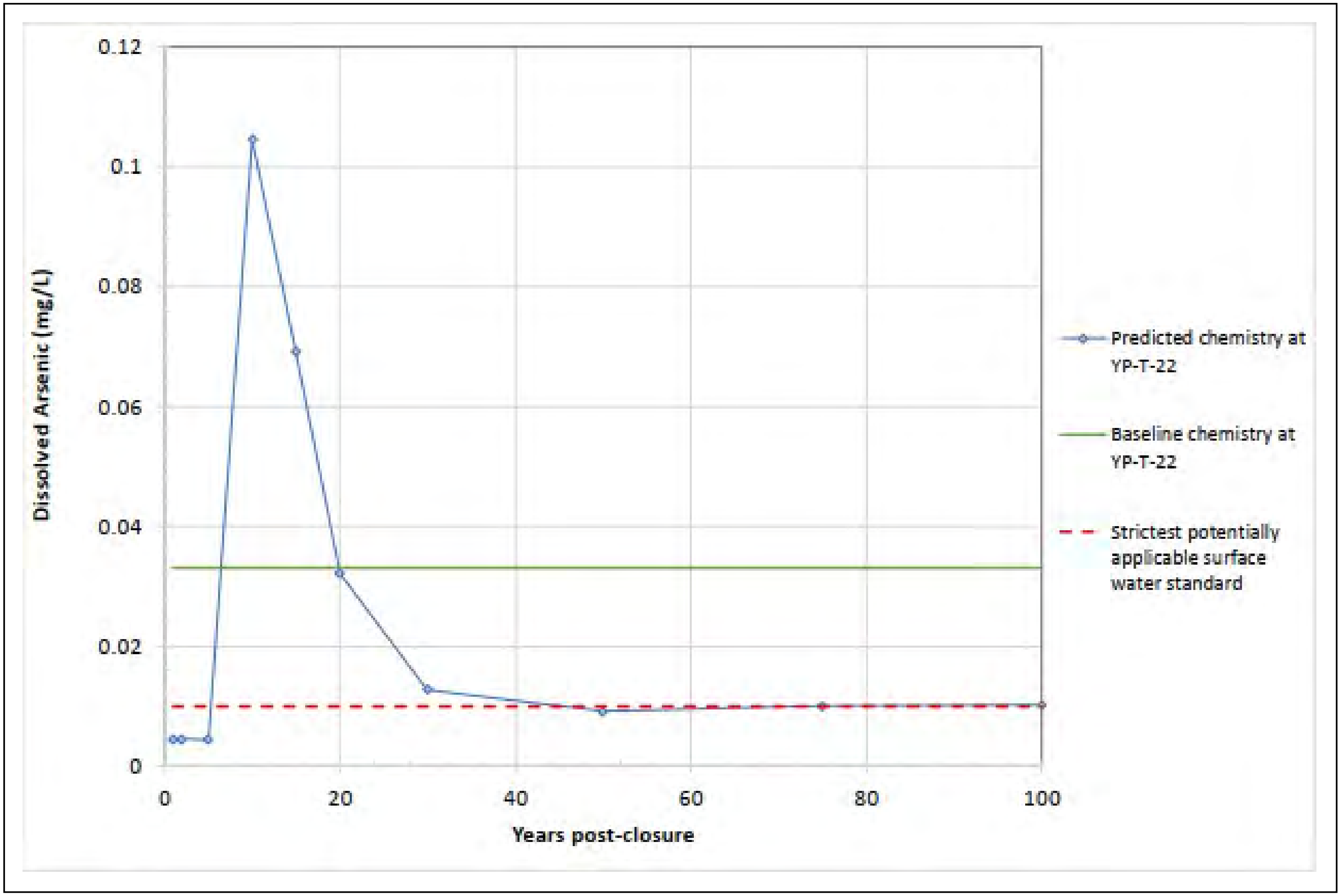


Figure Source: SRK 2018b, Figure 8-24

Figure 4.9-4 Predicted Dissolved Arsenic Concentrations at YP-T-22

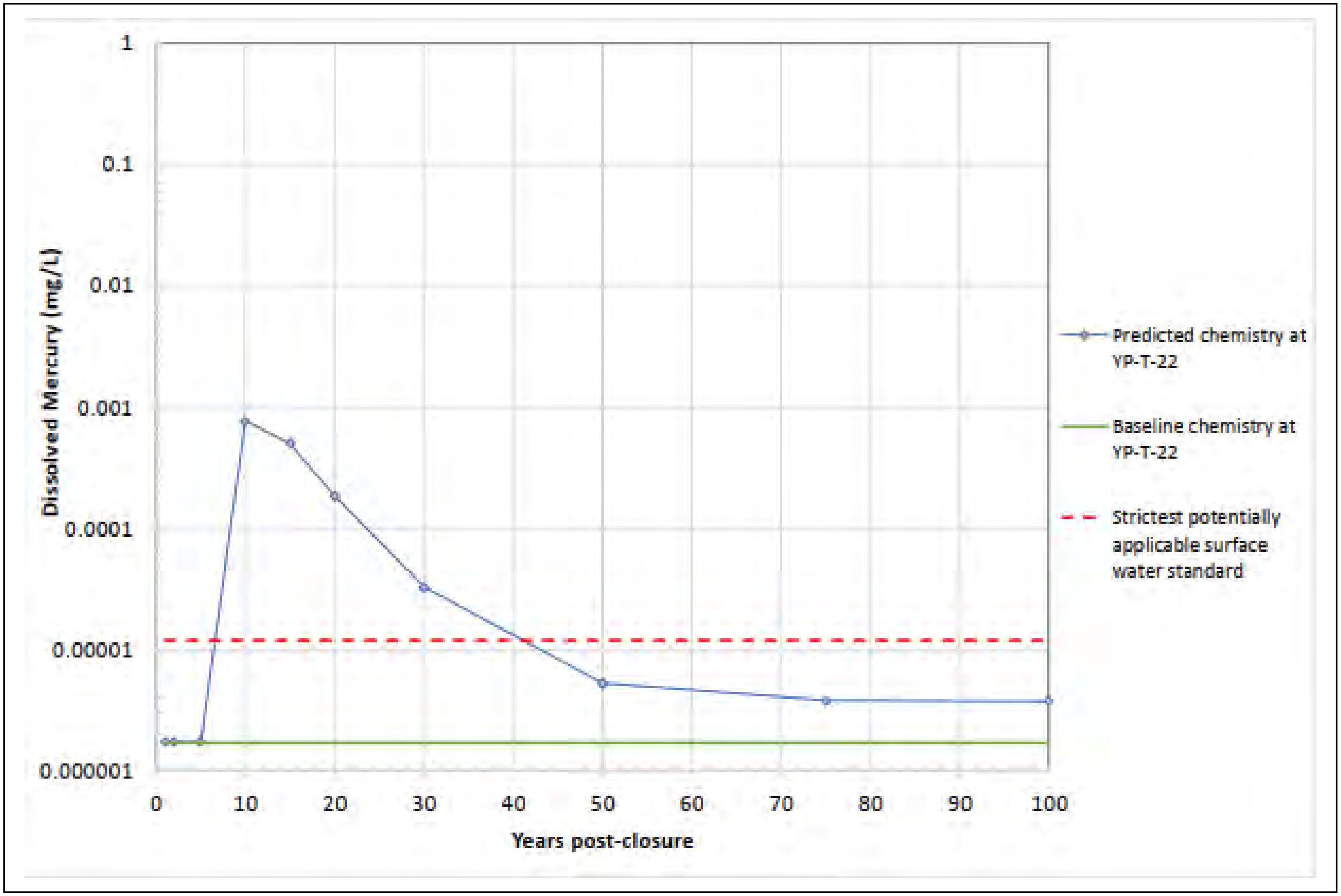


Figure Source: SRK 2018b, Figure 8-25

Figure 4.9-5 Predicted Dissolved Mercury Concentrations at YP-T-22

To prevent predicted arsenic and mercury exceedances in Fiddle Creek, Midas Gold would passively treat toe seepage from the Fiddle DRSF in perpetuity using a BCR and aerobic vertical flow wetland. The passive system would be constructed prior to the end of mine operations so that it can be brought online as soon as mining is complete. The treatment approach would follow the same basic design described for the TSF passive system above. The goal of treatment would be to reduce arsenic and mercury concentrations in the toe seepage to the surface water quality standard. Concentration changes in Fiddle Creek from treating the Fiddle DRSF toe seepage have not been modeled for Alternative 1.

West End Creek

The West End pit would be situated in the unfractured bedrock aquifer and is simulated to fill slowly over approximately 41 years, after which it would seasonally discharge to West End Creek. Geochemical model predictions indicate that PAG material in the pit walls would not cause acidification of the pit lake, as the long-term pH is predicted to be moderately alkaline (pH 8.4). The major ion chemistry of the pit lake would be dominated by magnesium and bicarbonate, a slight departure from the current calcium-magnesium-bicarbonate-sulfate signature for West End Creek. Certain constituents associated with mining are predicted to be elevated above surface water standards in the West End pit lake, including arsenic, mercury, and antimony. Predicted arsenic concentrations range from 0.15 to 0.27 mg/L during the post closure period, and mercury concentrations range from 0.0003 to 0.00043 mg/L. Antimony concentrations are predicted to be elevated above the surface water quality standard for the first 5 years post closure, with predicted concentrations ranging from 0.007 to 0.02 mg/L during this time (SRK 2018b). Overall, these predicted exceedances are attributable to pit wall flushing effects, the inflow of toe seepage and groundwater from beneath the West End DRSF, and the elevated concentrations of these constituents in existing bedrock groundwater.

After the West End pit lake reaches its maximum elevation, the lake is predicted to spill over during short seasonal periods. The volume of periodic spill-over to West End Creek is expected to be less than 0.5 percent of total flow in the creek, but may still require an IPDES permit that includes discharge limits. Regardless of whether discharge limits are applied to the pit lake, the periodic spillovers are not predicted to have a detrimental effect on downstream water quality in West End Creek. Because the West End DRSF would be covered with growth media (resulting in non-contact runoff water from the DRSF surface), and legacy mining waste would be removed from the West End drainage, Alternative 1 is predicted to lower arsenic and antimony concentrations at node YP-T-6 in West End Creek by 77 percent and 64 percent, respectively (SRK 2018b).

Midnight Creek

The Midnight Area pit lake is predicted to fill in approximately 10 years due to runoff from the pit walls and direct precipitation into the pit, with only minor contributions from bedrock groundwater. After post closure year 10, the pit lake would spill over seasonally into Midnight Creek during spring runoff periods. The long-term pH of the pit lake is predicted to be moderately alkaline (pH 8.4 to 8.5), indicating that the small amount of PAG material in the pit walls would not cause ARD. The major ion chemistry of the pit lake would be dominated by magnesium and bicarbonate. Despite the moderately alkaline pH, concentrations of arsenic, mercury, antimony, and copper are predicted to be elevated in the pit lake above applicable surface water quality standards for years 1 to 100 post closure. Predicted arsenic concentrations would range from 0.40 to 0.81 mg/L, compared to the 0.01 mg/L water quality standard. Mercury concentrations would range from 0.00067 to 0.0014 mg/L compared to the 0.000012 mg/L standard, antimony concentrations would range from 0.056 to 0.11 mg/L compared to the 0.0052 mg/L standard, and copper concentrations would range from 0.0031 to 0.0040 mg/L compared to the 0.0024 mg/L standard (SRK 2018b). Overall, these predicted exceedances are attributable to both pit wall flushing effects and the lack of surface water and groundwater inflows to dilute concentrations derived from the pit walls.

Although the pit lake would eventually discharge to Midnight Creek, mass loading of arsenic, mercury, antimony, and copper into the creek would still be relatively low because the annual volume of overflow from the pit would typically be less than 0.5 cubic feet per second, which equates to between 10 and 15 percent of the mean annual flow in Midnight Creek (SRK 2018b). Discharges from the Midnight Area pit lake to Midnight Creek would likely be regulated under an IPDES permit. Additionally, measures to prevent discharge from the pit lake, such as enhanced evaporation, can be considered as mitigation under Alternative 1 for potential downstream impacts in Midnight Creek.

Table 4.9-10 Alternative 1 Maximum Annual Average Post Closure Concentrations at the EFSFSR Assessment Nodes

Constituent	Units	Strictest Potentially Applicable Surface Water Quality Standard	YP-SR-10	YP-SR-8	YP-SR-6	YP-SR-4	YP-SR-2
Arsenic	mg/L	0.010	0.059	0.061	0.067	0.090	0.059
Mercury	mg/L	0.000012	0.00039	0.00038	0.00037	0.00034	0.00020
Antimony	mg/L	0.0052	0.009	0.015	0.014	0.026	0.016
Copper	mg/L	0.0024	0.0027	0.0026	0.0025	0.0024	0.0013

Table Source: SRK 2018b

Table Notes:

Concentration values represent the dissolved fraction unless otherwise noted.

Bolded values exceed the strictest potentially applicable surface water quality standard.

EFSFSR

As the principal drainage for the mine site, the EFSFSR would receive solute loading from TSF runoff, DRSF toe seepage, groundwater discharge, and pit lake outflows. This solute loading would be offset to some degree by the removal and repurposing of legacy mine waste in the Meadow Creek valley. The net result would be a general improvement in surface water quality for some parameters (e.g., antimony), but degradation of water quality for other constituents that are less abundant in historical mining wastes. Predicted concentration changes include the following:

- Antimony would remain elevated above the surface water standard at all five nodes in the EFSFSR (**Table 4.9-10**). Predicted peak average annual antimony concentrations are between 0.009 mg/L at YP-SR-10 and 0.026 mg/L at YP-SR-4 (SRK 2018b). However, in all cases, the predicted antimony concentrations are less than average baseline concentrations (**Figure 4.9-1**), representing up to a 33 percent concentration reduction.
- Arsenic is predicted to be elevated above the surface water standard at all five nodes in the EFSFSR (**Table 4.9-10**). Predicted peak average annual arsenic concentrations are between 0.059 mg/L at YP-SR-10 and YP-SR-2 and 0.090 mg/L at YP-SR-4 (SRK 2018b). However, the predicted concentrations at these nodes are typically lower than average baseline concentrations (**Figure 4.9-1**). The only exception is between post closure years 5 and 20, when arsenic concentrations in the EFSFSR are predicted to be above the measured baseline range without treatment of consolidation water runoff from the TSF.
- Dissolved mercury is predicted to be elevated above the strictest potentially applicable surface water standard (which applies to total recoverable mercury) at all five nodes in the EFSFSR between post closure years 5 and 30. The elevated dissolved mercury concentrations in the EFSFSR would be caused by consolidation water runoff from the TSF. These predicted dissolved mercury values may underestimate mercury-related impacts because the modeled concentrations do not include potential contributions of particulates found in total mercury.
- Average annual copper concentrations are predicted to be above the Biotic Ligand Model criterion at nodes YP-SR-10, YP-SR-8, and YP-SR-6 during post closure year 10.

Future concentrations in the EFSFSR also would be affected by passive treatment systems proposed for the TSF consolidation water runoff and Fiddle DRSF toe seepage. However, the effects of passive treatment have not been modeled for Alternative 1.

Temperature – Alternative 1

Under Alternative 1, changes to stream flow, groundwater-surface water interactions, and stream shading have the potential to affect stream temperatures. Surface water tends to warm when streams become shallower, receive smaller fluxes of groundwater inflow, or receive more direct sunlight due to removal of riparian vegetation. Effluent from permitted discharges also can affect stream temperature. Predictions of future stream temperatures were generated by Brown and Caldwell (2019a) using a SPLNT model.

The Alternative 1 SPLNT modeling scenario accounts for the following changes to the mine site surface water management:

- Lining of some channels (preventing exchange with groundwater).
- Mining and vegetation removal (altering shade and topography).
- Dewatering pits (lowering of the groundwater table with subsequent reductions to stream flow rates in some reaches).
- Permitted discharge of treated water or non-contact water to surface water.
- Discharge of non-contact water to RIBs (adding water to the stream system as additional diffuse flow).

The stream temperature analysis presented below focuses on comparing predicted future temperatures to existing temperature conditions. The operational and post closure predictive simulations were compared to a No Action model developed to simulate conditions that would be expected if the Proposed Action is not implemented. The No Action model provides a representation very similar to existing conditions that allows for direct comparison and quantification of mining-related impacts.

Table 4.9-11 summarizes the predicted maximum weekly summer condition, average weekly summer condition, maximum weekly fall condition, and average weekly fall temperatures for several stream reaches throughout the mine site that approximate (but are not identical to) the ten surface water assessment nodes discussed above. Temperature statistics for the No Action model also are provided in the table for comparison. For information on how predicted stream temperatures compare to aquatic life temperature standards, refer to Section 4.12, Fish Resources and Fish Habitat. Overall, Alternative 1 would result in water temperature increases for each simulated stream reach during the mine operational and post closure period.

Seasonal temperature increases of above 10 degrees Celsius (°C) are predicted for two different stream reaches, including the summer maximum temperatures in Fiddle Creek (12.3-degree increase) and West End Creek (10.5-degree increase). Both increases are predicted to occur during the mine operational period, with predicted temperatures cooling somewhat during post closure, but remaining elevated above existing conditions.

During the post closure period at EOY 18, Meadow Creek above the East Fork Meadow Creek is predicted to have a maximum summer temperature of 26.2°C, more than 8 degrees above the existing condition. The reason for the high temperature is the limited vegetation regrowth that would occur during the first six years post closure, and the relatively low flows that would persist in Meadow Creek until the creek channel is reclaimed.

At the EFSFSR downstream of Sugar Creek, summer and fall stream temperatures would increase during the mine operational period and early post closure period to reach a maximum at the EOY 18. After that time, average and maximum temperatures would remain stable or gradually decrease as riparian vegetation is reestablished. However, maximum summer (19.3°C) and fall (14.4°C) temperatures and average summer temperatures (13.2°C) are still predicted to be as much as 4.4 degrees above baseline 100 years into the post closure period. This finding shows that water temperature increases from Alternative 1 would extend downstream in the EFSFSR past Sugar Creek (near the approximate location of surface water assessment node YP-SR-2) and would persist for at least 112 years after mining is initiated.

Table 4.9-11 Maximum and Average Weekly Summer and Fall Stream Temperatures Simulated for Alternative 1

Area	Simulated Daily Temperature Statistic	Existing Condition/No Action	EOY 6	EOY 12	EOY 18	EOY 22	EOY 27	EOY 32	EOY 52	EOY 112	Maximum Simulated Temperature	Maximum Increase from Existing Condition
Upper EFSFSR (above Meadow Creek)	Summer Max:	13.4	13.9	13.8	13.7	13.9	13.9	13.9	13.9	13.9	13.9	0.5
	Fall Max:	11.1	11.5	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.5	0.4
	Summer Avg:	10.3	10.7	10.8	10.8	10.6	10.6	10.6	10.6	10.6	10.8	0.5
	Fall Avg:	8.8	9.1	9.3	9.3	9.1	9.1	9.1	9.1	9.1	9.3	0.5
Meadow Creek above East Fork Meadow Creek	Summer Max:	17.9	23.7	23.8	26.2	21.1	21.1	21.1	20.5	19.9	26.2	8.3
	Fall Max:	15.1	18.8	18.7	19.8	16.3	16	16	15.1	14.6	19.8	4.7
	Summer Avg:	12.7	14	14	16.3	15	15	15	14.5	14.5	16.3	3.6
	Fall Avg:	10.4	10.6	10.7	12.1	11.6	11.6	11.6	11	11	12.1	1.7
Meadow Creek below East Fork Meadow Creek	Summer Max:	19.8	22.9	23.4	21.2	21.2	21.2	21.2	21.2	21.2	23.4	3.6
	Fall Max:	16.2	17.7	17.6	17.3	17.3	17.8	17.8	17.8	17.8	17.8	1.6
	Summer Avg:	13.4	14.4	14.4	19.2	19.2	19.2	19.2	19.2	19.2	19.2	5.8
	Fall Avg:	10.8	11.1	10.9	12.1	12.1	12.1	12.1	11.7	11.7	12.1	1.3
Middle EFSFSR (between Meadow and Fiddle Creeks)	Summer Max:	17.4	19.3	18.9	20	20	20	20	20	20	20	2.6
	Fall Max:	14	15.1	14.8	16.2	15.4	15.4	15.4	15.4	15.1	16.2	2.2
	Summer Avg:	12.2	12.9	12.8	14.3	14.3	14.3	14.3	14.3	14.3	14.3	2.1
	Fall Avg:	9.9	10.1	10.1	10.3	9.9	9.9	9.9	9.9	9.9	10.3	0.4
Fiddle Creek	Summer Max:	11.4	19.1	23.7	19.6	19.6	19.2	19.2	18	17.4	23.7	12.3
	Fall Max:	9.9	16.3	18.8	17.1	15	15	15	14	13.5	18.8	8.9
	Summer Avg:	9.2	11.4	13.5	12.5	12.5	12.5	12.5	11.9	11.7	13.5	4.3
	Fall Avg:	8.2	9.3	10.2	10.4	9.6	9.6	9.6	9.2	9.2	10.4	2.2
Lower EFSFSR (between Fiddle and Sugar Creek)	Summer Max:	17.4	20.1	21.7	22.3	22.3	22.3	22.3	21.8	21.6	22.3	4.9
	Fall Max:	14	15.6	16.5	17.5	16.5	16.5	16.5	16.1	15.9	17.5	3.5
	Summer Avg:	12.2	13.1	13.9	14.7	14.7	14.7	14.7	14.5	14.4	14.7	2.5
	Fall Avg:	9.9	10.2	10.6	11.1	10.4	10.4	10.4	10.4	10.2	11.1	1.2
West End Creek	Summer Max:	12.9	23.4	19.6	21.7	21.7	21.2	20.6	19.2	18.6	23.4	10.5
	Fall Max:	11	18.2	16.3	17.3	16.7	15.7	15	14.3	13.4	18.2	7.2
	Summer Avg:	11.1	12.5	13.2	15.2	15.2	14.6	14.6	14	13.5	15.2	4.1
	Fall Avg:	9.6	9.9	10.5	12.4	12.4	11.8	11.8	11.4	11.2	12.4	2.8
Lower Sugar Creek	Summer Max:	15.4	16.2	16.2	16.3	16.3	16.3	16.3	16.3	16.3	16.3	0.9
	Fall Max:	12.2	12.8	12.8	13.7	12.9	12.9	12.9	12.9	12.9	13.7	1.5
	Summer Avg:	10.7	11.1	11.1	11.2	11.2	11.2	11.2	11.2	11.2	11.2	0.5
	Fall Avg:	9.1	9.2	9.3	9.6	9.4	9.4	9.4	9.4	9.4	9.6	0.5

Area	Simulated Daily Temperature Statistic	Existing Condition/No Action	EOY 6	EOY 12	EOY 18	EOY 22	EOY 27	EOY 32	EOY 52	EOY 112	Maximum Simulated Temperature	Maximum Increase from Existing Condition
EFSFSR downstream of Sugar Creek	Summer Max:	14.9	18	19.3	19.7	19.7	19.7	19.7	19.3	19.3	19.7	4.8
	Fall Max:	11.9	14	14.9	15.6	14.7	14.7	14.7	14.4	14.4	15.6	3.7
	Summer Avg:	12.4	12.2	12.7	13.2	13.2	13.2	13.2	13.2	13.2	13.2	0.8
	Fall Avg:	10	9.7	10.1	10.4	10.4	9.9	9.9	9.9	9.9	10.4	0.4

Table Source: Brown and Caldwell 2019b, Table B-46

Table Notes:

Temperatures in °C.

EOY - End of Year.

Sediment – Alternative 1

Surface disturbance caused by Alternative 1 would cause erosion of soil and overburden material. These eroded sediments could in turn affect surface water quality if the sediment is blown or washed into adjacent streams. Erosion and sedimentation effects on surface water quality are indicated primarily by changes in turbidity and total suspended solids in the receiving environment. Predictions of these water quality indicators were not included in the SWWC modeling. As such, changes in turbidity and total suspended solids have been qualitatively assessed using best available data, professional judgement, and consideration of proposed management and mitigation strategies for the SGP.

Proposed activities at the mine site would result in some erosion and sedimentation within Meadow Creek, Sugar Creek, and the EFSFSR during active surface material disturbance associated with mine construction, operations, reclamation, and closure, with the greatest potential for in-stream impacts occurring during times of higher overland flow. The effect to surface water quality as a result of sedimentation and erosion would be limited by applicable mitigation strategies and control techniques, by the limited duration of surface disturbing activities, and by the adaptability of the receiving environment (as indicated by the typically low baseline levels of total suspended solids and turbidity with seasonally variable spikes at times of higher overland flow).

Another SGP component that could increase stream sediment loads is draining the current Yellow Pine pit lake in preparation for mining. Midas Gold would limit the potential for sedimentation impacts by following conditions in the Dewatering Practices section of their current Multi-Sector General Permit, or the Multi-Sector General Permit that is in place at the time (Brown and Caldwell 2020). During mine construction, the Yellow Pine pit would be drained after the EFSFSR has been diverted around the pit lake, and the lake stage would be allowed to passively drop to the lake outlet elevation. The remaining water in the lake would then be withdrawn near the shoreline or from a floating intake managed to prevent disturbance of bottom sediments, thereby minimizing turbidity in the lake and in the discharged water. Water removed from the lake would be pumped downstream without treatment except for turbidity controls as needed. After the pit lake level is sufficiently below the outlet elevation, the nearly empty pit would be used for storm water management during pre-stripping of the pit highwalls. When complete drainage of the pit is necessary for mining, any water remaining in the pit bottom would either be used for construction purposes, transferred to the TSF for future use in ore processing, or contained in contact water ponds. By managing the Yellow Pine pit in this manner, excess sediment loading in the EFSFSR could effectively be prevented.

Surface water quality also could be impacted during construction, operations, closure and reclamation by fugitive dust from vehicles and heavy equipment that settles into adjacent water bodies. Reduction of these potential impacts would be achieved through fugitive dust control at the mine site. In dry months, Midas Gold would spray water on mine haul roads as necessary to mitigate dust emissions. As appropriate and in compliance with U.S. Forest Service (Forest Service) requirements and mitigation measures, Dust control products, such as magnesium chloride, lignin sulfonate, or other appropriate and environmentally-acceptable products, to further enhance dust control at the site would be incorporated. The Forest Service would require that where haul roads pass within 25 feet (slope distance) of surface water, dust abatement would only be applied to a 10-foot swath down the centerline of the road. The rate and quantity of application would be regulated to ensure the chemical is absorbed before leaving the road surface.

The extent of sedimentation effects from erosion and fugitive dust would be concentrated at the mine site; however, due to the nature of sediment transport by streams, the geographic extent of the impact could extend farther downstream in the EFSFSR depending on many site- and event-specific factors. The duration for traffic-related dust and erosion/sedimentation would last throughout the mine construction, operational, and post closure periods; however, the potential for these effects would be incrementally reduced during closure and reclamation due to reduced activity at the mine site.

Organic Carbon – Alternative 1

Sewage from the planned worker housing facility would be managed via a wastewater treatment plant that would discharge via a surface water outfall directly to the EFSFSR. A package plant consisting of a membrane bioreactor or equivalent system would treat the sanitary wastewater to meet applicable IPDES permit standards, and effluent would be discharged in an acceptable manner as approved by the permit. Sewage effluent systems would have waste containment and runoff control structures to prevent escape of untreated waste to the EFSFSR. The discharge volume from the wastewater treatment plant would vary between the mine construction, operation, and closure and reclamation periods, depending on the number of workers present at the mine site. However, the overall discharge rate from the plant is expected to be small relative to ambient flow in the EFSFSR (Brown and Caldwell 2020).

Surface water quality changes resulting from the wastewater treatment plant discharge have not been calculated through modeling exercises. Qualitatively, operation of the wastewater treatment plant would incrementally increase organic carbon mass loading rates in the Headwater EFSFSR subwatershed. But the overall impact on organic carbon concentrations in the river are expected to be low given the small volume of wastewater effluent relative to average streamflow, and the planned adherence to IPDES permit limits for the treated water discharge.

Methylmercury – Alternative 1

Geochemical modeling by SRK (2018b) indicates that mining activity would contribute to higher dissolved mercury concentrations in the mine site drainages. During the post closure period, peak annual average mercury concentrations are predicted to increase above baseline levels at 9 of the 10 surface water assessment nodes (**Figure 4.9-1**). The absolute concentration increases over baseline are shown in **Table 4.9-12**. Although these concentration changes may increase methylmercury (MeHg) levels in the watershed, there are many other factors that affect MeHg production. Methylation efficiency is partially dependent on the bioavailability of inorganic mercury to anaerobic bacteria, which is not fixed in space or time and has the potential to change as environmental conditions change. Other water quality characteristics that influence MeHg production include pH, sulfate, total organic carbon, and wetland abundance in the watershed. The relationships between these factors and MeHg production are depicted in **Figure 4.9-6**.

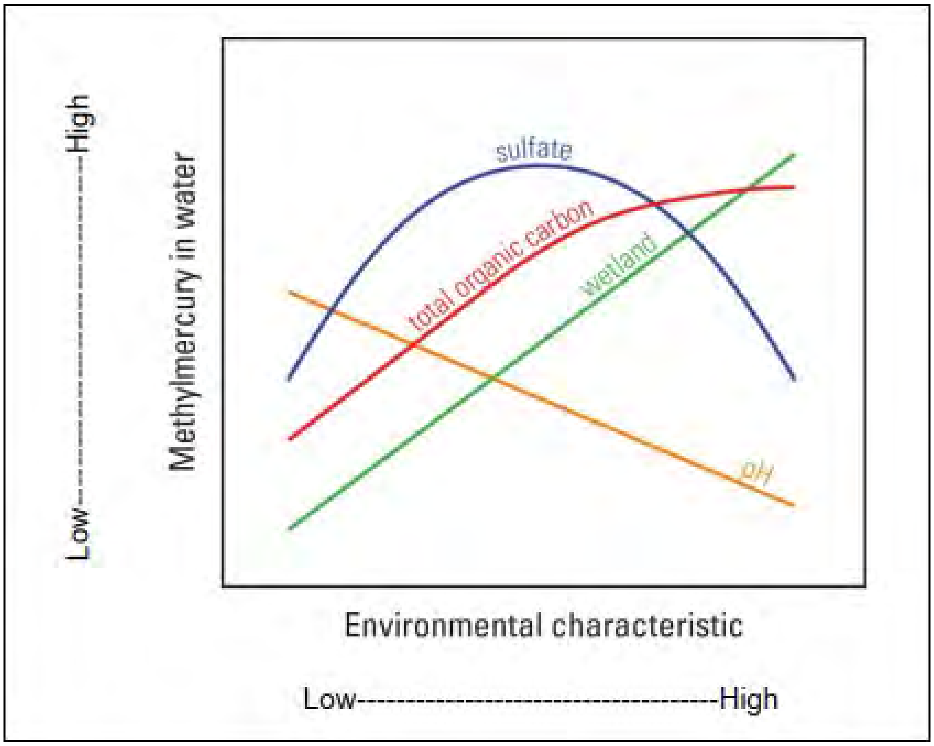


Figure Source: Modified from U.S. Geological Survey 2015

Figure 4.9-6 Relationship between MeHg in Surface Water and Environmental Characteristics

Without a detailed characterization of methylation efficiency, a ratio method is the simplest way to estimate future MeHg concentrations in the watershed. Holloway et al. (2017) determined that MeHg represents 1.6 to 2.0 percent of total mercury in water samples from Sugar Creek and the EFSFSR between Sugar Creek and the Meadow Creek confluence. If it is assumed that dissolved mercury introduced into the system from mining would be converted to methylmercury in a similar proportion, post closure annual average MeHg concentrations are likely to increase as shown in **Table 4.9-12**. The MeHg values in this table were calculated by multiplying the difference between baseline and predicted annual average dissolved mercury concentrations by 2 percent. The calculation assumes that the initial MeHg concentration at each assessment node is zero, which is a reasonable assumption given the frequency of non-detects in the baseline MeHg dataset (90 percent; Section 3.9.3.1.1.4, Methylmercury), and the large mercury concentration increases expected from mining. The estimates in **Table 4.9-12** show that post closure MeHg concentrations would likely be highest in the Meadow Creek drainage due to consolidation water runoff from the TSF, and would decrease downstream in the EFSFSR.

This simplified analysis does not take into account passive treatment of the TSF consolidation water, which would help prevent future MeHg increases by removing dissolved mercury from the TSF runoff before it is discharged to Meadow Creek.

Table 4.9-12 Alternative 1 Post Closure Methylmercury Concentrations Estimated as a Proportion of Model-Simulated Average Annual Dissolved Mercury Values

Stream	Node	Dissolved Mercury Concentration (ng/L)			Post Closure Annual Max Dissolved MeHg (ng/L)
		Baseline	Post Closure Annual Max	Predicted Change	
Meadow Creek	YP-T-27	1.5	1500	1499	30
Meadow Creek	YP-T-22	1.7	760	758	15
EFSFSR	YP-SR-10	2.5	390	388	7.8
EFSFSR	YP-SR-8	2.4	380	378	7.6
EFSFSR	YP-SR-6	2.4	370	368	7.4
EFSFSR	YP-SR-4	2.4	340	338	6.8
EFSFSR	YP-SR-2	5.7	200	194	3.9
Fiddle Creek	YP-T-11	1.8	110	108	2.2
West End Creek	YP-T-6	4.2	6.9	2.7	0.05

Table Source: Midas Gold 2019; SRK 2018b

Table Notes:

ng/L = nanograms per liter.

MeHg = methylmercury.

Post Closure Annual Max = maximum annual average dissolved mercury concentration predicted during the post closure period.

Post Closure Annual Max MeHg = 0.02 * (Post Closure Annual Max – Baseline).

Calculation of the Post Closure Annual Max MeHg concentration assumes that the baseline MeHg concentration is zero.

Fuels and Hazardous Chemicals – Alternative 1

Aboveground tanks for storage of fuels and other fluids, including gasoline, diesel fuel, lubricants, coolants, hydraulic fluids, and propane would be used for the SGP. Section 4.7, Hazardous Materials, provides details on the storage and containment requirements for oil and hazardous waste spill prevention, preparedness, and response to prevent oil and hazardous waste discharges to navigable waters of the U.S. For example, a Spill Prevention, Control, and Countermeasure (SPCC) Plan would be maintained for operations. The SPCC Plan would address site-specific spill prevention measures, fuel hauling guidelines, fuel unloading procedures, inspections, secondary containment of on-site fuel storage tanks, and staff training. Minimum secondary containment requirements mandated by federal regulations include a requirement for containment of 100 percent of the largest tank volume plus freeboard which is typically interpreted as 110 percent secondary containment capacity of the largest tank volume. Routine inspection and maintenance of storage vessels, containment, and preventative infrastructure (e.g., cathodic protection, alarms, etc.) would be conducted at prescribed intervals per planning documents.

Overall, implementation of required standard design, permit stipulations, and regulatory requirements governing fuel storage and handling would reduce the risk of spills and ensure that effective response is provided should a spill occur, which would limit impacts to surface water quality.

Impaired Waterbodies – Alternative 1

As discussed previously, the inventoried waterbodies at the mine site (except for West End Creek) are 303(d) listed as impaired waters. The causes for listing of these waters are associated with arsenic, with the EFSFSR also being listed for antimony (downstream of Meadow Creek) and Sugar Creek also being listed for mercury. Each of the 303(d)-listed waterbodies has designated beneficial uses of “cold water communities,” “salmonid spawning,” and “primary contact recreation,” and all (except Sugar Creek) have designated beneficial uses of “drinking water supply.”

Surface water management at the mine site would involve diverting the portions of these streams that run through areas proposed for mining-related disturbance, which would result in these waterbodies remaining diverted over a period of approximately 8 to 20 years (depending on the stream).

As discussed above, post closure chemistry modeling for the EFSFSR indicates the following:

- Antimony would remain elevated above the surface water standard at all five nodes in the EFSFSR. Predicted peak average annual antimony concentrations are between 0.009 mg/L at YP-SR-10 and 0.026 mg/L at YP-SR-4 (SRK 2018b). However, in all cases, the predicted antimony concentrations are less than average baseline concentrations (**Figure 4.9-1**), representing up to a 33 percent reduction in concentrations.

- Arsenic is predicted to be elevated above the surface water quality standard at all five nodes in the EFSFSR. Predicted peak average annual arsenic concentrations are between 0.059 mg/L at YP-SR-10 and YP-SR-2 and 0.090 mg/L at YP-SR-4 (SRK 2018b). However, the predicted concentrations at these nodes are typically lower than average baseline concentrations (**Figure 4.9-1**), except between post closure years 5 and 20, when arsenic concentrations in the EFSFSR are predicted to be above the measured baseline range as a result of consolidation water runoff from the TSF.

Although Alternative 1 would indirectly address the designated beneficial uses of these 303(d)-listed waterbodies (through the removal, reprocessing, and proper disposal of legacy mine waste), it is likely that the streams would remain impaired for arsenic, antimony (EFSFSR), and mercury (Sugar Creek) after closure, based on post closure modeling predictions for these constituents (without water treatment). As such, the IDEQ would still be expected to identify goals towards developing a water quality improvement plan/total maximum daily loads (TMDLs) for these waterbodies. Alternative 1 would not affect the upstream source of mercury in Sugar Creek from the Cinnabar (mercury) mine.

4.9.2.1.2.2 Access Roads

Construction and use of roads can accelerate erosion and sediment delivery to streams and have been identified as the primary contributor of sediments to stream channels in managed watersheds (Trombulak and Frissell 2000). Roads are often chronic sources of sediment delivery from cut-slopes, ditch- lines, and running surfaces, and act as potential sites for accelerated mass movements (e.g., mud slides). Roads also intercept subsurface flows, concentrate flows in ditch lines and through culverts and bridges, and act as direct conduits for sediment delivery to stream channels (Beschta 1978). The minimum road culvert size for mining projects in Idaho is 18-inch diameter (IDAPA 20.03.02.140.05.c).

The access roads used under Alternative 1 would cross 71 different named and unnamed streams, as inventoried in **Table 4.9-13**.

Table 4.9-13 Alternative 1 Access Road Stream Crossings

Road/ Component	Route/Access	Number of Crossings[1]	Stream Names
Warm Lake Road (CR 10-579)	Yellow Pine Route & Burntlog Route	16	▪ Alpine Creek ▪ Beaver Creek ▪ Big Creek ▪ Deep Creek ▪ Little Creek ▪ Little Pearsol Creek ▪ Pearsol Creek ▪ South Fork Salmon River ▪ Warm Lake Creek ▪ 7 Unnamed creeks

Road/ Component	Route/Access	Number of Crossings[1]	Stream Names
Johnson Creek Road (CR 10-413)	Yellow Pine Route	16	▪ Bear Creek ▪ Coffee Creek ▪ Ditch Creek ▪ Halfway Creek ▪ Hanson Creek ▪ Johnson Creek ▪ Lunch Creek ▪ Moose Creek ▪ Olson Creek ▪ Park Creek ▪ Pid Creek ▪ Riordan Creek ▪ Rustican Creek ▪ Sheep Creek ▪ Trapper Creek ▪ Trout Creek
McCall-Stibnite Road (CR 50-412)	Yellow Pine Route	11	▪ 3 Unnamed creeks ▪ Double A Creek ▪ EFSFSR ▪ Profile Creek ▪ Tamarack Creek ▪ Salt Creek ▪ Sugar Creek ▪ Vibika Creek ▪ Whiskey Creek
Johnson Creek Road (CR 10-413)	Burntlog Route	21	▪ Burntlog Creek ▪ East Fork Burntlog Creek ▪ EFSFSR ▪ Johnson Creek ▪ Landmark Creek ▪ Peanut Creek ▪ Rabbit Creek ▪ Riordan Creek ▪ Trapper Creek ▪ Unnamed creeks (12)
Cabin Creek Groomed OSV Route (FR 467)	Cabin Creek Groomed OSV Route	7	▪ Cabin Creek ▪ Lunch Creek ▪ Pid Creek ▪ Park Creek ▪ Sheep Creek ▪ Trout Creek ▪ Warm Lake Creek

Table Source: IDEQ 2018

Table Notes:

1 The number of crossings listed for each road segment/route is for individual streams; in some cases, the road/route segment may cross one or more streams at multiple locations.

CR = County Road.

FR = National Forest System Road.

During the construction phase (approximately 2 to 3 years), the mine site would be accessed via Warm Lake Road (CR 10-579 and then the Yellow Pine Route (Johnson Creek Road [CR 10-413] and McCall-Stibnite [CR 50-412] Road), which would cross 43 of the 71 streams listed in **Table 4.9-13**. In addition to these stream crossings, the Yellow Pine Route is located in close proximity to streams (i.e., within 100 feet) for 6.5 miles or 18 percent of its 36-mile length. A total of 45 heavy vehicles and 20 light vehicles are anticipated on average per day (year-round) during construction, for an annual average daily trip (AADT) total of 65 round trips utilizing the Yellow Pine Route.

During the mining and ore processing operations phase (approximately 12 years), mine site access would use the same existing Warm Lake Road (CR 10-579) and then the Burntlog Route (upgraded portions of Burnt Log Road [FR 477] and new road portions connecting to Meadow Creek Lookout Road [FR 51290]), which would cross 37 of the 71 streams listed in **Table 4.9-13**. The Alternative 1 Burntlog Route alignment would be located within 100 feet of streams for approximately 1.69 miles or 4 percent of its 38.2-mile length. A total of 49 heavy vehicles and 19 light vehicles are anticipated on average per day (year-round) during operations, for an AADT total of 68 round trips utilizing the Burntlog Route. Additionally, public access along the Cabin Creek groomed over snow vehicle (OSV) route during operations would include a total of 7 stream crossings.

During the closure and reclamation phase (approximately 5 years, but with up to an additional 5 years for certain facilities including the need to use Burntlog Route), traffic along Burntlog Route would be reduced to a total of 13 heavy vehicles and 12 light vehicles on average per day (year-round), for an AADT total of 25 round trips.

The remainder of this section discusses surface water impacts in the context of applicable water quality indicators.

Sediment – Alternative 1

Road, Culvert, and Bridge Construction

During Burntlog Route construction, the potential exists for increased runoff, erosion, and sedimentation as a result of localized vegetation removal and excavation of soil, rock, and sediment, which could result in increased sediment load in streams. Expected permit stipulations from the Idaho Department of Water Resources (IDWR) and IDEQ would ensure that streambank vegetation would be protected except where its removal is absolutely necessary; that new cut or fill slopes not protected with some form of riprap would be seeded and planted with native vegetation to prevent erosion; use of temporary erosion and sediment control best management practices (BMPs) associated with a stormwater pollution prevention plan; and that all activities would be conducted in accordance with Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations.

For operation and use of Burntlog Route, the potential for sedimentation would be reduced using standard erosion control measures, such as silt fencing, ditch checks, and other measures, which would be installed and maintained to minimize the potential for erosion and sedimentation. Numerous small (15- to 60-inch) drainage culverts would be installed along the Burntlog Route to reduce rutting and shunt water out of ditches and off the road prism, which would serve to reduce erosion from the road into streams. Midas Gold would maintain a hardened road surface with gravel surfacing to promote an efficient and useable all-weather road.

For stream crossings, Midas Gold would replace existing, or install new, culverts or bridges at crossings along the Johnson Creek (CR 10-579), McCall-Stibnite (CR 50-412), and Burnt Log (FR 447) roads. Existing bridges and culverts along Warm Lake Road would remain. If not properly designed, constructed, and maintained, culverts and bridges could constrict natural streamflow leading to an increase in water velocity at the downstream end of the structure. This could lead to stream bank and/or streambed erosion, and/or excessive erosion at the structure. Erosion of the streambed and/or banks could result in downstream sedimentation, a change in the morphology of the stream, and/or a change to the aquatic habitat. If a structure does not allow for adequate flow, water could pool excessively on the upstream side. As such, stream crossings associated with access roads would be designed to minimize potential impacts on surface water hydrology, water quality, and fish passage. The Forest Service would require stream crossings to be designed to accommodate a 100-year flood recurrence interval, unless site-specific analysis using calculated risk tools, or another method determines a more appropriate recurrence interval.

Additionally, Midas Gold would be required to comply with specific design requirements as part of the IDWR Stream Channel Alteration Permit, such as line of approach, minimum bridge clearance and minimum culvert size per length, and anchoring on steep slopes.

During bridge and culvert construction, the potential exists for increased runoff, erosion, and sedimentation as a result of localized vegetation removal and excavation of soil, rock, and sediment. Expected permit stipulations from IDWR and IDEQ would ensure that preparation of culvert bedding or bridge footing installations do not create unnecessary turbidity or stream channel disturbance; that streambank vegetation would be protected except where its removal is absolutely necessary; and use of temporary erosion and sediment control BMPs associated with a stormwater pollution prevention plan. Bridges and culverts would be maintained to allow proper drainage and limit sediment delivery to area streams.

Based on permit-related design requirements, use of BMPs, and required maintenance activities, the potential for access road-related erosion and sedimentation would be minimal (limited to periods of substantial overland flow, such as from very large rainfall events). The duration for this erosion/sedimentation potential would last throughout the entire period of use of Burntlog Route (approximately 25 years) until it is reclaimed. Due to the nature of sediment transport by streams, the geographic extent of the impact could be hundreds of feet to miles, depending on many site- and event-specific factors, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

Traffic-related Dust and Erosion

During construction, operations, and closure and reclamation, dust from vehicles using access roads could become airborne, settle, and impact surface waterbodies. Wear and tear of the access roads, especially by heavy vehicles, could cause rutting and other types of damage to the road surface, which could convey storm water in a manner that creates rills, and facilitates erosion and sedimentation.

Prevention of these types of impacts would be achieved through proper road design, construction, grade control, fugitive dust control and, in the winter months, snow removal and “sanding” using gravel and coarse sand with minimal fines to avert slippery conditions and reduce off-site sedimentation during the spring runoff season. Motor graders would be used to retain a good running surface that includes the maintenance of road grade, crown, super elevation, shoulder and intersections. Routine grading and spot gravelling would be undertaken on an as-needed basis, and road surface and culverts would be kept free of major obstructions (e.g., fallen trees, stray rocks). Additionally, Midas Gold would avoid major road maintenance and reshape-work during periods of high rainfall and snowmelt, as practicable, to prevent road erosion.

In dry months, Midas Gold would water the Burntlog Route as necessary to mitigate dust emissions. As appropriate and in compliance with Forest Service requirements and mitigation measures, Midas Gold would incorporate dust control products, such as magnesium chloride, lignin sulfonate or other appropriate and environmentally-acceptable products, to further enhance dust control along the route. The Forest Service would require that where the road surface is within 25 feet (slope distance) of surface water, dust abatement would only be applied to a 10-foot swath down the centerline of the road. The rate and quantity of application would be regulated to ensure the chemical is absorbed before leaving the road surface.

During winter months, the Burntlog Route would be plowed for snow removal and sanded for winter driving safety. To protect surface water, snow removal standards or performance would include depositing snow and ice away from stream channels; maintaining appropriate snow floor depth to protect the roadway; clearly marking culverts and stream crossings; and no use of ice and snow removal chemicals.

It also should be noted that use of the Burntlog Route (in-lieu of the existing roads along the Yellow Pine Route) could lower sedimentation impacts by reducing the number of stream crossings (37 versus 43 crossings) and eliminating travel along and adjacent to Johnson Creek and the EFSFSR, as Johnson Creek and McCall-Stibnite roads follow and have multiple crossings of these two waterbodies.

Overall, based on identified maintenance activities, design features proposed by Midas Gold, mitigation measures required by the Forest Service, and permit stipulations from state and federal agencies, traffic-related dust and erosion/sedimentation would be within the normal range of properly maintained forest roads. The duration for traffic-related dust and erosion/sedimentation would last throughout the entire period of use of Burntlog Route (approximately 25 years) until it is successfully reclaimed; however, the potential for these effects would be incrementally reduced during closure and reclamation (when AADT would be reduced from 68 to 25 round trips). Due to the nature of airborne dust and sediment transport by streams, the geographic extent of the impact could be hundreds of feet to miles, depending on many site- and event-specific factors, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

Fuels and Hazardous Chemicals – Alternative 1

There is the potential for spills to occur along access roads as fuel and other materials are trucked to the mine site. If a spill were to occur at a stream crossing or near a stream, surface water could be impacted. Discussion of very low probability scenarios for a large release (tanker truck or concentrate truck rollover), and more probable scenarios involving small releases, is provided in Section 4.7, Hazardous Materials. Overall, design features proposed by Midas Gold (**Appendix D, Table D-2**), mitigation measures required by the Forest Service (**Appendix D, Table D-1**), and permit stipulations and regulatory requirements from state and federal agencies (including use of U.S. Department of Transportation [USDOT]-certified containers and USDOT-registered transporters) would reduce the risk of spills and ensure that effective response is provided should a spill occur.

Impaired Waterbodies – Alternative 1

Of the 71 stream crossings for access roads, 14 are listed by IDEQ as impaired. **Table 4.9-14** lists the Category 4 or 5 streams, the cause of impairment, and the beneficial use.

Table 4.9-14 Alternative 1 Access Road Stream Crossings of Impaired Waters

Road	Stream Name	IDEQ Category	Cause of Impairment (Designated Beneficial Use[1])
Burnt Log Road & Stibnite Road	EFSFSR	5	Arsenic (DWS) Arsenic (SCR)
Burnt Log Road & Johnson Creek Road	Johnson Creek	4A	Water temperature (SS)
Burnt Log Road	Landmark Creek	4A	Water temperature (SS)
Cabin Creek Groomed OSV	Cabin Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Lunch Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Park Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Pid Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Sheep Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Trout Creek	4A	Water temperature (SS)
McCall-Stibnite Road	Profile Creek	4A	Water temperature (SS)
McCall-Stibnite Road	Sugar Creek	5	Mercury (COLD) Arsenic (SCR)

Road	Stream Name	IDEQ Category	Cause of Impairment (Designated Beneficial Use[1])
Warm Lake Road	Beaver Creek	5	Combined biota/habitat bioassessments (COLD)
Warm Lake Road	South Fork Salmon River	4A	Water temperature (SS) Sedimentation (COLD)
Warm Lake Road	Warm Lake Creek	4A	Water temperature (SS)

Table Source: IDEQ 2018

Table Notes:

1 DWS = domestic water supply; SCR = secondary contract recreation; SS = salmonid spawning; COLD = cold water aquatic life.

Most of the impaired waterbodies are listed for temperature, which is affected when riparian vegetation canopy shading is reduced from natural and anthropogenic impacts such as landslides or wildfires, road construction, and timber harvest. Access roads associated with Alternative 1 would likely have a very small effect on temperature at stream crossings, where vegetation removal of shade-providing canopy would be localized, if required at all.

Access road crossings of the EFSFSR and Sugar Creek would not contribute arsenic or mercury loading as long as arsenic and mercury are not present in the disturbed soils. Additionally, the Warm Lake Road crossings of the South Fork Salmon River and Beaver Creek are existing paved crossings, where additional SGP-related traffic would not be expected to contribute to sedimentation at the South Fork Salmon River Bridge or have effects to biota or habitat in Cascade. As such, access roads associated with Alternative 1 would not be expected to affect overall progress toward beneficial use attainment of listed streams.

4.9.2.1.2.3 Utilities

Utilities associated with Alternative 1 (existing transmission line upgrades and structure work, right-of-way (ROW) clearing, new transmission line, and transmission line access roads) would cross 37 different streams, as inventoried in **Table 4.9-15**.

Of the 37 streams that would be crossed, 26 would be related to the upgrade of existing Idaho Power Company (IPCo) transmission lines, where the existing transmission line ROW crosses various streams. The existing transmission line would be upgraded from 69 kilovolts (kV) to 138 kV service, which would require removing vegetation to widen the ROW corridor and replacing existing power poles with taller structures. Structure work would result in some ground disturbance at or near five streams. Use of the transmission line access road to facilitate year-round maintenance of the line also would result in disturbance at three stream crossings.

Additionally, Midas Gold would construct a new 8.5-mile, 138-kV transmission line from the Johnson Creek substation to a new substation at the mine site. The new transmission line corridor would require vegetation clearing along the ROW (intersecting three streams).

The remainder of this section discusses surface water impacts in the context of applicable water quality indicators.

Table 4.9-15 Alternative 1 Utility Stream Crossings

Component	Number of Intersects[1]	Stream Names
Upgraded Transmission Line	26	▪ Alpine Creek ▪ Bear Creek ▪ Beaver Creek ▪ Big Creek ▪ Boulder Creek ▪ Cabin Creek ▪ Coffee Creek ▪ Deep Creek ▪ Ditch Creek ▪ Halfway Creek ▪ Hanson Creek ▪ Hargrave Creek ▪ Hot Spring Creek ▪ Johnson Creek ▪ Lake Fork ▪ Little Creek ▪ Little Pearsol Creek ▪ Moose Creek ▪ Olson Creek ▪ Pearsol Creek ▪ Rustican Creek ▪ South Fork Salmon River ▪ Trapper Creek ▪ Trout Creek ▪ Warm Lake Creek ▪ Willow Creek
Structure Work for Upgraded Transmission Line	5	▪ Beaver Creek ▪ Big Creek ▪ Hot Spring Creek ▪ Pearsol Creek ▪ Willow Creek
Transmission Line Access Road	3	▪ Big Creek ▪ Cabin Creek ▪ Unnamed Creek
New Transmission Line	3	▪ No Man's Creek ▪ Riordan Creek ▪ Unnamed Creek

Table Source: IDEQ 2018

Table Notes:

1 The number of intersects listed for each component is for individual streams; in some cases, the utility-related component may intersect one or more streams at multiple locations.

Sediment – Alternative 1

During transmission line upgrades and new transmission line construction, the potential exists for increased runoff, erosion, and sedimentation as a result of vegetation removal within the ROW, and the localized excavation of soil, rock, and sediment for structure work and/or ROW access roads. Expected permit stipulations from IDWR and IDEQ would be similar to the examples provided above for access roads and would ensure the use of erosion and sediment control BMPs associated with a stormwater pollution prevention plan. All activities would be conducted in accordance with Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations. It is important to note that ROW vegetation clearing would be for the purpose of maintaining low height during operations and would not entail clearing and grubbing to bare dirt. Consequently, the vegetation root structure within soils would be retained, reducing erosion concerns.

Based on the type of vegetation removal, the localized and discontinuous ground disturbance for structure footings and ROW access roads, and permit-related requirements including use of BMPs, the potential for transmission line-related erosion and sedimentation would be minimal (i.e., limited to periods of substantial overland flow). The duration of erosion/sedimentation potential would occur from the time new transmission line is constructed until it is reclaimed at the end of mine closure and reclamation (approximately 25 years). The upgrades to IPCo's existing transmission line corridor would be permanent. Due to the nature of sediment transport by streams, the geographic extent of increased sedimentation could be hundreds of feet to miles, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

Impaired Waterbodies – Alternative 1

Of the 37 stream intersects for utilities, 11 are listed by IDEQ as impaired. **Table 4.9-16** lists the Category 4 or 5 streams, the cause of impairment, and the beneficial use.

The utilities planned for Alternative 1 would not contribute to waterbody impairments associated with phosphorous or flow regime alterations. The intersection of the upgraded transmission line with Boulder Creek, which has an impairment associated with sedimentation, is within the flat agricultural valley near Donnelly. No ground disturbance or ROW vegetation clearing would be required at this intersect because there is no tall vegetation associated with the agricultural operation. Likewise, at the intersection of the upgraded transmission line with the South Fork Salmon River, which also has an impairment associated with sedimentation, the existing transmission line extends high across both the South Fork Salmon River and the Warm Lake Road bridge over the river at the same location. Structure footings on either side of the South Fork Salmon River are approximately 300 to 350 feet from the river bank. The distance between the footings and the river, combined with implementation of permit stipulations and BMPs, would avoid increased sediment inputs to the river.

Beaver Creek is 303(d)-listed and therefore does not have an adopted TMDL for the biota/habitat impairment. The intersection of the upgraded transmission line and structure footings with Beaver Creek occurs in the flat agricultural valley near Cascade where there is substantial existing disturbance of the creek and adjacent lands (based on aerial imagery). Replacement of the existing structures at this location would not be expected to result in a substantial change to the present disturbed condition. The other impaired waterbodies intersected by the transmission line corridors are listed for water temperature. All of these intersections would be associated with the upgraded transmission line, where vegetation removal to widen the ROW corridor would occur. This could result in removal of shade-providing canopy at the streams; however, vegetation removal at the stream crossings would be localized, would occur where vegetation is already maintained to be low in height for the existing ROW, and would be relatively small in comparison to the overall length of the listed stream segment.

For these reasons, any necessary vegetation removal associated with the need for a wider ROW would likely have a negligible effect on overall water temperature. As such, utilities associated with Alternative 1 would not be expected to affect overall progress toward beneficial use attainment of listed streams.

Table 4.9-16 Alternative 1 Transmission Line Stream Intersects of Impaired Waters (IDEQ Categories 4 and 5)

Component	Stream Name	IDEQ Category	Cause of Impairment (Designated Beneficial Use[1])
Upgraded Transmission Line	Boulder Creek	4A, 4C, 5	4A: Total phosphorus (COLD) 4A: Sedimentation (COLD) 4C: Flow Regime Alterations (COLD) 5: Temperature (COLD)
Upgraded Transmission Line & Structure Work for Upgraded Transmission Line	Beaver Creek	5	Combined biota/habitat bioassessments (COLD)
Upgraded Transmission Line & Transmission Line Access Road	Cabin Creek	4A	Water temperature (SS)
Upgraded Transmission Line	Hot Spring Creek	4A	Total Phosphorus (COLD)
Upgraded Transmission Line	Johnson Creek	4A	Water temperature (SS)
Upgraded Transmission Line	Lake Fork	4C	Low Flow Alterations (COLD)
Upgraded Transmission Line	South Fork Salmon River	4A	Water temperature (SS) Sedimentation (COLD)
Upgraded Transmission Line	Trout Creek	4A	Water temperature (SS)
Upgraded Transmission Line	Warm Lake Creek	4A	Water temperature (SS)
Upgraded Transmission Line & Structure Work for Upgraded Transmission Line	Willow Creek	4A	Total Phosphorus (COLD)
Structure Work for Upgraded Transmission Line	Hot Spring Creek	4A	Total Phosphorus (COLD)

Table Source: IDEQ 2018

Table Notes:

1 DWS = domestic water supply; SCR = secondary contract recreation; SS = salmonid spawning; COLD = cold water aquatic life.

Additionally, the upgraded transmission line would span Cascade Reservoir, which is listed by IDEQ as impaired (Category 4A) for pH and phosphorous tied to the designated beneficial use of cold-water aquatic life. The upgraded transmission line would not contribute to water quality impairments associated with phosphorous and pH, and would not be expected to affect overall progress toward beneficial use attainment of Cascade Reservoir.

4.9.2.1.2.4 Off-site Facilities

Stibnite Gold Logistics Facility – Alternative 1

The Stibnite Gold Logistics Facility (SGLF) along Warm Lake Road would require approximately 27 acres of disturbance to accommodate employee parking, an assay laboratory building, a core sampling, logging, and storage facility, warehouses, laydown yards, equipment inspection areas, a truck scale, and an administration building for SGP personnel. The SGLF would act as a transportation hub for the mine site, as Midas Gold would maintain a parking and assembly area to accommodate approximately 250 light vehicles for employees using mandated bus or van pooling to the mine site. Midas Gold also would require supply truck drivers to check in at the SGLF and direct them to either proceed to the mine site or unload at the warehouse for temporary storage and assembly of their load. The check-in process would include general safety and road readiness inspection of incoming trucks and equipment being transported to the mine site. The SGLF also would include a septic system for sanitary waste disposal.

The nearest waterbodies to the SGLF (approximately 650 to 2,100 feet) would be Big Creek, Deep Creek, and an un-named stream, none of which are listed by IDEQ as impaired. Construction and operation of the SGLF has the potential for increased runoff, erosion, sedimentation, or discharge to nearby waterbodies, which could occur as a result of vegetation removal, excavation of soil, rock, and sediment, and operation of the transportation hub and septic system. However, design features proposed by Midas Gold (such as facility siting), mitigation measures required by the Forest Service (including design requirements and maintenance standards), and permit stipulations from state and federal agencies (including BMPs, a septic system permit, and SPCC Plan) would control runoff, erosion, sedimentation, and the potential for discharges.

Overall, based on the implementation of required standard design and permit stipulations, and distance to the nearest waterbodies, impacts to surface water as a result of the SGLF would be controlled such that the magnitude of impact would be low and likely only notable during overland flow from very large rainfall events. The duration of Midas Gold operations at the SGLF would be concurrent to mining and ore processing operations. Midas Gold has identified a “light industry” post-mining land use for the SGLF in which it could be maintained by a third party for future use, meaning the presence of the facility and the possibility of a similar type of operations by a separate operator (and associated water quality considerations) would be permanent.

Landmark Maintenance Facility – Alternative 1

The Landmark Maintenance Facility at the intersection of Warm Lake and Johnson Creek roads would house sanding/snowplowing trucks, snow blowers, road graders, and support equipment as a base for operational road maintenance. The facility would include three buildings: a 7,000-square foot maintenance building; a 7,000-square foot aggregates storage building; and a 4,050-square foot equipment shelter. Additionally, the facility would include a double-contained fuel storage area with three 2,500-gallon fuel tanks for on-road diesel, off-road diesel, and unleaded gasoline. A 1,000-gallon used oil tank would be located inside the maintenance facility and a 1,000-gallon propane tank would provide for facility heating. The Landmark Maintenance Facility also may include covered stockpiles of coarse sand and gravel for winter sanding activities. The Landmark Maintenance Facility also would include a septic system for sanitary waste disposal.

The nearest waterbodies to the Landmark Maintenance Facility (approximately 400 to 700 feet) would be Landmark and Johnson Creeks, both of which are listed by IDEQ as impaired (Category 4A) for water temperature, with a designated beneficial use of salmonid spawning.

Construction and operation of the Landmark Maintenance Facility has the potential for increased runoff, erosion, sedimentation (as a result of vegetation removal and excavation of soil, rock, and sediment) and fuel and/or material discharge to nearby waterbodies during operations (if not properly stored or contained). However, design features proposed by Midas Gold (such as facility siting), mitigation measures required by the Forest Service (including design requirements and maintenance standards), and permit stipulations from state and federal agencies (including BMPs, a septic system permit, and SPCC Plan) would control runoff, erosion, sedimentation, and the potential for discharges. Section 4.7, Hazardous Materials, provides details on the storage and containment requirements for oil and hazardous waste spill prevention, preparedness, and response to prevent oil and hazardous waste discharges to navigable waters of the U.S. Minimum secondary containment requirements mandated by federal regulations include a requirement for containment of 100 percent of the largest tank volume plus freeboard which is typically interpreted as 110 percent secondary containment capacity of the largest tank volume. Routine inspection and maintenance of storage vessels, containment, and preventative infrastructure (e.g., cathodic protection, alarms, etc.) would be conducted at prescribed intervals per planning documents.

Overall, based on the implementation of required standard design and permit stipulations, and distance to the nearest waterbodies, impacts to surface water as a result of the Landmark Maintenance Facility would be controlled such that the magnitude of impacts associated with runoff, erosion, sedimentation, and spills would be very low and likely only notable during substantial overland flow from very large rainfall events. The duration of operations at the Landmark Maintenance Facility would be concurrent to mining and ore processing operations and need for road maintenance (approximately 25 years); after which the facility would be reclaimed.

Regarding the impaired waterbodies listed for water temperature, the Landmark Maintenance Facility would be situated far enough away (between 400 to 700 feet away) such that any vegetation removal associated with construction of the facility would not impact canopy vegetation over either Landmark or Johnson creeks. As such, the Landmark Maintenance

Facility would not affect overall progress toward beneficial use attainment of these listed streams.

4.9.2.1.3 GROUNDWATER QUALITY

Consistent with the groundwater quality analysis area, the discussion in this section is focused on the mine site. Predicted water quality impacts due to the influence of mine tailings, development rock, and pit wall rock are organized around the groundwater quality indicators. All predicted concentration values presented in this section are based on the average precipitation model scenario. Concentration results are similar for the below average and above average precipitation scenarios, demonstrating that groundwater chemistry is unlikely to be affected by the amount of precipitation and subsequent recharge in any given year (SRK 2018b).

4.9.2.1.3.1 General Chemistry (pH, Major Ions, TDS, Metals)

Tailings – Alternative 1

During mine operations, the mine tailings could impact groundwater quality through solute loading and seepage from the base of the TSF.

The potential for seepage impacts would be managed through construction of an engineered liner beneath the TSF that includes the following components:

- Over liner drain system to encourage dewatering and consolidation of deposited tailings;
- 60-mil (0.060-inch) linear low-density polyethylene liner;
- Geosynthetic clay liner approximately 6 millimeters (mm) thick; and
- At least 12-inches of compacted foundation soil.

Underdrains also would be installed beneath the liner to collect groundwater flow from springs and seeps, collect any leakage from the tailings, and convey the water beneath the TSF.

If installed properly, the engineered liner would minimize seepage through the base of the TSF. However, there could be manufacturing defects, post-installation damage, holes in the liner, or weaknesses along the seams that may allow minor amounts of seepage to occur. Estimated leakage rates through the liner have been developed by Tierra Group (2018) using the assumption of one liner defect per acre. The estimated leakage rates for the mine operational and post closure periods are summarized in **Table 4.9-17** below.

The data in **Table 4.9-17** indicate that area-weighted leakage rates through the liner (in mm per year) would be low, ranging from zero during the first year of mining to approximately 0.5 mm per year (0.02 inch per year) during the post closure period. For comparison, the average natural groundwater recharge rate from precipitation in the alluvial valleys is estimated to be 310 mm per year (12.2 inches per year) (Brown and Caldwell 2018), a value that is over 500 times higher than the maximum leakage rate predicted through the liner. Thus, impacts from seepage on the water quality of the underlying aquifer are likely to be negligible, because the predicted liner leakage rates are so much lower than the natural groundwater recharge rate in undisturbed areas surrounding the TSF. Even if the liner performance proves to be worse than expected, the rate of seepage from the TSF should still be substantially lower than natural recharge, helping to limit water quality impacts in the underlying aquifer. Additionally, seepage that does leak through the TSF liner would be captured by the underdrain system and conveyed to a collection sump (Section 2.3.5.7, Tailings Storage Facility, TSF Underdrain System). The sump water would be sampled at routine intervals to evaluate whether the water quality of the underdrain flow has been impacted by tailings seepage.

Table 4.9-17 Alternative 1 TSF Liner Leakage Estimates

Mine Year	TSF Area (m^2)	Maximum Head on Liner (m)	Liner Leakage (m^3/yr)	Liner Leakage (mm/yr)
1	280,429	40	0	0
2	430,798	57	18	0.04
3	553,520	70	58	0.10
4	663,207	81	108	0.16
5	757,423	90	168	0.22
6	855,078	97	229	0.27
7	952,621	104	295	0.31
8	1,055,566	110	363	0.34
9	1,153,165	116	435	0.38
10	1,241,478	121	511	0.41
11	1,322,603	126	588	0.44
12	1,363,373	128	668	0.49
Post Closure	1,363,373	128	710	0.52

Table Source: Tierra Group 2018

Table Notes:

m = meter.

m^2 = square meters.

m^3/yr = cubic meter per year. mm/yr = millimeter per year.

Geochemical modeling performed by SRK (2018b) supports the interpretation of negligible groundwater quality impacts from the TSF. The geochemical model predicts that groundwater quality beneath the TSF would be almost identical to existing groundwater chemistry during both the operational and post closure periods. In addition, the constituents modeled, including arsenic, antimony, and mercury, are uniformly predicted to be below IDAPA 58.01.11 groundwater quality standards in the underlying aquifer.

Development Rock – Alternative 1

The predicted groundwater chemistry beneath the DRSFs is discussed below for the average precipitation climate scenario. Groundwater quality predictions also have been made for the above average and below average precipitation scenarios. Overall, results from the three climate scenarios are very similar, indicating that future groundwater quality is unlikely to be affected by the amount of precipitation and subsequent recharge through the DRSFs in any given year (SRK 2018b).

TSF Embankment

No modeling has been performed to quantify groundwater quality effects associated with the TSF embankment. At mine closure, the TSF would overlap the embankment on the upstream side, with the tailings separated from the embankment material by the engineered liner (**Figure 4.9-7**). The downstream face of the embankment would be covered by the Hangar Flats DRSF. Overall, only a small portion of the embankment crest would be exposed near the surface, limiting the amount of meteoric water that would infiltrate through the embankment material. But some infiltration would still occur and could contact the development rock and SODA placed in the embankment.

The development rock used to construct the embankment would consist of non-PAG material (SRK 2018b). Additionally, the 5.8 MT of SODA planned for embankment construction also is net neutralizing and presents a low risk for acid generation (SRK 2017). Despite the low acid-generating potential, kinetic testing of the SODA material showed that arsenic and antimony were consistently leached from humidity test cells at concentrations above water quality criteria (SRK 2017). As such, placing the SODA in the TSF embankment could contribute to mass loading of arsenic and antimony in the underlying alluvial aquifer.

Hangar Flats DRSF

The Hangar Flats DRSF is not expected to produce visible seepage at the toe of the facility since it would be constructed on top of the Meadow Creek alluvial aquifer, which should infiltrate all seepage water from the DRSF due to the relatively high aquifer permeability. Therefore, the main pathway for the Hangar Flats DRSF to impact groundwater quality is from seepage through the base of the DRSF. During the mine operational and post closure period, the groundwater pH beneath the DRSF is predicted to be consistently around 6.75 (SRK 2018b), which is relatively unchanged from the baseline pH of 6.9 standard units. Arsenic concentrations in groundwater beneath the facility are predicted to be elevated above the IDAPA 58.01.11 groundwater quality standard (0.05 mg/L) from year 3 of operations onward. The groundwater arsenic concentration would increase during each year of operations as the size of Hangar Flats DRSF increases, before stabilizing around mine year 10 at a concentration of 0.25 mg/L. A similar level of arsenic would persist in the aquifer throughout the entire 100-year post closure period. The arsenic-impacted groundwater beneath the DRSF would migrate downgradient before eventually discharging to the Hangar Flats pit lake, and has been included as a source term in the pit lake model (SRK 2018b).

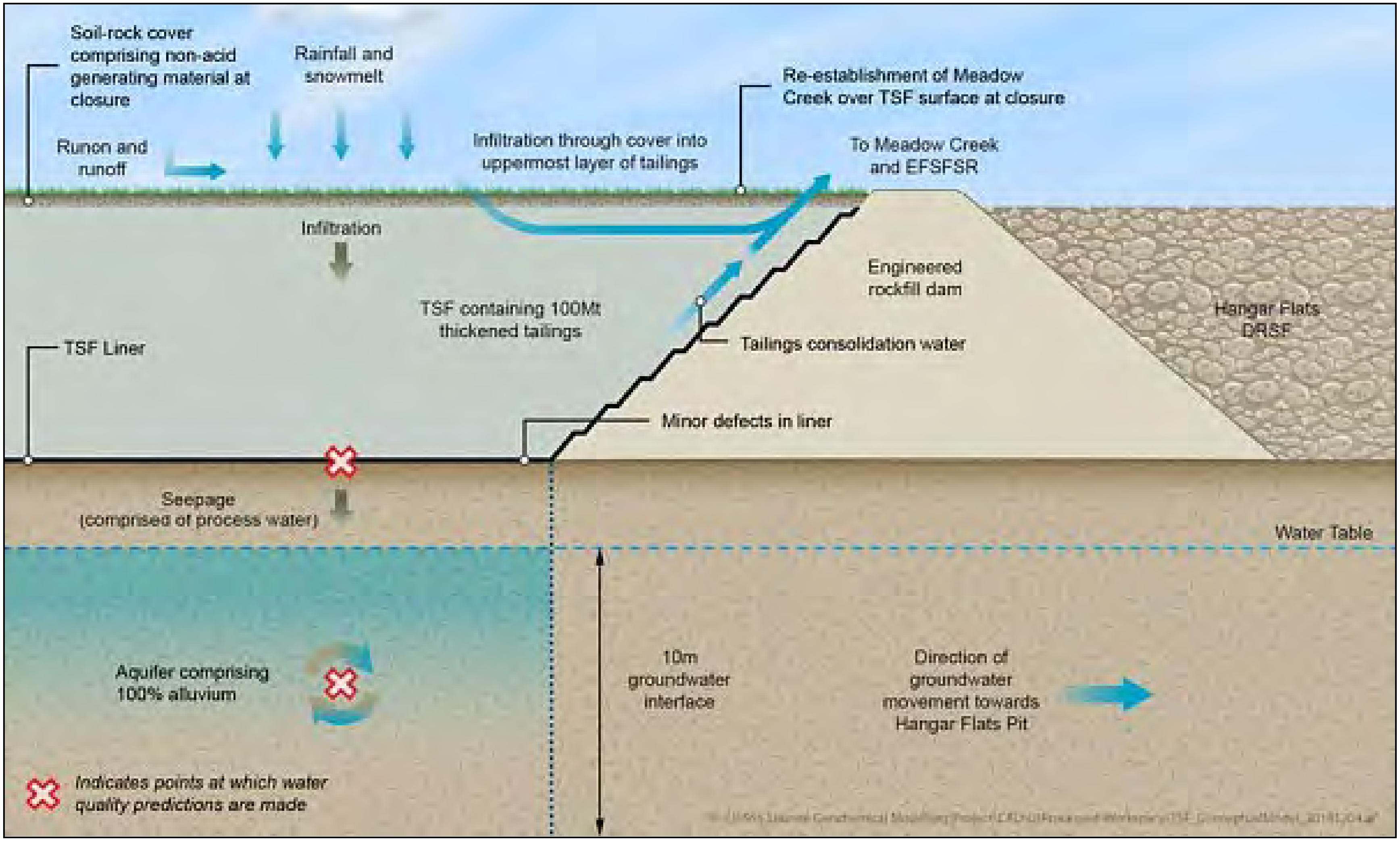


Figure Source: Modified from SRK 2018b, Figure 5-1

Figure 4.9-7 Geochemical Conceptual Model for TSF and Embankment

Groundwater concentrations of iron (1.75 to 2.01 mg/L) are predicted to be elevated above the IDAPA 58.01.11 groundwater quality standard (0.3 mg/L) for all years during mine operations and post closure. However, this constituent is already elevated (2.63 mg/L) in the alluvial aquifer, and no increases in concentration are predicted as a result of DRSF development.

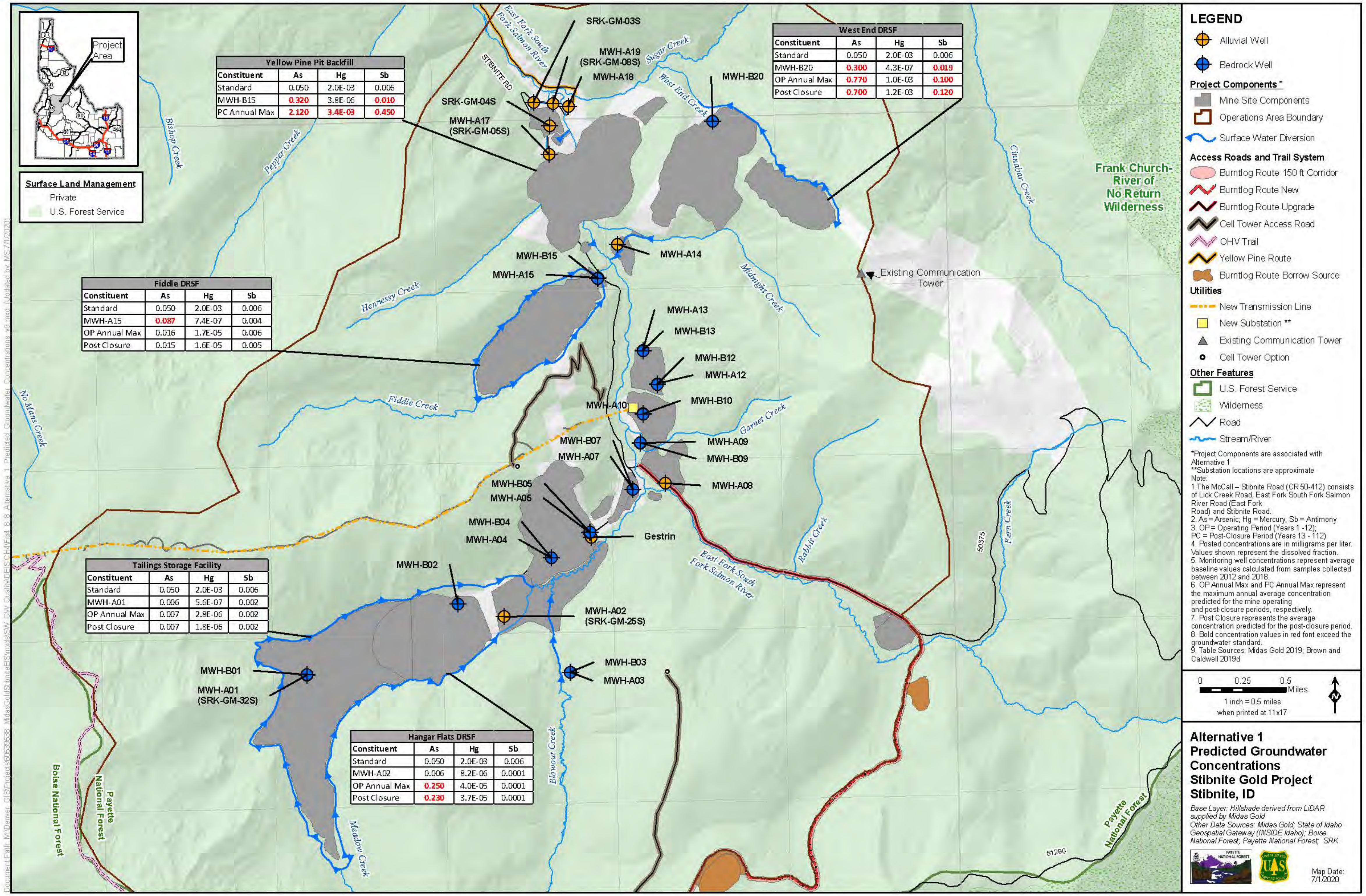
Concentrations of manganese (2.41 to 2.50 mg/L) also are predicted to be elevated above the IDAPA 58.01.11 groundwater quality standard (0.05 mg/L) for all years during operations and post closure. However, this constituent is already elevated (2.63 mg/L) in the alluvial aquifer, and no increases in concentration are predicted as a result of DRSF development.

All other modeled constituents are predicted to remain below IDAPA 58.01.11 groundwater quality standards in groundwater underlying the Hangar Flats DRSF.

West End DRSF

The groundwater pH in the bedrock aquifer beneath the West End DRSF is predicted to be around 8.0 during both the mine operational and post closure period, similar to the baseline pH level of 8.15. Concentrations of arsenic (0.52 to 0.77 mg/L) are predicted to be elevated above both the IDAPA 58.01.11 groundwater quality standard (0.05 mg/L) and the baseline arsenic level (**Figure 4.9-8**) for all years during operations. Additionally, concentrations of antimony (0.080 to 0.13 mg/L) are predicted to be elevated above the groundwater quality standard (0.0060 mg/L) for all years during mine operations (SRK 2018b). The current concentration of antimony in the groundwater is 0.023 mg/L (**Figure 4.9-8**). The predicted concentrations for the mine operational period are higher relative to predictions for the Hangar Flats DRSF, mostly because the West End DRSF would be situated primarily on the bedrock aquifer, which has lower porosity than the alluvial aquifer and therefore results in less dilution. The elevated arsenic and antimony levels would persist throughout the post closure period, with the impacted groundwater migrating downgradient before discharging into the West End pit lake.

Concentrations of nitrate + nitrite (as nitrogen) underlying the West End DRSF also are predicted to be elevated (10.6 to 19.7 mg/L) above the IDAPA 58.01.11 groundwater quality standard (10 mg/L) for all years during operations. The presence of elevated nitrate + nitrite relates to flushing of explosives residue from the development rock. However, due to the highly soluble nature of nitrogen compounds, the nitrate + nitrite should be rapidly flushed from the groundwater system during mine operations and would thus decrease to background levels (0.050 mg/L) during the post closure period (SRK 2018b). The flushed concentrations of nitrate + nitrite would report to the West End and Midnight Area pit lakes, causing a brief concentration spike in the lakes (0.83 mg/L and 5.64 mg/L nitrate + nitrite in West End and Midnight pits, respectively) that would dissipate after the first year of the post closure period.



Yellow Pine Pit Backfill			
Constituent	As	Hg	Sb
Standard	0.050	2.0E-03	0.006
MWH-B15	**0.320**	3.8E-06	**0.010**
PC Annual Max	**2.120**	**3.4E-03**	**0.450**

West End DRSF			
Constituent	As	Hg	Sb
Standard	0.050	2.0E-03	0.006
MWH-B20	**0.300**	4.3E-07	**0.019**
OP Annual Max	**0.770**	1.0E-03	**0.100**
Post Closure	**0.700**	1.2E-03	**0.120**

Fiddle DRSF			
Constituent	As	Hg	Sb
Standard	0.050	2.0E-03	0.006
MWH-A15	**0.087**	7.4E-07	0.004
OP Annual Max	0.016	1.7E-05	0.006
Post Closure	0.015	1.6E-05	0.005

Tailings Storage Facility			
Constituent	As	Hg	Sb
Standard	0.050	2.0E-03	0.006
MWH-A01	0.006	5.6E-07	0.002
OP Annual Max	0.007	2.8E-06	0.002
Post Closure	0.007	1.8E-06	0.002

Hangar Flats DRSF			
Constituent	As	Hg	Sb
Standard	0.050	2.0E-03	0.006
MWH-A02	0.006	8.2E-06	0.0001
OP Annual Max	**0.250**	4.0E-05	0.0001
Post Closure	**0.230**	3.7E-05	0.0001

Figure Source: AECOM 2020

Figure 4.9-8 Alternative 1 Predicted Groundwater Concentrations

This page intentionally left blank

Fiddle DRSF

Alluvial groundwater underlying the Fiddle DRSF is predicted to remain nearly neutral; the predicted pH of 7.45 for the mine operational and post closure periods would be close to the existing baseline pH of 7.21. The near-neutral pH would help preserve existing groundwater quality beneath the Fiddle DRSF, with future concentrations of arsenic predicted to decrease compared to the existing level (**Figure 4.9-8**), most likely as a result of increased arsenic adsorption onto iron oxyhydroxides (SRK 2018b). This would occur as a result of both additional iron leaching from development rock in the Fiddle DRSF, and from elevated total iron concentrations locally present in groundwater that act as an effective adsorbent for metals and metalloids (particularly arsenic). The decreasing arsenic values in groundwater are predicted to be below the IDAPA 58.01.11 groundwater quality standard (0.05 mg/L) beginning in Year 2 of the mine operational period through post closure. The remaining constituents analyzed also are predicted to be below groundwater standards during both the mine operational and post closure periods.

Yellow Pine Pit Backfill

Only post closure model results were generated for Yellow Pine pit because the pit would not be backfilled until the conclusion of mining. Although future hydraulic properties of the backfill material are not known, SRK (2018b) assumed for modeling purposes that the backfill would contain approximately 20 percent fine particles and that meteoric water infiltrating the backfill would be restricted to movement along preferential flow paths contacting approximately 20 percent of the rock volume. During the post closure period, pore water in the pit backfill is predicted to be moderately alkaline with pH values ranging from 8.6 to 8.9. These pH values are marginally elevated above the maximum pH guideline of 8.5 standard units, though it appears that the high pH in pore water is mainly a byproduct of the relatively high background pH in groundwater upgradient of Yellow Pine pit, which averages 8.54 at bedrock monitoring well MWH-B15 (HDR 2016).

Within the pit backfill, several constituents are predicted to spike in concentration during the first year of the post closure period as a result of solute flushing from the backfill as it becomes submerged. However, the rapid submergence of the backfill is predicted to quickly dissipate the solute flushing effects and would help stabilize the pore water chemistry from post closure year 2 onwards. This prediction is illustrated by the concentration trend for mercury (**Figure 4.9-9**), which initially exceeds the applicable groundwater standard before decreasing and stabilizing at concentrations below the standard. A similar trend also applies to predicted arsenic (**Figure 4.9-10**) and antimony concentrations (**Figure 4.9-11**), with predicted concentrations of arsenic decreasing by 34 percent between post closure years 1 and 2, and predicted antimony concentrations decreasing by 51 percent during the same timeframe. However, the predicted decreases are not enough to achieve compliance with groundwater standards, as both constituents remain at concentrations above the standard for the entire post closure period. These long-term groundwater quality impacts are directly related to mining, and show that arsenic and antimony concentrations in the vicinity of Yellow Pine pit would be elevated relative to existing bedrock groundwater (**Figure 4.9-8**). The impacted groundwater may migrate beyond the final extent of the pit through fractures in the pit walls or though native alluvium at the downgradient edge of the pit.

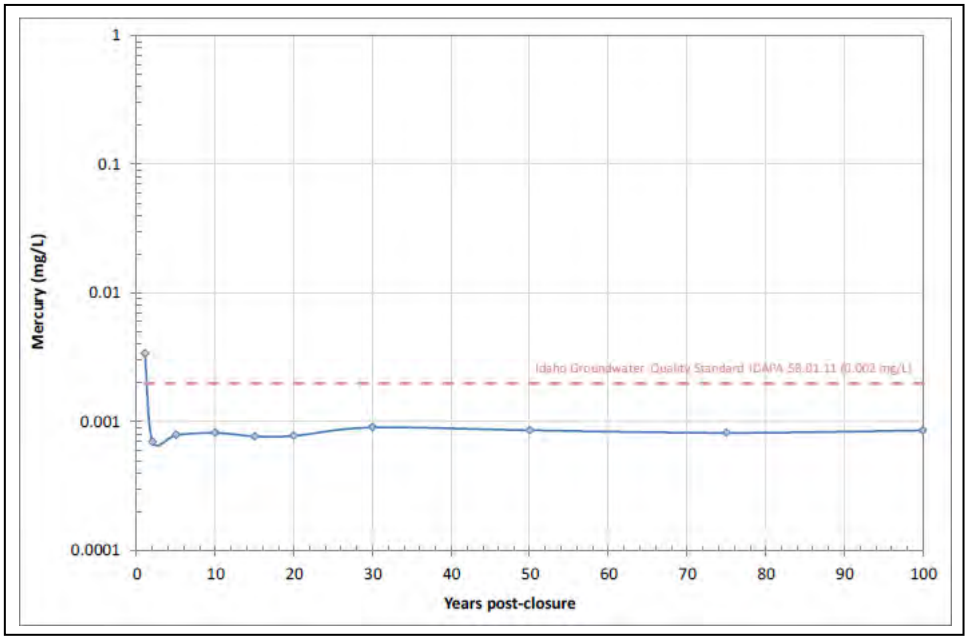


Figure Source: Modified from SRK 2018b, Figure 7-34

Figure 4.9-9 Predicted Dissolved Mercury Concentrations in Yellow Pine Pit Backfill

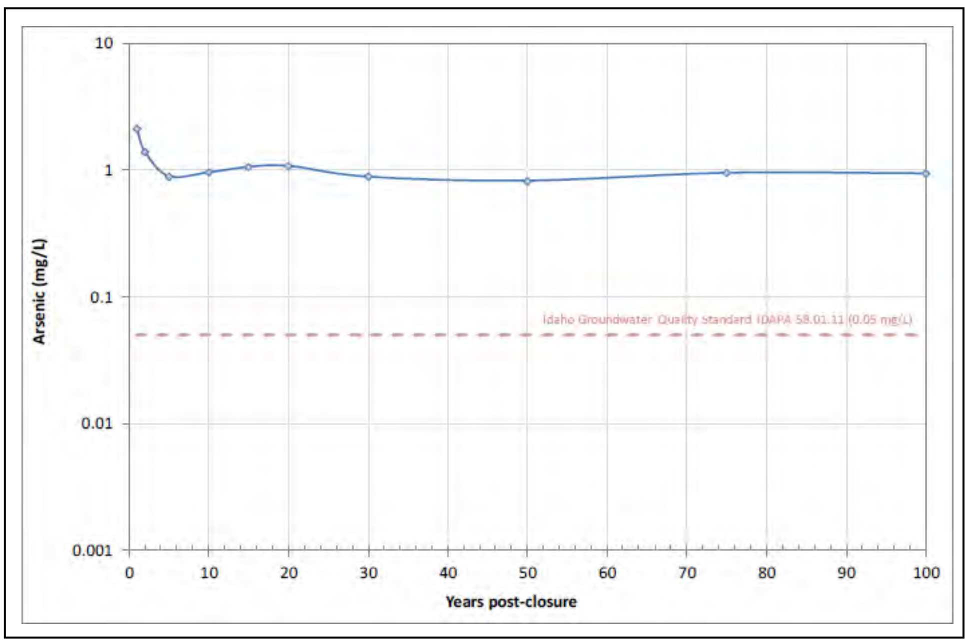


Figure Source: Modified from SRK 2018b, Figure 7-33

Figure 4.9-10 Predicted Dissolved Arsenic Concentrations in Yellow Pine Pit Backfill

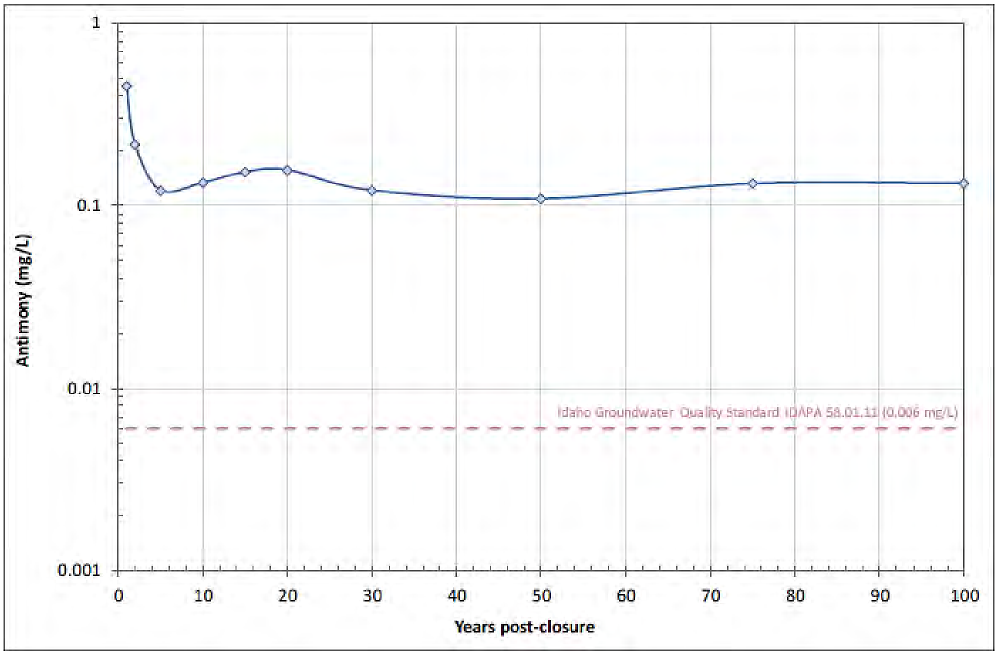


Figure Source: Modified from SRK 2018b, Figure 7-33

Figure 4.9-11 Predicted Dissolved Antimony Concentrations in Yellow Pine Pit Backfill

Rapid Infiltration Basins – Alternative 1

Groundwater quality in the alluvial aquifer could be impacted by the chemistry of untreated dewatering water discharged to the RIBs. SRK (2018b) prepared temporal estimates of water quality entering the RIBs for each year of mine operations by mixing dewatering water from the mine pits in ratios defined by the average annual pit dewatering rates. The predicted water quality results show that several constituents would be elevated above groundwater quality standards in water entering the RIBs that has not been treated. These constituents include arsenic, iron, and antimony for the entire mine operational period, aluminum for mine years 1 through 7, and manganese for mine years 7 through 12 (SRK 2018b). In addition, pH is predicted to be marginally elevated above the maximum pH guideline of 8.5 during mine years 1 through 6.

Although arsenic, iron, antimony, aluminum, and manganese concentrations would be elevated in the RIB water, these constituents already exceed applicable groundwater quality standards in alluvial monitoring well MWH-A07 near where the RIBs would be constructed (HDR 2016). Thus, operation of the RIBs would likely maintain (and not degrade) existing alluvial groundwater quality along the EFSFSR below Meadow Creek. Additionally, discharge limits for antimony and arsenic would likely be incorporated into the reuse permit or IPDES permit issued for the RIBs. Per IDEQ, a determination of whether the RIB discharges qualify as discharges to waters of the United States would be made during the permitting process. Because applicable permit limits are not known at this time, water quality impacts have been evaluated conservatively assuming that no limits would be in place. Active water treatment of mine dewatering water is another possible mitigation measure that could be considered for Alternative 1 that would reduce constituent concentrations and help meet permit limits for the RIB discharge.

4.9.2.1.3.2 Fuels and Hazardous Chemicals

Accidental spills of fuels, lubricants, coolant, hydraulic fluid, or other chemicals could impact groundwater quality if the spilled material infiltrates into the uppermost aquifer. Section 4.7, Hazardous Materials, provides details on storage and containment requirements for oil and hazardous waste spill prevention, preparedness, and response to prevent oil and hazardous waste discharges from impacting groundwater resources. Overall, implementation of required standard design, permit stipulations, and regulatory requirements governing fuel storage and handling would reduce the risk of spills and ensure that effective response is provided should a spill occur, which would limit impacts to groundwater quality.

4.9.2.2 Alternative 2

4.9.2.2.1 GEOCHEMISTRY

In general, Alternatives 1 and 2 would result in similar impacts to the geochemical indicators outlined in Section 4.9.1, Effects Analysis Indicators and Methodology of Analysis. There would be no change to plans for removal of legacy mine tailings and waste rock, or to the leachate chemistry of development rock and tailings. The volume of development rock produced by mining also would remain the same. However, the disposition of development rock would change as a result of eliminating the West End DRSF, which would require an alternate disposal strategy for approximately 25.1 MT of West End development rock. Per Chapter 2, Alternatives Including the Proposed Action, the development rock would be redistributed as follows:

- Approximately 1 MT of development rock from the West End pit would be sent to the on-site lime generation plant;
- Approximately 6 MT of development rock from the West End pit would be used to partially backfill the Midnight pit; and
- Approximately 18 MT of development rock from the West End pit would be used to partially backfill the Hangar Flats pit.

The surface area of different lithology types in the Yellow Pine, Hangar Flats, West End, and Midnight area pit walls would remain the same. However, the exposed surface area of the Hangar Flats and Midnight area pit walls would be reduced due to partially backfilling these pits.

Eliminating the West End DRSF, redistributing 25 MT of West End development rock, and reducing the exposed surface area of the final Hangar Flats and Midnight area pit walls would affect surface water and groundwater quality at the mine site. Modeled water quality impacts resulting from these changes are discussed in subsequent sections.

4.9.2.2.2 Surface Water Quality

4.9.2.2.2.1 Mine Site

General Chemistry (pH, Major Ions, TDS, Metals) – Alternative 2

Under Alternative 2, Midas Gold would limit potential surface water quality impacts by constructing a centralized, active water treatment plant (Centralized WTP) to treat mine contact water and open pit dewatering water. Additional smaller-scale active and passive systems also would be implemented to treat certain contact water flows during mine construction, operation, closure and reclamation, and post closure. The active treatment system for mine contact water was initially developed to accommodate flows and concentrations anticipated for Alternative 2, but could be adapted and scaled to any of the action alternatives. Active water treatment could therefore be considered as mitigation for Alternatives 1, 3, and 4.

The surface water quality analysis for Alternative 2 is organized by first discussing SWWC model predictions developed without water treatment, followed by a description of the water treatment approach proposed for the various stages of mining. Information is then presented to describe how active and passive treatment systems would reduce solute loads derived from mining to meet permit discharge limits and prevent surface water quality degradation in the mine site area. The analysis of water quality impacts post-treatment assumes that any treated water discharge would meet applicable water quality standards at the permitted outfall. It does not take into account mixing zones or higher discharge concentration limits that could be requested by Midas Gold. Any requests from Midas Gold for higher discharge limits would be based on the site-specific surface water quality criteria regulations in the Idaho Water Quality Standards (IDAPA 58.01.02), and would be subject to public notice and comment. If site-specific criteria are granted by the permitting agency, future surface water concentrations would fall somewhere between the model scenario with no water treatment, and the model scenario where all treated water effluent is assumed to meet water quality standards.

<u>Mine Construction and Operations</u>

Without water treatment, impacts to surface water quality during the mine operational period would be the same for Alternatives 1 and 2, because changes to waste rock and surface water management under Alternative 2 mainly apply to the post closure period. The predicted impacts from Alternative 1 included elevated antimony concentrations at YP-SR-10 and YP-SR-8 during operational years 8 through 10, and elevated arsenic concentrations at the EFSFSR assessment nodes during operational years 7 through 10. These impacts were predicted due to infiltration of untreated dewatering watering through the RIBs (SRK 2018b).

Midas Gold would limit these predicted water quality impacts under Alternative 2 by implementing a temporary membrane treatment system during the first three years of mining, followed by active treatment at the Centralized WTP beginning in mining year 4 (operational year 7). The goal of these active systems would be to treat mine contact and dewatering water to meet applicable surface water quality standards for arsenic (0.010 mg/L), antimony (0.0052 mg/L), and mercury (0.000012 mg/L). At the Centralized WTP, reduction of these constituents would be achieved through iron coprecipitation, with supplemental sulfide precipitation if secondary treatment is needed to meet the mercury water quality standard. Effluent from the Centralized WTP would either infiltrate to groundwater through the RIBs or would be discharged to the EFSFSR through an IPDES-permitted outfall near Garnet Creek.

The active treatment processes proposed by Midas Gold are consistent with treatment approaches that have been proposed, installed, and demonstrated on other similar applications for treating arsenic, antimony, and mercury. Further, these processes can easily be adapted and expanded with additional unit processes, such as additional chemical treatments, positive solids barriers including membranes, or adsorptive media to enhance treatment if site-specific conditions at the mine site are not sufficient to achieve the required level of removal.

During the mine operational period, treating water at the Centralized WTP and recharging treated effluent through the RIBS would result in lower antimony and arsenic concentrations in the EFSFSR compared to the scenario without treatment. Modeling results presented in the Water Quality Management Plan (Brown and Caldwell 2020) suggest that water treatment would decrease predicted arsenic concentrations in the EFSRSR, particularly during mining years 7 through 10 (operational years 10 through 13) when peak arsenic levels are expected to occur. For example, the maximum annual average arsenic concentration at YP-SR-10 would decrease from 0.047 mg/L without treatment to around 0.015 mg/L with treatment, which is less than the average baseline arsenic concentration at this node (0.025 mg/L) (Brown and Caldwell 2020; Midas Gold 2019). Similar reductions in arsenic concentrations with water treatment are predicted to occur at the other four EFSFSR assessment nodes, with the predicted concentrations consistently falling below baseline levels.

Operational antimony concentrations in the EFSFSR also are predicted to decrease relative to the scenario without treatment, but to a lesser degree than arsenic because initial antimony concentrations in the mine contact water are expected to be lower relative to the treatment target. Overall, water treatment would help maintain antimony concentrations in the river at or slightly below baseline levels (Brown and Caldwell 2020). This shows that with water treatment, Alternative 2 would generally maintain existing surface water quality in the Headwaters EFSFSR subwatershed during the mine operational period.

Mine Closure and Reclamation

Results for the post closure pit lakes and SWWC modeling are discussed by drainage in the following sections.

Meadow Creek

Under Alternative 2, the Hangar Flats pit lake is predicted to have an alkaline pH between about 8.2 and 8.3 for the entire post closure period. Predicted concentrations of arsenic (0.05 to 0.08 mg/L) and mercury (0.000015 to 0.00019 mg/L) would exceed applicable surface water standards during post closure years 1 through 100. In post closure year 1, the predicted copper concentration (0.0029 mg/L) also would exceed the Biotic Ligand Model copper criterion (Brown and Caldwell 2019c). Additionally, long-term steady state concentrations of several constituents (e.g., aluminum, arsenic, iron, and mercury) would be higher under Alternative 2 than Alternative 1. These changes are due to multiple aspects of Alternative 2 that have both positive and negative effects on the pit lake water quality:

- Meadow Creek would be permanently routed around Hangar Flats pit, reducing freshwater inflows that help to dilute constituent concentrations in the pit lake through continuous flushing.
- Partial pit backfill with West End development rock would introduce additional solute loading into the pit prior to the backfill being fully submerged.
- Installation of a low permeability geosynthetic cover on top of the Hangar Flats DRSF would reduce infiltration through the development rock material (but some infiltration would still occur).

To limit water quality impacts in Meadow Creek, Midas Gold would treat the Hangar Flats pit lake discharge in perpetuity at the Centralized WTP. The water treatment plant objective would be the same as the mine operational period, (i.e., to meet applicable surface water quality standards for arsenic [0.010 mg/L], antimony [0.0052 mg/L], and mercury [0.000012 mg/L] in the plant effluent). Copper also would be treated to meet the 0.0024 copper criterion. Discharge from the Centralized WTP would be through an IPDES-permitted outfall to the EFSFSR below Garnet Creek.

The Centralized WTP also would be used to treat TSF supernatant pond water and TSF consolidation water for the first eight years of the post closure period until flow from these sources has dropped below 750 gallons per minute. After that time, Midas Gold would begin treating the TSF consolidation water runoff with the passive BCR treatment system and vertical flow wetland discussed for Alternative 1. Similar to active treatment, the goal of the passive BCR would be to reduce constituent concentrations in the consolidation water runoff to meet applicable surface water quality standards. The ability of the passive system to achieve water quality standards would be confirmed through pilot testing. If standards cannot be met using passive treatment alone, the TSF consolidation water would be routed to the Centralized WTP.

Without water treatment, average annual arsenic concentrations at YP-T-22 in Meadow Creek are predicted to be at or just below the 0.010 mg/L surface water quality standard from post closure years 10 through 100 (Brown and Caldwell 2019c). However, with the proposed active and passive treatment systems, long-term average arsenic concentrations at this node would be reduced approximately 50 percent to around 0.005 mg/L, and would fall consistently below the surface water criterion (Brown and Caldwell 2020). Similarly, without water treatment, dissolved mercury concentrations at YP-T-22 are predicted to peak between mine years 5 and 15 at a concentration around 0.00001 mg/L, just below the standard for total recoverable mercury (Brown and Caldwell 2019c). Water treatment would decrease peak mercury concentrations at this node to approximately 0.000004 mg/L, a reduction of 60 percent (Brown and Caldwell 2020). Therefore, the analysis shows that active and passive water treatment under Alternative 2 would be effective for achieving arsenic and mercury standards in Meadow Creek.

Fiddle Creek

Under Alternative 2, restricting infiltration through the DRSF by installing a synthetic cover would improve surface water quality in Fiddle Creek. However, post closure arsenic concentrations at YP-T-11 (0.03 mg/L to 0.06 mg/L) (Brown and Caldwell 2019b) would still exceed both the arsenic water quality standard of 0.01 mg/L and the average baseline arsenic concentration at this node (**Figure 4.9-12**) (Midas Gold 2019). Mercury concentrations at YP-T-11 are predicted to be consistently below the surface water quality standard.

Due to the possibility of arsenic impacts in Fiddle Creek, Midas Gold would passively treat toe seepage from the Fiddle DRSF in perpetuity using the BCR and aerobic vertical flow wetland discussed for Alternative 1. The goal of treatment would be to reduce arsenic concentrations in the toe seepage (and other constituents, as needed) to the surface water quality standard. If the arsenic criterion cannot be met using passive treatment alone, the Fiddle DRSF toe seepage would be routed to the Centralized WTP for additional treatment.

The combination of passive (primary) and active treatment (contingent) of the Fiddle DRSF toe seepage would substantially reduce arsenic loading to Fiddle Creek, such that predicted arsenic concentrations at YP-T-11 would remain below the surface water standard during the entire post closure period. With treatment, the maximum predicted arsenic concentration at this node would be approximately 0.008 mg/L during post closure year 2 (Brown and Caldwell 2020), representing a 75 to 85 percent reduction compared to predicted concentrations without water treatment.

West End Creek

Under Alternative 2, stormwater inflows to the West End pit lake would be lower due to elimination of the West End DRSF. This would result in an increase in the relative proportion of groundwater flowing into the pit. Consequently, constituents that are more concentrated in bedrock groundwater, such as antimony and arsenic, also would be more concentrated in the pit lake. Alternative 2 post closure arsenic concentrations in the West End pit lake are predicted to range from 0.20 to 0.28 mg/L compared to the 0.01 mg/L arsenic standard.

Predicted antimony concentrations would range from 0.0085 to 0.026 mg/L, consistently exceeding the 0.0052 mg/L antimony standard (Brown and Caldwell 2019b). Post closure mercury concentrations are predicted to range from 0.00007 to 0.00012 mg/L compared to the 0.000012 mg/L standard for total recoverable mercury. Finally, surface water in the West End pit would still be moderately alkaline, with the predicted pH remaining stable near 8.4 standard units throughout the entire post closure period.

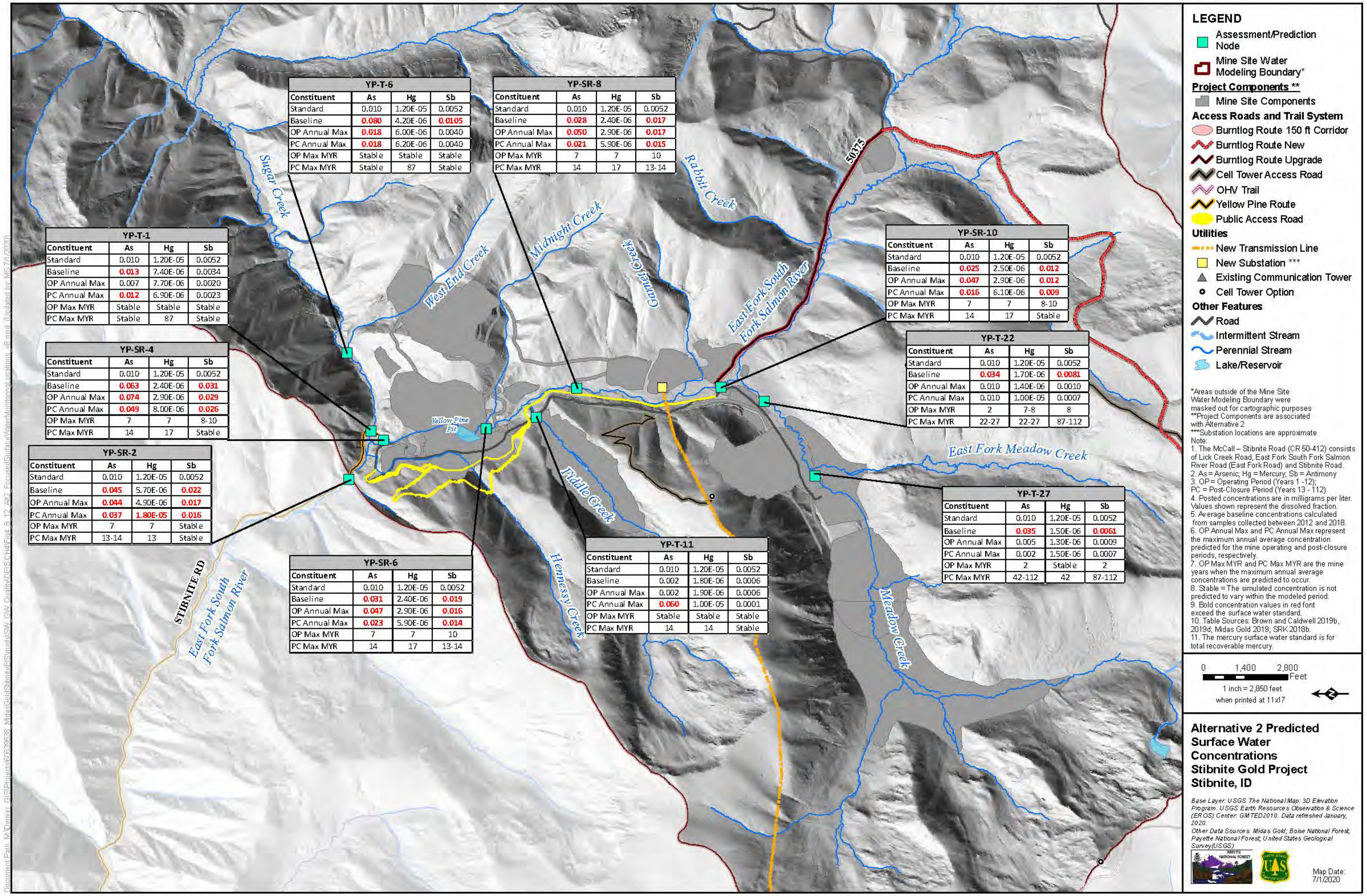


Figure Source: AECOM 2020

Figure 4.9-12 Alternative 2 Predicted Surface Water Concentrations

This page intentionally left blank

Discharge from the West End pit lake is expected to be infrequent because during average and below average precipitation years, evaporation from the lake surface would maintain the pit lake stage below the spillover elevation. On average, the lake is expected to discharge to West End Creek one out of every 20 years (Brown and Caldwell 2020). To prevent these periodic discharges from impacting West End Creek, Midas Gold proposes to mobilize a temporary treatment system when the lake level rises above a preset threshold, and continue operating the system until the lake level has decreased to below the threshold and is projected to continue declining. The methods used for temporary treatment may include enhanced evaporation, diversion of upgradient catchments, membrane treatment, or some combination of these measures. Treated water from the West End pit lake would be released through an outfall to West End Creek at a location close to where the temporary treatment system would be placed. Specific treatment provisions and the discharge location would be negotiated with IDEQ during the permit process as mine closure approaches.

Although periodic treatment of the West End pit lake discharge could be required in perpetuity, the treatment is not expected to lower arsenic, antimony, and mercury concentrations in West End Creek. This is because the flow rate in West End Creek is much larger than the projected discharge volume, providing sufficient capacity to dilute the inflowing pit lake water without increasing stream concentrations. Therefore, predicted arsenic, antimony, and mercury levels in West End Creek (node YP-T-6) would be the same with or without treatment of pit lake discharges (Brown and Caldwell 2019b, 2020).

Midnight Creek

Under Alternative 2, the Midnight Area pit would be partially backfilled with development rock sourced from the West End pit. Backfilling the pit would prevent formation of a pit lake.

However, groundwater levels would still rebound during the post closure period to saturate a portion of the backfill material. The rising water table would cause some solute release from the pit walls and development rock backfill. Specific impacts to groundwater quality from this solute flushing are discussed in the Alternative 2 groundwater quality section.

Water balance modeling indicates that a small volume of seepage from the Midnight area backfill would recharge Midnight Creek. The annual average seepage rate from the backfilled pit is predicted to range from 0.01 to 0.03 cubic feet per second, generally representing less than 10 percent of the total flow in Midnight Creek (Brown and Caldwell 2019b). Because this predicted flux is lower than the pit lake overflow rate under Alternative 1, mass loading rates of arsenic, mercury, copper, and antimony to Midnight Creek would be the same or less than Alternative 1.

EFSFSR

The maximum predicted annual average concentrations for arsenic, mercury, and antimony during the 100-year post closure period are presented in **Table 4.9-18** for the EFSFSR surface water assessment nodes. Predicted concentration changes relative to baseline include the following:

- Antimony concentrations would remain elevated above the surface water standard at all five nodes in the EFSFSR (**Table 4.9-18**). Predicted peak average annual antimony concentrations are between 0.009 mg/L at YP-SR-10 and 0.026 mg/L at YP-SR-4 (Brown and Caldwell 2019b). However, for each location, the predicted antimony concentrations are less than average baseline concentrations (**Figure 4.9-12**), representing up to a 27 percent concentration reduction.
- Arsenic is predicted to be elevated above the surface water standard during at least part of the post closure period at all five nodes in the EFSFSR. Predicted peak average annual arsenic concentrations are between 0.016 mg/L at YP-SR-10 and 0.049 mg/L at YP-SR-4 (Brown and Caldwell 2019b). However, predicted arsenic concentrations within the EFSFSR are typically lower than average baseline concentrations (**Figure 4.9-12**).
- Mercury is predicted to be below the surface water standard at 80 percent of the EFSFSR surface water assessment nodes. The only exception is the farthest downgradient assessment node (YP-SR-2) below the confluence with Sugar Creek, where the maximum post closure mercury concentration is predicted to be 0.000018 mg/L (Brown and Caldwell 2019b).
- Copper concentrations in the EFSFSR are not predicted to exceed the Biotic Ligand Model copper criterion under Alternative 2.

These maximum predicted concentrations are typically similar to or less than the maximum predicted values for Alternative 1. For example, under Alternative 1, post closure mercury concentrations would be above the surface water quality standard at all five EFSFSR assessment nodes, but for Alternative 2, the only exceedance occurs at the farthest downstream location (YP-SR-2) below Sugar Creek in Year 1 of the post closure period. These concentration changes relative to Alternative 1 are largely due to installing low-permeability geosynthetic covers on the Hangar Flats and Fiddle DRSFs, and permanently routing Meadow Creek around the Hangar Flats pit lake.

Table 4.9-18 Alternative 2 Maximum Predicted Post Closure Concentrations at the EFSFSR Assessment Nodes (No Water Treatment)

Constituent	Units	Strictest Potentially Applicable Surface Water Quality Standard	YP-SR-10	YP-SR-8	YP-SR-6	YP-SR-4	YP-SR-2
Arsenic	mg/L	0.01	**0.016**	**0.021**	**0.023**	**0.049**	**0.037**
Mercury	mg/L	0.000012	0.000006	0.000006	0.000006	0.000008	**0.000018**
Antimony	mg/L	0.0052	**0.009**	**0.015**	**0.014**	**0.026**	**0.016**
Copper	mg/L	0.0024	0.00028	0.00029	0.00029	0.00029	0.00008

Table Source: Brown and Caldwell 2019b, IDAPA 58.01.02

Table Notes:

Concentration values represent the dissolved fraction unless otherwise noted.

Bolded values exceed the strictest potentially applicable surface water quality standard.

The post closure water treatment planned under Alternative 2 would focus on treating waste streams reporting to Meadow Creek, Fiddle Creek, and West End Creek. As such, the impacts from water treatment on the EFSFSR would be indirect (except at the permitted Centralized WTP outfall), and would generally result in lower concentration reductions in the EFSFSR compared to upstream tributaries. The greatest relative concentration decreases from water treatment would occur for arsenic; dissolved antimony and mercury concentrations in the river would only be marginally affected. For antimony, a negligible reduction in post closure concentrations is predicted because discharge from the West End pit lake is the primary waste stream requiring antimony treatment, but all of the EFSFSR assessment nodes except YP-SR-2 are located upstream of the West End pit (Brown and Caldwell 2020).

Although the proposed active and passive treatment would have a relatively small impact on the EFSFSR, the combination of water treatment and the Alternative 2 mine site configuration would help maintain predicted arsenic, antimony, and mercury concentrations at or below baseline levels. The only exception would occur at assessment node YP-SR-4, where the mercury concentration is predicted to exceed baseline but remain below the surface water standard of 0.000012 mg/L for total recoverable mercury (Brown and Caldwell 2020). This shows that with water treatment, Alternative 2 would generally maintain existing surface water quality in the Headwaters EFSFSR subwatershed and prevent new exceedances of applicable water quality standards.

Temperature – Alternative 2

The Alternative 2 SPLNT modeling scenario incorporates planned Alternative 1 stream diversions and surface water management, plus the following changes:

- Piping low flows in stream diversions around the TSF, DRSFs, and Hangar Flats pit.
- Routing Hennessy Creek south towards Fiddle Creek in a surface diversion channel during mining.
- Extending the liner beneath the Meadow Creek diversion channel on the south side of Hangar Flats pit 1,050 feet farther downstream than Alternative 1.
- Relocating the West End Creek diversion farther downstream due to eliminating the West End DRSF.
- Retaining the operational Meadow Creek diversion channel on the south side of Hangar Flats pit as the permanent channel.
- Diverting combined stream flows in Meadow Creek and East Fork Meadow Creek above 5 cubic feet per second into the Hangar Flats pit lake until the lake is full to accelerate filling.
- Continuing to operate and send treated water from the Yellow Pine pit dewatering wells to the RIBs during seasonal low flows until the Hangar Flats pit lake is filled.
- Active treatment of some contact water flows in the Centralized WTP, and discharge of treated effluent through RIBs and/or an outfall on the EFSFSR.

The stream temperature analysis presented below focuses on comparing predicted future temperatures to existing temperature conditions. The analysis was first performed assuming that no active water treatment would occur. The Alternative 2 operational and post closure predictive simulations without treatment were compared to a No Action model developed to simulate conditions that would be expected if the SGP is not implemented. The No Action model provides a representation very similar to existing conditions that allows for direct comparison and quantification of mining-related impacts. Following that analysis, additional analysis was performed to determine any additional temperature effects resulting from water treatment in the Centralized WTP.

Table 4.9-19 summarizes the predicted maximum weekly summer condition, average weekly summer condition, maximum weekly fall condition, and average weekly fall temperatures for several stream reaches throughout the mine site that approximate (but are not identical to) the ten surface water assessment nodes discussed above. Temperature statistics for the No Action model also are provided in the table for comparison. For information on how predicted stream temperatures compare to aquatic life temperature standards, the reader is referred to Section 4.12, Fish Resources and Fish Habitat. Overall, Alternative 2 (without treatment) would result in water temperature increases for each simulated stream reach during the mine operational and post closure period. Seasonal temperature increases of above 10°C are predicted for two different stream reaches, including the summer maximum temperatures in Fiddle Creek (12.2-degree increase) and West End Creek (13.2-degree increase). Both increases are predicted to occur during the early post-closure period, with predicted temperatures cooling somewhat later in time, but remaining elevated above existing conditions.

At the EFSFSR downstream of Sugar Creek, summer and fall stream temperatures would increase during the mine operational period and early post closure period to reach a maximum at the EOY 18. After that time, average and maximum temperatures would remain stable or gradually decrease as riparian vegetation is reestablished. However, maximum summer (19.0°C) and fall (14.5°C) temperatures and average summer temperatures (13.0°C) are still predicted to be as much as 4.1°C above baseline 100 years into the post closure period. This finding shows that water temperature increases from Alternative 2 (without treatment) would extend downstream in the EFSFSR past Sugar Creek (near the approximate location of surface water assessment node YP-SR-2), and would persist for at least 112 years after mining is initiated. The long-term temperature increases occur despite replanted vegetation along reclaimed stream channels reaching full maturity at the end of the post closure period. The additional shading provided by vegetation regrowth is offset by other reclamation practices, such as backfilling the Yellow Pine pit and creating longer channels post-reclamation to provide additional fish habitat and lower gradient reaches (Brown and Caldwell 2019c).

Other conclusions from the Alternative 2 SPLNT model without treatment include the following:

- During mine operations, conveying diverted Meadow Creek low flows in a buried pipe would result in water temperatures that are the same or less than existing conditions for diverted channel segments in the Meadow Creek valley (Brown and Caldwell 2019b). This occurs because the pipes would be fully shaded, blocking solar radiation that currently reaches the creek due to the current disturbed landscape caused by historical mining.

- Post closure, choosing not to route Meadow Creek through Hangar Flats pit lake would help to lower the average stream temperatures, but also would lead to higher maximum summer temperatures. For example, starting at EOY 22, the average summer temperature in Meadow Creek below the East Fork of Meadow Creek is predicted to be 19.2°C for Alternative 1 and 15.4 to 16°C for Alternative 2 (**Tables 4.9-11** and **4.9-19**). During that same time frame, the maximum summer temperature at this location is predicted to be 21.2°C for Alternative 1 and 22.4 to 23.1°C for Alternative 2. The reason for this difference is the moderating effect of the Hangar Flats pit lake. In the Alternative 1 scenario where Meadow Creek is routed through the pit lake, discharge temperatures from the pit lake outlet would be less variable during the summer season. Conversely, if the creek is left as a free-flowing stream around Hangar Flats pit lake (as in Alternative 2), it would remain cooler during the high flow snowmelt period but would be more vulnerable to extreme temperatures during the hottest part of the summer when stream flows tend to be lower.
- In the EFSFSR below the Meadow Creek confluence, there is little difference in the maximum simulated stream temperatures between Alternatives 1 and 2. However, simulated average temperatures throughout this segment would be slightly lower under Alternative 2 due to permanently routing Meadow Creek around the Hangar Flats pit lake. For example, average post closure summer temperatures in the Middle EFSFSR are predicted to be 14.3°C for Alternative 1 and 13.6 to 14.0°C for Alternative 2 (**Tables 4.9-11** and **4.9-19**).

Active water treatment and discharge of treated water could further influence surface water temperatures under Alternative 2. Midas Gold evaluated potential temperature impacts of treatment in the Water Quality Management Plan (Brown and Caldwell 2020). Three actions associated with water treatment in the Centralized WTP would potentially have an effect on surface water temperatures:

- Warming of water by the addition of a heat load in the treatment process;
- Warming of contact runoff water residing in contact water storage ponds; and
- Addition of pit dewatering water to the contact water runoff in the Centralized WTP.

With respect to temperature changes within the Centralized WTP, Brown and Caldwell (2020) noted that the treatment process does not involve any active addition of a heat load. However, the treatment equipment would be housed within an enclosed building occupied by workers, where the ambient temperature would be controlled at approximately 25°C. As a result, Brown and Caldwell (2020) concluded that the treatment process could result in warming by a maximum of 1°C, although an increase of no more than 0.5°C was more likely.

Table 4.9-19 Maximum and Average Weekly Summer and Fall Stream Temperatures Simulated for Alternative 2

Area	Simulated Daily Temperature Statistic	Existing Condition/ No Action	EOY 6	EOY 12	EOY 18	EOY 22	EOY 27	EOY 32	EOY 52	EOY 112	Maximum Simulated Temperature	Maximum Increase from Existing Condition
Upper EFSFSR (above Meadow Creek)	Summer Max:	13.4	13.8	13.8	13.9	13.9	13.9	13.9	13.9	13.9	13.9	0.5
	Fall Max:	11.1	11.5	11.5	11.4	11.4	11.4	11.4	11.4	11.4	11.45	0.4
	Summer Avg:	10.3	10.6	10.7	10.5	10.5	10.5	10.5	10.5	10.5	10.7	0.4
	Fall Avg:	8.8	9.1	9.1	8.9	8.9	8.9	8.9	8.9	8.9	9.1	0.3
Meadow Creek above East Fork Meadow Creek	Summer Max:	17.9	14.6	14.6	24.2	24.2	23.8	23.4	22.5	22.7	24.2	6.3
	Fall Max:	15.1	12.7	12.7	18.3	17.8	17.1	16.8	16.2	15.7	18.3	3.2
	Summer Avg:	12.7	11.4	11.4	15.6	15.4	15.1	14.9	14.5	14.5	15.6	2.9
	Fall Avg:	10.4	9.3	9.3	11.9	11.5	11.1	11.1	10.6	10.5	11.9	1.5
Meadow Creek below East Fork Meadow Creek	Summer Max:	19.8	20.1	20.1	23.1	23.1	22.9	22.6	22.4	22.4	23.1	3.3
	Fall Max:	16.2	16.8	16.8	17.0	17.0	16.5	16.3	16.0	16.0	17	0.8
	Summer Avg:	13.4	13.0	12.9	16.1	16.0	15.8	15.6	15.5	15.4	16.1	2.7
	Fall Avg:	10.8	10.5	10.3	12.0	11.8	11.5	11.5	11.3	11.3	12	1.2
Middle EFSFSR (between Meadow and Fiddle Creeks)	Summer Max:	17.4	18.9	18.6	20.1	20.0	20.0	20.0	19.7	19.8	20.1	2.7
	Fall Max:	14.0	15.1	15.0	15.7	15.3	15.2	15.2	15.1	15.1	15.7	1.7
	Summer Avg:	12.2	12.5	12.5	14.0	13.9	13.8	13.8	13.7	13.6	14	1.8
	Fall Avg:	9.9	9.9	9.9	10.8	10.5	10.5	10.4	10.3	10.3	10.8	0.9
Fiddle Creek	Summer Max:	11.4	11.8	23.6	20.5	20.4	20.1	20.0	17.4	17.4	23.6	12.2
	Fall Max:	9.9	10.1	18.6	17.2	15.2	15.1	14.9	13.6	13.6	18.6	8.7
	Summer Avg:	9.2	10.0	13.4	12.6	12.4	12.3	12.3	11.9	11.7	13.4	4.2
	Fall Avg:	8.2	8.4	10.0	10.4	9.5	9.4	9.4	9.5	9.2	10.4	2.2
Lower EFSFSR (between Fiddle and Sugar Creek)	Summer Max:	17.4	19.3	21.7	21.5	21.4	21.3	21.1	20.8	20.7	21.7	4.3
	Fall Max:	14.0	15.2	16.7	16.9	16.2	16.0	15.9	15.7	15.7	16.9	2.9
	Summer Avg:	12.2	12.7	13.7	14.4	14.3	14.3	14.2	14.1	14.0	14.4	2.2
	Fall Avg:	9.9	9.9	10.5	11.2	10.7	10.6	10.6	10.5	10.5	11.2	1.3
West End Creek	Summer Max:	12.9	13.5	13.5	26.1	20.9	20.3	19.6	18.8	17.9	26.1	13.2
	Fall Max:	11.0	11.1	11.1	20.4	15.7	14.6	14.1	13.7	13.3	20.4	9.4
	Summer Avg:	11.1	11.5	11.5	17.4	15.0	14.4	14.1	13.8	13.3	17.4	6.3
	Fall Avg:	9.6	9.6	9.6	14.7	12.1	11.6	11.5	11.3	11.1	14.7	5.1
Lower Sugar Creek	Summer Max:	15.4	16.1	16.1	16.2	16.2	16.2	16.2	16.1	16.1	16.2	0.8
	Fall Max:	12.2	12.8	12.8	13.6	12.8	12.8	12.8	12.8	12.8	13.6	1.4
	Summer Avg:	10.7	11.1	11.0	11.1	11.1	11.1	11.1	11.1	11.1	11.1	0.4
	Fall Avg:	9.1	9.3	9.2	9.6	9.3	9.3	9.3	9.3	9.3	9.6	0.5

Area	Simulated Daily Temperature Statistic	Existing Condition/ No Action	EOY 6	EOY 12	EOY 18	EOY 22	EOY 27	EOY 32	EOY 52	EOY 112	Maximum Simulated Temperature	Maximum Increase from Existing Condition
EFSFSR downstream of Sugar Creek	Summer Max:	14.9	17.7	19.2	19.4	19.3	19.3	19.2	18.9	19.0	19.4	4.5
	Fall Max:	11.9	13.7	14.9	15.7	14.8	14.8	14.7	14.6	14.5	15.7	3.8
	Summer Avg:	12.4	12.0	12.6	13.2	13.2	13.1	13.1	12.9	13.0	13.2	0.8
	Fall Avg:	10.0	9.6	9.9	10.7	10.2	10.2	10.2	10.1	10.0	10.7	0.7

Table Source: Brown and Caldwell 2019b, Table B-47

Table Notes:

Temperatures in °C. EOY - End of Year.

The temperature of contact water runoff in the storage ponds would vary throughout the year, with maximum warming occurring during the summer months. In the water temperature modeling, the input temperature of the contact water runoff ranged from 0.7ºC in January to 11.0ºC in July. Water withdrawal from the ponds would be managed to minimize holding times during the summer, when the greatest degree of warming would occur, and maximize withdrawal prior to winter in order to create space for storage of spring runoff. In addition, the analysis noted that the temperature of water withdrawn from the contact water storage ponds could be managed, as needed to minimize temperature impacts, by adjusting the depth of water withdrawal during the year.

Pit dewatering water was assumed to have a constant temperature of 7.3ºC in the analysis. This was based on average of the median bedrock and alluvial aquifer temperatures. Pit dewatering water would not be stored in contact water storage ponds but would instead be sent directly to the Centralized WTP. Therefore, the input temperature of the pit dewatering water would not vary on a seasonal basis.

The temperature of the treated effluent discharged to the EFSFSR and the RIBs would be influenced by all three factors and would vary seasonally. In summer months, water from the contact water ponds would be at a higher temperature that ambient conditions in the EFSFSR, but it would be mixed with dewatering water that would be at a lower temperature. The holding time in the Centralized WTP building also would exert a small temperature increasing effect. In winter months, the reverse would happen, with contact water pond temperatures being approximately the same as ambient conditions in the EFSFSR, but dewatering water having a higher temperature. The temperature of the effluent could be managed to modulate temperature, to a certain extent, by modifying the withdrawal depth in the contact water ponds, and by adjusting the volume fraction of contact pond water with that of dewatering water.

Midas Gold incorporated these revised input parameters into a re-run of their SPLNT model to estimate the effect of water treatment on surface water temperatures in the EFSFSR. The analysis determined that there would negligible change in surface water temperature during the summer months. From November through March, stream temperatures at the outfall would increase from 0 to 4ºC. In the Water Quality Management Plan (Brown and Caldwell 2020), several potential mitigation measures to address this temperature increase were identified, if needed to meet IPDES permit limits. It was noted that the temperature increase would occur during months when the ambient air temperature is generally at or below 0ºC, so that implementing methods to cool the water may be accomplished with passive methods rather than energy intensive methods. Other methods identified included adjusting water withdrawal depths in the Hangar Flats pit lake, modifying plans for stream bank restoration plantings to reduce summer warming, and modifying the design of the Centralized WTP to use ambient outdoor temperatures to reduce the temperature of the effluent.

Sediment – Alternative 2

Under Alternative 2, sediment inputs to upper West End Creek may decrease due to reduced surface disturbance from eliminating the West DRSF. Other than this change, impacts to surface water quality from erosion and sedimentation would be the same as Alternative 1.

Organic Carbon – Alternative 2

Potential surface water organic carbon impacts from the worker housing sanitary wastewater treatment facility would be the same as Alternative 1.

Methylmercury – Alternative 2

Under Alternative 2, the partial backfill of Hangar Flats pit and permanently routing Meadow Creek around the pit lake would result in higher pit lake concentrations of dissolved mercury relative to Alternative 1. Mercury concentrations in the pit lake are predicted to range from 0.000015 to 0.00019 mg/L and would exceed applicable surface water standards during post-closure years 1 through 100 (Brown and Caldwell 2019b). The higher pit lake mercury concentrations expected under Alternative 2 could lead to greater MeHg production in the lake if the mercury methylation rate is not offset by other factors such as the shallower pit lake depth. Any additional MeHg produced would remain within the pit lake or be routed with the pit lake outflow to the Centralized WTP. If there is evidence of MeHg in the pit lake outflow, tests would be performed prior to mine closure and reclamation to confirm whether the Centralized WTP is capable of removing MeHg or if additional treatment components would be required.

Backfilling the Midnight area pit with development rock would eliminate another potential source of MeHg production because a pit lake would no longer form in the Midnight Creek drainage. Although some groundwater from the pit backfill would still discharge to Midnight Creek, the discharge rate is expected to be lower than Alternative 1 (Brown and Caldwell 2019b), thereby limiting the potential for mercury loading and MeHg production in the Midnight Creek drainage.

Outside of the mine pits, active and passive water treatment would maintain surface water dissolved mercury concentrations at or below baseline levels. The only exception (as noted above) would occur at YP-SR-4, where the predicted mercury concentration would increase from a baseline average of 2.4 ng/L to a seasonal maximum concentration of approximately 6 ng/L (Brown and Caldwell 2020). Assuming that 2 percent of the increase in dissolved mercury is converted to MeHg, the net increase in MeHg would be less than 0.1 ng/L, which is the lower limit of detection for MeHg shown in **Table 3.9-7**. Thus, with water treatment for mercury, Alternative 2 would have no discernible effect on MeHg concentrations in mine site streams.

Fuels and Hazardous Chemicals – Alternative 2

Potential surface water quality impacts from accidental spills of fuels and hazardous chemicals would be the same as Alternative 1.

Impaired Waterbodies – Alternative 2

Except for West End Creek, the inventoried waterbodies at the mine site are 303(d) listed. The causes for listing of these waters are associated with arsenic, with the EFSFSR also listed for antimony (downstream of Meadow Creek) and Sugar Creek also listed for mercury.

As discussed above, post closure chemistry modeling for the EFSFSR indicates the following:

- Antimony concentrations would remain elevated above the surface water standard at all five nodes in the EFSFSR (**Table 4.9-18**). Future antimony concentrations would continue to exceed the antimony standard even with water treatment (Brown and Caldwell 2020).
- Arsenic is predicted to be elevated above the surface water standard during at least part of the post closure period at all five nodes in the EFSFSR (**Table 4.9-18**). Like antimony, the arsenic exceedances would persist even with Midas Gold's proposed water treatment (Brown and Caldwell 2020).

Although Alternative 2 would indirectly address the designated beneficial uses of these 303(d)-listed waterbodies (through water treatment and the removal, reprocessing, and proper disposal of legacy mine waste), it is likely that they would remain impaired for arsenic, antimony (EFSFSR), and mercury (Sugar Creek) after closure, based on the post closure modeling predictions of these elements remaining above the strictest potentially applicable water quality standard. As such, IDEQ would still be expected to identify goals towards developing a water quality improvement plan/TMDLs for these waterbodies. However, the modeled post closure decreases of antimony and arsenic relative to baseline concentrations (**Figure 4.9-12**) may help improve or maintain overall progress toward beneficial use attainment that led to the listing of arsenic and antimony for the EFSFSR and its tributaries. Alternative 2 would not affect the upstream source of mercury in Sugar Creek from the Cinnabar (mercury) mine.

4.9.2.2.2.2 Access Roads

The access roads used under Alternative 2 would cross 69 different named and unnamed streams, as inventoried in **Table 4.9-20**.

The Yellow Pine Route used for access during mine construction would cross 43 of the 69 streams listed in **Table 4.9-20**. The Yellow Pine Route also is located within 100 feet of a surface water body for 6.5 miles or 18 percent of its approximately 36-mile length. A total of 45 heavy vehicles and 20 light vehicles are anticipated on average per day (year-round) during construction, for an AADT total of 65 round trips utilizing the Yellow Pine Route.

Table 4.9-20 Alternative 2 Access Road Stream Crossings

Road/ Component	Route/Access	Number of Crossings[1]	Stream Names
Warm Lake Road (CR 10-579)	Yellow Pine Route & Burntlog Route	16	▪ Alpine Creek ▪ Beaver Creek ▪ Big Creek ▪ Deep Creek ▪ Olson Creek ▪ Park Creek ▪ Pid Creek ▪ Sheep Creek ▪ Trapper Creek ▪ Trout Creek
McCall-Stibnite Road (CR 50-412)	Yellow Pine Route	11	▪ 3 Unnamed creeks ▪ Double A Creek ▪ EFSFSR ▪ Profile Creek ▪ Tamarack Creek ▪ Salt Creek ▪ Sugar Creek ▪ Vibika Creek ▪ Whiskey Creek
Burnt Log Road (FR 447)	Burntlog Route	19	▪ Burntlog Creek ▪ East Fork Burntlog Creek ▪ EFSFSR ▪ Johnson Creek ▪ Landmark Creek ▪ Peanut Creek ▪ Rabbit Creek ▪ Riordan Creek ▪ Trapper Creek ▪ Unnamed creeks (10)
Cabin Creek Groomed OSV Route (FR 467)	Cabin Creek Groomed OSV Route	7	▪ Cabin Creek ▪ Lunch Creek ▪ Pid Creek ▪ Park Creek ▪ Sheep Creek ▪ Trout Creek ▪ Warm Lake Creek

Table Source: IDEQ 2018

Table Notes:

1 The number of crossings listed for each road segment/route is for individual streams; in some cases, the road/route segment may cross one or more streams at multiple locations.

During the mining and ore processing operations phase (approximately 12 years), mine site access would utilize the Burntlog Route, which would cross 35 of the 69 streams listed in **Table 4.9-20**. Additionally, the Alternative 2 Burntlog Route alignment would be located within 100 feet of streams for 1.56 miles or 4 percent of its 37-mile length. Under Alternative 2, heavy vehicle traffic to the mine site would be lower than Alternative 1 due to on-site lime generation using crushed limestone produced from a limestone formation in the West End pit. A total of 34 heavy vehicles and 19 light vehicles are anticipated on average per day (year-round) during operations, for an AADT total of 53 round trips utilizing the Burntlog Route. Additionally, public access along the Cabin Creek Groomed OSV Route during operations would include a total of 7 crossings.

During the closure and reclamation phase (approximately 5 years, but with up to an additional 5 years for certain facilities including the need to use Burntlog Route), Plan-related traffic along Burntlog Route would be reduced to a total of 13 heavy vehicles and 12 light vehicles on average per day (year-round), for an AADT total of 25 round trips.

The remainder of this section discusses surface water impacts in the context of applicable water quality indicators.

Sediment – Alternative 2

Road, Culvert, and Bridge Construction

The number of streams crossed along Yellow Pine Route (43) would be the same as Alternative 1. Therefore, surface water quality impacts from erosion and sedimentation along Yellow Pine Route would be the same as Alternative 1.

During construction of the Burnt Log Road extension, stream impacts from sedimentation would be less compared to Alternative 1 because there would be two fewer streams crossed due to realignment of the Riordan Creek segment. The two streams that would no longer be crossed include two unnamed creeks. In the absence of a road crossing over these waterbodies, the sediment content of the unnamed creeks would likely remain similar to existing conditions.

Overall, the potential for access road-related erosion and sedimentation to impact surface water quality would be minimal and limited to periods of substantial overland flow, such as from very large rainfall events. The duration for this erosion/sedimentation potential would last throughout the entire period of use of Burntlog Route (approximately 25 years) until it is reclaimed. Due to the nature of sediment transport by streams, the geographic extent of the impact could be hundreds of feet to miles, depending on many site- and event-specific factors, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

Traffic-related Dust and Erosion

During mine construction, the number of daily vehicle trips to the mine site would be the same as Alternative 1. Therefore, surface water quality impacts from traffic-related dust and erosion would be the same for Alternatives 1 and 2.

During mine operations, there would be less wear and tear of the Burntlog Route road surface and less dust generated due to the reduction in AADT achieved through on-site lime generation. The number of light vehicle trips would remain the same as Alternative 1, but the number of heavy vehicle trips would be reduced by approximately 31 percent. The reduction in heavy vehicle trips would help maintain the road in better condition, thereby limiting potential surface water quality impacts from rutting and erosion of the road surface.

It also should be noted that use of the Burntlog Route (in-lieu of use of existing roads along the Yellow Pine Route) would reduce the number of stream crossings (35 versus 43 crossings) and would eliminate travel along and adjacent to Johnson Creek and the ESFSR, as Johnson Creek and Stibnite roads follow and have multiple crossings of these two waterbodies.

Overall, based on identified maintenance activities, design features proposed by Midas Gold, mitigation measures required by the Forest Service, and permit stipulations from state and federal agencies, traffic-related dust and erosion/sedimentation would be within the normal range of properly maintained National Forest System roads. The duration for traffic-related dust and erosion/sedimentation would last throughout the entire period of use of Burntlog Route (approximately 25 years) until it is successfully reclaimed; however, the potential for these effects would be incrementally reduced during closure and reclamation (when AADT would be reduced from 50 to 25 round trips). Due to the nature of airborne dust and sediment transport by streams, the geographic extent of the impact could be hundreds of feet to miles, depending on many site- and event-specific factors, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

Fuels and Hazardous Chemicals – Alternative 2

Compared to Alternative 1, the potential for surface water quality impacts from accidental fuel or chemical spills along the mine access roads would generally be less for Alternative 2 due to the approximate 31 percent reduction in heavy vehicle trips that would be achieved through on-site lime generation. Overall, design features proposed by Midas Gold, mitigation measures required by the Forest Service, and permit stipulations and regulatory requirements from state and federal agencies (including use of USDOT-certified containers and USDOT-registered transporters) would reduce the risk of spills and ensure that effective response is provided should a spill occur.

Impaired Waterbodies – Alternative 2

The access roads planned for Alternative 2 would cross the same impaired stream segments as Alternative 1. Although the reduction in heavy vehicle traffic along Burntlog Route under Alternative 2 would generally reduce surface water quality impacts from erosion, this change would have no effect on impaired waterbodies, because the only crossing of a listed stream with a sedimentation impairment (the South Fork Salmon River along Warm Lake Road) would occur at an existing paved crossing, where sediment contributions from the road surface are already negligible.

4.9.2.2.2.3 Utilities

Utilities associated with Alternative 2 (existing transmission line upgrades and structure work, ROW clearing, new transmission line, and transmission line access roads) would cross 36 different streams, as inventoried in **Table 4.9-21**.

Table 4.9-21 Alternative 2 Utility Stream Crossings

Component	Number of Intersects[1]	Stream Names
Upgraded Transmission Line	26	▪ Alpine Creek ▪ Bear Creek ▪ Beaver Creek ▪ Big Creek ▪ Boulder Creek ▪ Cabin Creek ▪ Coffee Creek ▪ Deep Creek ▪ Ditch Creek ▪ Halfway Creek ▪ Hanson Creek ▪ Hargrave Creek ▪ Hot Spring Creek ▪ Johnson Creek ▪ Lake Fork ▪ Little Creek ▪ Little Pearsol Creek ▪ Moose Creek ▪ Olson Creek ▪ Pearsol Creek ▪ Rustican Creek ▪ South Fork Salmon River ▪ Trapper Creek ▪ Trout Creek ▪ Warm Lake Creek ▪ Willow Creek
Structure Work for Upgraded Transmission Line	3	▪ Big Creek ▪ Pearsol Creek ▪ Willow Creek
Transmission Line Access Road	4	▪ Big Creek ▪ Cabin Creek ▪ Pearsol Creek ▪ Unnamed Creek

Table Source: IDEQ 2018

Table Notes:

1 The number of intersects listed for each component is for individual streams; in some cases, the utility-related component may intersect one or more streams at multiple locations.

The approximately 63-mile IPCo transmission line upgrade would cross 26 of the 36 streams listed in **Table 4.9-20**. Overall, the same streams would be crossed as Alternative 1, even with the ROW re-alignments proposed to utilize an old railroad grade and to avoid the Thunder Mountain Estates subdivision. Similar to Alternative 1, the transmission line upgrade would require widening the ROW corridor and replacing existing power poles with taller structures. This structure work would result in ground disturbance at or near three streams. Use of the transmission line access road to facilitate year-round maintenance of the line also would result in disturbance at four stream crossings.

Additionally, the new 8.5-mile, 138-kV transmission line would require vegetation clearing along the ROW (intersecting three streams).

The remainder of this section discusses surface water impacts in the context of applicable water quality indicators.

Sediment – Alternative 2

Because the transmission line upgrade would cross the same streams as Alternative 1, the location and magnitude of sediment-related impacts also would be the same. However, Alternative 2 would not require structure work near Beaver Creek or Hot Spring Creek. With no structure work in the vicinity of these streams, surface water quality impacts from erosion and sedimentation would effectively be avoided.

Surface disturbance for the upgraded transmission line access road would impact one additional stream (Pearsol Creek) compared to Alternative 1. The access road constructed in the vicinity of Pearsol Creek could increase erosion and add additional sediment load to the creek during both construction and operation of the upgraded transmission line.

Stream crossings along the new 1.38-kV line from Johnson Creek substation to the mine site would be the same as Alternative 1 and would consequently result in the same degree of surface water quality impacts.

Based on the type of vegetation removal, the localized and discontinuous ground disturbance for structure footings and ROW access roads, and permit-related requirements including use of BMPs, the potential for transmission line-related erosion and sedimentation would be minimal (i.e., limited to periods of substantial overland flow). The duration of erosion/sedimentation potential would occur from the time new transmission line is constructed until it is reclaimed at the end of mine closure and reclamation (approximately 25 years). The upgrades to IPCo's existing transmission line corridor would be permanent. Due to the nature of sediment transport by streams, the geographic extent of increased sedimentation could be hundreds of feet to miles, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

Impaired Waterbodies – Alternative 2

The utility alignments planned for Alternative 2 would cross the same impaired stream segments as Alternative 1. Therefore, water quality effects related to impaired waterbodies also would be the same.

4.9.2.2.2.4 Off-site Facilities

Stibnite Gold Logistics Facility – Alternative 2

Surface water quality impacts from the SGLF would be the same as Alternative 1, because there would be no change to the facility location under this alternative.

Burntlog Maintenance Facility – Alternative 2

Under Alternative 2, the maintenance facility location would be moved to a borrow source approximately 4.4 miles east of the intersection of Johnson Creek Road and Warm Lake Road. The building constructed at this new location would be referred to as the Burntlog Maintenance Facility. The maintenance facility would include the same structures and parking areas described for the Landmark Maintenance Facility above, but the configuration would be modified to fit within the borrow source site.

The nearest waterbody to the Burntlog Maintenance Facility location (approximately 100 to 150 feet away) would be Peanut Creek. This creek could be impacted during construction of the maintenance facility by increased runoff, erosion, sedimentation (as a result of vegetation removal and excavation of soil, rock, and sediment), and accidental spills of fuels or other chemicals (if not properly stored or contained). However, design features proposed by Midas Gold (such as facility siting), mitigation measures required by the Forest Service (including design requirements and maintenance standards), and permit stipulations from state and federal agencies (including BMPs, a septic system permit, and SPCC Plan) would control runoff, erosion, sedimentation, and the potential for discharges.

Overall, based on the implementation of required standard design and permit stipulations, and distance to the nearest waterbodies, impacts to surface water as a result of the Burntlog Maintenance Facility would be controlled such that the magnitude of impacts associated with runoff, erosion, sedimentation, and spills would be very low and likely only notable during substantial overland flow from very large rainfall events. The duration of operations at the Burntlog Maintenance Facility would be concurrent to mining and ore processing operations and the need for road maintenance (approximately 25 years), after which the facility would be reclaimed.

4.9.2.2.3 GROUNDWATER QUALITY

Consistent with the groundwater quality analysis area, the discussion in this section is focused on the mine site. All predicted concentration values presented in this section are based on the average precipitation model scenario.

4.9.2.2.3.1 General Chemistry (pH, Major Ions, TDS, Metals)

Tailings – Alternative 2

The liner design was modified for Alternative 2 to include a drainage layer that would function as a leakage collection and recovery system. The Alternative 2 design consists of a composite liner with a leakage collection system between the primary and secondary geomembranes. Starting at ground surface, the composite liner would consist of the following layers:

- Prepared subgrade
- Geosynthetic clay liner
- 60-mil high density polyethylene AGRU MicroDrain® Liner
- 60-mil high density polyethylene geomembrane primary liner

The 60-mil high density polyethylene AGRU MicroDrain® Liner functions as a combined secondary liner and leakage collection layer that would allow any leaks to flow toward the area of the TSF embankment where a collection sump would be located. The sump would contain a level control and a submersible pump. A pipe would run from the sump up the embankment to the surface to allow monitoring for leakage and pumping if needed. Any water pumped from the collection sump would be released into the supernatant pond on the top of the TSF.

It should be noted that the liner system proposed under Alternative 2 does not meet the regulatory requirements of IDAPA 50.01.13, Rules for Ore Processing byCyanidation. However, at the request of the Idaho Mining Association, IDEQ has entered into rulemaking on the existing regulations to change the regulatory requirements from prescriptive requirements to performance-based requirements. No schedule has been determined for completion of the rulemaking. Midas Gold has indicated that the TSF liner design would be modified as needed to meet IDAPA regulatory requirements in effect at the time of facility permitting.

Assuming that the Alternative 2 composite liner system is designed properly, installed according to specifications, and functions as intended, seepage through the liner would be low compared to the natural rate of groundwater recharge, helping to maintain existing groundwater quality beneath the TSF. However, if the design, construction, and/or performance of the composite liner proves to be inadequate, seepage through the liner could reach levels where groundwater quality below the TSF would be impacted.

Development Rock – Alternative 2

TSF Embankment and Hangar Flats DRSF

Under Alternative 2, the materials used to construct the TSF embankment would be the same as Alternative 1. Although the TSF liner design would be modified for this alternative as described above and in Section 2.4.5.4, Tailings Storage Facility, the modified composite liner would still cover the upstream face of the embankment, and the Hangar Flats DRSF would abut the downstream face. Meteoric water infiltration through the embankment material would be limited to the embankment crest. Thus, groundwater quality impacts from the TSF embankment would be the same as Alternative 1.

Changes to the Hangar Flats DRSF under Alternative 2 would include a geosynthetic cover installed on top of the facility to restrict infiltration through the development rock material. Solute loading from the development rock would therefore be reduced relative to Alternative 1, resulting in groundwater chemistry beneath the DRSF that is similar to existing conditions for many constituents. The main exception is arsenic, which has a predicted future concentration of 0.36 mg/L (Brown and Caldwell 2019b), well above the IDAPA 58.01.11 groundwater quality standard (0.05 mg/L). By comparison, the average baseline arsenic concentration in the alluvium near Hangar Flats is approximately 0.006 mg/L (**Figure 4.9-13**).

The mine operational and post closure groundwater pH predicted beneath the Hangar Flats DRSF for Alternative 2 would be around 6.76 (Brown and Caldwell 2019b), relatively unchanged from the baseline pH of 6.9 standard units. The groundwater iron concentration beneath the DRSF (1.69 mg/L) is predicted to be elevated above the IDAPA 58.01.11 groundwater quality standard (0.3 mg/L) but would still be below the average baseline iron concentration measured for the alluvial aquifer (2.63 mg/L). Predicted manganese concentrations (2.39 mg/L) also would be below background (2.63 mg/L), but above the groundwater quality standard (0.05 mg/L).

All other modeled constituents are predicted to remain below IDAPA 58.01.11 groundwater quality standards in groundwater underlying the Hangar Flats DRSF.

West End DRSF

Groundwater quality in the West End Creek valley would be the same as existing conditions because the West End DRSF would be eliminated under this alternative. Surface water quality impacts to the West End pit lake and West End Creek are discussed in Section 4.9.2.2.2.1, Mine Site, under Section 4.9.2.2.2, Surface Water for Alternative 2.

Fiddle DRSF

Installing a geosynthetic cover on top of the Fiddle DRSF would reduce infiltration through the development rock material by up to 95 percent (Brown and Caldwell 2019b). As a result, alluvial groundwater underlying the DRSF is predicted to remain nearly neutral. The predicted pH of 7.37 for the mine operational and post closure periods would be close to the existing baseline pH of 7.21. This near-neutral pH would help preserve existing groundwater quality beneath the Fiddle DRSF, with future concentrations of arsenic predicted to decrease compared to the existing level (**Figure 4.9-13**). The decreasing arsenic values in groundwater are predicted to be below the IDAPA 58.01.11 groundwater quality standard (0.05 mg/L). The remaining constituents analyzed also are predicted to be below groundwater standards during both the mine operational and post closure periods.

Yellow Pine Pit Backfill

Groundwater quality impacts within the Yellow Pine pit backfill would be the same as Alternative 1 (**Figure 4.9-13**).

Midnight Area Pit Backfill

Only post closure model results are applicable to the Midnight pit backfill because backfilling would not commence until the conclusion of mining. Pore water in the pit backfill is predicted to be moderately alkaline with pH values ranging from 8.7 to 8.9 during the 100-year post closure period. These pH values are marginally elevated above the maximum pH guideline of 8.5 standard units. Additional constituents that would exceed groundwater quality standards in the backfill pore water include arsenic, mercury, antimony, and TDS. Arsenic concentrations are predicted to range from 1.3 to 2.2 mg/L compared to the 0.05 mg/L arsenic standard (**Figure 4.9-13**). Post-closure mercury concentrations are predicted to range from 0.0024 to 0.0042 mg/L compared to the 0.002 mg/L mercury standard. Groundwater antimony concentrations would be above the 0.006 mg/L antimony standard, with predicted concentrations ranging from 0.27 to 0.42 mg/L. Finally, groundwater TDS concentrations would be marginally elevated above the 500 mg/L TDS standard in post closure years 1, 2, and 20 based on geochemical model predictions (Brown and Caldwell 2019b).

Rapid Infiltration Basins – Alternative 2

Under Alternative 2, dewatered groundwater would be treated in the Centralized WTP before being discharged to the RIBs. The water would be treated to the same standards as the treated water discharged to the EFSFSR through a permitted IPDES outfall. As a result, groundwater quality within the alluvial aquifer along the EFSFSR below Meadow Creek is expected to improve under Alternative 2. Per IDEQ, the RIBs would be permitted through either a groundwater reuse permit or an IPDES permit. A determination of whether the RIBs qualify as discharges to waters of the United States would be made during the permitting process.

4.9.2.2.3.2 Fuels and Hazardous Chemicals

Potential groundwater quality impacts from accidental spills of fuels and hazardous chemicals would be the same as Alternative 1.

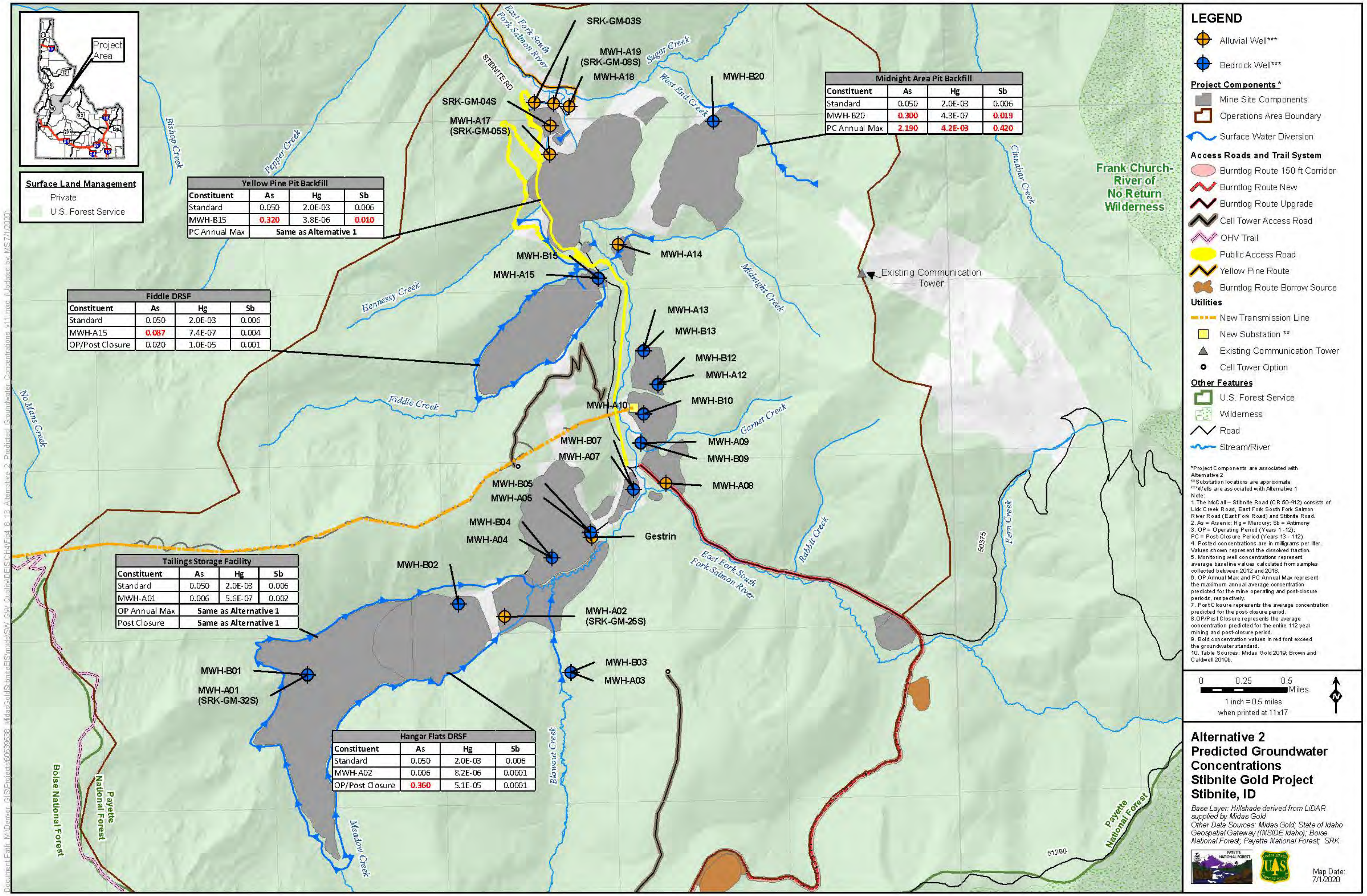


Figure Source: AECOM 2020

Figure 4.9-13 Alternative 2 Predicted Groundwater Concentrations

This page intentionally left blank

4.9.2.3 Alternative 3

4.9.2.3.1 GEOCHEMISTRY

Under Alternative 3, the volume of tailings and development rock generated by mining would be the same as Alternative 1. However, rather than placing tailings and development rock in the Meadow Creek valley, the mine waste material would instead be disposed in the upper part of the EFSFSR drainage above the confluence with Meadow Creek. The EFSFSR TSF would contain around 97 MT of tailings at full buildout, and the TSF embankment would contain the same amount of development rock planned for Alternatives 1 and 2 (61 MT). The Hangar Flats DRSF would be eliminated with all development rock (81 MT) instead being placed in a new DRSF on the downstream side of the TSF. The volumes and locations of the Fiddle and West End DRSFs would be similar to Alternative 1. Due to relocation of the TSF, Alternative 3 would not include removal of the SODA or Bradley tailings. Not removing and repurposing these legacy mine wastes would change future predictions of surface water and groundwater quality compared to Alternatives 1 and 2. Leaving the SODA in place also would eliminate 5.8 MT of construction material needed for the TSF embankment. A different source of development rock material would be needed to complete the embankment construction, which would reduce the size of another on-site DRSF by 5.8 MT. Additionally, leaving the Bradley tailings in place would slightly reduce the final size of the TSF from 100 MT under Alternatives 1 and 2 to approximately 97 MT under Alternative 3 (M3 2019).

The other two geochemical indicators (lithologic composition of the final pit walls, predicted leachate chemistry of development rock and tailings) would be the same as Alternative 1.

4.9.2.3.2 SURFACE WATER QUALITY

4.9.2.3.2.1 Mine Site

General Chemistry (pH, Major Ions, TDS, Metals) – Alternative 3

<u>Mine Construction and Operations</u>

Under Alternative 3, not removing the legacy mine waste from Meadow Creek valley and shifting the TSF and Hangar Flats DRSF to the upper EFSFSR would noticeably impact surface water quality in both drainages. During the mine operational period, concentrations of arsenic, antimony, sulfate, and manganese in Meadow Creek assessment nodes YP-T-27 and YP-T-22 are predicted to be similar to existing conditions, primarily because the SODA and Bradley tailings would be left in place (Brown and Caldwell 2019d). This means that average arsenic and antimony concentrations at YP-T-27 and YP-T-22 would continue to exceed applicable surface water quality standards during the mine operational period.

In the upper EFSFSR drainage above Meadow Creek, constructing the EFSFSR TSF would not have an immediate impact on the surface water quality of this reach. Predicted concentrations of arsenic, antimony, sulfate, pH, mercury, aluminum, iron, and manganese during build-out of the EFSFSR TSF and DRSF are comparable to existing conditions, with arsenic concentrations predicted to be seasonally elevated above the surface water quality standard (Brown and Caldwell 2019d).

In the EFSFSR below Meadow Creek, antimony and arsenic are predicted to exceed surface water quality standards during the mine operational period. Antimony concentrations would be elevated above the strictest potentially applicable surface water quality standard at the EFSFSR assessment nodes, with predicted average concentrations between 0.013 mg/L at YP-SR-10 and 0.030 mg/L at YP-SR-4 (Brown and Caldwell 2019d). These antimony concentrations are generally consistent with measured baseline values (**Figure 4.9-14**). Arsenic concentrations also are predicted to be elevated above the strictest potentially applicable surface water quality standard at the EFSFSR assessment nodes, with predicted average concentrations ranging from 0.062 mg/L at YP-SR-2 to 0.11 mg/L at YP-SR-4 (Brown and Caldwell 2019d). The operational arsenic concentrations at these nodes would be higher than average measured baseline concentrations (**Figure 4.9-14**).

Elevated concentrations of antimony and arsenic predicted for the EFSFSR are related to the legacy mining waste being left in place in Meadow Creek valley. Without removing this waste, concentrations of these constituents in Hangar Flats dewatering water are expected to be higher compared to Alternatives 1 and 2. As the dewatering water infiltrates through the RIBs, the higher concentration water would affect downstream drainages as it is transported through the alluvium and discharges to surface water channels. Discharge limits incorporated into the IPDES permit for the RIBs would help reduce predicted antimony and arsenic concentrations during the mine operational period. The discharge limit concentrations could be met through active treatment of the mine dewatering water which could be a mitigation measure implemented for Alternative 3.

The predicted Alternative 3 operational chemistry for Fiddle Creek, West End Creek, and Midnight Creek is the same as Alternative 1, because the legacy mine wastes and TSF location would not influence the water quality of these streams.

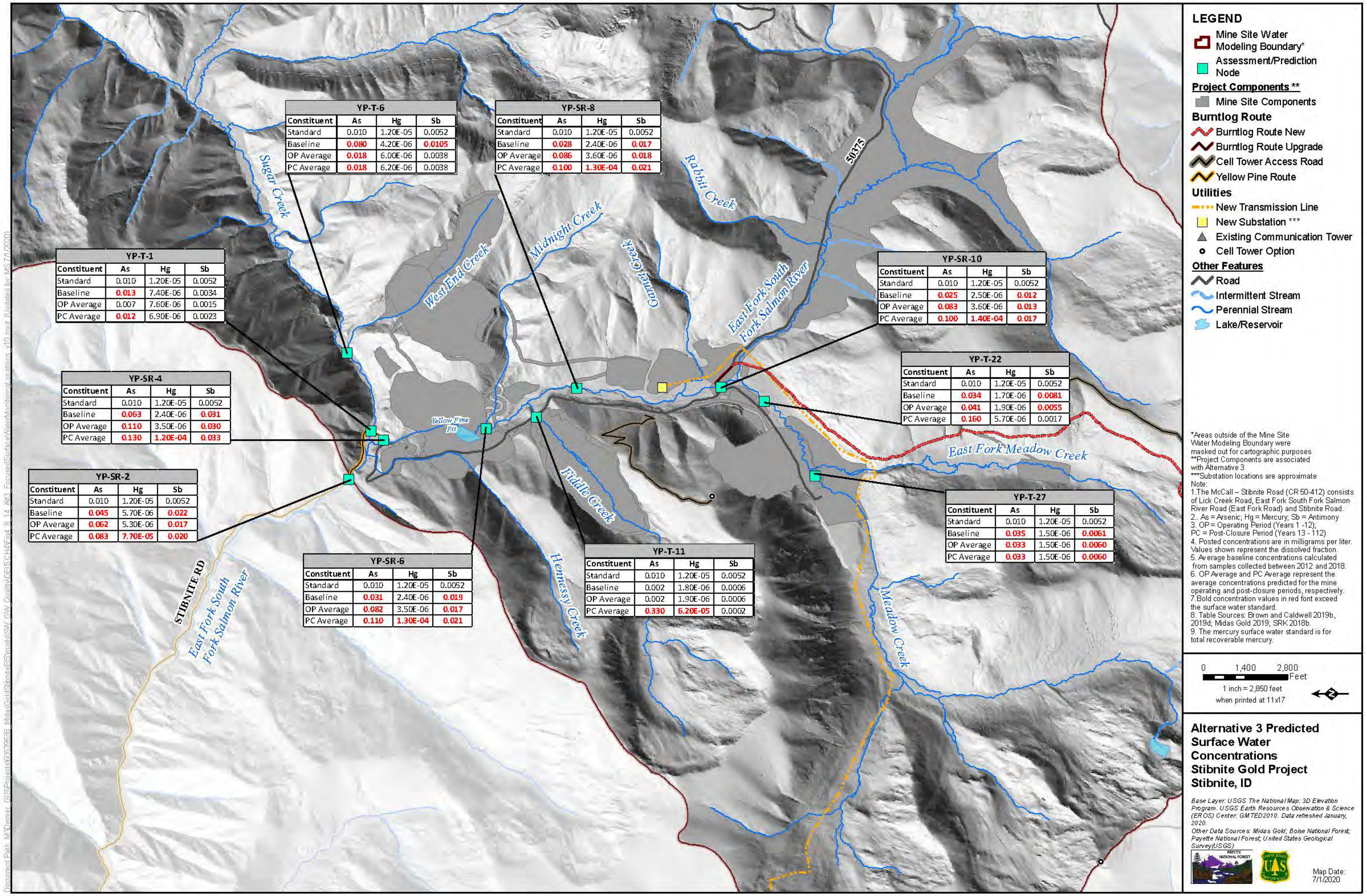


Figure Source: AECOM 2020

Figure 4.9-14 Alternative 3 Predicted Surface Water Concentrations

This page intentionally left blank

Mine Closure and Reclamation

Results for the post closure pit lakes and SWWC modeling are discussed by drainage in the following sections.

Under Alternative 3, the Hangar Flats pit lake is predicted to have an alkaline pH between about 8.1 and 8.3 for the entire post closure period. Predicted concentrations of arsenic (0.15 to 1.07 mg/L) would exceed applicable surface water standards during post closure years 1 through 100. Mercury concentrations (0.000013 to 0.000032 mg/L) also would exceed the water quality standard for years 1 through 10 (Brown and Caldwell 2019d). These elevated constituent concentrations would influence Meadow Creek beginning in post closure year 7 when the reclaimed Meadow Creek channel would be routed through the Hangar Flats pit lake. As a result, predicted post closure arsenic concentrations at assessment node YP-T-22 would exceed the average baseline concentration (**Figure 4.9-14**). The predicted mercury concentration at YP-T-22 also would exceed baseline, but would be below the standard for total recoverable mercury (**Figure 4.9-14**). Factors that influence the predicted post closure concentrations include the legacy mining waste material in Meadow Creek valley, which would not be removed under Alternative 3, and relocation of the TSF and Hangar Flats DRSF into the EFSFSR drainage.

In the upper EFSFSR valley above Meadow Creek, average predicted post closure concentrations of arsenic, mercury, and antimony would exceed both surface water quality standards and average baseline concentrations of these constituents. The average arsenic concentration would be 0.042 mg/L compared to the 0.010 baseline concentration, which is the same as the surface water quality standard. The average mercury concentration (0.00030) would increase two order of magnitude over existing conditions (0.000003 mg/L) and consequently, would exceed the 0.000012 mg/L standard for total recoverable mercury. Finally, the average post closure antimony concentration (0.018 mg/L) would increase by an order of magnitude above baseline (0.001 mg/L) and would exceed the 0.0052 antimony standard (Brown and Caldwell 2019d). These increases are due to constructing the TSF and DRSF in the upper EFSFSR drainage post closure.

In the EFSFSR below Meadow Creek, several constituents are predicted to exceed surface water quality standards during the post closure period:

- Average antimony concentrations would remain elevated above the surface water quality standard at all five nodes in the EFSFSR (**Table 4.9-22**). Predicted average antimony concentrations are between 0.017 mg/L at YP-SR-10 and 0.033 mg/L at YP-SR-4 (Brown and Caldwell 2019d). These antimony concentrations are mostly higher than average baseline values in the EFSFSR (**Figure 4.9-14**).
- Average mercury concentrations are predicted to be elevated above the strictest potentially applicable surface water quality standard at all five nodes in the EFSFSR, with predicted concentrations between 0.000077 mg/L at YP-SR-2 and 0.00014 mg/L at YP-SR-10 (Brown and Caldwell 2019d). The predicted mercury concentrations at these

nodes are consistently higher than average measured baseline concentrations (**Figure 4.9-14**).

- Average arsenic concentrations also are predicted to be elevated above the surface water standard at all five nodes in the EFSFSR (**Table 4.9-22**). The predicted arsenic concentrations range from 0.083 mg/L at YP-SR-2 to 0.13 mg/L at YP-SR-4 (Brown and Caldwell 2019d), and are higher than the average baseline concentrations at these nodes (**Figure 4.9-14**).
- As shown in **Table 4.9-22**, average copper concentrations under Alternative 3 would not exceed the copper criterion.

These elevated post closure arsenic, mercury, and antimony concentrations are related to the legacy mining waste being left in place in Meadow Creek valley, the relatively poor water quality predicted for the Hangar Flats pit lake, and untreated consolidation water runoff from the TSF post closure. To reduce these predicted surface water quality impacts, Midas Gold would treat the EFSFSR TSF consolidation water runoff using a passive treatment system after the runoff flows drop below 750 gallons per minute. The passive treatment system would be the same as described for Alternatives 1 and 2, but would be located in the upper EFSFSR drainage. Treated water from the passive system would be routed to an effluent monitoring station before final discharge to the river. Concentration changes that would occur in the EFSFSR from treating the TSF consolidation water runoff have not been modeled for Alternative 3.

A possible mitigation measure for predicted Meadow Creek and EFSFSR water quality impacts could include adapting the Centralized WTP designed for Alternative 2 to treat discharge from the Hangar Flats pit lake.

The predicted Alternative 3 post closure chemistry for the West End pit lake, Midnight area pit lake, Fiddle Creek, West End Creek, and Midnight Creek is the same as Alternative 1, because the legacy mine wastes and TSF location would not influence the water quality of these features.

Table 4.9-22 Alternative 3 Maximum Predicted Post Closure Concentrations at the EFSFSR Assessment Nodes

Constituent	Units	Strictest Potentially Applicable Surface Water Quality Standard	YP-SR-10	YP-SR-8	YP-SR-6	YP-SR-4	YP-SR-2
Arsenic	mg/L	0.01	**0.10**	**0.10**	**0.11**	**0.13**	**0.083**
Mercury	mg/L	0.000012	**0.00014**	**0.00013**	**0.00013**	**0.00012**	**0.000077**
Antimony	mg/L	0.0052	**0.017**	**0.021**	**0.021**	**0.033**	**0.020**
Copper	mg/L	0.0024	0.0011	0.0011	0.0011	0.0010	0.00051

Table Source: Brown and Caldwell 2019d

Table Notes:

Concentration values represent the dissolved fraction unless otherwise noted.

Bolded values exceed the strictest potentially applicable surface water quality standard.

Temperature – Alternative 3

To simulate stream temperatures for Alternative 3, the Alternative 1 SPLNT model was modified to incorporate the EFSFSR TSF. The applicable model changes include:

- Routing surface water from upstream of the EFSFSR TSF through lined diversion channels around the TSF
- Modifying shade characteristics in the upper EFSFSR drainage to account for vegetation clearing and removal
- Reverting to the No Action model configuration for Meadow Creek upstream of Hangar Flats pit, since no alterations to this segment of Meadow Creek would be made under Alternative 3
- Incorporating the planned Meadow Creek diversion around the south side of Hangar Flats pit
- Incorporating an underdrain beneath the EFSFSR TSF that would capture groundwater and return it to the EFSFSR

The stream temperature analysis presented below focuses on comparing predicted future temperatures to existing temperature conditions. The Alternative 3 operational and post closure predictive simulations were compared to a No Action model developed to simulate conditions that would be expected if the SGP is not implemented. The No Action model provides a representation very similar to existing conditions that allows for direct comparison and quantification of mining-related impacts.

Table 4.9-23 summarizes the predicted maximum weekly summer condition, average weekly summer condition, maximum weekly fall condition, and average weekly fall temperatures for several stream reaches throughout the mine site that approximate (but are not identical to) the ten surface water assessment nodes discussed above. Temperature statistics for the No Action model also are provided in the table for comparison. Overall, Alternative 3 would result in higher temperatures within Meadow Creek and the upper EFSFSR during both the mine operational and post closure period. For information on how predicted stream temperatures compare to aquatic life temperature standards, the reader is referred to Section 4.12, Fish Resources and Fish Habitat.

In Meadow Creek, simulated stream temperatures above East Fork Meadow Creek would be warmer than existing conditions due to reduced stream baseflows from dewatering Hangar Flats pit. Simulated maximum summer temperatures are up to 1.4°C higher during operations and 0.9°C higher in the ear years of post closure. Simulated maximum fall temperatures are predicted to be up to 1.1°C higher during operations and 1.3°C higher in the post closure period (**Table 4.9-23**) (Brown and Caldwell 2019d).

Table 4.9-23 Maximum and Average Weekly Summer and Fall Stream Temperatures Simulated for Alternative 3

Area	Simulated Daily Temperature Statistic	Existing Condition/No Action	EOY 6	EOY 12	EOY 18	EOY 22	EOY 27	EOY 32	EOY 52	EOY 112	Maximum Simulated Temperature	Maximum Increase from Existing Condition
Upper EFSFSR (above Meadow Creek)	Summer Max:	13.4	20.5	20.5	25.5	24.8	24.1	23.8	23	22.4	25.5	12.1
	Fall Max:	11.1	16	16	19.2	18.2	17.1	16.7	15.7	15.5	19.2	8.1
	Summer Avg:	10.3	12.3	12.3	15.2	14.7	14.3	14.2	13.7	13.4	15.2	4.9
	Fall Avg:	8.8	9.5	9.5	11.2	10.7	10.2	10	9.6	9.5	11.2	2.4
Meadow Creek above East Fork Meadow Creek	Summer Max:	17.9	19.1	19.3	18.7	18.8	18.7	18.7	18.8	18.8	19.3	1.4
	Fall Max:	15.1	16	16.2	16	15.4	16	16	16.4	16.1	16.4	1.3
	Summer Avg:	12.7	13.1	13	12.6	12.6	12.6	12.6	12.6	12.6	13.1	0.4
	Fall Avg:	10.4	10.6	10.5	10.2	10.1	10.3	10.2	10.2	10.3	10.6	0.2
Meadow Creek below East Fork Meadow Creek	Summer Max:	19.8	21.2	20.9	21.2	21.2	21.2	21.2	21.2	21.2	21.2	1.4
	Fall Max:	16.2	17	16.9	16.5	17.6	16.4	16.2	16.2	17.3	17.6	1.4
	Summer Avg:	13.4	13.9	13.8	19.2	19.2	19.1	19.1	19.1	19.1	19.2	5.8
	Fall Avg:	10.8	11	11	12.1	12	11.9	11.8	11.8	11.8	12.1	1.3
Middle EFSFSR (between Meadow and Fiddle Creeks)	Summer Max:	17.4	21.8	21.4	23	22.8	22.7	22.6	22.4	22.3	23	5.6
	Fall Max:	14	16.5	16.4	17.2	16.5	16.2	16.1	15.9	16.3	17.2	3.2
	Summer Avg:	12.2	13.8	13.7	16.6	16.3	16.2	16.1	15.9	15.8	16.6	4.4
	Fall Avg:	9.9	10.5	10.5	11.5	10.9	10.7	10.6	10.5	10.4	11.5	1.6
Fiddle Creek	Summer Max:	11.4	19.1	23.3	19.9	19.7	19.5	19.5	18.5	17.9	23.3	11.9
	Fall Max:	9.9	16.4	18	17	15.1	14.8	14.7	14	13.6	18	8.1
	Summer Avg:	9.2	11.4	13.3	12.5	12.4	12.3	12.2	11.8	11.6	13.3	4.1
	Fall Avg:	8.2	9.3	10	10.4	9.6	9.5	9.4	9.2	9	10.4	2.2
Lower EFSFSR (between Fiddle and Sugar Creek)	Summer Max:	17.4	22	22.9	23.1	22.9	22.8	22.7	22.4	22.2	23.1	5.7
	Fall Max:	14	16.5	17	17.6	16.6	16.3	16.2	15.9	16	17.6	3.6
	Summer Avg:	12.2	13.9	14.6	16.1	15.9	15.8	15.7	15.5	15.4	16.1	3.9
	Fall Avg:	9.9	10.5	10.9	11.7	10.8	10.9	10.8	10.6	10.5	11.7	1.8
West End Creek	Summer Max:	12.9	23.4	19.6	21.7	21.7	21.2	20.6	19.9	18.6	23.4	10.5
	Fall Max:	11	18.1	16.3	17.2	16.7	15.7	15	14.3	13.4	18.1	7.1
	Summer Avg:	11.1	12.5	13.2	15.2	15.2	14.7	14.4	14	13.5	15.2	4.1
	Fall Avg:	9.6	9.8	10.5	12.4	12.2	11.8	11.6	11.4	11.2	12.4	2.8
Lower Sugar Creek	Summer Max:	15.4	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	0.8
	Fall Max:	12.2	12.8	12.8	13.6	12.9	12.8	12.8	12.8	12.8	13.6	1.4
	Summer Avg:	10.7	11	11	11.2	11.2	11.2	11.2	11.2	11.2	11.2	0.5
	Fall Avg:	9.1	9.2	9.2	9.6	9.3	9.3	9.3	9.3	9.3	9.6	0.5

Area	Simulated Daily Temperature Statistic	Existing Condition/No Action	EOY 6	EOY 12	EOY 18	EOY 22	EOY 27	EOY 32	EOY 52	EOY 112	Maximum Simulated Temperature	Maximum Increase from Existing Condition
EFSFSR downstream of Sugar Creek	Summer Max:	14.9	18.8	19.9	19.8	19.7	19.7	19.6	19.4	19.4	19.9	5
	Fall Max:	11.9	14.2	15	15.5	14.5	14.5	14.4	14.3	14.2	15.5	3.6
	Summer Avg:	12.4	12.5	13.1	13.8	13.7	13.6	13.6	13.5	13.4	13.8	1.4
	Fall Avg:	10	9.8	10.1	10.7	10.1	10.1	10.1	10	9.9	10.7	0.7

Table Source: Brown and Caldwell 2019b, Table B-48

Table Notes:

Temperatures in °C.

EOY - End of Year.

In Meadow Creek below East Fork Meadow Creek, simulated maximum summer temperatures are up to 1.4°C higher during both mine operations and post closure. Simulated maximum fall temperatures are up to 0.8°C higher during operations and 1.4°C higher through the post-closure period (**Table 4.9-23**) (Brown and Caldwell 2019d). Post closure conditions in lower Meadow Creek are driven by simulated discharges from the Hangar Flats pit lake.

The EFSFSR above Meadow Creek is not in an area of previous mining or wildfire. However, construction of the EFSFSR TSF under Alternative 3 would require removal of vegetation and an altered stream channel that are predicted to result in maximum summer temperatures throughout this segment that are up to 7.1°C higher during mine operations and 12.1 degrees higher during the early years of post closure (**Table 4.9-23**) (Brown and Caldwell 2019d). The maximum fall condition displays a similar temperature pattern, but the magnitude of the increase in temperature is not as pronounced compared to summer.

In the EFSFSR downstream of Meadow Creek, simulated stream temperatures for Alternative 3 also are warmer than existing conditions. Simulated maximum summer temperatures are up to 5.5°C higher during operations and 5.7°C higher during the early years of post closure. Simulated temperatures for the fall also are warmer than existing conditions, but the degree of increase is less than summer. The largest simulated increase (3.6°C) is for the maximum fall temperature which occurs early in the post closure period (**Table 4.9-23**) (Brown and Caldwell 2019d).

Sediment – Alternative 3

Under Alternative 3, sediment inputs to Meadow Creek upstream of Hangar Flats pit may decrease due to reduced surface disturbance from relocating the TSF and Hangar Flats DRSF to the EFSFSR drainage. However, the local reduction in erosion would likely be offset at the watershed scale by increased sedimentation in the upper EFSFSR above Meadow Creek. Other than these localized changes resulting from the TSF relocation, impacts to surface water quality from erosion and sedimentation would be the same as Alternative 1.

Organic Carbon – Alternative 3

The EFSFSR TSF would require relocating the worker housing facility to the East Fork Meadow Creek (also known as Blowout Creek) valley. The sanitary wastewater treatment facility also would be relocated to this area for proximity to the worker housing facility. As a result of these changes, wastewater effluent from the permitted wastewater outfall would be discharged to a tributary of Meadow Creek instead of the EFSFSR. The wastewater treatment plant would still be designed according to all applicable IPDES permit standards and effluent would be discharged in an acceptable manner as approved by the permit. Sewage effluent systems would have waste containment and runoff control structures to prevent escape of untreated waste to East Fork Meadow Creek.

4.9.2.3.3 Methylmercury – Alternative 3

Under Alternative 3, mercury concentrations in the EFSFSR would be similar to existing conditions during the mine operational period. However, after consolidation water runoff from the EFSFSR TSF stops being managed in post closure year 6, mercury concentrations are predicted to increase downstream. As a result, average post closure dissolved mercury concentrations would be above baseline levels at 8 of the 10 surface water assessment nodes.

Table 4.9-24 provides an estimate of average post closure MeHg concentrations calculated using the same methodology as Alternative 1. Estimated MeHg values shown in the table represent the difference between the average baseline and average post closure dissolved mercury concentrations, multiplied by a methylation potential of 2 percent. This calculation assumes that the initial MeHg concentration at each assessment node is zero, which is reasonable given the frequency of non-detects in the baseline MeHg dataset (90 percent; Section 3.9.3.1.1.2), and the relatively large mercury concentration increases expected from mining.

The data in **Table 4.9-24** indicate that, with the TSF and Hangar Flats DRSF relocated to the upper EFSFSR drainage, measurable MeHg production is unlikely to occur in Meadow Creek. However, consolidation water runoff from the TSF could increase both dissolved mercury and MeHg downstream in the EFSFSR, with post closure MeHg concentrations in the river ranging from 1.4 to 2.8 ng/L.

Overall, the simplified analysis presented here is conservative and may overestimate the amount of MeHg that would be produced during the post closure period. Water treatment for mercury could be considered as mitigation and would be effective for preventing these estimated MeHg increases, because the treatment would remove dissolved mercury from mine contact water before it is discharged to the EFSFSR.

Table 4.9-24 Alternative 3 Post Closure Methylmercury Concentrations Estimated as a Proportion of Model-Simulated Average Dissolved Mercury Values

Stream	Node	Mercury Concentration (ng/L)			Post Closure Average MeHg (ng/L)
		Baseline	Post Closure Average	Predicted Change	
Meadow Creek	YP-T-27	1.5	1.5	0	0
Meadow Creek	YP-T-22	1.7	5.7	4.0	0.08
EFSFSR	YP-SR-10	2.5	140	138	2.8
EFSFSR	YP-SR-8	2.4	130	128	2.6
EFSFSR	YP-SR-6	2.4	130	128	2.6
EFSFSR	YP-SR-4	2.4	120	118	2.4
EFSFSR	YP-SR-2	5.7	77	71	1.4

Stream	Node	Mercury Concentration (ng/L)			Post Closure Average MeHg (ng/L)
		Baseline	Post Closure Average	Predicted Change	
Fiddle Creek	YP-T-11	1.8	62	60	1.2
West End Creek	YP-T-6	4.2	6.2	2.0	0.04

Table Source: Brown and Caldwell 2019d; Midas Gold 2019

Table Notes:

ng/L = nanograms per liter.

MeHg = methylmercury.

Post Closure Average = average dissolved mercury concentration predicted during the post closure period.

Post Closure Average MeHg = 0.02 * (Post closure Average – Baseline).

Calculation of the Post Closure Average MeHg concentration assumes that the baseline MeHg concentration is zero.

Fuels and Hazardous Chemicals – Alternative 3

Potential surface water quality impacts from accidental spills of fuels and hazardous chemicals would be the same as Alternatives 1.

Impaired Waterbodies – Alternative 3

Except for West End Creek, the inventoried waterbodies at the mine site are 303(d) listed. The causes for listing of these waters are associated with arsenic, with the EFSFSR also listed for antimony (downstream of Meadow Creek) and Sugar Creek also listed for mercury.

As discussed above, post closure chemistry modeling for the EFSFSR indicates the following:

- Average antimony concentrations would remain elevated above the surface water quality standard at all five nodes in the EFSFSR (Brown and Caldwell 2019d). Predicted antimony concentrations are mostly higher than average baseline values (**Figure 4.9-14**).
- Average arsenic concentrations also are predicted to be elevated above the surface water standard at all five nodes in the EFSFSR (Brown and Caldwell 2019d), and would be higher than average baseline concentrations at these nodes (**Figure 4.9-14**).

Based on these predictions, antimony and arsenic concentrations in the EFSFSR would likely be higher than existing conditions. As such, it is likely that the mine site streams would remain impaired for arsenic, antimony (EFSFSR), and mercury (Sugar Creek) during the post closure period. IDEQ would consequently be expected to identify goals towards developing a water quality improvement plan/TMDLs for these waterbodies. Alternative 3 would not affect the upstream source of mercury in Sugar Creek from the Cinnabar (mercury) mine.

4.9.2.3.3.1 Access Roads

The access roads planned for Alternative 3 would cross the same streams as Alternative 1; average expected vehicle trips also would be the same. The only notable change between the two alternatives is that Burntlog Route would cross the EFSFSR farther downstream under Alternative 3 due to construction of the TSF in the EFSFSR valley. This change would lengthen the distance of Burntlog Route to 40.5 miles, but would decrease the amount of mine access road located within 100 feet of a surface water body to 1.24 miles, or 2.8 percent of the total route length.

4.9.2.3.3.2 Utilities

Under Alternative 3, the only utility-related changes would involve realigning new transmission lines within the mine site. These minor realignments would not result in any new or additional stream crossings compared to Alternative 1. As such, surface water quality impacts from the utility corridors would be the same as Alternative 1.

4.9.2.3.3.3 Off-site Facilities

Under Alternative 3, there would be no changes to the locations of the SGLF or the Landmark Maintenance Facility. Therefore, surface water quality impacts from these facilities would be the same as Alternative 1.

4.9.2.3.4 GROUNDWATER QUALITY

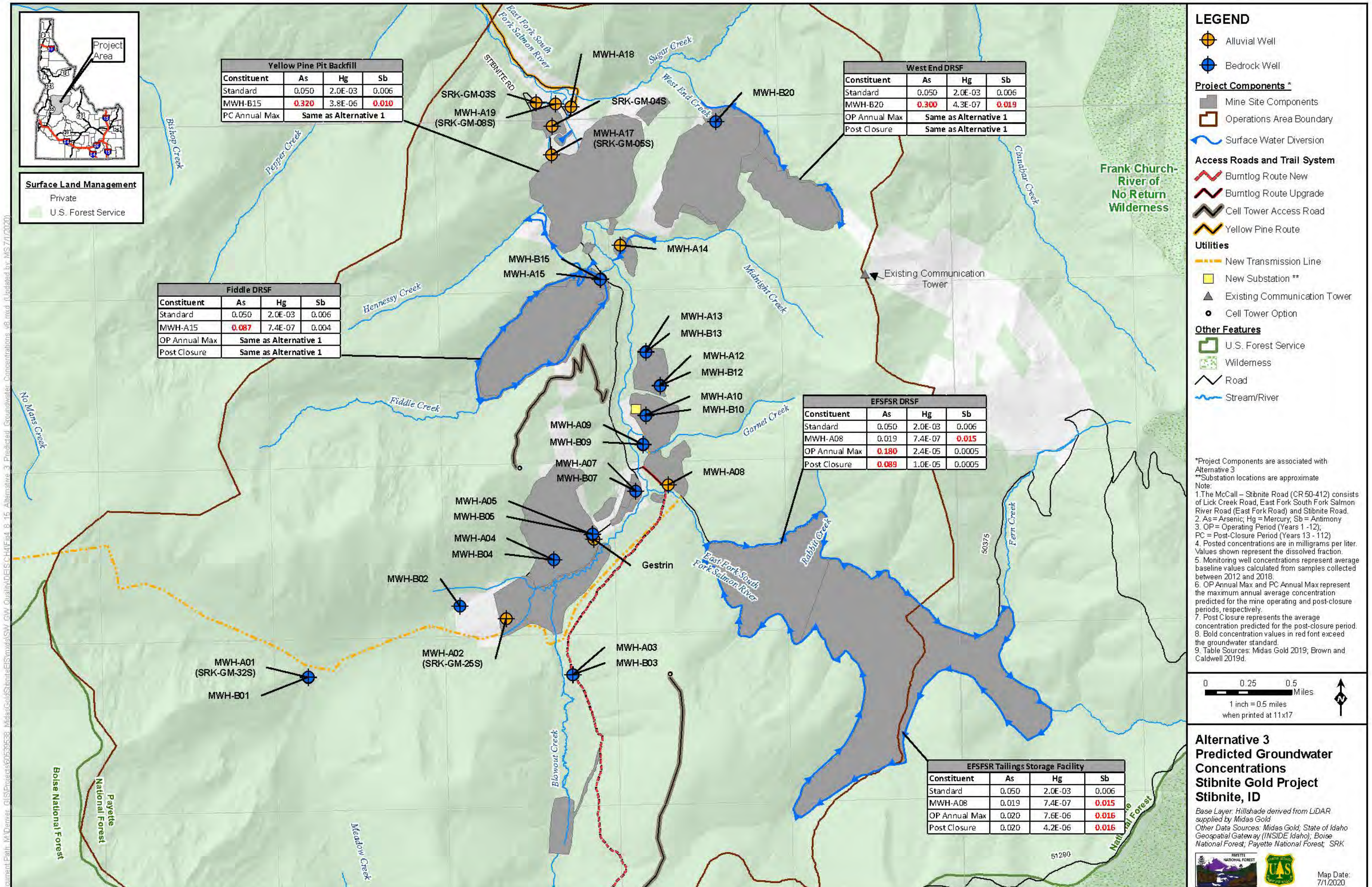
Consistent with the groundwater quality analysis area, the discussion in this section is focused on the mine site. All predicted concentration values presented in this section are based on the average precipitation model scenario.

4.9.2.3.4.1 General Chemistry (pH, Major Ions, TDS, Metals)

Tailings – Alternative 3

Under Alternative 3, the TSF configuration would be the same as Alternative 1, but the facility would be located in the upper EFSFSR drainage. As such, the magnitude and duration of groundwater quality impacts would be the same as Alternative 1, but the extent of impacts would occur in the EFSFSR alluvial aquifer rather than the Meadow Creek alluvial aquifer.

Geochemical modeling results indicate that predicted groundwater chemistry under the EFSFSR TSF would be almost identical to existing conditions, and all modeled parameters except antimony are predicted to be below IDAPA 58.01.11 groundwater quality standards (**Figure 4.9-15**) (Brown and Caldwell 2019d). The only reason for the predicted antimony exceedance is that antimony concentrations are already elevated above the groundwater quality standard in the EFSFSR alluvium, based on data collected from monitoring well MWH-A08. No increases in the antimony concentration are predicted as a result of the EFSFSR TSF.



Yellow Pine Pit Backfill

Constituent	As	Hg	Sb
Standard	0.050	2.0E-03	0.006
MWH-B15	**0.320**	3.8E-06	**0.010**
PC Annual Max	Same as Alternative 1		

West End DRSF

Constituent	As	Hg	Sb
Standard	0.050	2.0E-03	0.006
MWH-B20	**0.300**	4.3E-07	**0.019**
OP Annual Max	Same as Alternative 1		
Post Closure	Same as Alternative 1		

Fiddle DRSF

Constituent	As	Hg	Sb
Standard	0.050	2.0E-03	0.006
MWH-A15	**0.087**	7.4E-07	0.004
OP Annual Max	Same as Alternative 1		
Post Closure	Same as Alternative 1		

EFSFSR DRSF

Constituent	As	Hg	Sb
Standard	0.050	2.0E-03	0.006
MWH-A08	0.019	7.4E-07	**0.015**
OP Annual Max	**0.180**	2.4E-05	0.0005
Post Closure	**0.089**	1.0E-05	0.0005

EFSFSR Tailings Storage Facility

Constituent	As	Hg	Sb
Standard	0.050	2.0E-03	0.006
MWH-A08	0.019	7.4E-07	**0.015**
OP Annual Max	0.020	7.6E-06	**0.016**
Post Closure	0.020	4.2E-06	**0.016**

Figure Source: AECOM 2020

Figure 4.9-15 Alternative 3 Predicted Groundwater Concentrations

This page intentionally left blank

Groundwater quality impacts from the TSF would effectively be prevented by the engineered liner. Although the liner may have small defects and would be subject to hydrostatic pressure from water in the tailings, the likely seepage rate through the liner is still predicted to be very low compared to the natural rate of groundwater recharge. As such, constituent loading through the base of the TSF would likely be negligible.

Development Rock – Alternative 3

TSF Embankment and EFSFSR DRSF

Development rock planned for storage in the TSF embankment and Hangar Flats DRSF would be moved to the upper EFSFSR drainage under this alternative. Consequently, groundwater quality impacts from the embankment and DRSF would occur in the EFSFSR alluvial aquifer. Geochemical modeling results for Alternative 3 indicate that alluvial groundwater beneath the DRSF is predicted to remain near neutral with a pH of 7.1. With the exception of arsenic, concentrations of the modeled constituents are predicted to be below IDAPA 58.01.11 groundwater quality standards. Arsenic concentrations would likely be elevated above the groundwater standard for all years during mine operations and post closure, with predicted concentrations between 0.06 mg/L and 0.18 mg/L compared to the 0.05 mg/L arsenic standard (Brown and Caldwell 2019d). The predicted arsenic concentrations also are consistently above the average baseline arsenic concentration of 0.019 mg/L (**Figure 4.9-15**).

West End DRSF, Fiddle DRSF, and Yellow Pine Pit Backfill

The Alternative 3 configurations for West End DRSF, Fiddle DRSF, and the Yellow Pine pit backfill would be the same as Alternative 1 (**Figure 4.9-15**). Therefore, groundwater quality impacts associated with these facilities also would be the same.

Legacy Mine Waste – Alternative 3

Although the Bradley Tailings and SODA would be left in place under Alternative 3, and the TSF and Hangar Flats DRSF would not be constructed in Meadow Creek valley, there would still be some changes to the Meadow Creek alluvial aquifer groundwater quality compared to existing conditions. The water quality changes would occur due to removal of the Hecla heap as part of developing Hangar Flats pit. Removing the Hecla heap is predicted to reduce concentrations of arsenic, antimony, manganese, and sulfate in alluvial groundwater by between 19 and 29 percent relative to existing concentrations. Despite these decreases, arsenic (1.34 mg/L), manganese (1.30 mg/L), and antimony (0.049 mg/L) concentrations are still predicted to exceed IDAPA 58.01.11 groundwater quality standards. Total iron concentrations in the Meadow Creek alluvium (0.91 mg/L) also are predicted to exceed the groundwater standard and would increase in concentration relative to existing conditions (Brown and Caldwell 2019d).

Rapid Infiltration Basins – Alternative 3

The groundwater quality of the Meadow Creek alluvial and bedrock aquifers were used by Brown and Caldwell (2019c) to define the chemistry of dewatering water pumped from Hangar

Flats pit that would recharge the RIBs. The predicted water quality results show that several constituents would be elevated above groundwater quality standards in water entering the RIBs that has not been treated, including aluminum, arsenic, iron, manganese, and antimony (Brown and Caldwell 2019d). However, these constituents already exceed applicable groundwater quality standards in alluvial monitoring well MWH-A07 near where the RIBs would be constructed (HDR 2016; Midas Gold 2019). Thus, operation of the RIBs would likely maintain existing alluvial groundwater quality along the EFSFSR below Meadow Creek.

IDEQ would likely issue an IPDES permit for the RIBs in conjunction with permitting under the Idaho Groundwater Quality Rule. The discharge limit concentrations established by the IPDES permit could be met through active treatment of mine dewatering water, which could be considered as a mitigation measure for Alternative 3.

4.9.2.3.4.2 Fuels and Hazardous Chemicals

Potential groundwater quality impacts from accidental spills of fuels and hazardous chemicals would be the same as Alternatives 1.

4.9.2.4 Alternative 4

4.9.2.4.1 Geochemistry

Under Alternative 4, the open mine pits, TSF, and DRSFs would be the same as described in Alternative 1. Additionally, the SODA and Bradley tailings would be removed from Meadow Creek drainage and repurposed following the same protocols as Alternative 1. Therefore, there would be no change to the geochemical indicators described in Section 4.9.2.1.1, Geochemistry for Alternative 1.

4.9.2.4.2 Surface Water Quality

4.9.2.4.2.1 Mine Site

General Chemistry (pH, Major Ions, TDS, Metals) – Alternative 4

Because there would be no changes to the mine site geochemistry from Alternative 1, impacts to the pH, TDS, major ion composition, and metals concentrations in Meadow Creek, the EFSFSR, and other mine site drainages would be the same as described in Section 4.9.2.1.2.1, Mine Site.

Temperature – Alternative 4

During mine operations, Meadow Creek would be routed in a pipeline around Hangar Flats pit. Diverting this segment of the creek in a pipe would help prevent warming and maintain existing stream temperatures because the pipe would be fully shaded, blocking solar radiation that would otherwise reach the creek. The magnitude of temperature impacts would be similar to Alternative 2, which also would pipe Meadow Creek low flows around the TSF, Hangar Flats DRSF, and Hangar Flats pit. However, stream temperatures would be maintained near existing conditions over a shorter distance, primarily because Alternative 4 would only pipe the Meadow Creek segment around Hangar Flats pit.

Sediment – Alternative 4

Two modifications prescribed under Alternative 4 could affect sediment concentrations in Meadow Creek. The first is diversion of Meadow Creek in a pipeline around Hangar Flats pit. Section 2.6.5.2, Surface Water Management, states that immediately upstream of the entrance to the pipeline, a sediment trap would be constructed to capture sediment before the flows enter the pipeline. This change would have the effect of reducing downstream sediment concentrations below Hangar Flats pit compared to an open channel.

The other relevant modification is creation of step pools in Blowout Creek in place of the rock drain. The average slope of the step pools would be between 3 and 7 percent within the stream channel. It is possible that the step pool configuration would lower the streamflow velocity throughout the incised portion of Blowout Creek, helping to deposit much of the existing sediment load. However, during spring peak flow conditions, excess sediment would still likely be transported downstream through the step pool structures.

Overall, the magnitude of sediment reduction from these changes cannot be quantified. The extent of sediment reductions would be localized to Blowout Creek and Meadow Creek downstream of Hangar Flats pit. In Blowout Creek, the lower average sediment loads would persist as long as the step pool geometry was left in place. In the piped segment of Meadow Creek, the duration of sediment reduction would be limited to the mine operational period.

Organic Carbon – Alternative 4

Potential surface water organic carbon impacts from the worker housing sanitary wastewater treatment facility would be the same as Alternatives 1.

Methylmercury – Alternative 4

Impacts related to methylmercury would be the same as Alternative 1, and could be mitigated through active and passive water treatment of mine contact water that contains dissolved mercury.

Fuels and Hazardous Chemicals – Alternative 4

Potential surface water quality impacts from accidental spills of fuels and hazardous chemicals would be the same as Alternatives 1.

Impaired Waterbodies – Alternative 4

Under Alternative 4, effects to impaired waterbodies would be the same as Alternative 1.

4.9.2.4.2.2 Access Roads

Under Alternative 4, the approximately 36-mile Yellow Pine Route would be upgraded to access the mine site during construction, operation, and post closure. The Burntlog Route would not be built. The Yellow Pine Route consists of two existing roads (i.e., Johnson Creek and McCall-Stibnite roads) and also would use Warm Lake Road, although not described as part of the Yellow Pine Route, that cross 43 different streams (**Table 4.9-25**). Additionally, public access along the Cabin Creek Groomed OSV Route during operations would include a total of 7 crossings.

Because Johnson Creek Road parallels the course of Johnson Creek, the Yellow Pine Route (on average) is located in closer proximity to surface water bodies than the Burntlog Route considered under Alternatives 1, 2, and 3. Overall, it passes within 100 feet of streams for 6.5 miles or 16 percent of its 40-mile length.

Under Alternative 4, average daily vehicle trips to the mine during construction, operations, and reclamation would be the same as Alternative 1 (except that all traffic would be on the Yellow Pine Route).

Table 4.9-25 Alternative 4 Access Road Stream Crossings

Road	Route/Access	Number of Crossings[1]	Stream Names
Warm Lake Road	Yellow Pine Route	16	▪ Alpine Creek ▪ Beaver Creek ▪ Big Creek ▪ Deep Creek ▪ Little Creek ▪ Little Pearsol Creek ▪ Pearsol Creek ▪ South Fork Salmon River ▪ Warm Lake Creek ▪ 7 Unnamed creeks
Johnson Creek Road	Yellow Pine Route	16	▪ Bear Creek ▪ Coffee Creek ▪ Ditch Creek ▪ Halfway Creek ▪ Hanson Creek ▪ Johnson Creek ▪ Lunch Creek ▪ Moose Creek ▪ Olson Creek ▪ Park Creek ▪ Pid Creek ▪ Riordan Creek ▪ Rustican Creek ▪ Sheep Creek

Road	Route/Access	Number of Crossings[1]	Stream Names
			▪ Trapper Creek ▪ Trout Creek
McCall-Stibnite Road	Yellow Pine Route	11	▪ 3 Unnamed creeks ▪ Double A Creek ▪ EFSFSR ▪ Profile Creek ▪ Tamarack Creek ▪ Salt Creek ▪ Sugar Creek ▪ Vibika Creek ▪ Whiskey Creek
Cabin Creek Groomed OSV Route	Cabin Creek Groomed OSV Route	7	▪ Cabin Creek ▪ Lunch Creek ▪ Pid Creek ▪ Park Creek ▪ Sheep Creek ▪ Trout Creek ▪ Warm Lake Creek

Table Source: IDEQ 2018

Table Notes:

1 The number of crossings listed for each road segment/route is for individual streams; in some cases, the road/route segment may cross one or more streams at multiple locations.

The remainder of this section discusses surface water impacts in the context of applicable water quality indicators.

Sediment – Alternative 4

Road and Culvert Construction

The number of streams crossed along Yellow Pine Route (43) would be the same as Alternative 1. However, the Yellow Pine Route would be widened and upgraded under Alternative 4. Therefore, surface water quality impacts from erosion and sedimentation during access road construction could increase during the construction activities and would require implementation of sediment and erosion BMPs.

Not developing mine site access along the Burntlog Route, and not constructing the Burnt Log Road (FR 447) extension, would avoid construction-related impacts from sedimentation at 21 different streams compared to Alternative 1. These streams include Burntlog Creek, East Fork Burntlog Creek, the EFSFSR, Johnson Creek, Landmark Creek, Peanut Creek, Rabbit Creek, Riordan Creek, Trapper Creek, and 12 unnamed waterbodies.

Based on permit-related design requirements, use of BMPs, and required maintenance activities, the potential for access road-related erosion and sedimentation would be minimal under this alternative (limited to periods of substantial overland flow, such as from very large rainfall events). The duration for this erosion/sedimentation potential would last throughout the entire period of use of Yellow Pine Route (approximately 25 years). Due to the nature of sediment transport by streams, the geographic extent of the impact could be hundreds of feet to miles, depending on many site- and event-specific factors, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

Traffic-related Dust and Erosion

During mine construction, the number of daily vehicle trips to the mine site would be the same as Alternative 1. The number of daily vehicle trips also would be the same during mine operations and reclamation; however, all vehicle trips would traverse the Yellow Pine Route under this alternative, resulting in greater use of the Yellow Pine Route access roads, and more fugitive dust generation and greater wear and tear on the road surface. In addition, use of the Yellow Pine Route would require 2 extra years of construction. The resulting surface water quality impacts from erosion and sedimentation would therefore differ in location and extent compared to Alternative 1 but would be similar in magnitude because the number of vehicle trips to the mine site would remain the same.

Prevention of these types of impacts would be achieved through proper road design, construction, grade control, fugitive dust control and, in the winter months, snow removal and “sanding” using gravel and coarse sand with minimal fines to avert slippery conditions and reduce off-site sedimentation during the spring runoff season. Motor graders would be used to retain a good running surface that includes the maintenance of road grade, crown, super-elevation, shoulder, and intersections. Routine grading and spot gravelling would be undertaken on an as-needed basis, and road surface and culverts would be kept free of major obstructions (e.g., fallen trees and stray rocks). Additionally, Midas Gold would strive to avoid major road maintenance and reshape-work during periods of high rainfall and snowmelt to prevent road erosion.

In dry months, Midas Gold would water the Yellow Pine Route as necessary to mitigate dust emissions. As appropriate and in compliance with Forest Service requirements and mitigation measures, Midas Gold would incorporate dust control products, such as magnesium chloride, lignin sulfonate, or other appropriate and environmentally acceptable products, to further enhance dust control along the route. The Forest Service would require that where the road surface is within 25 feet (slope distance) of surface water, dust abatement would only be applied to a 10-foot swath down the centerline of the road. The rate and quantity of application would be regulated to ensure the chemical is absorbed before leaving the road surface.

During winter months, Yellow Pine Route would be plowed for snow removal and sanded for winter driving safety. To protect surface water, snow removal standards or performance would include: depositing snow and ice away from stream channels, maintaining appropriate snow floor depth to protect the roadway; clearly marking culverts and stream crossings; and no use of ice and snow removal chemicals.

Overall, based on identified maintenance activities, design features proposed by Midas Gold, mitigation measures required by the Forest Service, and permit stipulations from state and federal agencies, traffic-related dust and erosion/sedimentation would be within the normal range of properly maintained National Forest System roads. The duration for traffic-related dust and erosion/sedimentation would last throughout the entire period of use of the Yellow Pine Route (approximately 27 years); however, the potential for these effects would be incrementally reduced during closure and reclamation (when AADT would be reduced). Due to the nature of airborne dust and sediment transport by streams, the geographic extent of the impact could be hundreds of feet to miles, depending on many site- and event-specific factors, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

Fuels and Hazardous Chemicals – Alternative 4

The potential for surface water quality impacts from accidental fuel or chemical spills along the mine access roads would be the same as Alternative 1. However, all vehicle trips would traverse the Yellow Pine Route under this alternative, resulting in greater use of the Yellow Pine Route access roads. The potential location and extent of accidental spills would therefore differ compared to Alternative 1. The Yellow Pine Route is located in close proximity to streams (i.e., within 100 feet) for 6.5 miles or 18 percent of its approximately 36-mile length, so the potential for fuel and hazardous chemical spills impacting surface water quality is higher than for travel on the Burntlog Route. Overall design features proposed by Midas Gold, mitigation measures required by the Forest Service, and permit stipulations and regulatory requirements from state and federal agencies (including use of USDOT-certified containers and USDOT-registered transporters) would reduce the risk of spills and ensure that effective response is provided should a spill occur.

Impaired Waterbodies – Alternative 4

Of the 43 streams crossed by the Yellow Pine Route and Cabin Creek Groomed OSV, 13 are listed by IDEQ as impaired. **Table 4.9-26** lists the Category 4 or 5 streams, the cause of impairment, and the beneficial use.

Most of the impaired waterbodies are listed for temperature, which is affected when riparian vegetation canopy shading is reduced from natural and anthropogenic impacts such as landslides or wildfires, road construction, and timber harvest. Access roads associated with Alternative 4 would likely have a very small effect on temperature at stream crossings, where vegetation removal of shade-providing canopy would be localized, if required at all. Should removal of canopy be necessary for culvert installation or replacement, the localized nature of canopy removal at crossings would be very small in comparison to the overall listed stream segments (which in many cases are listed for temperature due to widespread loss of canopy as a result of forest fire), and would likely have a negligible effect on overall water temperature.

Access road crossings of the EFSFSR and Sugar Creek would not contribute any arsenic or mercury loading. Additionally, the Warm Lake Road crossings of the South Fork Salmon River and Beaver Creek are existing paved crossings, where additional SGP-related traffic would not be expected to contribute to sedimentation at the South Fork Salmon River Bridge or have effects to biota or habitat in Cascade. As such, access roads associated with Alternative 4 would not be expected to affect overall progress toward beneficial use attainment of listed streams.

Table 4.9-26 Alternative 4 Access Road Stream Crossings of Impaired Waters

Road	Stream Name	IDEQ Category	Cause of Impairment (Designated Beneficial Use[1])
McCall-Stibnite Road	EFSFSR	5	Arsenic (DWS) Arsenic (SCR)
Johnson Creek Road	Johnson Creek	4A	Water temperature (SS)
Cabin Creek Groomed OSV	Cabin Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Lunch Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Park Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Pid Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Sheep Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Trout Creek	4A	Water temperature (SS)
McCall-Stibnite Road	Profile Creek	4A	Water temperature (SS)
McCall-Stibnite Road	Sugar Creek	5	Mercury (COLD) Arsenic (SCR)
Warm Lake Road	Beaver Creek	5	Combined biota/habitat bioassessments (COLD)
Warm Lake Road	South Fork Salmon River	4A	Water temperature (SS) Sedimentation (COLD)
Warm Lake Road	Warm Lake Creek	4A	Water temperature (SS)

Table Source: IDEQ 2018

Table Notes:

1 DWS = domestic water supply; SCR = secondary contract recreation; SS = salmonid spawning; COLD = cold water aquatic life.

4.9.2.4.2.3 Utilities

The utility alignments and electrical substations planned for Alternative 4 would be the same as Alternative 1. As such, surface water quality impacts resulting from these features also would be the same.

One noteworthy difference with this alternative is that very high frequency radio repeater and cell tower sites located within inventoried roadless areas managed for backcountry/restoration would be constructed and maintained using helicopters. This method of construction and maintenance would reduce the amount of surface disturbance because access roads to the radio repeater and cell tower sites would not be necessary. Any elimination of access roads would help reduce erosion and limit the amount of sediment generated that could potentially impact surface water quality.

4.9.2.4.2.4 Off-site Facilities

Stibnite Gold Logistics Facility – Alternative 4

There would be no change to the SGLF under Alternative 4. Therefore, surface water quality impacts from this facility would be the same as Alternative 1.

Landmark Maintenance Facility – Alternative 4

Under Alternative 4, the Landmark Maintenance Facility would be moved to a site on the south side of Warm Lake Road approximately 0.1 mile south of Landmark. The maintenance facility buildings, including building dimensions and parking/laydown areas would be the same as Alternative 1.

The nearest waterbody to the relocated Landmark Maintenance Facility would be Landmark Creek, which would be just a few feet away from the facility footprint. Landmark Creek is listed by IDEQ as impaired (Category 4A) for water temperature, with a designated beneficial use of salmonid spawning.

Construction and operation of the Landmark Maintenance Facility has the potential for increased runoff, erosion, sedimentation (as a result of vegetation removal and excavation of soil, rock, and sediment) and fuel and/or material discharge to nearby waterbodies during operations (if not properly stored or contained). The potential for these types of impacts would be higher under Alternative 4 due to the very close proximity of the creek to the maintenance facility. However, mitigation measures required by the Forest Service (including design requirements and maintenance standards), and permit stipulations from state and federal agencies (including BMPs, a septic system permit, and SPCC Plan) would help control runoff, erosion, sedimentation, and the potential for discharges. The duration of SGP-related operations at the Landmark Maintenance Facility would be concurrent to mining and ore processing operations and need for road maintenance (approximately 25 years), after which the facility would be reclaimed.

It also should be noted that under this alternative, the maintenance facility would be close enough to Landmark Creek that vegetation removal associated with facility construction could impact canopy vegetation over the creek. As such, the maintenance facility could affect overall progress toward beneficial use attainment of lowering the water temperature in Landmark Creek.

4.9.2.4.3 GROUNDWATER QUALITY

Consistent with the groundwater quality analysis area, the discussion in this section is focused on the mine site.

4.9.2.4.3.1 General Chemistry (pH, Major Ions, TDS, Metals)

Because there would be no changes to the mine site geochemistry compared to Alternative 1, impacts to groundwater pH, TDS, major ion composition, and metals concentrations would be the same as that alternative.

4.9.2.4.3.2 Fuels and Hazardous Chemicals

Potential groundwater quality impacts from accidental spills of fuels and hazardous chemicals would be the same as Alternatives 1.

4.9.2.5 Alternative 5

Under Alternative 5, the Forest Service would not approve the SGP, and therefore no activities proposed on Forest Service lands would be approved as part of the EIS.

Alternative 5 would not include any surface (open-pit) mining or ore processing to extract gold, silver, and antimony, and no underground exploration or sampling or related operations on Forest Service lands would occur. Midas Gold would continue to implement surface exploration and associated activities that have been previously approved on Forest Service lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project Environmental Assessment (Forest Service 2016). These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads), and drilling on both Forest Service and private lands at and in the vicinity of the mine site. The continuation of approved exploration activities at the mine site by Midas Gold would result in the continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip (located primarily on patented land), which would require the continued use of diesel, gasoline, and jet fuel (approximately 141,000 gallons per calendar year) that is stored in aboveground tanks.

Midas Gold would be required to continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and Environmental Assessment, which include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices, and monitoring to ensure that sediment and stormwater BMPs are in place and effective so that soil erosion and other potential resource impacts are avoided or minimized. Additionally, Midas Gold could, pursuant to development of another plan of operations, continue information collecting activities at the mine site and vicinity such as groundwater and surface water monitoring and reporting beyond which is required as part of the Golden Meadows Exploration Environmental Assessment, care and maintenance of stormwater BMPs at over 140 historical mining impact locations, and monitoring stream flow measurements from stream gages installed within creeks.

In the absence of an approved action alternative, access to public land in the area would continue as governed by law, regulation, policy, and existing and future landownership constraints.

4.9.2.5.1 GEOCHEMISTRY

The only geochemical indicator that would be affected by Alternative 5 is the removal of legacy mine tailings and waste rock, which would not occur under the No Action scenario. Leaving the SODA and Bradley tailings in place would perpetuate metals leaching from these sources, effectively preserving the existing mine site geochemistry while simultaneously preventing reductions in current baseline metals concentrations that exceed water quality standards.

4.9.2.5.2 SURFACE WATER QUALITY

4.9.2.5.2.1 Mine Site

The legacy mining wastes have contributed to elevated metals concentrations in surface water. Recent data indicate that antimony, arsenic, and mercury routinely exceed surface water quality standards below the Bradley tailings (HDR 2017). Water quality data collected between 2012 and 2017 indicate that these constituents exceed surface water standards in 44 percent of the samples collected for dissolved and total antimony, 55 to 57 percent of the samples collected for dissolved and total arsenic, and 3 to 27 percent of the samples collected for dissolved and total mercury (Midas Gold 2019). These impacts exist despite the near-neutral surface water pH (median value of 7.41), which shows that the historical mining waste is not causing ARD. Overall, the elevated metals concentrations found in surface water are unlikely to improve in the future without additional remediation which is not currently planned.

Based on water quality data from the mine site seeps, sampled constituents that routinely exceed regulatory criteria in the seeps include aluminum, antimony, arsenic, cyanide, iron, manganese, and mercury (HDR 2017). Water quality data collected between 2012 and 2017 indicate that these constituents exceeded the applicable surface water standard in 42 percent of the seep samples collected for total aluminum, 85 to 88 percent of the samples collected for dissolved and total antimony, 95 percent of the samples collected for dissolved and total arsenic, 23 percent of the samples collected for total cyanide, 21 to 52 percent of the samples collected for dissolved and total iron, 39 to 48 percent of the samples collected for dissolved and total manganese, and 10 to 44 percent of the samples collected for dissolved and total mercury (Midas Gold 2019). Although removal and repurposing of the legacy mine waste would not guarantee an immediate improvement in the water quality of these seeps (unless the seeps also were removed), metals concentrations in the seeps are expected to remain largely static under Alternative 5 because the mine waste would be left in place with no plans for long-term cleanup.

4.9.2.5.2.2 Access Roads

Under Alternative 5, there would be no new or upgraded access roads. Current access to the area, via Johnson Creek Road and Stibnite Road, would continue to be used and would be expected to have traffic levels similar to current conditions. There would be no change to the existing condition of surface water quality related to roads.

4.9.2.5.2.3 Utilities

Under Alternative 5, there would be no changes to the existing transmission lines and no new segment of transmission line constructed. No new communication towers would be established. As such, there would be no change to the existing condition of surface water quality related to utilities.

4.9.2.5.2.4 Off-site Facilities

The SGLF and Landmark Maintenance Facility would not be constructed under this alternative. Existing facilities would likely continue to be used in a similar manner. As such, there would be no change to the existing condition of surface water quality related to off-site facilities.

4.9.2.5.3 GROUNDWATER QUALITY

Soil sampling and analysis indicate that legacy mining wastes have influenced concentrations of arsenic, antimony, and mercury in soil within the mine site. The elevated soil concentrations and continued presence of the waste material provide a pathway for these constituents to leach into groundwater. A review of arsenic, antimony, and mercury data for groundwater samples collected in the Meadow Creek valley between 2012 and 2017 (Midas Gold 2019) shows that concentrations of antimony and arsenic exceed the applicable standard in both alluvial and bedrock wells installed near the historic tailings. The average groundwater antimony concentrations in the Meadow Creek valley range up to 0.99 mg/L in the alluvium and 0.099 mg/L in the bedrock, compared to the Idaho groundwater standard of 0.006 mg/L. Average groundwater arsenic concentrations in the Meadow Creek valley are similarly elevated, ranging up to 1.96 mg/L in the alluvium and up to 0.39 mg/L in bedrock relative to the 0.050 mg/L arsenic standard. The elevated antimony and arsenic concentrations in groundwater are unlikely to improve in the future under Alternative 5.

4.9.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.9.4 Cumulative Effects

The cumulative effects analysis area for surface water quality that could be directly or indirectly affected by the SGP consists of the 22 subwatersheds containing the proposed mine site, access roads, transmission lines, and off-site facilities (**Figure 3.9-1**). This is the same area used to analyze impacts from the SGP and was selected to encompass the extent where potential cumulative surface water quality effects could occur, such as constituent loading and sediment transport.

The cumulative effects analysis area for geochemistry and groundwater quality includes the Sugar Creek and Headwaters EFSFSR subwatersheds (**Figure 3.8-1**). This also is the same extent that was used to analyze impacts from the SGP.

Cumulative effects associated with the SGP consider the range of existing and foreseeable activities and their potential effects with respect to surface water and groundwater quality. Past and present actions that have, or are currently, affecting surface water quality include development projects, transportation projects, mineral exploration and mining activities, and closure and reclamation projects. Past and present actions that have or are currently affecting the mine site geochemistry and groundwater quality mainly include historical mining activity and recent mineral exploration undertaken by Midas Gold.

Reasonably foreseeable future actions that could cumulatively contribute to water quality impacts in the analysis area include:

- South Fork Restoration and Access Management Plan; and
- East Fork Salmon River Restoration and Access Management Plan.

4.9.4.1 Alternative 1

4.9.4.1.1 Surface Water Quality

Historical mining activity in the analysis area has contributed to elevated concentrations of antimony, arsenic, and mercury in mine site streams. Alternative 1 would reduce some of the existing water quality impacts observed in Meadow Creek and the EFSFSR by removing and repurposing legacy mine wastes. Alternative 1 also would contribute new sources of mine waste material to the EFSFSR drainage. Cumulative effects of historical mining activity, removing the legacy waste material, and the proposed open pit mining were incorporated into the Alternative 1 geochemical modeling, and have already been discussed in Section 4.9.2.1.2, Alternative 1 – Surface Water Quality. There are no other past, present, or reasonably foreseeable future actions in the immediate mine site vicinity that would interact with or contribute to water quality effects modeled for the SGP.

Across the rest of the cumulative effects analysis area, future actions that could impact surface water quality would mainly affect stream temperatures and stream sediment concentrations. Other reasonably foreseeable future actions in the analysis area would mainly contribute sediment loading to adjacent streams. Although most of these future actions would likely have sediment control measures in place, the cumulative effect across the watershed may still include higher sediment loads in the EFSFSR and its tributaries.

Valley County Quarry, an active aggregate mine approximately 0.25 mile east-southeast of the village of Yellow Pine, is separated from the EFSFSR and Johnson Creek by the village itself, as well as several FRs and native vegetation buffers. The quarry also includes surface water management features that retain runoff within the mine perimeter Forest Service 2017). Thus, the Valley County Quarry would not contribute to cumulative surface water quality effects in the analysis area.

4.9.4.1.2 GROUNDWATER QUALITY

Historical mining activity in the analysis area also has contributed to elevated concentrations of antimony and arsenic in mine site groundwater. Alternative 1 would reduce some of the existing mine site impacts in the alluvial aquifer by removing and repurposing legacy mine wastes, including the SODA and Bradley tailings. New sources of mine waste material also would be introduced to the analysis area as a result of the SGP. Cumulative effects of the historical mining activity, removing the legacy waste material, and the proposed open pit mining were incorporated into the Alternative 1 geochemical modeling, and have already been discussed in Section 4.9.2.1.3.

4.9.4.2 Alternative 2

4.9.4.2.1 SURFACE WATER QUALITY

Cumulative effects of historical mining activity, removing legacy waste material, and the proposed open pit mining were incorporated into the Alternative 2 geochemical modeling, and have already been discussed in Section 4.9.2.2.2, Surface Water Quality, under Section 4.9.2.2, Alternative 2. There are no other past, present, or reasonably foreseeable future actions in the immediate mine site vicinity that would interact with or contribute to water quality effects modeled for the SGP.

Cumulative effects to stream temperatures and sediment concentrations from reasonably foreseeable future actions would generally be the same as Alternative 1.

4.9.4.2.2 GROUNDWATER QUALITY

Cumulative effects of historical mining activity, removing legacy waste material, and the proposed open pit mining were incorporated into the Alternative 2 geochemical modeling, and have already been discussed in Section 4.9.2.2.3, Groundwater Quality under Section 4.9.2.2, Alternative 2.

4.9.4.3 Alternative 3

4.9.4.3.1 Surface Water Quality

Cumulative effects of historical mining activity and the proposed open pit mining were incorporated into the Alternative 3 geochemical modeling and have already been discussed in Section 4.9.2.3.2, Surface Water Quality, under Section 4.9.2.3, Alternative 3. The SODA and Bradley tailings would not be removed under this alternative, a condition which also was accounted for in the Alternative 3 modeling.

Cumulative effects to stream temperatures and sediment concentrations from reasonably foreseeable future actions would be the same as Alternative 1.

4.9.4.3.2 Groundwater Quality

Cumulative effects of historical mining activity and the proposed open pit mining were incorporated into the Alternative 3 geochemical modeling and have already been discussed in Section 4.9.2.3.3, Groundwater Quality, under Section 4.9.2.3, Alternative 3. The SODA and Bradley tailings would not be removed under this alternative, a condition which also was accounted for in the Alternative 3 modeling.

4.9.4.4 Alternative 4

4.9.4.4.1 Surface Water Quality

Cumulative surface water quality effects of historical mining activity, removing legacy waste material, and the proposed open pit mining would be the same as Alternative 1. During mine operations, cumulative temperature effects in Meadow Creek would be similar to Alternative 2, due to routing the creek in a pipeline around Hangar Flats pit.

Cumulative effects to stream sediment concentrations from reasonably foreseeable future actions would be affected by mine access because Alternative 4 would require all mine-related traffic during construction, operations, and reclamation to use the Yellow Pine Route. This would increase traffic on Yellow Pine Route during the mine operational and reclamation period, leading to greater rutting and degradation, greater road maintenance needs, and potentially higher erosion rates from the road surface along the Yellow Pine Route instead of the Burntlog Route. The cumulative effect from this change could combine with other planned activities in the Johnson Creek watershed to increase the sediment load in Johnson Creek compared to other alternatives. This consideration is especially important given that Johnson Creek Road, the longest segment of Yellow Pine Route, primarily follows the course of Johnson Creek. Thus, any additional sediment or dust generated from increased traffic on the Yellow Pine Route would have a direct pathway be deposited into Johnson Creek.

4.9.4.4.2 GROUNDWATER QUALITY

Cumulative groundwater quality effects of historical mining activity, removing legacy waste material, and the proposed open pit mining would be the same as Alternative 1.

4.9.4.5 Alternative 5

4.9.4.5.1 SURFACE WATER QUALITY

The existing baseline surface water quality associated with the mine site would remain static under Alternative 5, because legacy mining materials would be left in place with no plans for long-term cleanup. Although no new impacts would occur, the propagation of elevated arsenic, antimony, and mercury concentrations could be a cumulative impact that, combined with inputs from other sources, would continue to cause contaminant loading to the environment. For example, mercury inputs from legacy mine wastes at the site would combine with mercury inputs from natural sources (i.e., atmospheric inputs) and other historical mines in the area to contribute to mercury loads in surface water.

Cumulative surface water quality impacts also could occur at the mine site area due to continuing surface exploration for the Golden Meadows Exploration Project. These previously-approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads), and drilling on both Forest Service and private lands at and in the vicinity of the mine site. The continuation of approved exploration activities at the mine site by Midas Gold could cumulatively increase stream sediment levels resulting from surface disturbance and erosion. Exploration activities also could cause cumulative surface water quality impacts through accidental spills of diesel, gasoline, and jet fuel stored at the mine site in aboveground tanks.

4.9.4.5.2 GROUNDWATER QUALITY

Under Alternative 5, groundwater at the mine site would continue to contain elevated arsenic and antimony concentrations as long as the legacy mining materials are left in place. Cumulative groundwater quality impacts also could occur as a result of continued subsurface exploration conducted for the Golden Meadows Exploration Project.

4.9.5 Irreversible and Irretrievable Commitments of Public Resources

4.9.5.1 Alternative 1

With respect to geochemistry, gold, silver, and antimony are non-renewable resources that would be mined from ore deposits and then milled to remove the metals, constituting an irreversible commitment of mineral/geochemical resources. Other metals and elements present in the Yellow Pine, Hangar Flats, and West End Deposits that are not currently economically viable also would be removed from their native geologic setting, and may not be retrievable in the future.

Additionally, under Alternative 1, the geochemistry of the mine site would be altered by removing and disposing of legacy mine waste, and by introducing new sources of waste material to the natural environment, including tailings, development rock, and exposed PAG material in the pit walls. The geochemical changes brought about by mining would therefore be irretrievable, because in many cases the geochemical impacts are predicted to persist throughout the entire 100-year post closure period.

No irreversible surface water quality impacts would occur because surface water is a renewable resource. However, surface water quality changes caused by Alternative 1 would effectively be irretrievable when they are predicted to persist throughout the entire 100-year post closure period. For example, average mercury concentrations in Meadow Creek are predicted to be above the measured baseline range from post closure year 5 onwards (**Figure 4.9-5**). This type of long-term concentration change would be considered an irretrievable impact because it may limit the productivity of the surface water resource for designated uses.

Groundwater at the mine site also can be considered a renewable resource because it is adequately replenished by natural recharge, preventing the occurrence of irreversible groundwater impacts except beneath mine facilities such as the TSF and DRSFs where reductions in recharge would permanently lower groundwater levels. Irretrievable impacts would occur when concentration changes in the mine site groundwater are predicted to persist throughout the entire 100-year post closure period. For example, average arsenic concentrations in groundwater beneath the Hangar Flats DRSF are predicted to exceed the baseline level starting in mine year 2 and extending through the post closure period. This type of long-term concentration change would be considered an irretrievable impact because it may limit the productivity of groundwater for designated uses.

4.9.5.2 Alternative 2

Irreversible and irretrievable geochemical impacts would be the same as Alternative 1. Even though the mine site configuration would change under this alternative, the same amount of ore would be mined, and the same amount of waste material would be generated.

Alternative 2 would reduce the magnitude of irretrievable surface water and groundwater quality impacts relative to Alternative 1 due to mitigation measures proposed by Midas Gold. However, long-term water quality constituent concentration increases would still occur that represent irretrievable water quality impacts. For example, mercury concentrations at EFSFSR assessment node YP-SR-10 would exceed the average background level from post closure year 5 onwards (Brown and Caldwell 2019b). In groundwater, average post closure arsenic concentrations beneath the Hangar Flats DRSF also are predicted to be above the baseline level.

4.9.5.3 Alternative 3

Under Alternative 3, irreversible geochemical impacts would be the same as Alternative 1. However, irretrievable impacts would change because the SODA and Bradley tailings would not be removed. Due to leaving these legacy materials in place, irretrievable surface water and groundwater quality impacts would be higher in magnitude and longer in duration than the other alternatives. This concept is illustrated by the predicted arsenic trend at EFSFSR assessment node YP-SR-6 (**Figure 4.9-16**), where the Alternative 3 arsenic concentrations remain elevated above baseline (and above the other alternatives) throughout the entire post closure period.

4.9.5.4 Alternative 4

Under Alternative 4, irreversible geochemical impacts would be the same as Alternative 1. Irretrievable geochemical and water quality impacts also would be the same.

4.9.5.5 Alternative 5

Under Alternative 5, there would be no open pit mining or removal of legacy waste material at the mine site. Consequently, no changes would occur to current geochemical, surface water, or groundwater conditions in the analysis area, and no change to the current commitment of these resources would occur. Therefore, there would be no irreversible or irretrievable commitment of geochemical, surface water, or groundwater resources.

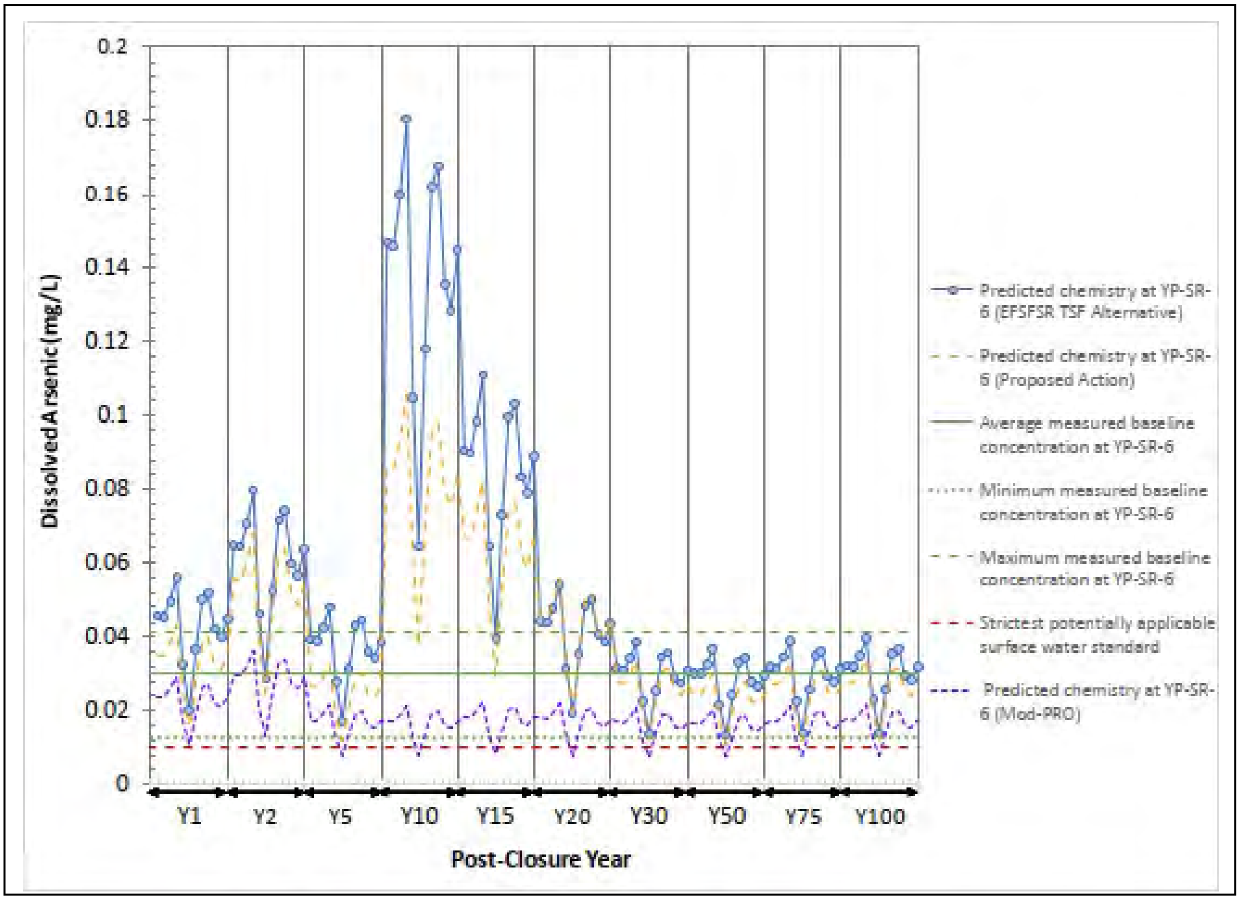


Figure Source: Modified from Brown and Caldwell 2019b, Figure C-37

Figure 4.9-16 Predicted Arsenic Concentrations at YP-SR-6

4.9.6 Short-term Uses versus Long-term Productivity

4.9.6.1 Alternative 1

Mining by its nature is a short-term land use that typically results in long-term geochemical impacts by permanently altering the natural environment. For Alternative 1, mining-related changes include open pit mining and disposition of mine waste material in the TSF and DRSFs. The long-term impacts associated with these features have been quantified through modeling as discussed above, and would be offset to a degree by removal, reprocessing, and disposal of the SODA and Bradley tailings material currently present in Meadow Creek valley. However, there are still several constituents that are predicted to be permanently elevated above background and/or applicable water quality standards in surface water or groundwater throughout the entire 100-year model-simulated post closure period. Due to these predicted water quality changes, water treatment of several mine-related discharges would be required to maintain the long-term productivity of water resources both within and downgradient of themine area.

4.9.6.2 Alternative 2

Similar to Alternative 1, the long-term productivity of water resources would be affected for the entire 100-year post closure period by the short-term mining land use. However, based on geochemical modeling results, Alternative 2 would reduce the magnitude of surface water and groundwater productivity losses due to mitigation measures proposed by Midas Gold.

4.9.6.3 Alternative 3

Losses in long-term surface water and groundwater productivity would be greatest under Alternative 3 due to not removing the legacy mine waste material from Meadow Creek valley. This concept is illustrated in a general sense by predicted post closure arsenic concentration trends in the EFSFSR, as shown on **Figure 4.9-16** above.

4.9.6.4 Alternative 4

Under Alternative 4, long-term losses of groundwater and surface water productivity would be the same as Alternative 1.

4.9.6.5 Alternative 5

Under Alternative 5, there would be no open pit mining or removal of legacy waste material at the mine site. Consequently, no short-term use would occur that would affect geochemical, surface water, or groundwater resources, and no change in long-term productivity would occur.

4.9.7 Summary

All action alternatives would include handling and storage of mineralized materials which could potentially leach major ions, total dissolved solids, and/or metals and could result in adverse impacts to surface water and/or groundwater chemistry. Mineralized materials that would be managed include ore, development rock, and newly generated tailings. The management of these materials would include blasting, excavation, crushing, ore processing to remove the saleable mineral fraction, and onsite disposal of the materials in mine pits, DRSFs, and the TSF. The actions of blasting and crushing would result in potential exposure of these materials to oxygen and water, leading to leaching of major ions, total dissolved solids, and /or metals into nearby surface water and groundwater resources. Similarly, mineralized materials would be exposed in pit walls, also resulting in exposure to oxygen and water, and the potential for leaching. Several proposed activities, including storage of mineralized materials above engineered liners and below engineered caps, diversion of stormwater and surface water around the disposal locations, and movement of legacy mineralized materials (tailings) from their current locations to engineered disposal facilities, would reduce, but not eliminate, the potential for the release of leached chemicals to surface water and groundwater.

The potential impacts of these mineralized materials have been quantified in terms of the volume, area, and location of the exposures, in terms of the chemistry of resulting leachate, and in terms of the resulting surface water and groundwater quality. All action alternatives would result in the generation and deposition of development rock in four locations, including the TSF embankment (61 MT), Hangar Flats DRSF and TSF buttress (81 MT), Fiddle DRSF (68 MT), and Yellow Pine pit DRSF (111 MT). Under Alternatives 1, 3, and 4, development rock also would be deposited in the West End DRSF (25 MT). The West End DRSF would not be developed under Alternative 2. Under Alternative 2, development rock would be deposited in the Midnight pit (6 MT), Hangar Flats pit (18 MT). In addition, 1 MT of waste rock associated with lime generation would be developed under Alternative 2.

All action alternatives also would result in exposure of mineralized rock in pit walls, including some rock materials that would be PAG. These exposures would be within the Hangar Flats pit (37,076 m^2), West End pit (3,333 m^2), Midnight pit (262 m^2), and Yellow Pine pit (120,424 m^2). The exposures would be the same under all action alternatives. Potential leaching from these exposures would be mitigated by backfilling with development rock and/or development of pit lakes, which would reduce the potential for exposure to oxygen.

The analysis shows that the development rock, both that deposited in DRSFs and other receptacles, and that remaining in the pit walls, would be generally non-acid generating, but would be capable of leaching arsenic, antimony, aluminum, manganese, sulfate, TDS, copper, cadmium and zinc into surface water and groundwater in concentrations that exceed water quality criteria.

Under all action alternatives, 100 MT of mineralized material (tailings) would be generated and deposited in the TSF. Under Alternatives 1, 2, and 4, the TSF would be located within the Meadow Creek valley, while the TSF would be located within the EFSFSR drainage under Alternative 3. Legacy tailings, including the Bradley Tailings and SODA materials, would be removed under Alternatives 1, 2, and 4, and placed within the TSF, reducing the potential for these materials to contribute to leaching in the future. These materials would not be removed under Alternative 3. Ore from the West End pit, expected to be representative of potential tailings, would be capable of leaching arsenic, antimony, copper, cyanide, manganese, mercury, nitrite, sulfate, and TDS into surface water and groundwater in concentrations that exceed water quality criteria.

Alternatives 1, 3, and 4 would result in adverse impacts to surface water quality during operations and the post closure/reclamation period. Antimony concentrations are predicted to be elevated above the strictest potentially applicable surface water quality standard of 0.0052 mg/L at 5 of the 10 assessment nodes, with predicted concentrations between 0.009 mg/L and 0.03 mg//L. However, antimony concentrations at most of the nodes are typically less than average measured baseline (i.e., existing) concentrations, representing an overall improvement in water quality. Arsenic concentrations are predicted to be elevated above the strictest potentially applicable surface water quality standard of 0.01 mg/L at six of the ten assessment nodes, with predicted concentrations ranging from 0.014 mg/L to 0.077 mg/L. Predicted arsenic concentrations are generally less than average measured baseline concentrations, representing an improvement in water quality. Under Alternatives 1, 3, and 4, mercury loading caused by mining has the potential to increase production of methyl mercury.

Exceedance of water quality standards would continue after operations into the post closure/reclamation period under Alternatives 1, 3, and 4. Surface water exceedances associated with Yellow Pine pit dewatering would continue until that dewatering was complete in approximately Year 18. Surface water associated with the consolidation of the TSF would exceed water quality standards until the volume of flow dropped to a level where it could be treated in a passive BCR system at the toe of the facility. This exceedance would occur within Meadow Creek under Alternatives 1 and 4, and within the upper EFSFSR under Alternative 3. The exceedance in Meadow Creek also would continue in perpetuity, due to the flow of Meadow Creek through Hangar Flats pit lake.

Under Alternative 2, water in contact with development rock, exposed mineralized surfaces, and tailings would be collected separately from non-contact water, and would be treated to remove antimony, arsenic, and mercury. Treatment would be tailored to the amount and location of water requiring treatment at different locations and different times, and would treat water to meet IPDES permit limits, resulting in water quality standards being met in surface waters. During construction and early operations, small-scale temporary water treatment units would use iron coprecipitation and/or membrane treatment to address water from the Yellow Pine pit and West End pit, TSF embankment and Hangar Flats DRSF, and legacy tailings areas. Water treatment at the WTP under Alternative 2 also may include sulfide precipitation of mercury, if needed to meet IPDES permit limitations.

During closure and reclamation and the post closure period of Alternative 2, toe seepage water from the Fiddle DRSF would be treated in a passive BCR or equivalent system. The WTP would continue to be used to treat water from the TSF consolidation, Yellow Pine pit dewatering, and Hangar Flats pit lake overflow. Once the volume of flow from the TSF dropped to a level where it could be treated in a passive BCR system, that flow to the WTP would cease. Similarly, once Yellow Pine pit dewatering was completed, that flow would cease. However, overflow from the Hangar Flats pit lake would be treated in the WTP in perpetuity. Periodic discharge from the West End pit lake also would be treated in perpetuity using enhanced evaporation or a temporary treatment system.

Surface water quality also could be impacted by modification of temperature due to removal of shading vegetation, development of pit lakes, and modification of stream depth during construction, operations, or the post closure/reclamation period. Baseline summer maximum temperatures range from 11.4°C in Fiddle Creek to 19.8°C in Meadow Creek below East Fork Meadow Creek. Summer maximum temperatures could increase up to 10.5°C under Alternatives 1 and 4, 13.2°C under Alternative 2, and 12.1°C under Alternative 3. As part of the water treatment in the WTP under Alternative 2, there would be little or no change in summer maximum temperatures, but winter temperatures at the discharge outfall on the EFSFSR could increase by up to 4°C.

Surface water quality also could be impacted by increased sedimentation associated with mining activities, access road construction and use, and the construction and maintenance of required utilities. Erosion and sedimentation could occur during active surface material disturbance associated with mine construction, operations, closure, and reclamation, with the greatest potential for in-stream impacts occurring during times of higher overland flow. The effect to surface water quality as a result of sedimentation and erosion would be limited by applicable mitigation strategies and control techniques, by the limited duration of active surface disturbing activities, and by the adaptability of the receiving environment. The magnitude and location of erosion and sedimentation associated with mining activities is expected to be approximately the same for all action alternatives.

Sedimentation impacts also could be caused by the deposition of fugitive dust from vehicles and heavy equipment into adjacent water bodies. These potential impacts would be addressed through fugitive dust control on mine haul roads as necessary to mitigate dust emissions. The extent of sedimentation effects from erosion and fugitive dust would be concentrated at the mine site; however, due to the nature of sediment transport by streams, the geographic extent of the impact could extend farther downstream in the EFSFSR. Impacts also could occur at stream crossings associated with access roads during construction and operations. Access routes would cross 71 streams under Alternative 1, 69 streams under Alternative 2, 71 streams under Alternative 3, and 50 streams under Alternative 4. The magnitude of potential sedimentation impacts associated with site access is expected to be lowest under Alternative 2, due to the 31 percent reduction in heavy vehicle traffic. Under Alternative 4, the magnitude of impacts is expected to be similar to that associated with Alternative 1, but the location of the impacts would be different due to the use of the Yellow Pine Route for site access.

Similar to access roads, surface water quality impacts associated with utilities would primarily occur at stream crossings. Utilities routes would cross 37 streams under Alternative 1, 36 streams under Alternative 2, and 37 streams under Alternative 3. Under Alternative 4. Potential impacts would be reduced due to the use of helicopters for construction and maintenance of communications sites.

Groundwater quality could potentially be impacted by infiltration through mineralized materials in the TSF, through development rock in the DRSFs and pit backfills, and through direct discharge in the RIBs. Under all action alternatives. The TSF would be constructed with a liner system, although the type and location of liner would vary among alternatives. Under Alternative 1, the liner system would include over-drains to collect water that drains to the base of the tailings, which would flow to a sump and be pumped to the tailings supernatant pond for reuse. Underdrains also would be installed beneath the liner to collect groundwater from springs and seeps and convey the water beneath the TSF. Geochemical modeling predicts that groundwater quality beneath the TSF under Alternative 1 would be almost identical to existing groundwater chemistry during both the operational and post closure periods. In addition, the constituents modeled, including arsenic, antimony, and mercury, are uniformly predicted to be below IDAPA 58.01.11 groundwater quality standards in the underlying aquifer.

The TSF liner design under Alternative 2 would include a drainage layer that would function as a leakage collection and recovery system. The liner system under Alternative 3 would be the same as for Alternative 1, but the system would be located within the upper EFSFSR drainage instead of the Meadow Creek drainage. Under Alternative 4, the liner system would be designed to meet current IDAPA standards. Although the liner system proposed under Alternatives 1, 2, and 3 does not meet the default regulatory requirements of IDAPA 50.01.13, Rules for Ore Processing by Cyanidation, Midas Gold has indicated that the TSF liner design would be modified to meet IDAPA regulatory requirements in effect at the time of facility permitting. Therefore, it is likely that the potential for leakage through the liner is low, and approximately equal, for all action alternatives.

Under all action alternatives, metal concentrations would exceed IDAPA 58.01.11 groundwater quality standards below the development rock depositories. At the Hangar Flats DRSF, arsenic concentrations in groundwater beneath the facility are predicted to be elevated above the IDAPA 58.01.11 groundwater quality standard. Concentrations of iron and manganese also would exceed their respective standards, but would not increase above their baseline concentrations. This groundwater would ultimately be discharged to the Hangar Flats pit lake and is incorporated into the water quality calculations for surface water quality discharged from the lake into lower Meadow Creek. Under Alternative 2, this water, now in the Hangar Flats pit lake, would be treated in the WTP in perpetuity, so would not be discharged untreated into lower Meadow Creek.

At the West End DRSF under all action alternatives, arsenic and antimony concentrations would exceed their respective IDAPA 58.01.11 groundwater quality standards beginning during operations, and continuing throughout post closure.

At the Fiddle DRSF under all alternatives, elevated total iron concentrations present in groundwater and development rock would act as an effective adsorbent for metals such as arsenic. The current arsenic concentration, which exceeds the IDAPA 58.01.11 groundwater quality standard, would drop below the standard beginning in Year 2 of the mine operational period and remain below the standard throughout post closure.

At the Yellow Pine pit backfill area, under all action alternatives, concentrations of arsenic, antimony, mercury, and TDS would increase rapidly shortly after the backfill was placed, but would then decrease over time. Mercury and TDS concentrations would drop to below their respective standards, but arsenic and antimony would continue to exceed their respective standards throughout the post closure period.

Disposal of untreated dewatered groundwater into the RIBs under Alternatives 1, 3, and 4 would likely maintain (and not degrade) existing alluvial groundwater quality along the EFSFSR below Meadow Creek. This is because the discharged water would be derived from primarily alluvial groundwater a short distance away which has similar quality. Under Alternative 2, the water disposed in the RIBs would first be treated in the Centralized WTP to meet surface water quality standards. As a result, operation of the RIBs under Alternative 2 would improve groundwater quality within the alluvial aquifer along the EFSFSR below Meadow Creek. Per IDEQ, the RIBs would be permitted through either a groundwater reuse permit or an IPDES permit. A determination of whether the RIBs qualify as discharges to waters of the U.S. would be made during the permitting process.

Both surface water and groundwater quality could potentially be impacted by accidental spills and releases of fuels and hazardous chemicals used in mine construction or operations under all action alternatives. In both cases, implementation of required standard design, permit stipulations, and regulatory requirements governing fuel storage and handling would reduce the risk of spills and ensure that effective response is provided should a spill occur, which would limit impacts to both surface water and ground water quality.

Table 4.9-27 provides a summary comparison of surface water and groundwater quality impacts by issues and indicators for each alternative.

This page intentionally left blank

Table 4.9-27 Comparison of Surface Water and Groundwater Quality Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may affect soil and water resources through acid rock drainage and/or metals leaching from mineralized rock in the mine pits, DRSFs, and TSF.	Volume and disposition of mineralized waste generated.	No new mining waste generated.	Development Rock: • TSF embankment (61 MT) • Hangar Flats DRSF and TSF buttress (81 MT) • Fiddle DRSF (68 MT) • West End DRSF (25 MT) • Yellow Pine Pit backfill (111 MT) Tailings: • TSF (100 MT)	Development Rock: • TSF embankment (61 MT) • Hangar Flats DRSF and TSF buttress (81 MT) • Fiddle DRSF (68 MT) • Yellow Pine Pit backfill (111 MT) • Midnight Pit backfill (6 MT) • Hangar Flats Pit partial backfill (18 MT) • On-site lime generation (1 MT) Tailings: • TSF (100 MT)	Development Rock: • TSF embankment (61 MT) • EFSFSR DRSF and TSF buttress (81 MT) • Fiddle DRSF (68 MT) • West End DRSF (25 MT) • Yellow Pine Pit backfill (111 MT) Tailings: • EFSFSR TSF (100 MT)	Same as Alternative 1.	No new mining waste generated.
	Lithologic composition of final pit walls and exposure of potentially acid-generating material.	No known mapped extent of exposed lithologies in existing Yellow Pine and West End pits.	Area of PAG rock exposed in pit walls: • Hangar Flats Pit (37,076 m^2, 5.1% of total surface area). • West End Pit (3,333 m^2, 0.4%) • Midnight Area Pit (262 m^2, 0.1%) • Yellow Pine Pit (120,424 m^2, 10.5%)	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Not applicable.
	Removal of legacy mine tailings and waste rock. Predicted leachate chemistry of development rock and tailings.	Legacy waste in Meadow Creek valley from historical mining operations, including SODA and Bradley tailings. Not Applicable.	SODA and Bradley tailings removed and repurposed. Development Rock: • Generally non- acid generating but capable of leaching arsenic, antimony, aluminum, manganese, sulfate, TDS, copper, cadmium and zinc above water quality criteria (Section 4.9.2.1.1.4). Tailings: • Anticipated tailings process water chemistry and leachate chemistry provided in **Table 498-9**	SODA and Bradley tailings removed and repurposed. Same as Alternative 1.	No removal of SODA and Bradley Tailings. Same as Alternative 1.	SODA and Bradley tailings removed and repurposed. Same as Alternative 1.	No removal of SODA and Bradley Tailings. Not applicable.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may cause changes in surface water and groundwater quality.	Surface water quality parameters (e.g., pH, temperature, major ions, total dissolved solids, metals, sediment content, and organic carbon).	EFSFSR[1]: • Aluminum (0.010 to 0.016 mg/L) • Antimony (**0.012** to **0.031** mg/L) • Arsenic (**0.025** to **0.063** mg/L) • Copper (0.00023 to 0.00032 mg/L) • Mercury (2.4E-6 to 5.7E-6 mg/L) • Summer Max Temperature (13.4 to 17.4°C) Access Roads: • No mine- related traffic on existing Forest Service roads Utilities: • No transmission line upgrades or new lines constructed	EFSFSR Post-Closure[1, 2]: • Aluminum (0.003 to 0.014 mg/L) • Antimony (**0.009** to **0.026** mg/L) • Arsenic (**0.059** to **0.09** mg/L) • Copper (0.00005 to **0.00268** mg/L) • Mercury (**2.04E-4** to **3.9E-4** mg/L) • Summer Max Temperature (13.9 to 22.3°C) Access Roads: • Mine access roads would cross 71 different streams • 1.69 miles (4 percent) of mine operations access route w/in 100 feet of streams • Sedimentation and fugitive dust predicted to be within the normal range of properly maintained Forest Service roads Utilities: • Mine utility work would cross 37 different streams • Potential for transmission line-related erosion and sedimentation would be minimal	EFSFSR Post-Closure[1,2]: • Aluminum (0.007 to 0.018 mg/L) • Antimony (**0.009** to **0.026** mg/L) • Arsenic (**0.016 to 0.049** mg/L) • Copper (0.00005 to 0.00029 mg/L) • Mercury (5.9E-6 to **1.8E-5** mg/L) • Summer Max Temperature (13.9 to 21.7°C) Access Roads: • Mine access roads would cross 69 different streams • 1.56 miles (4 percent) of mine operations access route within 100 feet of streams • Sedimentation and fugitive dust likely lower than Alternative 1 due to approximate 31 percent reduction in heavy vehicle trips during mine operations Utilities: • Mine utility work would cross 36 different streams • Potential for transmission line-related erosion and sedimentation would be minimal	EFSFSR Post-Closure[1,2]: • Aluminum (0.00047 to 0.020 mg/L) • Antimony (**0.017** to **0.033** mg/L) • Arsenic (**0.083** to **0.13** mg/L) • Copper (0.000033 to **0.010** mg/L) • Mercury (**7.7E-5** to **0.00014** mg/L) • Summer Max Temperature (23 to 25.5°C) Access Roads: • Stream crossings same as Alternative 1 • 1.24 miles (2.8 percent) of mine operations access route within 100 feet of streams Utilities: • Same as Alternative 1	EFSFSR Post-Closure: • Same as Alternative 1 Access Roads: • Mine access roads would cross 50 different streams • 6.5 miles (16 percent) of mine operations access route within 100 feet of streams • Sedimentation and fugitive dust similar in magnitude to Alternative 1, but would differ in location due to exclusive use of YPR for mine access Utilities: • Same as Alternative 1 except for communication sites that would be constructed/ maintained using helicopters, limiting the need for new access roads to these facilities.	Same as existing conditions.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Groundwater quality parameters (e.g., pH, major ions, total dissolved solids, metals).	TSF[1]: • pH (7.57) • Arsenic (0.006 mg/L) • Antimony (0.0020 mg/L) • Mercury (5.6E-7 mg/L) Hangar Flats DRSF[1]: • pH (6.90) • Arsenic (0.006 mg/L) • Iron (**2.63** mg/L) • Manganese (**2.63** mg/L) West End DRSF[1]: • pH (8.15) • Arsenic (**0.30 mg/L)** • Antimony (**0.019** mg/L) • Nitrate+nitrite (0.050 mg/L) Fiddle DRSF[1]: • pH (7.21) • Arsenic (**0.087** mg/L) Yellow Pine Pit Backfill[1]: • pH (**8.54**) • Arsenic **(0.32** mg/L) • Antimony (**0.010** mg/L) • Mercury (3.8E-6 mg/L)	TSF[1]: • pH (7.57) • Arsenic (0.007 mg/L) • Antimony (0.002 mg/L) • Mercury (1.8E-6 mg/L) Hangar Flats DRSF[1]: • pH (6.75) • Arsenic (**0.23** mg/L) • Iron (**1.75 to 2.01** mg/L) • Manganese (**2.41 to 2.50** mg/L) West End DRSF[1]: • pH (8.15) • Arsenic (0.**70** mg/L) • Antimony (**0.13** mg/L) • Nitrate+nitrite (0.05 to **19.7** mg/L) Fiddle DRSF[1]: • pH (7.45) • Arsenic (0.015 mg/L) Yellow Pine Pit Backfill[1]: • pH (**8.6 to 8.9**) • Arsenic (**2.12** mg/L) • Antimony (**0.45** mg/L) • Mercury (**0.0034** mg/L)	TSF: • Same as Alternative 1 Hangar Flats DRSF[1]: • pH (6.76) • Arsenic (**0.36** mg/L) • Iron (**1.69** mg/L) • Manganese (**2.39** mg/L) West End DRSF: • Eliminated (same as existing conditions) Fiddle DRSF[1]: • pH (7.37) • Arsenic (0.02 mg/L) Yellow Pine Pit Backfill[1]: • Same as Alternative 1 Midnight Area Pit Backfill[1]: • pH (**8.7 to 8.9**) • Arsenic (**2.2** mg/L) • Mercury (**0.0042** mg/L) • Antimony (**0.42** mg/L)	TSF[1]: • No change to existing groundwater conditions in the upper EFSFSR EFSFSR DRSF[1]: • pH (7.1) • Arsenic (**0.089** mg/L) • All other constituents below groundwater standards West End DRSF: • Same as Alternative 1 Fiddle DRSF: • Same as Alternative 1 Yellow Pine Pit Backfill: • Same as Alternative 1	Same as Alternative 1.	Same as existing conditions.
The SGP may cause increased mercury methylation in adjacent waterbodies through SGP-related emissions and activities.	Predicted impact on methylmercury production.	MeHg *not detected* in 90 percent of baseline stream samples (<0.1 ng/L)	Post closure MeHg concentrations up to 7.8 ng/L in the EFSFSR without water treatment	No detectable change in MeHg with water treatment	Post closure MeHg concentrations up to 2.8 ng/L in the EFSFSR without water treatment	Same as Alternative 1	Same as existing conditions

Table Notes:

1 **Bolded** concentration values exceed the respective water quality standard.

2 Concentration data for the EFSFSR represent the maximum annual average (Alternatives 1 and 2) or the average (Alternative 3) post closure concentrations predicted for the EFSFSR assessment nodes (YP-SR-10, YP-SR-8, YP-SR-6, YP-SR-4, and YP-SR-2), and do not include effects of water treatment. (Concentration summaries for each individual node by alternative are provided in **Figures 4.9-1, 4.9-12, 4.9-14**, and **Tables 4.9-10, 4.9-18,** and **4.9-22**). Although not discussed in the text of Section 4.9, predicted concentrations are presented in the summary table above for aluminum since aluminum concentrations are relevant to the fish impacts analysis (Section 4.12).

This page intentionally left blank

4.9.8 Model Uncertainty

The model results discussed for groundwater and surface water are based on calibrated groundwater flow and geochemical mass balance models (Brown and Caldwell 2018; SRK 2018b). In the process of preparing this EIS, the project team performed a technical adequacy review of the hydrologic model and SWWC model setup, parameterization, and calibration (ERM 2019). The technical adequacy review of the SWWC existing conditions model found that 75 percent of mass balance concentrations were comparable to actual conditions (i.e., within the ±20 percent acceptable relative percent difference threshold) prior to model calibration, indicating that the major chemistry controls were accounted for in the calculations. These results show that the uncalibrated model can accurately predict most constituents to within ±20 percent of measured values.

For constituents and nodes where the relative percent difference was greater than the 20 percent threshold (which included antimony and arsenic at several nodes), the discrepancy between simulated and observed concentrations was attributed to diffuse unquantified sources of constituent loading in the EFSFSR between Fiddle Creek and Sugar Creek, likely originating from several sources including mineralized bedrock outcrops and subsurface groundwater load inputs. To improve the model calibration, additional loading was added or subtracted from the model to represent the non-specific input to the river and achieve calibration for that constituent at a particular node. This is standard model calibration practice, and the additional loads that were added or subtracted to achieve calibration were carried forward to the Proposed Action (Alternative 1) SWWC model used to generate future water quality predictions.

Despite the overall strengths of the SWWC model, there is uncertainty inherent in the model predictions, as there would be for any model of this type. The technical adequacy review identified the following sources of model uncertainty and potentially non-conservative model assumptions:

1. During the geochemical characterization program, three waste grade development rock samples were reported with paste pH less than 6. Non-acid generating test results indicate that multiple development rock samples could go acidic given that non-acid generating values greater than 10 kilograms sulfuric acid per ton and pH values less than four were confirmed. In addition, the NPR cutoff value used to classify PAG material was arbitrarily selected as the mid-point between PAG and non-PAG thresholds identified in the Global Acid Rock Drainage Guide (International Network for Acid Prevention 2014), and may not fully capture all development rock lithology types with the potential for long-term acid generation. Consequently, there is a risk that the proposed action SWWC model predictions (SRK 2018b) do not adequately capture future PAG contributions to surface water quality. If development rock with NPR ratios greater than 1.5 prove to have PAG properties, the PAG source term used in modeling would need to be applied to a greater number of lithology types, which could result in additional metals loading to the EFSFSR above what is currently predicted.

2. First-flush chemistry for contact water coming off the DRSFs was not considered relevant to surface water quality predictions (SRK 2018b). This is deemed a non-conservative assumption. First-flush releases from the development rock material could cause short-term increases in downstream concentrations above and beyond what is currently predicted by the model.
3. The initial SWWC model predictions did not include mass loading inputs from permitted IPDES outfalls that would be required for the SGP. Additionally, mercury inputs from atmospheric deposition caused by the SGP have not been considered in the model. These additional loads could cause incremental increases in downstream concentrations of mercury and other constituents.
4. Using an air temperature correction to scale laboratory reaction rates to field conditions underestimates modeled chemical release rates and consequent surface water quality impacts.
5. Predictions for ammonia concentrations were not included in the SWWC model report (SRK 2018b).

Additional aspects of the SGP design that could decrease the future accuracy of the SWWC model predictions include:

6. The Proposed Action (Alternative 1) SWWC Model assumes that during the post closure period, surface runoff from the reclaimed DRSFs would only interact with the growth media covers and would not encounter the underlying development rock. As such, post closure runoff from the facilities was assumed to represent rainwater chemistry. However, it is possible that runoff from the DRSFs may be altered by the presence of elevated metals concentrations in growth media soils obtained from the mine site, leading to higher metals concentrations in the DRSF runoff. It is not known to what extent this impact could occur, but if metals concentrations in the DRSF runoff do end up being higher than assumed, the result could be higher than predicted post closure metals concentrations at the downstream surface water assessment nodes. Additionally, if the growth media cover erodes in places and runoff contacts the underlying development rock, constituent concentrations in downgradient streams receiving the runoff could prove to be higher during the post closure period.

7. Predicted concentrations generated by the SWWC Model are for the dissolved fraction only, and may underpredict concentration levels for constituents such as mercury that have been shown to occur in particulate form.

The degree of potential predictive error from the above model assumptions and SGP design features was evaluated through sensitivity analysis simulations (SRK 2019a). Of the model uncertainties identified above, the sensitivity analysis mainly addressed the NPR cutoff value used to classify PAG material, and the air temperature correction used to scale laboratory reaction rates to field conditions. Additional model runs also were conducted to evaluate the sensitivity of scaling assumptions related to the proportion of flow paths and fine particles in the DRSFs and Yellow Pine pit backfill, as well as the pit wall fracture thickness and density.

Findings from the SWWC sensitivity analysis evaluation include the following:

- Varying model input parameters for the sensitivity analysis had no impact on the mine operations model results. This is because the RIBs represent the main loading source that affects surface water quality during mine operations, and contributions from waste rock leachate represent only a small component of the total RIB flow.
- In one of the model sensitivity runs, the NPR cutoff for defining PAG material was increased to 2 (resulting in a greater percentage of pit wall rock and development rock lithology types being classified as PAG). The post closure model results were not sensitive to increasing the NPR cutoff. The lack of model sensitivity to this parameter occurs because the mass loading rates for some constituents are lower in the PAG model source term input compared to some non-PAG units (SRK 2019a). Thus, increasing the percentage of PAG rock in the DRSF and pit lake models does not lead to higher predicted post closure concentrations.
- The model is not sensitive to varying the pit wall blast-damaged zone thickness.
- The SWWC model is most sensitive to inputs that vary the bulk scaling factor of reactive rock, including the percentage of development rock fines, the percentage of rock contacted due to preferential flow paths through the DRSFs, and increasing the reaction temperature.
- When the bulk scaling factor of reactive rock is increased, concentrations of arsenic, antimony, sulfate, mercury, and aluminum are predicted to increase in contact water derived from the DRSFs (SRK 2019a). The constituents exceeding surface water standards in DRSF contact water were the same as those predicted for the Proposed Action (Alternative 1) SWWC Model (SRK 2018b), but the duration of contact water exceedances was affected in the model sensitivity runs.
- When contact water from the development rock is mixed with other sources, such as the post closure pit lakes, most constituent concentrations that are higher in the contact water runoff do not increase to the same extent at modeled downstream locations. The smaller downstream increases are due to mixing of contact water with other water sources and/or mineral precipitation. The main exception is arsenic, which was shown to increase substantially during the post closure period in the pit lakes and surface water assessment nodes when the reaction temperature was increased to 12°C (SRK 2019a).

Although not considered in the SWWC sensitivity analysis, mass loading from IPDES outfalls was included in the Alternative 2 water treatment model scenario presented in the Water Quality Management Plan (Brown and Caldwell 2020). Results of the water treatment simulation show that concentration reductions achieved by treating mine contact water greatly outweigh any loading contribution from the Centralized WTP outfall.

Overall, the SWWC Model Sensitivity Analysis (SRK 2019a) and the Alternative 2 water treatment modeling (Brown and Caldwell 2020) address model uncertainty and non-conservative assumptions associated with items 1 (acid generation potential), 3 (IPDES outfalls), and 4 (air temperature correction) above. The sensitivity analysis and model treatment simulations show that changing the NPR cutoff for defining PAG material and adding the load from the WTP outfall do not substantially alter predicted mine operational or post closure concentrations. However, increasing the reaction temperature in the DRSFs and pit walls was shown to produce higher post closure arsenic concentrations in the pit lakes and downstream assessment nodes. Effects of model uncertainty from first-flush chemistry, the DRSF growth media covers, potential ammonia generation, and simulating dissolved rather than total concentrations have not been evaluated.

4.10 VEGETATION: GENERAL VEGETATION COMMUNITIES, BOTANICAL RESOURCES, AND NON-NATIVE PLANTS

4.10.1 Effects Analysis Indicators and Methodology of Analysis

Issue: The Stibnite Gold Project (SGP) would impact forested Potential Vegetation Groups (PVGs) within U.S. Forest Service (Forest Service)-administered land and could impact the ability of these areas to reach desired conditions.

Indicators:

- Acres of SGP disturbance to previously undisturbed forest PVGs within Forest Service-administered land.

Issue: The SGP would impact non-forested areas (i.e., those that are identified through PVG mapping as not being successional to forests) within Forest Service-administered land and could impact the ability of these areas to reach desired conditions.

Indicators:

- Acres of SGP disturbance to previously undisturbed non-forested areas within Forest Service-administered land.

Issue: The SGP would impact vegetation outside the boundaries of the Forests.

Indicators:

- Acres of SGP disturbance in previously undisturbed LANDFIRE existing vegetation types outside Forest Service boundaries.

Issue: The SGP would remove whitebark pine individuals, and habitat conversion associated with the SGP would impact seed production, dispersal, and establishment of this species.

Indicators:

- Number of acres of whitebark pine occupied habitat impacted by the SGP.
- Estimated number of mature whitebark pine trees to be cut during SGP construction.

Issue: The SGP would impact known occurrences of Regional and Forest-specific designated sensitive and forest watch plant species.

Indicators:

- Presence of known occurrences of sensitive or forest watch plant species or occupied habitat within 300 feet of the SGP disturbance area.

Issue: The SGP would result in a direct loss of modeled potential habitat for Regional and Forest-specific designated sensitive and forest watch plant species.

Indicators:

- Acres of modeled potential habitat for Regional and Forest-specific designated sensitive and forest watch plant species disturbed by the SGP.

Issue: SGP actions would result in increased potential for non-native plant establishment and spread.

Indicator:

- Total acres of land disturbed by the SGP.

4.10.1.1 Data Sources

4.10.1.1.1 Available Information

Vegetation was analyzed using information referenced from a variety of sources.

The following sources provide the basis for analysis of impacts to vegetation communities in the analysis area:

- Forest Service Vegetation Classification Mapping and Quantitative Inventory (VCMQ) existing vegetation mapping for the Payette National Forest (PNF) and the Boise National Forest (BNF), last updated in 2016 (PNF) and 2017 (BNF);
- Forest Service potential vegetation mapping for the PNF and BNF, last updated in 2005 (PNF) and 2017 (BNF); and
- LANDFIRE existing vegetation type layer, which is based on NatureServe Ecological Systems, Version 1.13 (Data date: Oct. 23, 2009).

The following sources provided the basis for analysis of impacts to threatened, endangered, proposed, or candidate, sensitive, and forest watch plant species in the analysis area:

- U.S. Fish and Wildlife Service Information, Planning, and Conservation Online Database (2019);
- Forest Service Region 4 Plant List for sensitive and forest watch species for the PNF and BNF (2016);
- Idaho Natural Heritage Program tracked plant list (2014) and Idaho Fish and Game Conservation Data Center Website (2019);

- Forest Service Rare Plant Geographic Information System Data for the SGP Area (Idaho Fish and Wildlife Information System [IFWIS] 2017);
- Results of past plant species surveys and review (HDR, Inc. [HDR] 2017);
- Vegetation Baseline Study, which was prepared by HDR in November 2013 and revised in April 2017 to characterize existing vegetation in the SGP area (HDR 2017); and
- Addendum #1 to the Vegetation Baseline Study, which was prepared by HDR in December 2014 and revised April 2017 to characterize vegetation along the existing 71-mile-long transmission line corridor that runs from a substation south of the community of Lake Fork to approximately 10 miles west of the mine site (HDR 2017) (Note: no special status plants were located during this survey).
- PNF rare plant list and species habitat descriptions (Forest Service no date);
- BNF rare plant list and species habitat descriptions (Forest Service 2015);
- Reported voucher specimens in Consortium for Pacific Northwest Herbaria (Consortium for Pacific Northwest Herbaria 2018);
- Results of special status plant potential habitat modeling in the analysis area (AECOM 2020a); and
- Results of surveys for whitebark pine (Tetra Tech 2020).

The following sources provided the basis for analysis of impacts relating to non-native plants in the analysis area:

- Geographic Information System information for locations of noxious weeds and non-native plants in the PNF and BNF (Forest Service 2019a).

4.10.1.1.2 Incomplete or Unavailable Information

- PVG and existing vegetation mapping was not available for the portion of the Salmon-Challis National Forest that is overlapped by the SGP.

4.10.2 Direct and Indirect Effects

The following analysis of effects associated with vegetation is considered in the overall context of the affected environment presented in Section 3.10, Vegetation: General Vegetation Communities, Botanical Resources, and Non-Native Plants. Elements of this context include:

- Botanical resources are protected under various regulations, as described in Section 3.10.2, Relevant Laws, Regulations, Policies, and Plans.
- Removal of vegetation can have impacts on other resources such as wildlife, as vegetation is a key component of ecosystems.

Under all action alternatives, the SGP would be required to adhere to Forest Service-required measures (**Table D-1** in **Appendix D**, Mitigation Measures); SGP design features and resource protection measures (**Table D-2** in **Appendix D**, Mitigation Measures); and expected requirements relating to vegetation (expected as part of Endangered Species Act (ESA) Section 7 consultation regarding potential impacts to whitebark pine). Procedures described in the Reclamation and Closure Plan (Tetra Tech 2019) also must be followed.

For organizational purposes, analysis of general effects is presented in this section by the issues outlined above.

4.10.2.1 Types of Impacts Common to All Action Alternatives

This section describes types of impacts that are common to all action alternatives and provides a general description of types of impacts by each phase of the SGP: construction, operations, and closure and reclamation as one discussion. Further discussion of acres impacted under each action alternative are presented in Sections 4.10.2.2 through 4.10.2.5, Alternative 1 through Alternative 4.

4.10.2.1.1 Issue: Impacts to Forested PVGs within Forest Service-Managed Land

Direct and indirect impacts of forested PVGs are described in this subsection. Direct impacts are the ground disturbance and removal of vegetation that would occur immediately at the time of construction. Indirect impacts are those that would occur in the surrounding ecosystem as a result of soil disturbance and vegetation removal.

4.10.2.1.1.1 Direct Impacts

For the purpose of this analysis, direct impacts are those that would occur immediately at the time of SGP construction and within the footprint of construction impacts. Construction would require removal of all vegetation to the ground level for construction of SGP features (i.e., mine site and associated facilities and infrastructure, new road construction and road widening, and transmission line infrastructure). Construction and operation also would require clearing of tall trees within a 50-foot-wide corridor centered on the new and upgraded transmission lines. Vegetation removal and tree clearing would not maintain or move towards desired conditions for vegetation (i.e., species composition, size class, canopy closure, snags and coarse woody debris) as described in the Payette National Forest Land and Resource Management Plan (Payette Forest Plan) (Forest Service 2003) and the Boise National Forest Land and Resource Management Plan (Boise Forest Plan) (Forest Service 2010a). The loss of potential of meeting desired conditions would be a result of impacts including vegetation removal, snags and coarse woody debris removal, and changes to soil structure and composition in areas where soil is disturbed, and a result of several changes to understory plant communities where tall trees are cleared for safe operation of the transmission line.

Clearing of tall trees for the new transmission line corridor would include removing tall tree species and leaving behind species of low growing vegetation such as grasses and shrubs. Other trees within the 100-foot right-of-way and hazard trees that are at risk of obstructing the safe operation of the transmission line would either be trimmed or removed as necessary. Vegetation removal and tall tree clearing would occur during the construction and operation phases in the disturbance footprint of SGP activities. Clearing of tall trees for operation of the transmission line would continue during the operations phase as needed. Impacts of tall tree clearing associated with existing transmission lines would continue in perpetuity, as the existing transmission lines are likely to be maintained by Idaho Power Company after SGP closure and reclamation.

Tall tree clearing would increase availability of soil nutrients, water, and sunlight and likely result in changes of understory species composition and cover in these areas over time (Abella and Springer 2014). Changes to understory vegetation community composition would have cascading effects on the value of these areas as habitat for wildlife and for the distribution of fuels in these areas that are difficult to predict within the SGP area. Heavy vehicle use in disturbed areas and in the area where transmission line tree clearing would occur would result in soil compaction that would negatively impact the ability of these areas to support vegetation.

SGP disturbance to vegetation would begin during construction and continue until decommissioning, where all disturbed areas (with the exception of new, permanent pit lakes, or portions of pit highwalls that are too steep for re-vegetating) would be revegetated during the closure and reclamation phase (Tetra Tech 2019). Revegetation would be done according to Payette or Boise Forest Plan Standards and under the supervision of a Forest Service botanist. However, since it is not possible to precisely determine when or if disturbed or cleared areas would regain the potential for meeting desired conditions, it is assumed that all direct impacts of SGP disturbance or tree clearing on vegetation communities would continue into the foreseeable future.

4.10.2.1.1.2 Indirect Impacts

For the purpose of this analysis, indirect impacts are those that would occur outside construction footprints and possibly at a later time than direct impacts. Impacts from vegetation removal and tall tree clearing would occur in vegetation communities within and adjacent to the SGP. These effects would occur during construction and continue through closure and reclamation. It is likely that any or all these impacts may result in changes to the surrounding ecosystem that persist in perpetuity and would result in these areas not being able to meet desired conditions for the foreseeable future.

Increased Potential for Dust Impacts on Plants

Movement of machinery and vehicles in the SGP area could create dust that could impact the metabolic processes of plants in nearby areas (Farmer 1993). Dispersal distance of dust depends on particle size, wind velocities, and wind direction (Everett 1980) as well as terrain, climate conditions, and vegetation community characteristics in the surrounding area (Etyemezian et al. 2004). As these variables would be unknown throughout the life of the SGP, the distance to which dust deposition may travel is not analyzed. A study by Waser et al. (2017) found that flowering plants approximately 3 to 7 feet from roadsides received substantially more dust and less pollen than those 131 to 164 feet from roadsides, and that most dust was deposited within 98 feet from the road. For the SGP, the potential for dust deposition is likely to be higher in the immediate area of roads and other surface-disturbing actions, but would diminish with distance from these actions.

The impacts of increased dust propagation from SGP activities would be minimized with implementation of best management practices in the Fugitive Dust Control Plan associated with access roads in the SGP analysis area and haul roads at the mine site (Air Sciences Inc. 2018), which are:

1. Allow natural conditions such as wet weather (rain and snow) or inherent material moisture content to maintain dust control until the use of conventional dust control methods is necessary.
2. Limit the speed of the haul trucks and light vehicles.
3. Apply water and chemical dust suppressants on road surfaces.

However, even with strict adherence to dust suppression measures, it is likely that dust propagation would increase due to SGP construction and operations and that vegetation species within and adjacent to the SGP analysis area may be negatively impacted (i.e., metabolic inhibition and inhibition of pollination) as a result of increased dust deposition.

Dust impacts on plants would start during construction and continue through closure and reclamation. Some dust deposition also may occur in the post-closure period where monitoring-related travel on dirt roads would occur; however, this would be negligible. Effects of dust on individual plants would occur immediately at the time of dust propagating activities and is likely to continue throughout the lifetime of affected plants.

Increased Soil Erosion Effects on Plants

Removal of vegetation and disturbance of soil also increases the susceptibility of an area to soil erosion, which results in a variety of effects that tend to limit vegetation reestablishment and growth in an area (Jiao et al. 2009). The exact location and extent of these potential impacts are difficult to predict in relation to SGP facilities but would likely be more pronounced in areas downslope or downstream of facilities and surface-disturbing actions.

Alterations of Hydrology in Habitat for Hydrophilic and Wetland Plants

Road building such as that which would occur for the SGP has been shown to alter wetland hydrology at distances greater than 328 feet through such mechanisms as alteration of hydrologic fluxes, increased nutrient inputs, increased sedimentation rates, and facilitation of the spread of invasive exotic species (Jones 2003). These sorts of impacts could impact wetlands and fens in ways that that could affect the ability of these areas to function as habitat for wetland plants. The effects of hydrological alteration would be greater for species that are highly sensitive to changes in environmental conditions.

Increased Habitat Fragmentation Effects on Plant Populations

Fragmentation is the separation or isolation of similar types of habitat, either by natural events or human activities (Forest Service 2003). Habitat fragmentation due to construction and operations in previously undisturbed areas could have implications for genetics of plant populations, including decreases in genetic variation and gene flow between populations (Aguilar et al. 2008; Young et al. 1996). These effects would be greater for species with low population numbers that already have limited genetic variability.

Loss of Biodiversity and Loss or Disruption of Ecological Functions and Ecosystem Services

Construction and operations could reduce overall biodiversity in the analysis area if species are removed or reduced in numbers as a result of direct or indirect effects of the SGP. Overall reductions in vegetation cover and associated loss of biodiversity and may result in loss or disruption of ecological functions and ecosystem services (Sodhi and Ehrlich 2010), such as:

- Climate regulation (i.e., carbon sequestration)
- Pollution control
- Soil protection and formation (i.e., erosion control)
- Nutrient cycling
- Biodiversity protection
- Water regulation, purification, and supply
- Natural hazard regulation (i.e., the buffering of natural hazards such as flooding, drought, and landslides on the human and natural environment [Millennium Ecosystem Assessment 2005]).

4.10.2.1.2 ISSUE: IMPACTS TO NON-FORESTED VEGETATION COMMUNITIES WITHIN FOREST SERVICE-MANAGED LAND

As is the case for forested vegetation communities, the SGP would impact non-forested areas (i.e., those that are identified through PVG mapping as not being successional to forests), such as grasslands and shrublands. Vegetation removal and soil disturbance in these areas would not maintain or move towards desired conditions as defined by the Forest Plans into the foreseeable future for the same reasons as described in Section 4.10.2.1.1.2, Indirect Impacts.

4.10.2.1.3 ISSUE: IMPACTS TO VEGETATION COMMUNITIES OUTSIDE FOREST SERVICE-MANAGED LAND

Upgrades to the transmission line, and construction of the Stibnite Gold Logistics Facility would occur in areas outside the boundaries of Forest Service-managed lands where PVG mapping is not performed. Tall tree clearing would occur in an area within a 50-foot-wide corridor centered on the upgraded transmission lines in this area. Vegetation removal and soil disturbance in these areas also would result in the same types of direct and indirect impacts as described in Section 4.10.2.1.1, Issue: Impacts to Forested PVGs within Forest Service-Managed Land.

4.10.2.1.4 Issue: Impacts on Known Locations of Whitebark Pine

Construction would require removal of known whitebark pine individuals. Direct impacts to whitebark pine individuals would occur during the construction and operation phases. Removal of whitebark pine individuals, particularly mature, cone-bearing individuals, would reduce the population size of this species in the Forests and potentially have long-term consequences for this species in the analysis area. Loss of whitebark pine individuals would result in reductions in seed production and dispersal, which would result in reduced establishment of this species in and adjacent to the analysis area.

Transport of whitebark pine individuals that are cut down for SGP construction outside the SGP area also has the potential to spread conifer pathogens such as pathogenic bark beetle species (e.g., mountain pine beetle [*Dendroctonus ponderosae*]), which are a main cause of tree mortality in the coniferous forests of the western U.S. in recent years (Hinke et al. 2016). White pine blister rust disease, which is caused by the introduced pathogen *Cronartium ribicola*, is another conifer pathogen (Keane et al. 2017) that has the potential to spread if infected trees are transported outside the SGP area. These pathogens are a threat to whitebark pine in the PNF and BNF, and their potential spread as a result of SGP actions could detrimentally impact whitebark pine and other conifers within and outside the analysis area.

4.10.2.1.5 Issue: Impacts on Known Locations of Sensitive and Forest Watch Species

Direct and indirect impacts could occur where the SGP is planned within 300 feet of special status plant occurrences. The degree of impacts depends on species habitat requirements and the type of SGP activity. This buffer distance was selected based on the U.S. Fish and Wildlife Service Utah Ecological Services Field Office recommendation that a 300-foot buffer distance be in place between surface disturbing activities and plant occurrences to protect special status plants from indirect impacts of surface-disturbing activities (U.S. Fish and Wildlife Service 2014).

The most likely impacts on known occurrences of sensitive and forest watch species include dust impacts on plants and their pollinators due to construction, road use, and changes to hydrology for habitats that support wetland species due to construction of new roads. Species-specific impacts are presented in the analysis sections for each alternative.

4.10.2.1.6 Issue: Impacts on Modeled Potential Habitat for Sensitive and Forest Watch Species

SGP-related removal of vegetation and soil disturbance would result in direct impacts to modeled special status plant potential habitat overlain by SGP components. Additionally, clearing of tall trees within the 50-foot-wide corridor centered on the new and upgraded transmission lines would alter understory vegetation and cause soil compaction to the degree that there may no longer be suitable habitat for any associated special status plant species. Any loss of special status plant potential habitat in areas of vegetation removal or tall tree clearing would occur during SGP construction and would continue into perpetuity, as it is unlikely that potential habitat for these species could be recovered in the same location as soil disturbance would likely preclude conditions necessary for their germination and reestablishment.

Types of indirect impacts to habitat for special status plants would be the same as described for forested PVGs (Section 4.10.2.1.1.2, Indirect Impacts).

4.10.2.1.7 Issue: Increased Potential for Non-native Plant Establishment and Spread

Increases in soil nutrient bioavailability and sunlight associated with vegetation removal and soil disturbance is a driver of non-native species colonization and spread (Hobbs and Huenneke 1992). Soil disturbance and removal of overstory canopies increases the susceptibility of disturbed areas to colonization by non-native plant species in mountain environments (Averett et al. 2016). Negative effects of noxious weed and non-native plant species establishment and spread into natural vegetation communities could result in losses of biodiversity and habitat degradation, leading to losses or disruptions of ecological functioning of invaded areas.

Additionally, vehicle use on roads in the SGP area by construction machinery and other vehicles throughout the life of the SGP is likely to inadvertently transport non-native plants, thereby increasing the potential for non-native plant establishment and spread in areas adjacent to the SGP.

Non-native plant and noxious weed control measures would be employed for the SGP as described in the Weed Management Plan (Midas Gold Idaho, Inc. [Midas Gold] 2015). Specifically, the Weed Management Plan outlines measures for preventing and controlling noxious weed infestations. This plan also includes protocols for noxious weed surveys and reporting. This plan does not specifically discuss non-native plants that are not noxious weeds; however, Midas Gold also would be required to commit to Forest Service-required mitigation measures (**Appendix D**) that meet the intent of all applicable noxious weed and non-native species standards from the Payette and Boise Forest Plans (Forest Service 2003, 2010a). Revegetation that employs certified noxious-weed-free seed and other materials (e.g., mulch) as required under the Forest Plans would reduce the extent of disturbed soil and minimize the potential for colonization and spread of non-native plants, including noxious weeds.

Measures in the Sawtooth and Boise National Forests Invasive Species Project Final Environmental Impact Statement (EIS) and Record of Decision (Forest Service 2019b,c) and the South Fork Salmon River Subbasin Noxious and Invasive Weed Management Program EIS and Records of Decision (Forest Service 2007, 2010b,c) also would be followed.

With the implementation of these measures, potential for colonization and spread of noxious weeds and invasive species in disturbed areas would be reduced. However, even with strict adherence to noxious weed and non-native plant species control measures, some colonization and spread of noxious weeds and non-native species in and adjacent to the SGP area is possible.

Potential for colonization and spread of non-native plants is dependent on a variety of factors that are not able to be predicted for the SGP area. It is generally assumed that potential spread of non-native plants would be of a greater intensity closer to mine site disturbance areas, roadways, and other areas where soil would be disturbed and would dissipate at greater distances from SGP components. Total direct disturbance acres are used as the metric for relative potential colonization and spread of non-native plants under each alternative.

4.10.2.2 Alternative 1

Under Alternative 1, SGP activities would cause direct and indirect effects to vegetation communities, botanical resources, and non-native plants during the construction, operation and maintenance, and closure and reclamation periods.

4.10.2.2.1 Issue: Impacts to Forested Vegetation Communities within Forest Service-Managed Land

Anticipated acreages of direct impacts of vegetation clearing to previously undisturbed forested PVGs within Forest Service-managed lands under Alternative 1 are presented in **Table 4.10-1**. These areas would not maintain or move towards desired conditions into the foreseeable future. Most impacts to PVGs under this alternative would be related to disturbance activities at the mine site and would occur in the Warm, Dry Subalpine Fir (PVG 7) and Persistent Lodgepole Pine (PVG 10) types, which are the most extensive PVGs in the analysis area.

Table 4.10-1 Acres of Disturbance to Previously Undisturbed Forested PVGs Under Alternative 1

PVG	Mine Site	Access Roads	Utilities	Tall Tree Clearing[1]	Total
PVG 1 – Dry Ponderosa Pine/ Xeric Douglas-fir	-	2.1	0.6	0.1	2.7
PVG 2 – Warm, Dry Douglas-fir/ Moist Ponderosa Pine	0.2	56.0	52.4	57.1	165.8
PVG 3 – Cool, Moist Douglas-fir	-	1.4	1.7	3.4	6.5
PVG 4 – Cool, Dry Douglas-fir	2.7	35.9	30.4	38.9	107.9
PVG 5 – Dry Grand Fir	-	2.4	21.0	24.6	48.1
PVG 6 – Moist Grand Fir	-	1.1	13.5	14.8	29.4
PVG 7 – Warm, Dry Subalpine Fir	624.7	143.6	26.6	31.8	826.6
PVG 8 – Cool Moist Subalpine Fir	-	-	-	-	-
PVG 9 – Hydric Subalpine Fir	3.7	14.6	2.2	4.5	25.0

PVG	Mine Site	Access Roads	Utilities	Tall Tree Clearing[1]	Total
PVG 10 – Persistent Lodgepole Pine	354.9	204.5	56.8	59.2	675.6
PVG 11 – High Elevation Subalpine Fir (with Whitebark Pine)	0.3	17.3	5.3	7.0	29.9
TOTALS[2]	**986.6**	**478.9**	**210.6**	**241.4**	**1,917.5**

Table Source: AECOM 2020a; Acres of direct impacts were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017), omitting areas of previous mine site disturbance (Midas Gold 2019)

Table Notes:

1 Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.

2 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.2.2 Issue: Impacts to Non-Forested Vegetation Communities within Forest Service-Managed Land

Anticipated acreages of direct impacts of vegetation clearing to previously undisturbed areas identified as not successional to forested PVGs within Forest Service-managed lands under Alternative 1 are presented in **Table 4.10-2**. These areas would not maintain or move towards desired conditions into the foreseeable future. Most impacts to these areas would be related to disturbance activities at the mine site and would occur in the Douglas-fir and Lodgepole Pine existing vegetation types.

Table 4.10-2 Acres of Disturbance to Areas Identified as not Successional to Forested PVGs Under Alternative 1

Existing Vegetation Type[1]	Mine Site	Access Roads	Utilities	Tall Tree Clearing[2]	Offsite Facilities	Total
Aspen	-	0.1	-	-	-	0.1
Burned Forest Shrublands	-	1.8	0.8	1.9	-	4.5
Burned Herblands	3.4	3.3	1.8	3.3	-	11.8
Burned Sparse Vegetation	0.3	1.9	0.0	0.0	-	2.3
Developed	0.4	0.2	-	-	-	0.6
Douglas-fir	8.7	11.0	2.2	4.2	-	26.1
Douglas-fir/Lodgepole Pine	7.7	-	-	-	-	7.7
Douglas-fir/Ponderosa Pine	-	1.6	0.2	0.3	-	2.1
Engelmann’s Spruce	-	-	-	0.3	-	0.3
Forblands	-	5.0	0.1	1.0	-	6.1

Existing Vegetation Type[1]	Mine Site	Access Roads	Utilities	Tall Tree Clearing[2]	Offsite Facilities	Total
Forest Shrublands	-	1.2	0.9	1.2	-	3.2
Grasslands	2.9	0.3	0.1	0.4	-	3.6
Lodgepole Pine	7.7	9.3	1.4	2.2	3.4	24.1
Mountain Big Sagebrush	-	0.2	-	-	-	0.2
Ponderosa Pine	-	0.3	4.1	1.2	-	5.6
Riparian Herblands	1.9	0.5	-	-	-	2.4
Riparian Shrublands/ Deciduous Forests	1.6	1.1	0.3	2.2	<0.1	5.2
Sparse Vegetation	1.9	0.5	-	0.0	-	2.4
Subalpine Fir	-	3.0	0.1	0.5	-	3.6
Water	-	0.4	-	0.1	-	0.5
Whitebark Pine	-	0.1	0.1	-	-	0.2
TOTALS[3]	**36.6**	**41.7**	**12.0**	**18.9**	**3.5**	**112.6**

Table Source: AECOM 2020a; Acres of direct impacts were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017) and VCMQ mapping (Forest Service 2016), omitting areas of previous mine site disturbance (Midas Gold 2019)

Table Notes:

1 PVG mapping and existing vegetation mapping are performed using different processes and different objectives. As such, forest existing vegetation types may occur within areas identified as not successional to forests in PVG mapping, and alternatively, non-forest existing vegetation types may occur in areas identified as successional to forests in PVG mapping.

2 Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.

3 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.2.3 ISSUE: IMPACTS TO VEGETATION COMMUNITIES OUTSIDE FOREST SERVICE-MANAGED LAND

Anticipated acreages of vegetation clearing in vegetation communities outside Forest Service-managed lands under Alternative 1 are presented in **Table 4.10-3**. In addition to the direct impact of vegetation clearing, these areas would experience the types of indirect impacts described in Section 4.10.2.1.1.2, Indirect Impacts.

Table 4.10-3 Acres of Disturbance to Previously Undisturbed Vegetated Acres Outside Forests Under Alternative 1

PVG	Utilities	Tall Tree Clearing[1]	Offsite Facilities	Total
Artemisia tridentata ssp. *vaseyana* Shrubland Alliance	14.7	15.5	0.4	30.7
Columbia Plateau Low Sagebrush Steppe	0.6	0.1	-	0.8
Dry-mesic Montane Douglas-fir Forest	2.5	3.3	-	5.8
Inter-Mountain Basins Big Sagebrush Shrubland	<0.1	<0.1	-	<0.1
Inter-Mountain Basins Big Sagebrush Steppe	1.0	1.3	-	2.3
Inter-Mountain Basins Montane Sagebrush Steppe	1.7	2.0	-	3.7
Inter-Mountain Basins Sparsely Vegetated Systems	0.8	0.7	-	1.5
Introduced Upland Vegetation-Perennial Grassland and Forbland	4.6	5.2	4.7	14.5
Mesic Montane Douglas-fir Forest	0.2	0.5	0.7	1.4
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	1.6	1.6	-	3.2
Northern Rocky Mountain Conifer Swamp	<0.1	-	-	<0.1
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	11.3	9.2	2.0	22.5
Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	10.4	13.5	3.3	27.1
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	1.0	0.9	-	1.9
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	4.9	6.0	0.4	11.3
Northern Rocky Mountain Subalpine Deciduous Shrubland	2.9	2.5	-	5.4
Northern Rocky Mountain Subalpine-Upper Montane Grassland	0.7	0.8	-	1.5
Open Water	1.5	3.4	-	5.0
Rocky Mountain Alpine/Montane Sparsely Vegetated Systems	-	-	0.1	0.1
Rocky Mountain Lodgepole Pine Forest	1.8	2.5	2.0	6.3
Rocky Mountain Montane Riparian Forest and Woodland	4.9	5.7	-	10.6
Rocky Mountain Poor-Site Lodgepole Pine Forest	0.9	1.0	-	1.9
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	0.4	0.6	0.4	1.4
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	0.1	0.1	-	0.1
Rocky Mountain Subalpine/Upper Montane Riparian Forest and Woodland	1.7	2.0	2.4	6.2

PVG	Utilities	Tall Tree Clearing[1]	Offsite Facilities	Total
Rocky Mountain Subalpine-Montane Mesic Meadow	6.4	5.6	6.4	18.4
Rocky Mountain Wetland-Herbaceous	2.3	3.7	-	6.1
Subalpine Douglas-fir Forest	1.7	2.6	-	4.3
Xeric Montane Douglas-fir Forest	<0.1	<0.1	-	<0.1
TOTALS[2]	**80.6**	**90.4**	**22.9**	**193.9**

Table Source: AECOM 2020b; Acres of direct impacts were calculated by overlaying SGP components outside Forest Service boundaries with LANDFIRE data (LANDFIRE 2009)

Table Notes:

1 Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.

2 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.2.4 Issue: Impacts to Whitebark Pine

Alternative 1 would impact approximately 257.8 acres of occupied whitebark pine habitat and would remove an estimated 1,027 individual trees, 50 of which would be mature, cone-bearing individuals.

Detailed calculations of impacts to whitebark pine occupied habitat and individual trees are reported in **Appendix H-6**, Whitebark Pine Impacts.

The Forest Service has preliminarily determined that Alternative 1 would impact whitebark pine, but will not jeopardize the continued existence of this species.

4.10.2.2.5 Issue: Impacts to Known Locations of Sensitive and Forest Watch Species

Construction of Alternative 1 would impact several known occurrences of sensitive and forest watch plant species. Impacts to special status plants that would occur under this alternative are described in the following subsections.

4.10.2.2.5.1 Bent-flowered Milkvetch (*Astragalus vexilliflexus* var. *vexilliflexus*)

Several subpopulations of a single occurrence of bent-flowered milkvetch, a PNF forest watch species, occur to the east of the proposed mine site (IFWIS 2017; Mancuso 2016). One of the bent-flowered milkvetch subpopulations (the Cinnabar Peak subpopulation) extends from approximately one-quarter mile to approximately 300 feet upslope from the West End Development Rock Storage Facility (DRSF) and West End Creek diversion (Mancuso 2016).

Alternative 1 could impact the Cinnabar Peak subpopulation due to its proximity to the West End DRSF and West End Creek diversion. The most likely impact of the SGP on this subpopulation would be dust associated with construction of the West End DRSF and West End Creek diversion, which could travel upslope and impact this subpopulation or its pollinators. Impacts of dust on the Cinnabar Peak subpopulation could range from mild metabolic inhibition or inhibition of pollination to mortality of individuals; dust also could inhibit pollination success. These impacts may result in reduced ability of this subpopulation to serve as a seed source for future conservation efforts for this species.

The area of potential exploratory drilling (**Figure 2.3-9**) overlaps with subpopulations of this species. Exploratory drilling within this area has the potential to impact this species directly through removal or crushing and/or indirectly via dust deposition or impacts to pollinators.

Alternative 1 may indirectly impact bent-flowered milkvetch individuals and habitat but would not likely contribute to a loss of viability of the species within the planning area (i.e., PNF-administered lands).

4.10.2.2.5.2 Least Moonwort (*Botrychium simplex*)

Two subpopulations of a single occurrence of least moonwort, a Forest Service sensitive species on the PNF and a forest watch species on the BNF, are located in swales adjacent to Johnson Creek Road (County Road [CR] 10-413) (IFWIS 2017) in the BNF. Increased vehicle travel on this road associated with SGP activities would increase dust impacts that could impact these subpopulations and the swale habitat they occur in as compared to current conditions. Maintenance work on this road such as ditch and culvert repair and adding gravel to the road surface also could increase dust impacts on these subpopulations and swales. These subpopulations were not observed by Forest Service surveyors in the most recent survey year (2005; IFWIS 2017); however, if they still exist, increased dust deposition could result in impacts ranging from metabolic inhibition or mortality of individuals.

Alternative 1 may indirectly impact least moonwort individuals and habitat but would not likely contribute to a loss of viability of the species within the planning area (i.e., BNF-administered lands).

4.10.2.2.5.3 Blandow's Helodium (*Helodium blandowii*)

A single occurrence of Blandow’s helodium, a forest watch species on both the PNF and BNF, is found in the analysis area near Trapper Creek within approximately 100 feet from where the proposed Burntlog Route would cross the Trapper Flat wetland in the BNF (IFWIS 2017). Construction of the road in this area could impact hydrology of the wetland that this species inhabits, which could result in conditions that would not support this occurrence.

The SGP also could impact this occurrence due to dust associated with construction of the road and vehicle travel in this area. Increased dust deposition could result in impacts ranging from metabolic inhibition or mortality of individuals.

Alternative 1 may indirectly impact Blandow's helodium individuals but would not likely contribute to loss of viability of the species within the planning area (i.e., BNF-administered lands).

4.10.2.2.5.4 Sweetgrass (*Hierochloe odorata*)

Two subpopulations of a single occurrence of sweetgrass, a forest watch species on the BNF, are located in wetlands near Trapper Creek, the closest being approximately 780 feet and the farthest being 1,000 feet from new construction for Burntlog Route in the BNF (IFWIS 2017). This species is in an area that is hydrologically connected to wetlands that would be impacted by construction of Burntlog Route, and therefore it is considered to be within the analysis area for botanical resources. Construction of Burntlog Route through the wetlands in this area could impact hydrology of the wetland that this species inhabits, which could result in conditions that would not support these subpopulations.

Alternative 1 may indirectly impact sweetgrass individuals and habitat but would not likely contribute to loss of viability of the species within the planning area (i.e., BNF-administered lands).

4.10.2.2.5.5 Sacajawea's Bitterroot (*Lewisia sacajaweana*)

One occurrence of Sacajawea's bitterroot, a Forest Service sensitive species on both the PNF and BNF, occurs approximately 300 feet above Warm Lake Road (CR 10-579) and the existing transmission line corridor near the intersection of Warm Lake Road with Curtis Creek Road (IFWIS 2017) in the BNF. This occurrence is on a hillside above a portion of Warm Lake Road, and the polygon for this occurrence overlaps a transmission line access road that would be used by Idaho Power Company during transmission line reconstruction and SGP operation. Spur road construction and use of this dirt road during transmission line reconstruction and SGP operation would create dust that could negatively impact this occurrence of Sacajawea's bitterroot. Impacts of dust on this species could range from mild metabolic inhibition to mortality of individuals.

Alternative 1 may indirectly impact Sacajawea's bitterroot individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area (i.e., BNF-administered lands).

4.10.2.2.5.6 Rannoch-rush (*Scheuchzeria palustris*)

One occurrence of Rannoch-rush, a forest watch species on the BNF, is located in a wetland in the Mud Lake area in the BNF (Idaho Department of Fish and Game 2004; IFWIS 2017). This occurrence is within 300 feet of an existing portion of Burnt Log Road (National Forest System Road [FR] 447). This occurrence is likely to be impacted by dust associated with road widening and vehicle travel on Burntlog Route in this location. This occurrence also could be subject to other potential indirect effects described in Section 4.10.2.1.1.2, Indirect Impacts. The most likely impact of the SGP on this occurrence is dust associated with construction of the road and vehicle travel in this area. Increased dust deposition could result in impacts ranging from metabolic inhibition or mortality of individuals.

Alternative 1 may indirectly impact Rannoch-rush individuals and habitat but would not likely contribute to loss of viability to the species within the planning area (i.e., BNF-administered lands).

4.10.2.2.6 Issue: Impacts to Modeled Potential Habitat for Sensitive and Forest Watch Species

Table 4.10-4 presents acres of modeled potential habitat for special status plant species that would be directly impacted under Alternative 1 by SGP component. Direct removal of potential habitat would occur in these areas, as well as the types of impacts described in Section 4.10.2.1.1.2, Indirect Impacts.

As under all action alternatives, impacts to habitats for sensitive and forest watch species would predominantly occur at the mine site, with lesser extents of impacts occurring along access roads and transmission lines, including in areas of tall tree clearing.

Table 4.10-4 Acres of Direct Impacts to Modeled Special Status Plant Potential Habitat under Alternative 1

Scientific Name	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total
Allotropa virgata Candystick	74.9	10.6	8.7	5.5	-	99.7
Astragalus vexilliflexus var. *vexilliflexus* Bent-flowered milkvetch	6.7	2.3	3.4	2.1	-	14.5
Botrychium lineare and *B. simplex* Slender moonwort and least moonwort	175.7	38.6	26.5	26.7	<0.1	267.5
Botrychium crenulatum Scalloped moonwort	1.1	3.4	3.2	2.7	-	10.4
Bryum calobryoides Beautiful bryum	-	10.2	6.0	5.0	-	21.1
Buxbaumia viridis Green bug moss	1.4	9.2	11.8	8.8	-	31.2
Calamagrostis tweedyi Cascade reedgrass	651.2	215.8	83.1	49.1	-	999.2
Carex livida Livid sedge	152.5	36.2	20.1	21.0	<0.1	229.8
Carex straminiformis Shasta sedge	2.7	53.9	13.9	9.6	-	80.0
Cicuta bulbifera Bulblet-bearing water hemlock	7.3	1.1	2.3	1.9	-	12.5
Douglasia idahoensis Idaho douglasia	0.4	14.6	4.5	2.5	-	22.0
Draba incerta Yellowstone draba	9.2	23.3	12.2	7.8	-	52.5
Drosera intermedia Spoonleaf sundew	152.5	36.2	20.1	21.0	<0.1	229.8
Epilobium palustre Swamp willow weed	2.3	2.1	6.5	6.8	-	17.7
Epipactis gigantea Giant helleborine orchid	-	12.4	7.6	6.9	-	26.9

Scientific Name	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total
Helodium blandowii Blandow's helodium	123.5	11.4	17.7	18.6	<0.1	171.3
Hierochloe odorata Sweetgrass	76.3	18.6	35.1	19.1	<0.1	149.1
Lewisia sacajaweana Sacajawea's bitterroot	283.7	172.7	45.2	27.0	-	528.6
Mimulus clivicola Bank monkeyflower	-	9.9	20.8	19.0	-	49.7
Penstemon laxus Tufted penstemon	21.9	5.8	15.7	12.1	-	55.6
Polystichum kruckebergii Kruckeberg's sword-fern	126.7	43.1	28.8	13.4	-	212.1
Rhynchospora alba White beaksedge	22.4	5.5	14.8	15.1	-	57.8
Sanicula graveolens Sierra sanicle	180.1	54.3	10.2	3.5	-	248.1
Saxifraga tolmiei var. *ledifolia* Tolmie's saxifrage	68.8	47.7	11.3	7.4	-	135.2
Scheuchzeria palustris Rannoch-rush	152.5	36.2	20.1	21.0	<0.1	229.8
Sedum borschii and *S. leibergii* Borch's stonecrop and Leiberg stonecrop	34.7	4.7	0.2	0.1	-	39.7
Triantha occidentalis ssp. *brevistyla* Short-style tofieldia	125.3	24.5	15.4	16.3	-	181.5

Table Source: Acres of direct impacts to modeled habitat were calculated by overlaying SGP components with modeled potential habitat reported in AECOM 2020a

Table Notes:

1 Due to rounding, numbers presented in this table may not sum precisely to the totals provided. No total acreages for SGP features are presented in this table as modeled potential habitat for many species overlap that of other species.

4.10.2.2.7 ISSUE: INCREASED POTENTIAL FOR NON-NATIVE PLANT ESTABLISHMENT AND SPREAD

Anticipated acreages of vegetation clearing to previously undisturbed vegetation communities both inside and outside Forest Service boundaries under Alternative 1 are presented in **Table 4.10-5**. Increased establishment and spread of non-native plants is possible in these areas.

Table 4.10-5 Total Acres of Disturbance to Vegetation Communities due to SGP Components under Alternative 1

Vegetation	Mine Site	Access Roads	Utilities	Tall Tree Clearing[1]	Offsite Facilities	Total[2]
Forest PVGs (1-11) within Forest Service boundaries	986.6	478.9	210.6	241.4	-	1,917.5
Non-forest Areas within Forest Service boundaries	36.6	41.7	12.0	18.9	3.5	112.6
LANDFIRE vegetation outside Forest Service boundaries	-	-	80.6	90.4	22.9	193.9
TOTALS[2]	**1,023.2**	**520.6**	**303.2**	**350.7**	**26.4**	**2,224.0**

Table Source: AECOM 2020b; Acres of direct impacts to forest PVGs and non-forest areas within Forest Service boundaries were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017) and VCMQ mapping (Forest Service 2016), omitting areas of previous mine site disturbance (Midas Gold 2019). Acres of direct impacts to LANDFIRE vegetation outside Forest Service boundaries were calculated by overlaying SGP components outside Forest Service boundaries with LANDFIRE data (LANDFIRE 2009)

Table Notes:

1 Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.

2 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.3 Alternative 2

Under Alternative 2, the 5.3-mile-long Riordan Creek segment of the Burntlog Route would route it to the southern side of the Riordan Creek drainage and cross Riordan Creek north of Black Lake; the Burntlog Maintenance Facility would be constructed in a borrow source site approximately 4.4 miles east of the junction of Johnson Creek Road (CR 10-413) and Warm Lake Road (CR 10-579); and two sections of the existing transmission line would be relocated. Additionally, the new transmission line would be permanently retained to provide power to the Centralized Water Treatment Plant at the mine site as part of the post-closure Water Quality Management Plan under Alternative 2, and as such, associated tall tree clearing would continue in perpetuity.

4.10.2.3.1 ISSUE: IMPACTS TO FORESTED PVGS WITHIN FOREST SERVICE-MANAGED LAND

Anticipated acreages of disturbance associated with all SGP features in mapped PVGs under Alternative 2 are presented in **Table 4.10-6.** These areas would not maintain or move towards desired conditions into the foreseeable future. As under all action alternatives, most impacts to PVGs under this alternative would be related to disturbance activities at the mine site and would occur in the Warm, Dry Subalpine Fir (PVG 7) and Persistent Lodgepole Pine (PVG 10) types.

Table 4.10-6 Acres of Disturbance to Previously Undisturbed Forested PVGs Under Alternative 2

PVG	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Offsite Facilities	Total[1]
PVG 1 – Dry Ponderosa Pine/ Xeric Douglas-fir	-	2.1	0.6	0.1	-	2.7
PVG 2 – Warm, Dry Douglas-fir/ Moist Ponderosa Pine	0.2	56.0	53.9	60.3	-	170.5
PVG 3 – Cool, Moist Douglas-fir	-	1.4	1.7	3.4	-	6.5
PVG 4 – Cool, Dry Douglas-fir	5.9	35.9	31.5	41.0	-	114.3
PVG 5 – Dry Grand Fir	-	2.4	22.5	26.6	-	51.5
PVG 6 – Moist Grand Fir	-	1.1	14.6	16.5	-	32.2
PVG 7 – Warm, Dry Subalpine Fir	592.9	128.8	26.6	31.8	1.6	781.7
PVG 8 – Cool Moist Subalpine Fir	-	-	-	-	-	-
PVG 9 – Hydric Subalpine Fir	3.3	14.6	2.2	4.5	-	24.6
PVG 10 – Persistent Lodgepole Pine	322.7	197.5	56.8	59.2	3.0	639.3
PVG 11 – High Elevation Subalpine Fir (with Whitebark Pine)	-	17.1	5.3	7.0	-	29.4
TOTALS[1]	**925.0**	**456.9**	**215.7**	**250.5**	**4.6**	**1,852.7**

Table Source: AECOM 2020b; Acres of direct impacts to modeled habitat were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017), omitting areas of previous mine site disturbance (Midas Gold 2019)

Table Notes:

1 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.3.2 ISSUE: IMPACTS TO NON-FORESTED VEGETATION COMMUNITIES WITHIN FOREST SERVICE-MANAGED LAND

Anticipated acreages of direct impacts of vegetation clearing to previously undisturbed areas identified as not successional to forested PVGs within Forest Service-managed lands under Alternative 2 are presented in **Table 4.10-7**. These areas would not maintain or move towards desired conditions into the foreseeable future. As under all action alternatives, most impacts to these areas would be related to disturbance activities at the mine site and would occur in the Douglas-fir and Lodgepole Pine existing vegetation types.

Table 4.10-7 Acres of Disturbance to Previously Undisturbed Areas Identified as not Successional to Forested PVGs within Forest Service-managed lands Under Alternative 2

Existing Vegetation Type[1]	Mine Site	Access Roads	Utilities	Tall Tree Clearing[2]	Total[3]
Aspen	-	0.1	-	-	0.1
Burned Forest Shrublands	-	1.8	0.8	1.9	4.5
Burned Herblands	3.4	3.1	1.8	3.3	11.6
Burned Sparse Vegetation	0.3	3.1	0.0	0.0	3.5
Developed	0.4	0.2	0.2	0.2	1.0
Douglas-fir	8.7	11.0	2.2	4.2	26.2
Douglas-fir/Lodgepole Pine	7.7	-	-	-	7.7
Douglas-fir/Ponderosa Pine	-	1.6	0.2	0.3	2.1
Engelmann's Spruce	-	-	-	0.3	0.3
Forblands	-	5.0	0.1	1.0	6.1
Forest Shrublands	-	1.2	0.9	1.2	3.2
Grasslands	2.9	0.3	0.4	0.7	4.3
Lodgepole Pine	7.7	12.7	1.4	2.2	24.1
Mountain Big Sagebrush	-	0.2	-	-	0.2
Ponderosa Pine	-	0.3	4.4	1.4	6.1
Riparian Herblands	1.9	0.5	0.2	0.7	3.2
Riparian Shrublands/ Deciduous Forests	1.6	1.1	0.3	2.2	5.2
Sparse Vegetation	1.9	0.5	-	0.0	2.4

Existing Vegetation Type[1]	Mine Site	Access Roads	Utilities	Tall Tree Clearing[2]	Total[3]
Subalpine Fir	-	2.9	0.1	0.5	3.6
Water	-	0.4	-	0.1	0.5
Whitebark Pine	-	0.2	0.1	-	0.3
TOTALS[3]	**36.6**	**46.2**	**13.0**	**20.3**	**116.2**

Table Source: AECOM 2020b; Acres of direct impacts were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017) and VCMQ mapping (Forest Service 2016), omitting areas of previous mine site disturbance (Midas Gold 2019)

Table Notes:

1 PVG mapping and existing vegetation mapping are performed using different processes and different objectives. As such, forest existing vegetation types commonly occur within areas identified as not successional to forests in PVG mapping, and alternatively, non-forest existing vegetation types commonly occur in areas identified as successional to forests in PVG mapping.

2 Tall tree clearing would only be performed in areas with tree species, and as such, the actual extent of impacts due to tall tree clearing may not occur to the full acres reported in this column.

3 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.3.3 Issue: Impacts to Vegetation Communities outside Forest Service-Managed Land

Anticipated acreages of direct impacts of vegetation clearing in vegetation communities outside Forest Service-managed lands under Alternative 2 are presented in **Table 4.10-8**. These areas also would experience the types of impacts described in Section 4.10.2.1.1.2, Indirect Impacts.

Table 4.10-8 Acres of Disturbance to Previously Undisturbed Vegetated Acres Outside Forests Under Alternative 2

PVG	Utilities	Tall Tree Clearing[1]	Offsite Facilities	Total[2]
Artemisia tridentata ssp. *vaseyana* Shrubland Alliance	11.0	9.4	0.4	20.9
Columbia Plateau Low Sagebrush Steppe	0.4	0.1	-	0.5
Dry-mesic Montane Douglas-fir Forest	2.5	2.6	-	5.0
Inter-Mountain Basins Big Sagebrush Shrubland	<0.1	<0.1	-	<0.1
Inter-Mountain Basins Big Sagebrush Steppe	0.7	1.3	-	2.0
Inter-Mountain Basins Montane Sagebrush Steppe	1.6	1.4	-	3.0
Inter-Mountain Basins Sparsely Vegetated Systems	0.7	0.4	-	1.2
Introduced Upland Vegetation-Perennial Grassland and Forbland	4.5	4.4	4.7	13.7
Mesic Montane Douglas-fir Forest	0.2	0.5	0.7	1.4
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	1.1	1.4	-	2.5
Northern Rocky Mountain Conifer Swamp	<0.1	-	-	<0.1

PVG	Utilities	Tall Tree Clearing[1]	Offsite Facilities	Total[2]
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	10.7	7.5	2.0	20.2
Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	8.9	10.7	3.3	22.9
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	0.9	0.9	-	1.9
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	4.8	5.8	0.4	11.0
Northern Rocky Mountain Subalpine Deciduous Shrubland	2.6	2.8	-	5.4
Northern Rocky Mountain Subalpine-Upper Montane Grassland	0.4	0.4	-	0.8
Open Water	1.5	3.3	-	4.8
Rocky Mountain Alpine/Montane Sparsely Vegetated Systems	-	-	0.1	0.1
Rocky Mountain Lodgepole Pine Forest	1.9	2.5	-	4.4
Rocky Mountain Montane Riparian Forest and Woodland	4.9	5.5	-	10.4
Rocky Mountain Poor-Site Lodgepole Pine Forest	-	0.3	2.0	2.4
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	0.4	0.6	0.4	1.4
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	0.1	0.1	-	0.1
Rocky Mountain Subalpine/Upper Montane Riparian Forest and Woodland	1.7	2.0	2.4	6.2
Rocky Mountain Subalpine-Montane Mesic Meadow	5.1	5.4	6.4	16.9
Rocky Mountain Wetland-Herbaceous	2.9	4.7	-	7.7
Subalpine Douglas-fir Forest	1.6	2.5	-	4.1
Xeric Montane Douglas-fir Forest	<0.1	<0.1	-	<0.1
TOTALS[2]	**71.3**	**76.7**	**22.9**	**170.8**

Table Source: AECOM 2020b; Acres of direct impacts to modeled habitat were calculated by overlaying SGP components with LANDFIRE data (LANDFIRE 2009)

Table Notes:

1 Tall tree clearing would only be performed in areas with tree species, and as such, the actual extent of impacts due to tall tree clearing may not occur to the full acres reported in this column.

2 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.3.4 Issue: Impacts to Whitebark Pine

Alternative 2 would impact approximately 243.2 acres of occupied whitebark pine habitat and would remove an estimated 997 individual trees, 15 of which would be mature, cone-bearing individuals (**Appendix H-6**).

The Forest Service has preliminarily determined that Alternative 2 would impact whitebark pine, but will not jeopardize the continued existence of this species.

4.10.2.3.5 Issue: Impacts on Known Locations of Sensitive and Forest Watch Species

Alternative 2 would indirectly impact the same known occurrences of special status plants as Alternative 1 (Section 4.10.2.2.5, Issue: Impacts on Known Locations of Sensitive and Forest Watch Species under Alternative 1).

4.10.2.3.6 Issue- Impacts to Modeled Potential Habitat for Sensitive and Forest Watch Species

Tables 4.10-9 presents acres of modeled potential habitat for special status plant species that would be directly impacted under Alternative 2 by SGP component. Direct removal of potential habitat would occur in these areas, as well as the same types of impacts described for PVGs in Section 4.10.2.1.1.2, Indirect Impacts.

Impacts to habitats for sensitive and forest watch species would predominantly occur at the mine site, with lesser extents of impacts occurring along access roads and transmission lines, including in areas of tall tree clearing.

Table 4.10-9 Acres of Direct Impacts to Modeled Special Status Plant Potential Habitat under Alternative 2

Scientific Name	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total
Allotropa virgata Candystick	77.1	10.6	8.7	5.5	-	101.9
Astragalus vexilliflexus var. *vexilliflexus* Bent-flowered milkvetch	6.7	2.3	3.4	2.1	-	14.5
Botrychium lineare and *B. simplex* Slender moonwort and least moonwort	177.0	29.9	27.9	28.1	-	262.9
Botrychium crenulatum Scalloped moonwort	1.1	3.2	3.2	2.7	-	10.2
Bryum calobryoides Beautiful bryum	-	10.2	6.0	5.0	-	21.1
Buxbaumia viridis Green bug moss	1.5	9.2	11.9	8.8	-	31.3
Calamagrostis tweedyi Cascade reedgrass	609.0	190.1	83.1	49.1	0.8	932.0
Carex livida Livid sedge	153.6	27.5	21.5	22.3	-	224.9
Carex straminiformis Shasta sedge	-	69.4	13.9	9.6	-	92.8
Cicuta bulbifera Bulblet-bearing water hemlock	7.3	1.1	2.4	2.0	-	12.7
Douglasia idahoensis Idaho douglasia	0.4	13.1	4.5	2.5	-	20.5
Draba incerta Yellowstone draba	9.2	21.6	12.2	7.8	-	50.7
Drosera intermedia Spoonleaf sundew	153.6	27.5	21.5	22.3	-	224.9
Epilobium palustre Swamp willow weed	2.3	2.1	6.5	6.8	-	17.7

Scientific Name	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total
Epipactis gigantea Giant helleborine orchid	-	12.4	7.6	6.9	-	26.9
Helodium blandowii Blandow's helodium	124.6	10.9	19.2	20.0	-	174.6
Hierochloe odorata Sweetgrass	76.3	18.7	35.8	19.9	-	150.6
Lewisia sacajaweana Sacajawea's bitterroot	287.7	168.1	45.2	27.0	-	528.1
Mimulus clivicola Bank monkeyflower	-	9.9	21.9	19.9	-	51.6
Penstemon laxus Tufted penstemon	22.9	5.8	15.7	12.1	-	56.6
Polystichum kruckebergii Kruckeberg's sword-fern	122.5	41.5	28.8	13.4	0.3	206.5
Rhynchospora alba White beaksedge	23.4	5.5	16.2	16.4	-	61.6
Sanicula graveolens Sierra sanicle	182.2	44.0	10.2	3.5	-	239.9
Saxifraga tolmiei var. *ledifolia* Tolmie's saxifrage	64.2	44.6	11.3	7.4	0.3	127.9
Scheuchzeria palustris Rannoch-rush	153.6	27.5	21.5	22.3	-	224.9
Sedum borschii and *S. leibergii* Borch's stonecrop and Leiberg stonecrop	30.9	4.7	0.2	0.1	-	35.9
Triantha occidentalis ssp. *Brevistyla* Short-style tofieldia	125.6	15.9	15.4	16.4	-	173.2

Table Source: Acres of direct impacts to modeled habitat were calculated by overlaying SGP components with modeled potential habitat reported in AECOM 2020a

Table Notes:

Due to rounding, numbers presented in this table may not sum precisely to the totals provided. No total acreages are presented for SGP components in this table as modeled potential habitat for many species overlaps that of other species.

4.10.2.3.7 ISSUE: INCREASED POTENTIAL FOR NON-NATIVE PLANT ESTABLISHMENT AND SPREAD

Anticipated acreages of vegetation clearing to previously undisturbed vegetation communities both inside and outside Forest Service boundaries under Alternative 2 are presented in **Table 4.10-10**. Increased establishment and spread of non-native plants is possible in these areas.

Table 4.10-10 Total acres of Disturbance to Vegetation Communities due to SGP Components under Alternative 2

Vegetation	Mine Site	Access Roads	Utilities	Tall Tree Clearing[1]	Offsite Facilities	Total[2]
Forest PVGs (1-11) within Forest Service boundaries	925.0	456.9	215.7	250.5	4.6	1,852.7
Non-forest Areas within Forest Service boundaries	36.6	46.2	13.0	20.3	116.2	36.6
LANDFIRE vegetation outside Forest Service boundaries	-	-	71.3	76.7	22.9	170.8
TOTALS[2]	**961.6**	**503.1**	**300.0**	**347.5**	**143.7**	**2,060.1**

Table Source: AECOM 2020b; Acres of direct impacts to forest PVGs and non-forest areas within Forest Service boundaries were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017) and VCMQ mapping (Forest Service 2016), omitting areas of previous mine site disturbance (Midas Gold 2019). Acres of direct impacts to LANDFIRE vegetation outside Forest Service boundaries were calculated by overlaying SGP components outside Forest Service boundaries with LANDFIRE data (LANDFIRE 2009)

Table Notes:

1 Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.

2 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.4 Alternative 3

Under Alternative 3, the Tailings Storage Facility and buttressing DRSF would be located in the East Fork South Fork Salmon River drainage, requiring an approximately 3.2-mile-long segment of the Burntlog Route to be routed through the Blowout Creek Valley; approximately 2.5 miles of the new transmission line would be routed through the Meadow Creek valley within the mine site; the off-highway vehicle trail from Horse Heaven/Powerline to Meadow Creek Lookout Road (FR 51290) would not be constructed; and approximately 7.6 miles of Meadow Creek Lookout Road, from Burntlog Route at the upper portion of Blowout Creek drainage to Monumental Summit, would be improved for public access to connect with Thunder Mountain Road.

4.10.2.4.1 Issue: Impacts to Forested PVGs within Forest Service-Managed Land

Anticipated acreages of disturbance associated with all SGP features in mapped PVGs under Alternative 3 during the construction phase are presented in **Table 4.10-11**. These areas would not maintain or move towards desired conditions into the foreseeable future. As under all action alternatives, most impacts to PVGs would be related to disturbance activities at the mine site and would occur in the Warm, Dry Subalpine Fir (PVG 7) and Persistent Lodgepole Pine (PVG 10) types.

Table 4.10-11 Acres of Disturbance to Previously Undisturbed Forested PVGs Under Alternative 3

PVG	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Total[1]
PVG 1 – Dry Ponderosa Pine/ Xeric Douglas-fir	-	2.1	455.9	0.1	458.1
PVG 2 – Warm, Dry Douglas-fir/ Moist Ponderosa Pine	0.2	56.0	52.4	57.1	165.8
PVG 3 – Cool, Moist Douglas-fir	-	1.4	1.7	3.4	6.5
PVG 4 – Cool, Dry Douglas-fir	5.8	36.5	30.4	38.9	111.6
PVG 5 – Dry Grand Fir	-	2.4	21.0	24.6	48.1
PVG 6 – Moist Grand Fir	-	1.1	13.5	14.8	29.4
PVG 7 – Warm, Dry Subalpine Fir	626.3	154.2	29.5	24.4	834.4
PVG 8 – Cool Moist Subalpine Fir	-	-	-	-	-
PVG 9 – Hydric Subalpine Fir	4.7	14.5	2.2	4.5	26.0
PVG 10 – Persistent Lodgepole Pine	516.2	159.6	56.9	56.6	789.4
PVG 11 – High Elevation Subalpine Fir (with Whitebark Pine)	0.3	16.2	5.3	5.0	26.7
TOTALS[1]	**1,153.6**	**443.9**	**668.9**	**229.4**	**2,495.8**

Table Source: AECOM 2020b; Acres of direct impacts to modeled habitat were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017), omitting areas of previous mine site disturbance (Midas Gold 2019)

Table Notes:

1 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.4.2 ISSUE: IMPACTS TO NON-FORESTED VEGETATION COMMUNITIES WITHIN FOREST SERVICE-MANAGED LAND

Anticipated acreages of direct impacts of vegetation clearing to previously undisturbed areas identified as not successional to forested PVGs within Forest Service-managed lands under Alternative 3 are presented in **Table 4.10-12**. These areas would not maintain or move towards desired conditions into the foreseeable future. As under all action alternatives, most impacts to these areas would be related to disturbance activities at the mine site and would occur in the Douglas-fir and Lodgepole Pine existing vegetation types.

Table 4.10-12 Acres of Disturbance to Previously Undisturbed Areas Identified as not Successional to Forested PVGs within Forest Service-managed lands Under Alternative 3

Existing Vegetation Type[1]	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Offsite Facilities	Total[2]
Aspen	-	-	-	-	-	-
Burned Forest Shrublands	-	1.8	0.8	1.9	-	4.5
Burned Herblands	1.3	3.3	1.8	3.3	-	9.6
Burned Sparse Vegetation	0.2	1.9	0.0	0.0	-	2.2
Developed	0.4	0.2	-	-	-	0.6
Douglas-fir	13.3	11.0	2.2	4.2	-	30.7
Douglas-fir/Lodgepole Pine	0.6	0.1	-	-	-	0.7
Douglas-fir/Ponderosa Pine	-	1.6	0.2	0.3	-	2.1
Engelmann's Spruce	-	-	-	0.3	-	0.3
Forblands	-	5.0	0.1	1.0	-	6.1
Forest Shrublands	-	1.2	0.9	1.2	-	3.2
Grasslands	6.7	0.2	0.1	0.4	-	7.4
Lodgepole Pine	10.1	9.3	1.4	2.2	3.4	26.5
Mountain Big Sagebrush	-	0.2	-	-	-	0.2
Ponderosa Pine	-	0.3	4.1	1.2	-	5.6
Riparian Herblands	0.3	0.5	-	-	-	0.8
Riparian Shrublands/ Deciduous Forests	5.5	1.1	0.3	2.2	0.0	9.1
Sparse Vegetation	1.9	0.5	-	0.0	-	2.4

Existing Vegetation Type[1]	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Offsite Facilities	Total[2]
Subalpine Fir	-	3.0	0.1	0.5	-	3.6
Water	-	0.4	-	0.1	-	0.5
Whitebark Pine	-	-	0.1	-	-	0.1
TOTALS[2]	**40.4**	**41.7**	**12.0**	**18.9**	**3.5**	**116.4**

Table Source: AECOM 2020b; Acres of direct impacts were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017) and VCMQ mapping (Forest Service 2016), omitting areas of previous mine site disturbance (Midas Gold 2019)

Table Notes:

1 PVG mapping and existing vegetation mapping are performed using different processes and different objectives. As such, forest existing vegetation types commonly occur within areas identified as not successional to forests in PVG mapping, and alternatively, non-forest existing vegetation types commonly occur in areas identified as successional to forests in PVG mapping.

2 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.4.3 Issue: Impacts to Vegetation Communities outside Forest Service-Managed Land

Acres of impacts to vegetation communities outside Forest Service-managed land would be the same under Alternative 3 as under Alternative 1 (**Table 4.10-3**), and as such, impacts to vegetation outside Forest Service-managed land would occur to the same degree as under Alternative 1 (Section 4.10.2.2.3, Issue: Impacts to Vegetation Communities outside Forest Service-managed Land).

4.10.2.4.4 Issue: Impacts to Whitebark Pine

Alternative 3 would impact approximately 237.2 acres of occupied whitebark pine habitat and would remove an estimated 892 individual trees, 48 of which would be mature, cone-bearing individuals (**Appendix H-6**).

The Forest Service has preliminarily determined that Alternative 3 would impact whitebark pine, but will not jeopardize the continued existence of this species.

4.10.2.4.5 Issue: Impacts on Known Locations of Sensitive and Forest Watch Species

Alternative 3 would indirectly impact the same known occurrences of special status plants as Alternative 1 (Section 4.10.2.2.5, Issue: Impacts to Known Locations of Sensitive and Forest Watch Species).

4.10.2.4.6 Issue- Impacts to Modeled Potential Habitat for Sensitive and Forest Watch Species

Tables 4.10-13 presents acres of modeled potential habitat for special status plant species that would be directly impacted under Alternative 3 by SGP component. Direct removal of potential habitat would occur in these areas, as well as the types of impacts described for PVGs in Section 4.10.2.1.1.2, Indirect Impacts.

As under all action alternatives, impacts to habitats for sensitive and forest watch species would predominantly occur at the mine site, with lesser extents of impacts occurring along access roads and transmission lines, including in areas of tall tree clearing.

Table 4.10-13 Acres of Direct Impacts to Modeled Special Status Plant Potential Habitat under Alternative 3

Scientific Name	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total[1]
Allotropa virgata Candystick	84.0	8.5	3.2	5.5	-	101.2
Astragalus vexilliflexus var. *vexilliflexus* Bent-flowered milkvetch	6.7	1.9	1.7	2.1	-	12.4
Botrychium lineare and *B. simplex* Slender moonwort and least moonwort	202.7	36.5	5.5	26.7	0.0	271.5
Botrychium crenulatum Scalloped moonwort	1.1	3.3	0.8	2.7	-	7.9
Bryum calobryoides Beautiful bryum	-	10.2	1.6	5.0	-	16.8
Buxbaumia viridis Green bug moss	0.8	9.2	4.3	8.8	-	23.1
Calamagrostis tweedyi Cascade reedgrass	396.5	196.6	36.9	49.1	-	679.1
Carex livida Livid sedge	132.5	33.3	3.7	21.0	0.0	190.5
Carex straminiformis Shasta sedge	2.7	48.2	2.5	9.6	-	63.0
Cicuta bulbifera Bulblet-bearing water hemlock	7.3	1.1	0.2	1.9	-	10.4
Douglasia idahoensis Idaho douglasia	0.4	5.7	1.7	2.5	-	10.3
Draba incerta Yellowstone draba	8.5	17.7	3.2	7.8	-	37.1

Scientific Name	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total[1]
Drosera intermedia Spoonleaf sundew	132.5	33.3	3.7	21.0	0.0	190.5
Epilobium palustre Swamp willow weed	2.3	2.1	1.0	6.8	-	12.2
Epipactis gigantea Giant helleborine orchid	-	12.4	1.9	6.9	-	21.1
Helodium blandowii Blandow's helodium	109.9	9.1	3.1	18.6	0.0	140.8
Hierochloe odorata Sweetgrass	73.2	19.0	18.6	19.1	0.0	130.0
Lewisia sacajaweana Sacajawea’s bitterroot	437.8	129.1	14.7	27.0	-	608.7
Mimulus clivicola Bank monkeyflower	-	9.9	6.1	19.0	-	35.0
Penstemon laxus Tufted penstemon	23.2	5.8	6.6	12.1	-	47.7
Polystichum kruckebergii Kruckeberg’s sword-fern	98.1	43.4	16.2	13.4	-	171.1
Rhynchospora alba White beaksedge	23.6	5.5	2.5	15.1	-	46.8
Sanicula graveolens Sierra sanicle	170.4	53.2	3.7	3.5	-	230.8
Saxifraga tolmiei var. *ledifolia* Tolmie's saxifrage	54.5	41.1	3.1	7.4	-	106.2
Scheuchzeria palustris Rannoch-rush	132.5	33.3	3.7	21.0	0.0	190.5
Sedum borschii and *S. leibergii* Borch's stonecrop and Leiberg stonecrop	50.1	2.3	0.0	0.1	-	52.5
Triantha occidentalis ssp. *brevistyla* Short-style tofieldia	151.3	22.9	3.5	16.3	-	194.1

Table Source: Acres of direct impacts to modeled habitat were calculated by overlaying SGP components with modeled potential habitat reported in AECOM 2020a

Table Notes:

1 Due to rounding, numbers presented in this table may not sum precisely to the totals provided. No total acreages are presented for SGP components in this table as modeled potential habitat for many species overlaps.

4.10.2.4.7 Issue: Increased Potential for Non-native Plant Establishment and Spread

Anticipated acreages of vegetation clearing to previously undisturbed vegetation communities both inside and outside Forest Service boundaries under Alternative 3 are presented in **Table 4.10-14**. Increased establishment and spread of non-native plants is possible in these areas.

Table 4.10-14 Total Acres of Disturbance to Vegetation Communities due to SGP Components under Alternative 3

Vegetation	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Offsite Facilities	Total[1]
Forest PVGs (1-11) within Forest Service boundaries	1,153.6	443.9	668.9	229.4	-	2,495.8
Non-forest Areas within Forest Service boundaries	40.4	41.7	12.0	18.9	3.5	116.4
LANDFIRE vegetation outside Forest Service boundaries	-	-	80.6	90.4	22.9	193.9
TOTALS[1]	**1,194.0**	**485.6**	**761.5**	**338.7**	**26.4**	**2,806.1**

Table Source: AECOM 2020b; Acres of direct impacts to forest PVGs and non-forest areas within Forest Service boundaries were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017) and VCMQ mapping (Forest Service 2016), omitting areas of previous mine site disturbance (Midas Gold 2019). Acres of direct impacts to LANDFIRE vegetation outside Forest Service boundaries were calculated by overlaying SGP components outside Forest Service boundaries with LANDFIRE data (LANDFIRE 2009)

Table Notes:

1 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.5 Alternative 4

Under Alternative 4, the mine site and utilities would operate similarly to Alternative 1. The Burntlog Route would not be constructed, and the Yellow Pine Route would be used for access during mine construction, operations, and closure and reclamation. The Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road (CR 10-579), approximately 0.1 mile south of Landmark.

4.10.2.5.1 Issue: Impacts to Forested PVGs within Forest Service-Managed Land

Anticipated acreages of disturbance associated with all SGP features in mapped PVGs under Alternative 4 during the construction phase are presented in **Table 4.10-15**. These areas would not maintain or move towards desired conditions into the foreseeable future. As under all other alternatives, most impacts to PVGs would be related to disturbance activities at the mine site and would occur in the Warm, Dry Subalpine Fir (PVG 7) and Persistent Lodgepole Pine (PVG 10) types.

Table 4.10-15 Acres of Disturbance to Previously Undisturbed Forested PVGs Under Alternative 4

PVG	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Offsite Facilities	Total[1]
PVG 1 – Dry Ponderosa Pine/ Xeric Douglas-fir	-	2.1	0.6	0.1	-	2.7
PVG 2 – Warm, Dry Douglas-fir/ Moist Ponderosa Pine	0.2	69.2	52.3	57.1	-	178.8
PVG 3 – Cool, Moist Douglas-fir	-	1.4	1.7	3.4	-	6.5
PVG 4 – Cool, Dry Douglas-fir	5.0	28.5	30.4	38.9	0.1	102.9
PVG 5 – Dry Grand Fir	-	2.4	21.0	24.6	-	48.1
PVG 6 – Moist Grand Fir	-	1.1	13.5	14.8	-	29.4
PVG 7 – Warm, Dry Subalpine Fir	634.8	18.5	24.5	31.8	1.4	710.9
PVG 8 – Cool Moist Subalpine Fir	-	-	-	-	-	-
PVG 9 – Hydric Subalpine Fir	3.7	12.3	2.2	4.5	0.3	23.1
PVG 10 – Persistent Lodgepole Pine	355.2	44.9	54.1	59.2	2.3	515.7
PVG 11 – High Elevation Subalpine Fir (with Whitebark Pine)	0.3	-	4.3	7.0	-	11.6
TOTALS[1]	**999.2**	**180.2**	**204.7**	**241.4**	**4.0**	**1,629.6**

Table Source: AECOM 2020b; Acres of direct impacts to modeled habitat were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017), omitting areas of previous mine site disturbance (Midas Gold 2019)

Table Notes:

1 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.5.2 Issue: Impacts to Non-Forested Vegetation Communities within Forest Service-Managed Land

Anticipated acreages of direct impacts of vegetation clearing to previously undisturbed areas identified as not successional to forested PVGs within Forest Service-managed lands under Alternative 4 are presented in **Table 4.10-16**. These areas would not maintain or move towards desired conditions in the foreseeable future. As under all action alternatives, most impacts to these areas would be related to disturbance activities at the mine site and would occur in the Douglas-fir and Lodgepole Pine existing vegetation types.

Table 4.10-16 Acres of Disturbance to Previously Undisturbed Areas Identified as not Successional to Forested PVGs within Forest Service-managed Lands Under Alternative 4

Existing Vegetation Type[1]	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Total[2]
Aspen	-	-	-	-	-
Burned Forest Shrublands	-	0.5	0.7	1.9	3.1
Burned Herblands	3.4	1.4	1.8	3.3	9.9
Burned Sparse Vegetation	0.3	-	0.0	0.0	0.4
Developed	0.5	0.2	-	-	0.6
Douglas-fir	8.7	4.7	2.2	4.2	19.9
Douglas-fir/Lodgepole Pine	7.7	-	-	-	7.7
Douglas-fir/Ponderosa Pine	-	1.8	0.2	0.3	2.3
Engelmann's Spruce	-	-	-	0.3	0.3
Forblands	-	0.2	0.1	1.0	1.2
Forest Shrublands	-	1.2	0.9	1.2	3.2
Grasslands	2.9	0.2	0.1	0.4	3.5
Lodgepole Pine	7.7	9.6	1.4	2.2	20.9
Mountain Big Sagebrush	-	-	-	-	-
Ponderosa Pine	-	0.3	4.1	1.2	5.6
Riparian Herblands	1.9	0.2	-	-	2.1
Riparian Shrublands/ Deciduous Forests	1.6	0.7	0.3	2.2	4.8
Sparse Vegetation	1.9	0.7	-	0.0	2.6
Subalpine Fir	-	0.1	0.1	0.5	0.7
Water	-	0.3	-	0.1	0.5
Whitebark Pine	-	-	0.1	-	0.1
TOTALS[2]	**36.7**	**22.0**	**12.0**	**18.9**	**89.5**

Table Source: AECOM 2020b; Acres of direct impacts were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017) and VCMQ mapping (Forest Service 2016), omitting areas of previous mine site disturbance (Midas Gold 2019)

Table Notes:

1 PVG mapping and existing vegetation mapping are performed using different processes and different objectives. As such, forest existing vegetation types commonly occur within areas identified as not successional to forests in PVG mapping, and alternatively, non-forest existing vegetation types commonly occur in areas identified as successional to forests in PVG mapping.

2 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.5.3 ISSUE: IMPACTS TO VEGETATION COMMUNITIES OUTSIDE FOREST SERVICE-MANAGED LAND

Acres of impacts to vegetation communities outside Forest Service-managed land would be the same under Alternative 4 as under Alternative 1 (**Table 4.10-3**), and as such, impacts to vegetation outside Forest Service-managed land would occur to the same degree as under Alternative 1.

4.10.2.5.4 ISSUE: IMPACTS TO WHITEBARK PINE

Alternative 4 would impact 123.6 acres of occupied whitebark pine habitat and would remove an estimated 613 individual trees, 48 of which would be mature, cone-bearing individuals (**Appendix H-6**).

The Forest Service has preliminarily determined that Alternative 4 would impact whitebark pine, but will not jeopardize the continued existence of this species.

4.10.2.5.5 ISSUE: IMPACTS ON KNOWN LOCATIONS OF SENSITIVE AND FOREST WATCH SPECIES

Construction of Alternative 4 would impact several known occurrences of sensitive and forest watch plant species. Impacts to occurrences of special status plants that would occur under this alternative are described in the following subsections.

4.10.2.5.5.1 Bent-flowered Milkvetch (*Astragalus vexilliflexus* var. *vexilliflexus*)

Alternative 4 could impact the Cinnabar Peak bent-flowered milkvetch subpopulation in the same manner as would occur under Alternative 1 (Section 4.10.2.2.5.1, Bent-flowered Milkvetch) due to its proximity to the West End DRSF and West End Creek diversion.

Alternative 4 may indirectly impact bent-flowered milkvetch individuals and habitat but would not likely contribute to a loss of viability of the species within the planning area (i.e., PNF-administered lands).

4.10.2.5.5.2 Least Moonwort (*Botrychium simplex*)

Alternative 4 could impact subpopulations of the occurrence of least moonwort in the same manner as would occur under Alternative 1 (Section 4.10.2.2.5.2, Least Moonwort).

Alternative 4 may indirectly impact least moonwort individuals and habitat but would not likely contribute to a loss of viability of the species within the planning area (i.e. BNF-administered lands).

4.10.2.5.5.3 Sacajawea's Bitterroot (*Lewisia sacajaweana*)

Alternative 4 could impact the occurrence of Sacajawea's bitterroot in the same manner as would occur under Alternative 1 (Section 4.10.2.2.5.5, Sacajawea's Bitterroot).

Alternative 4 may indirectly impact Sacajawea's bitterroot individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area (i.e. BNF-administered lands).

4.10.2.5.6 Issue: Impacts to Modeled Potential Habitat for Sensitive and Forest Watch Species

Tables 4.10-17 presents acreages of direct impacts to modeled potential habitat for special status plant species that would be directly impacted under Alternative 4 by SGP component. Direct removal of potential habitat would occur in these areas, as well as the types of impacts described in Section 4.10.2.1.1.2, Indirect Impacts.

As under all action alternatives, impacts to habitats for sensitive and forest watch species would predominantly occur at the mine site, with lesser extents of impacts occurring along access roads and transmission lines, including in areas of tall tree clearing.

Table 4.10-17 Acres of Direct Impacts to Modeled Special Status Plant Potential Habitat under Alternative 4

Scientific Name	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total[1]
Allotropa virgata Candystick	77.8	4.9	8.7	5.5	0.8	97.8
Astragalus vexilliflexus var. *vexilliflexus* Bent-flowered milkvetch	6.7	-	3.4	2.1	-	12.2
Botrychium lineare and *B. simplex* Slender moonwort and least moonwort	177.4	12.3	26.4	26.7	-	242.9
Botrychium crenulatum Scalloped moonwort	1.1	2.1	3.2	2.7	-	9.1
Bryum calobryoides Beautiful bryum	-	11.7	6.0	5.0	-	22.6
Buxbaumia viridis Green bug moss	1.4	9.7	11.8	8.8	0.3	32.0
Calamagrostis tweedyi Cascade reedgrass	654.3	19.2	80.4	49.1	-	802.9
Carex livida Livid sedge	154.0	9.7	20.1	21.0	-	204.7
Carex straminiformis Shasta sedge	2.7	-	12.6	9.6	-	24.9
Cicuta bulbifera Bulblet-bearing water hemlock	7.3	0.8	2.3	1.9	-	12.3
Douglasia idahoensis Idaho douglasia	0.4	-	3.3	2.5	-	6.2
Draba incerta Yellowstone draba	9.2	-	10.8	7.8	-	27.8
Drosera intermedia Spoonleaf sundew	154.0	9.7	20.1	21.0	-	204.7
Epilobium palustre Swamp willow weed	2.3	1.8	6.5	6.8	-	17.4
Epipactis gigantea Giant helleborine orchid	-	14.8	7.6	6.9	-	29.3

Scientific Name	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total[1]
Helodium blandowii Blandow's helodium	124.9	9.6	17.7	18.6	-	170.9
Hierochloe odorata Sweetgrass	76.4	8.5	35.1	19.1	-	139.1
Lewisia sacajaweana Sacajawea's bitterroot	287.9	7.1	40.0	27.0	-	362.0
Mimulus clivicola Bank monkeyflower	-	10.5	20.7	19.0	-	50.2
Penstemon laxus Tufted penstemon	23.3	6.4	15.7	12.1	-	57.6
Polystichum kruckebergii Kruckeberg's sword-fern	127.1	6.6	28.8	13.4	-	175.9
Rhynchospora alba White beaksedge	23.8	5.7	14.8	15.1	-	59.3
Sanicula graveolens Sierra sanicle	182.8	4.3	10.2	3.5	-	200.8
Saxifraga tolmiei var. *ledifolia* Tolmie's saxifrage	68.8	1.4	9.2	7.4	-	86.7
Scheuchzeria palustris Rannoch-rush	154.0	9.7	20.1	21.0	-	204.7
Sedum borschii and *S. leibergii* Borch's stonecrop and Leiberg stonecrop	35.0	2.8	0.2	0.1	-	38.1
Triantha occidentalis ssp. *brevistyla* Short-style tofieldia	125.7	4.9	15.4	16.3	-	162.3

Table Source: Acres of direct impacts to modeled habitat were calculated by overlaying SGP components with modeled potential habitat reported in AECOM 2020a

Table Notes:

1 Due to rounding, numbers presented in this table may not sum precisely to the totals provided. No total acreages are presented for SGP components in this table as modeled potential habitat for many species overlaps that of other species.

4.10.2.5.7 ISSUE: INCREASED POTENTIAL FOR NON-NATIVE PLANT ESTABLISHMENT AND SPREAD

Anticipated acreages of vegetation clearing to previously undisturbed vegetation communities both inside and outside Forest Service boundaries under Alternative 4 are presented in **Table 4.10-18**. Increased establishment and spread of non-native plants is possible in these areas.

Table 4.10-18 Total acres of Disturbance to Vegetation Communities due to SGP Components under Alternative 4

Vegetation	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Offsite Facilities	Total[1]
Forest PVGs (1-11) within Forest Service boundaries	999.2	180.2	204.7	241.4	4.0	1,629.6
Non-forest Areas within Forest Service boundaries	36.7	22.0	12.0	18.9	-	89.5
LANDFIRE vegetation outside Forest Service boundaries	-	-	80.6	90.4	22.9	193.9
TOTALS[1]	**1,035.9**	**202.2**	**297.3**	**350.7**	**26.9**	**1,913.0**

Table Source: AECOM 2020b; Acres of direct impacts to forest PVGs and non-forest areas within Forest Service boundaries were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017) and VCMQ mapping (Forest Service 2016), omitting areas of previous mine site disturbance (Midas Gold 2019). Acres of direct impacts to LANDFIRE vegetation outside Forest Service boundaries were calculated by overlaying SGP components outside Forest Service boundaries with LANDFIRE data (LANDFIRE 2009)

Table Notes:

1 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.2.6 Alternative 5

Under Alternative 5, there would be no large-scale mining operations by Midas Gold and there would be no direct or indirect effects to vegetation and no changes to current conditions for vegetation in the analysis area from the SGP.

Midas Gold would continue to implement surface exploration and associated activities that have been previously approved on National Forest System (NFS) lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project Environmental Assessment (EA) (Forest Service 2015). These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads), and drilling on both NFS and private lands at and in the vicinity of the mine site. These exploration and subsequent reclamation activities would have only a small direct effect on vegetation resources, as the disturbance footprint associated with the Golden Meadows EA is limited to the temporary access roads to pads and the exploration drilling holes.

Midas Gold would be required to continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and EA, which include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices, and monitoring to ensure that sediment and stormwater best management practices are in place and effective so that impacts to vegetation are avoided or minimized.

4.10.3 Mitigation Measures and Effectiveness

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.10.4 Cumulative Effects

Effects of other past, present, and reasonably foreseeable future actions may cumulatively impact a resource if these actions overlap spatially with the potential direct and indirect effects of a proposed project. As such, the cumulative effects analysis area for vegetation resources is the same extent as the analysis area for direct and indirect impacts to vegetation, which is the 300-foot buffer around SGP and alternative components (**Figure 3.10-1**).

Past and present actions in the cumulative effects analysis area that have affected or are currently affecting vegetation are shown in **Table 4.10-19**. These actions are described in detail in Section 4.1.5, Cumulative Effects.

Table 4.10-19 Past and Present Actions in the Vegetation Analysis Area

Past or Present Action	Potential Effects on Vegetation
Past and present mineral exploration and mining in the vicinity of the mine site	Vegetation has been removed and soil conditions have been altered in areas with past and present mineral exploration and mining in the vicinity of the mine site. Increased dust and transportation of non-native plant propagules associated with these projects have likely indirectly impacted vegetation communities in the vicinity of these areas.
Wildland Fire	Wildland fires have occurred in the vegetation analysis area, which has resulted in changes to vegetation communities. Fires have been both characteristic and uncharacteristic.
Removal of Firewood	Removal of firewood by the public has likely occurred in the vegetation analysis area, resulting in loss of coarse woody debris and snags over time.
Recreation and tourism	Recreational activities (i.e., camping, hiking, hunting, trapping, trail riding, etc.) are likely to continue to affect vegetation communities. Increased road networks (e.g., new portions of Burntlog Route) open new NFS areas to additional human disturbance, which will likely result in increased non-native plant spread and establishment in the analysis area.
Mineral exploration and mining activities	Exploration activities for potential future mining development listed in Section 4.1.5 in the vegetation analysis area have likely impacted vegetation via removal and soil compaction at drill pad sites and temporary roads and will likely continue to do so as these activities continue.
Transportation projects	Road maintenance projects (McCall-Stibnite Road [CR 50-412], Profile Gap Road [CR 50340] and the road to the Big Creek Trailhead, and Yellow Pine Road) are ongoing in the analysis areas. Roadways impact vegetation communities through habitat fragmentation, noxious weed introduction, and possibly dust propagation during construction. Maintenance projects for existing roadways will likely impact vegetation indirectly and only during the time of construction.
Infrastructure Development projects	Transmission line upgrades in the West Central Mountain Electric Plan 2014, which follows the general location Stibnite Mine transmission line route, have required removal of tall trees in the right-of-way for safe operation of the transmission line. Removal of tall trees has altered understory vegetation community composition and likely removed potential habitat for special status plants.

Table Source: Section 4.1, Introduction

Reasonably foreseeable future actions in the cumulative effects analysis area that are anticipated to impact vegetation are shown in **Table 4.10-20**. These reasonably foreseeable future actions would result in loss of habitat, but all projects (private or federal actions) would have to meet the requirements of Section 7 of the ESA, which include consultation with federal agencies on listed plant species, completion of appropriate analysis documents, and compliance with agency-mandated reasonable and prudent measures to protect listed species.

Table 4.10-20 Reasonably Foreseeable Future Actions in the Vegetation Analysis Area

Project	Potential Effects on Vegetation
South Fork Restoration and Access Management Plan	The numerous actions relating to watershed restoration, motorized and non-motorized access, and improvements of recreation facilities within the South Fork Salmon River watershed within a 329,000-acre project area are likely to impact vegetation communities and special status plants in various ways. No specific acreages of potential impacts to vegetation are known for this project.
East Fork Salmon River Restoration and Access Management Plan	This travel management planning would likely impact vegetation communities and special status plants located within the spatial extent of the East Fork Salmon River Restoration and Access Management Plan which could include Yellow Pine, Big Creek, and Thunder Mountain within the Payette National Forest. No specific acreages of potential impacts to vegetation are known for this project.
Wildlife Conservation Strategy EIS	This EIS would present and analyze the impacts of short- and long-term management strategies and priorities for maintaining and restoring habitats associated with terrestrial wildlife species, some of which may impact vegetation communities and special status plants. No specific acreages of potential impacts to vegetation are known for this project.

Table Source: Section 4.1, Introduction

4.10.4.1 All Action Alternatives

Acres of previous disturbance from past mining actions within 300 feet of each action alternative are presented in **Table 4.10-21**. The total cumulative disturbance to vegetation in the analysis area under each action alternative is the sum of acres of previous disturbance within 300 feet of each alternative and the acres of previously undisturbed vegetation that would be impacted under each of the alternatives.

Table 4.10-21 Previous Disturbance to Vegetation Communities[1] within 300 Feet of Each Action Alternative

Vegetation	Alternative 1	Alternative 2	Alternative 3	Alternative 4
New Disturbance to Previously Undisturbed Areas	2,224.0	2,060.1	2,806.1	1,913.0
Previous Disturbance within 300 feet of an Alternative Footprint	853.3	830.1	787.2	856.9
Total Cumulative Disturbance to Vegetation within 300 feet of an Alternative Footprint[2]	**3,077.3**	**2,890.2**	**3,593.3**	**2,769.9**

Table Source: AECOM 2020b; Acres of new disturbance to previously undisturbed areas were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017), VCMQ data (Forest Service 2016), and LANDFIRE data (LANDFIRE 2009). Acres of previous disturbance within 300 feet of an alternative footprint were calculated by overlaying a 300-foot buffer of SGP components with previous mine site disturbance spatial data (Midas Gold 2019) and omitting areas of new disturbance

Table Notes:

1 Vegetation communities are defined for the purpose of these calculations as a combination of forest PVGs on NFS-administered lands, non-forest areas on NFS-administered lands identified through PVG mapping, and LANDFIRE vegetation classes outside NFS-administered lands.

2 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

PVG = Potential Vegetation Group.

SGP = Stibnite Gold Project.

VCMQ = Vegetation Classification, Mapping, and Quantitative Inventory.

Alternative 3 would result in the largest contribution to mining-related cumulative impacts to vegetation communities under the action alternatives, followed by Alternative 1 and Alternative 2. Alternative 4 would have the smallest contribution of mining-related cumulative impacts to vegetation communities under the action alternatives. Cumulative impacts of the SGP on botanical resources and non-native plants would follow the same ranking as for vegetation communities, with Alternative 3 having the highest potential and Alternative 4 having the lowest potential for negative impacts on botanical resources and non-native plants in conjunction with past mining actions.

Other past and present actions (**Table 4.10-19**) and reasonably foreseeable future actions (**Table 4.10-20**) have and will likely impact vegetation communities, occurrences of special status plants including whitebark pine, habitats for special status plants, and distribution of non-native plants throughout the analysis area. Specific impact acreages of most of these actions on these resources are not known. It is likely that the ranking of potential contribution of the SGP alternatives when combined with other reasonably foreseeable future actions on vegetation, most special status plants, and non-native plants would be the same as described in the preceding paragraph for mining-related impacts, with Alternative 3 having the highest potential for cumulative impacts, Alternative 4 having the lowest potential for cumulative impacts, and Alternatives 1 and 2 having intermediate degrees of potential for cumulative impacts on these resources based on disturbance acreage. For whitebark pine, the potential for cumulative impacts would be lowest under Alternative 4, highest under Alternative 1, and intermediate under Alternatives 2 and 3 based on disturbance acreage and estimated number of trees removed.

Cumulative impacts of the SGP on known special status plant occurrences from the alternatives are likely to be the same as described in Section 4.10.2, Direct and Indirect Effects, and when considered with past, present, and reasonably foreseeable future actions (i.e., no loss of viability or trend towards ESA listing for all species known to occur in the analysis area).

4.10.4.2 Alternative 5

Forest management, motorized use of road systems, fire suppression, prescribed fire and wildfire, dispersed camping, fishing, and hunting activities would continue in the cumulative effects area and vicinity, which would alter vegetation resources through direct removal (trampling, cutting, harvest, etc.) and incidental damage. Under Alternative 5, Midas Gold would continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and EA, which include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices. However, as described in the Golden Meadows EA, the exploration and subsequent reclamation activities would have only a small direct effect on vegetation resources, as the disturbance footprint associated with the Golden Meadows EA is primarily isolated to temporary access roads to pads and the exploration drilling holes. Therefore, implementation of Alternative 5 would present a minimal cumulative contribution to impacts to vegetation resources.

4.10.5 Irreversible and Irretrievable Commitments of Public Resources

4.10.5.1 Alternative 1

4.10.5.1.1 Irreversible

Certain biological resources that would be affected by the SGP are renewable only over long-time spans, including mature vegetation, special status plants, seedbanks, and topsoil. Loss of these resources would be considered irreversible. Soils will be stockpiled and reused to the greatest degree possible, but there will still be some irreversible commitment of soil to the SGP.

4.10.5.1.2 Irretrievable

Alternative 1 would remove the land from other uses while SGP is in operation, but the use would eventually be reversed through revegetation except for the approximately 357 acres of land where revegetation would not occur (i.e., in areas of new, permanent pit lakes or portions of pit highwalls that are too steep for re-vegetating). The temporal loss of the land for other uses would be irretrievable. This includes the loss of soil resources; even with reclamation, the temporal loss of the resource is irretrievable. Whitebark pine individuals removed for construction of the SGP would be irretrievable.

4.10.5.2 Alternative 2

The irreversible and irretrievable commitment of vegetation under Alternative 2 would be the same as under Alternative 1 with the exception that the West End DRSF would not be constructed (resulting in less vegetation removal) and the Midnight pit would be fully backfilled instead of becoming a pit lake (representing a smaller area that would not be able to be revegetated compared to Alternative 1). However, tall tree clearing around new portions of the transmission line would continue in perpetuity.

4.10.5.3 Alternative 3

The irreversible and irretrievable commitment of vegetation under Alternative 3 would be similar to that described under Alternative 1, except the location of the Tailings Storage Facility in the East Fork South Fork Salmon River rather than in Meadow Creek would change the location of vegetation communities that would be removed and revegetated. Vegetation impacts also would be greater under Alternative 3 in the area of the Meadow Creek Lookout Road (FR 51290) from Burntlog Route at the upper portion of Blowout Creek drainage to Monumental Summit, which would be improved for public access to connect with Thunder Mountain Road under this alternative.

4.10.5.4 Alternative 4

The irreversible and irretrievable commitment of vegetation under Alternative 4 would be the same as under Alternative 1.

4.10.5.5 Alternative 5

Under the No Action Alternative, there would be no irreversible or irretrievable commitment of vegetation.

4.10.6 Short-term Uses versus Long-term Productivity

4.10.6.1 Alternative 1

This evaluation considers whether the proposed SGP alternatives reduce the ability of the land and water to be used for other purposes. Under any of the action alternatives, the land and water in the SGP area would be used for the 20-year life of the mine. Short-term uses of the mineral resources would represent a beneficial use of these resources, but once used, provide no long-term productivity opportunities. Some lands that will be impacted by SGP components (e.g. pits, Tailings Storage Facility, and DRSFs) will no longer be available for their original productivity.

Concurrent with mining, and after SGP closure and reclamation, many elements of lost productivity, such as salmon streams and wildlife habitat, would be restored.

4.10.6.2 Alternatives 2 through 4

Under Alternatives 2 through 4, the effects of short-term use and long-term productivity would be the same as described for Alternative 1, because all the action alternatives include the same type and intensity of impacts to vegetation.

4.10.6.3 Alternative 5

Under Alternative 5, SGP would not be undertaken. Consequently, there would be no change in the current status of vegetation conditions in the SGP area, and no impacts to productivity would occur.

4.10.7 Summary

4.10.7.1 Issue: Impacts to Forested PVGs within Forest Service-Managed Land

Table 4.10-22 presents acres of direct disturbance to previously undisturbed forested PVGs within Forest Service-managed lands under the action alternatives. These areas would not maintain or move towards desired conditions in the foreseeable future due to the types of impacts described in Section 4.10.2.1, Types of Impacts Common to All Action Alternatives. The greatest extent of impacts would occur under Alternative 3, with lesser extents occurring under Alternatives 1 and 2, and the smallest extent of impacts occurring under Alternative 4.

Table 4.10-22 Acres of Direct Disturbance to Previously Undisturbed Forested PVGs Under Each Action Alternative

PVG	Alternative 1	Alternative 2	Alternative 3	Alternative 4
PVG 1 – Dry Ponderosa Pine/ Xeric Douglas-fir	2.7	2.7	458.1	2.7
PVG 2 – Warm, Dry Douglas-fir/ Moist Ponderosa Pine	165.8	170.5	165.8	178.8
PVG 3 – Cool, Moist Douglas-fir	6.5	6.5	6.5	6.5
PVG 4 – Cool, Dry Douglas-fir	107.9	114.3	111.6	102.9
PVG 5 – Dry Grand Fir	48.1	51.5	48.1	48.1
PVG 6 – Moist Grand Fir	29.4	32.2	29.4	29.4
PVG 7 – Warm, Dry Subalpine Fir	826.6	781.7	834.4	710.9
PVG 8 – Cool Moist Subalpine Fir	-	-	-	-
PVG 9 – Hydric Subalpine Fir	25.0	24.6	26.0	23.1

PVG	Alternative 1	Alternative 2	Alternative 3	Alternative 4
PVG 10 – Persistent Lodgepole Pine	675.6	639.3	789.4	515.7
PVG 11 – High Elevation Subalpine Fir (with Whitebark Pine)	29.9	29.4	26.7	11.6
TOTALS[1]	**1,917.5**	**1,852.7**	**2,495.8**	**1,629.6**

Table Source: AECOM 2020b; Acres of direct impacts were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017)

Table Notes:

1 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.7.2 Issue: Impacts to Non-Forested Vegetation Communities within Forest Service-Managed Land

Table 4.10-23 presents acres of direct disturbance to previously undisturbed non-forested PVGs within Forest Service-managed lands under the action alternatives. These areas would not maintain or move towards desired conditions into the foreseeable future due to the types of impacts described in Section 4.10.2.1.1.1, Direct Impacts. The greatest extent of impacts would occur under Alternatives 2 and 3, with lesser extents occurring under Alternative 1 and the smallest extent of impacts occurring under Alternative 4.

Table 4.10-23 Acres of Direct Disturbance to Previously Undisturbed Areas Identified as not Successional to Forested PVGs within Forest Service-managed Lands

Existing Vegetation Type in Non-Forested PVG (PVG 99)[1]	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Aspen	0.1	0.1	-	-
Burned Forest Shrublands	4.5	4.5	4.5	3.1
Burned Herblands	11.8	11.6	9.6	9.9
Burned Sparse Vegetation	2.3	3.5	2.2	0.4
Developed	0.6	1.0	0.6	0.6
Douglas-fir	26.1	26.2	30.7	19.9
Douglas-fir/Lodgepole Pine	7.7	7.7	0.7	7.7
Douglas-fir/Ponderosa Pine	2.1	2.1	2.1	2.3
Engelmann’s Spruce	0.3	0.3	0.3	0.3
Forblands	6.1	6.1	6.1	1.2
Forest Shrublands	3.2	3.2	3.2	3.2
Grasslands	3.6	4.3	7.4	3.5
Lodgepole Pine	24.1	24.1	26.5	20.9
Mountain Big Sagebrush	0.2	0.2	0.2	-
Ponderosa Pine	5.6	6.1	5.6	5.6
Riparian Herblands	2.4	3.2	0.8	2.1
Riparian Shrublands/ Deciduous Forests	5.2	5.2	9.1	4.8
Sparse Vegetation	2.4	2.4	2.4	2.6
Subalpine Fir	3.6	3.6	3.6	0.7
Water	0.5	0.5	0.5	0.5
Whitebark Pine	0.2	0.3	0.1	0.1
TOTALS[2]	**112.6**	**116.2**	**116.4**	**89.5**

Table Source: AECOM 2020b; Acres of direct impacts were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017) and VCMQ mapping (Forest Service 2016)

Table Notes:

1 PVG mapping and existing vegetation mapping are performed using different processes and different objectives. As such, forest existing vegetation types may occur within areas identified as not successional to forests in PVG mapping, and alternatively, non-forest existing vegetation types may occur in areas identified as successional to forests in PVG mapping.

2 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.7.3 Issue: Impacts to Vegetation Communities outside Forest Service-Managed Land

Table 4.10-24 presents acres of direct disturbance to previously undisturbed vegetation communities outside Forest Service-managed lands under the action alternatives. These areas would experience the types of impacts described in Section 4.10.2.1.1.1, Direct Impacts. The greatest extent of impacts would occur under Alternatives 2 and 3, with lesser extents occurring under Alternative 1 and the smallest extent of impacts occurring under Alternative 4.

Table 4.10-24 Acres of Direct Disturbance to Previously Undisturbed Vegetated Acres Outside Forests Under All Action Alternatives

PVG	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Artemisia tridentata ssp. *vaseyana* Shrubland Alliance	30.7	20.9	30.7	30.7
Columbia Plateau Low Sagebrush Steppe	0.8	0.5	0.8	0.8
Dry-mesic Montane Douglas-fir Forest	5.8	5.0	5.8	5.8
Inter-Mountain Basins Big Sagebrush Shrubland	<0.1	<0.1	<0.1	<0.1
Inter-Mountain Basins Big Sagebrush Steppe	2.3	2.0	2.3	2.3
Inter-Mountain Basins Montane Sagebrush Steppe	6.9	3.0	6.9	6.9
Inter-Mountain Basins Sparsely Vegetated Systems	1.5	1.2	1.5	1.5
Introduced Upland Vegetation-Perennial Grassland and Forbland	9.7	13.7	9.7	9.7
Mesic Montane Douglas-fir Forest	1.4	1.4	1.4	1.4
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	3.2	2.5	3.2	3.2
Northern Rocky Mountain Conifer Swamp	<0.1	<0.1	<0.1	<0.1
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	22.5	20.2	22.5	22.5
Northern Rocky Mountain Lower Montane-Foothill-Valley Grassland	27.1	22.9	27.1	27.1
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	1.9	1.9	1.9	1.9
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	11.3	11.0	11.3	11.3
Northern Rocky Mountain Subalpine Deciduous Shrubland	5.4	5.4	5.4	5.4
Northern Rocky Mountain Subalpine-Upper Montane Grassland	1.5	0.8	1.5	1.5
Open Water	5.0	4.8	5.0	5.0
Rocky Mountain Alpine/Montane Sparsely Vegetated Systems	0.1	0.1	0.1	0.1
Rocky Mountain Lodgepole Pine Forest	6.3	4.4	6.3	6.3

PVG	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Rocky Mountain Montane Riparian Forest and Woodland	10.6	10.4	10.6	10.6
Rocky Mountain Poor-Site Lodgepole Pine Forest	1.9	2.4	1.9	1.9
Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	1.4	1.4	1.4	1.4
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	0.1	0.1	0.1	0.1
Rocky Mountain Subalpine/Upper Montane Riparian Forest and Woodland	6.2	6.2	6.2	6.2
Rocky Mountain Subalpine-Montane Mesic Meadow	18.4	16.9	18.4	18.4
Rocky Mountain Wetland-Herbaceous	6.1	7.7	6.1	6.1
Subalpine Douglas-fir Forest	4.3	4.1	4.3	4.3
Xeric Montane Douglas-fir Forest	<0.1	<0.1	<0.1	<0.1
TOTALS[1]	**193.9**	**170.8**	**193.9**	**193.9**

Table Source: AECOM 2020b; Acres of direct impacts were calculated by overlaying SGP components outside Forest Service boundaries with LANDFIRE data (LANDFIRE 2009)

Table Notes:

1 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.7.4 Issue: Impacts on Known Locations of Whitebark Pine

Table 4.10-25 presents acreage of whitebark pine occupied habitat and number of individuals that would be removed under each of the action alternatives. The greatest extent of impacts to whitebark pine occupied habitat would occur under Alternative 2. A slightly smaller acreage of impacts to occupied habitat would occur under Alternative 1, and the smallest acreage of impacts would occur under Alternative 4.

Alternatives 1 and 2 would remove the greatest estimated number of whitebark pine individuals of all age classes, followed by Alternative 3. Alternative 4 would result in the removal of the smallest estimated number of whitebark pine individuals.

Alternatives 1, 3, and 4 would remove approximately the same number of cone-bearing mature whitebark pine individuals, predominantly as a result of construction of the West End DRSF. As the West End DRSF would not be constructed under Alternative 2, this alternative would have the smallest overall impact on mature whitebark pine trees.

Table 4.10-25 Acres of Whitebark Pine Occupied Habitat and Number of Individual Trees Removed under All Action Alternatives

Scientific Name	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Acres of Occupied Habitat Removed	257.8	243.2	237.2	123.6
Estimated Number of Individual Trees Removed	1,027	997	892	613
Estimated Number of Reproducing Trees Removed	50	15	48	48

Table Source: AECOM 2020b; Acres of direct impacts to occupied habitat and whitebark pine individuals were calculated by overlaying SGP components with results of whitebark pine surveys (Tetra Tech 2020). Detailed calculations of impacts to whitebark pine occupied habitat and individual trees are reported in **Appendix H-6**, Whitebark Pine Impacts

4.10.7.5 Issue: Impacts to Known Locations of Sensitive and Forest Watch Species

All action alternatives would impact the same known occurrences of bent-flowered milkvetch, least moonwort and Sacajawea’s bitterroot as described in Section 4.10.2.2.5, Impacts to Known Locations of Sensitive and Forest Watch Species. Alternatives 1 through 3 also would impact known occurrences of Blandow’s helodium, sweetgrass, and Rannoch-rush due to construction of Burntlog Route as described in Section 4.10.2.2.5, Impacts to Known Locations of Sensitive and Forest Watch Species.

4.10.7.6 Issue: Impacts to Modeled Potential Habitat for Sensitive and Forest Watch Species

Table 4.10-26 presents acres of modeled potential habitat directly impacted for special status plant species within the disturbance footprint of SGP components under each of the action alternatives.

Overall, Alternative 1 would impact the largest extent of modeled potential habitat for sensitive and forest watch plant species, followed by Alternative 2 and then Alternative 3. Alternative 4 would have the smallest extent of impacts to modeled potential habitat for sensitive and forest watch plant species.

Table 4.10-26 Acres of Modeled Potential Habitat for Special Status Plants Directly Impacted under All Action Alternatives

Scientific Name	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Allotropa virgata Candystick	99.7	101.9	101.2	97.8
Astragalus vexilliflexus var. *vexilliflexus* Bent-flowered milkvetch	14.5	14.5	12.4	12.2
Botrychium lineare and *B. simplex* Slender moonwort and least moonwort	267.5	262.9	271.5	242.9
Botrychium crenulatum Scalloped moonwort	10.4	10.2	7.9	9.1
Bryum calobryoides Beautiful bryum	21.1	21.1	16.8	22.6
Buxbaumia viridis Green bug moss	31.2	31.3	23.1	32.0
Calamagrostis tweedyi Cascade reedgrass	999.2	932.0	679.1	802.9
Carex livida Livid sedge	229.8	224.9	190.5	204.7
Carex straminiformis Shasta sedge	80.0	92.8	63.0	24.9
Cicuta bulbifera Bulblet-bearing water hemlock	12.5	12.7	10.4	12.3
Douglasia idahoensis Idaho douglasia	22.0	20.5	10.3	6.2
Draba incerta Yellowstone draba	52.5	50.7	37.1	27.8
Drosera intermedia Spoonleaf sundew	229.8	224.9	190.5	204.7
Epilobium palustre Swamp willow weed	17.7	17.7	12.2	17.4
Epipactis gigantea Giant helleborine orchid	26.9	26.9	21.1	29.3
Helodium blandowii Blandow's helodium	171.3	174.6	140.8	170.9
Hierochloe odorata Sweetgrass	149.1	150.6	130.0	139.1
Lewisia sacajaweana Sacajawea's bitterroot	528.6	528.1	608.7	362.0
Mimulus clivicola Bank monkeyflower	49.7	51.6	35.0	50.2
Penstemon laxus Tufted penstemon	55.6	56.6	47.7	57.6
Polystichum kruckebergii Kruckeberg's sword-fern	212.1	206.5	171.1	175.9

Scientific Name	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Rhynchospora alba White beaksedge	57.8	61.6	46.8	59.3
Sanicula graveolens Sierra sanicle	248.1	239.9	230.8	200.8
Saxifraga tolmiei var. *ledifolia* Tolmie's saxifrage	135.2	127.9	106.2	86.7
Scheuchzeria palustris Rannoch-rush	229.8	224.9	190.5	204.7
Sedum borschii and *S. leibergii* Borch's stonecrop and Leiberg stonecrop	39.7	35.9	52.5	38.1
Triantha occidentalis ssp. *brevistyla* Short-style tofieldia	181.5	173.2	194.1	162.3

Table Source: Acres of direct impacts to modeled habitat were calculated by overlaying SGP components with modeled potential habitat (AECOM 2020a). No total acreages are presented in this table as modeled potential habitat for many species overlaps that of other species

4.10.7.7 Issue: Increased Potential for Non-native Plant Establishment and Spread

Acreages of vegetation clearing within previously undisturbed vegetation communities both inside and outside Forest Service boundaries under all action alternatives are presented in **Table 4.10-27**. Increased establishment and spread of non-native plants is possible in these areas.

Total extent of disturbance to previously undisturbed vegetation communities, and thus increased potential for non-native plant establishment and spread, would be highest under Alternative 3, followed by Alternative 1, Alternative 2, and lowest under Alternative 4.

Table 4.10-27 Total acres of Direct Disturbance to Vegetation Communities due to SGP Components under All Action Alternatives

Vegetation	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Forest PVGs (1-11) within Forest Service boundaries	1,917.5	1,852.7	2,495.8	1,629.6
Non-forest areas within Forest Service boundaries	112.6	36.6	116.4	89.5
LANDFIRE vegetation outside Forest Service boundaries	193.9	170.8	193.9	193.9
TOTALS[1]	**2,224.0**	**2,060.1**	**2,806.1**	**1,913.0**

Table Source: AECOM 2020b; Acres of direct impacts to forest PVGs within Forest Service boundaries were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017). Acres of direct impacts to non-forest areas within Forest Service boundaries were calculated by overlaying SGP components with PVG data (Forest Service 2005, 2017) and VCMQ mapping (Forest Service 2016). Acres of direct impacts to LANDFIRE vegetation outside Forest Service boundaries were calculated by overlaying SGP components outside Forest Service boundaries with LANDFIRE data (LANDFIRE 2009)

Table Notes:

1 Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

4.10.7.8 Summary Table

Table 4.10-28 provides a summary comparison of vegetation resource impacts by issues and indicators for each alternative.

Table 4.10-28 Comparison of Vegetation Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP would impact forested PVGs within Forest Service-administered land and could impact the ability of these areas to reach desired conditions.	Acres of disturbance to previously undisturbed forest PVGs within Forest Service boundaries.	PVG data are available for the analysis area on Forest Service lands in the PNF and BNF. Maps of PVGs in the analysis area are included in **Appendix H-1a**.	Alternative 1 would remove an estimated 1,917.5 acres of previously undisturbed forest PVGs within the boundaries of the Forests. This is the second largest extent of impacts to forest PVGs under the action alternatives.	Alternative 2 would remove an estimated 1,852.7 acres of previously undisturbed forest PVGs within the boundaries of the Forests. This is the second smallest extent of impacts to forest PVGs under the action alternatives.	Alternative 3 would remove an estimated 2,495.8 acres of previously undisturbed forest PVGs within the boundaries of the Forests. This is the largest extent of impacts to forest PVGs under the action alternatives.	Alternative 4 would remove an estimated 1,629.6 acres of previously undisturbed forest PVGs within the boundaries of the Forests. This is the smallest extent of impacts to forest PVGs under the action alternatives.	None.
The SGP would impact non-forested areas (i.e., those that are identified through PVG mapping as not being successional to forests) within Forest Service-administered land and could impact the ability of these areas to reach desired conditions.	Acres of disturbance to previously undisturbed non-forested areas within Forest Service boundaries.	PVG and existing vegetation data are available for the analysis area on Forest Service lands in the PNF and BNF.	Alternative 1 would remove an estimated 112.6 acres of previously undisturbed non-forest areas within the boundaries of the Forests. This is the second smallest extent of impacts to non-forest areas under the action alternatives.	Alternative 2 would remove an estimated 116.2 acres of previously undisturbed non-forest vegetation within the boundaries of the Forests. This is the second largest extent of impacts to non-forest areas under the action alternatives.	Alternative 3 would remove an estimated 116.4 acres of previously undisturbed non-forest areas within the boundaries of the Forests. This is the largest extent of impacts to non-forest areas under the action alternatives.	Alternative 4 would remove an estimated 89.5 acres of previously undisturbed non-forest areas within the boundaries of the Forests. This is the smallest extent of impacts to non-forest areas under the action alternatives.	None.
The SGP would impact vegetation outside the boundaries of the Forests.	Acres of disturbance in previously undisturbed LANDFIRE existing vegetation types outside Forest Service boundaries.	LANDFIRE data are available for the analysis area outside Forest Service lands. Maps of LANDFIRE existing vegetation communities in the analysis area are included in **Appendix H-1b**.	Alternative 1 would remove an estimated 193.9 acres of previously undisturbed vegetation communities outside Forest Service-administered lands. Along with Alternatives 3 and 4, this would be the largest extent of vegetation removal outside Forest Service lands under the action alternatives.	Alternative 2 would remove an estimated 170.8 acres of previously undisturbed vegetation communities outside Forest Service-administered lands. This would be the smallest extent of vegetation removal outside Forest Service lands under the action alternatives.	Same as Alternative 1.	Same as Alternative 1.	None.
The SGP would remove whitebark pine individuals, and habitat conversion associated with the SGP would impact seed production, dispersal, and establishment of this species.	Number of acres of whitebark pine occupied habitat impacted by the SGP.	Results of whitebark pine surveys (Tetra Tech 2020) are available within suitable habitat in the analysis area. Approximately 2,310 acres of occupied whitebark pine habitat were identified within the analysis area.	Alternative 1 would remove an estimated 257.8 acres of occupied whitebark pine habitat (11.2% of occupied habitat in the analysis area). This would be the largest extent of removal under the action alternatives.	Alternative 2 would remove an estimated 243.2 acres of occupied whitebark pine habitat (10.5% of occupied habitat in the analysis area). This would be the second largest extent of removal under the action alternatives.	Alternative 3 would remove an estimated 237.2 acres of occupied whitebark pine habitat (10.2% of occupied habitat in the analysis area). This would be the second smallest extent of removal under the action alternatives.	Alternative 4 would remove an estimated 123.6 acres of occupied whitebark pine habitat (5.4% of occupied habitat in the analysis area). This would be the smallest extent of removal under the action alternatives.	None.
	Estimated number of mature whitebark pine trees to be cut during SGP construction.	Results of whitebark pine surveys (Tetra Tech 2020) are available within in the analysis area.	An estimated 1,027 individual trees, 50 of which would be cone-bearing trees, would be removed under Alternative 1. This would be the largest number of total whitebark pine individuals removed and cone-bearing individuals removed under the action alternatives.	An estimated 997 individual trees, 15 of which would be mature, cone-bearing trees, would be removed under Alternative 2. This would be the second largest number of total whitebark pine individuals removed and the lowest number of cone-bearing individuals removed under the action alternatives.	An estimated 892 individual trees, 48 of which would be mature, cone-bearing trees, would be removed under Alternative 3. This would be the second smallest number of total whitebark pine individuals removed and the second highest number of cone-bearing individuals removed under the action alternatives.	An estimated 613 individual trees, 48 of which would be mature, cone-bearing trees, would be removed under Alternative 4. This would be the smallest number of total whitebark pine individuals removed and the second highest number of cone-bearing individuals removed (the same as Alternative 3) under the action alternatives.	None.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP would impact known occurrences of sensitive and forest watch plant species.	Presence of known occurrences of special status plants or occupied habitat within 300 feet of the SGP disturbance area.	Rare Plant Geographic Information System Data are available for the SGP area (IFWIS 2017).	Alternative 1 would impact known occurrences of bent-flowered milkvetch, least moonwort, Sacajawea's bitterroot, Blandow's helodium, sweetgrass, and Rannoch-rush.	Same as Alternative 1.	Same as Alternative 1.	Alternative 4 would impact known occurrences of bent-flowered milkvetch, least moonwort and Sacajawea's bitterroot.	None.
The SGP would result in a direct loss of modeled potential habitat for sensitive and forest watch plant species.	Acres of modeled potential habitat for sensitive and forest watch plant species disturbed by the SGP.	Modeled potential habitat for special status plant species is available for the SGP area. Maps are included in **Appendix H-4**.	Alternative 1 would impact the largest extent of modeled potential habitat for scalloped moonwort, Cascade reedgrass, livid sedge, Idaho douglasia, Yellowstone draba, spoonleaf sundew, Kruckeberg's swordfern, Sierra sanicle, Tolmie's saxifrage, and Rannoch-rush. Alternative 1 would be equal to Alternative 2 in having the greatest extent of impacts to modeled potential habitat for bent-flowered milkvetch and swamp willow weed. Overall, Alternative 1 would impact the largest extent of modeled potential habitat for sensitive and forest watch species under the action alternatives.	Alternative 2 would impact the largest extent of modeled potential habitat for candystick, Shasta sedge, bulblet-bearing water hemlock, Blandow's helodium, sweetgrass, bank monkeyflower, and white beaksedge. Alternative 2 would be equal to Alternative 1 in impacting the largest extent of modeled potential habitat for bent-flowered milkvetch and swamp willow weed. Overall, Alternative 2 would impact the second largest extent of modeled potential habitat for sensitive and forest watch species under the action alternatives.	Alternative 3 would have the greatest extent of impacts to modeled potential habitat for slender moonwort and least moonwort, Sacajawea's bitterroot, Borch's stonecrop and Leiberg stonecrop, and short-style tofieldia. Overall, Alternative 3 would impact the second smallest extent of modeled potential habitat for sensitive and forest watch species under the action alternatives.	Alternative 4 would impact the largest extent of modeled potential habitat for beautiful bryum, green bug moss, giant helleborine orchid, and tufted penstemon. Overall, Alternative 4 would impact the smallest extent of modeled potential habitat for sensitive and forest watch species under the action alternatives.	None.
SGP actions would result in increased potential for non-native plant establishment and spread.	Total acres of land disturbed by the SGP.	PVG data are available for the analysis area on Forest Service lands in the PNF and BNF and LANDFIRE data are available for the analysis area outside Forest Service lands. Maps of non-native plants in the analysis area are included in **Appendix H-2**.	Alternative 1 would impact the second largest total extent of vegetation clearing (2,224.0 acres) under the action alternatives. Therefore, the potential for non-native plant establishment and spread in and near the SGP area would be second highest under this alternative.	Alternative 2 would impact the second smallest total extent of vegetation clearing (2,060.1 acres) under the action alternatives. Therefore, the potential for non-native plant establishment and spread in and near the SGP area would be second lowest under this alternative.	Alternative 3 would impact the largest total extent vegetation clearing (2,806.1 acres) under the action alternatives. Therefore, the potential non-native plant establishment and spread in and near the SGP area would be highest under this alternative.	Alternative 4 would impact the smallest total extent vegetation clearing (1,913.0 acres) under the action alternatives. Therefore, the potential for non-native plant establishment and spread in and near the SGP area would be lowest under this alternative.	None.

4.11 Wetlands and Riparian Resources

This section describes potential impacts of the Stibnite Gold Project (SGP) on wetlands and riparian resources within the analysis area for these resources defined in Section 3.11.1, Scope of Analysis for Wetlands and Riparian Resources, and shown in **Figure 3.11-1**[1]. Impacts to the characteristics and habitats of surface waters are described in the Surface Water and Groundwater Quality (Section 4.9) and Fish Resources and Fish Habitat (Section 4.12) portions of this Environmental Impact Statement (EIS). Due to the large number of individual wetlands, some of the impacts described in this chapter are summarized by wetland assessment area, which may include several similarly-situated wetlands. A summary of wetland impacts by assessment area is provided in **Appendix I**, along with a detailed map set showing wetland impacts in relation to the various alternatives analyzed in this section.

Potential impacts evaluated in this section include:

- Losses of wetland and riparian acreages due to removal (i.e., excavation) and/or deposition of fill materials.
- Losses of wetland functional units (as defined through the Montana Wetland Assessment Method [MWAM]) associated with losses of wetland acreages.
- Fragmentation of wetland and riparian areas associated with losses of acreages of these features.
- Effects of mine pit dewatering and surface water diversions on hydrologically connected wetlands and riparian areas.
- Effects of SGP actions that could impact surface water quality (as described in Section 4.9, Surface Water and Groundwater Quality) on hydrologically connected wetlands and riparian areas.

4.11.1 Effects Analysis Issues and Indicators

The analysis of effects to wetlands and riparian resources includes the following issues and indicators.

[1] This analysis separates the analysis area into two separate areas: the mine site focus area and the off-site focus area, as described in Section 3.11.1. The mine focus area, which includes the footprint of all mine site components, extends to the outermost extent of wetland Assessment Areas (AAs) 1 through 29, 38, 39, and 41 (defined via the most recent wetland functional assessment document; Tetra Tech 2018). Wetland delineation data are extensive in this portion of the analysis area. For areas within the off-site focus area, the analysis area extends to the 5th field (10-digit Hydrologic Unit Codes [HUC]) watersheds that overlap SGP disturbance areas. This portion of the analysis area includes wetland AAs 30 through 37, 40, and 42 through 44. Wetland acreages in this portion of the analysis area include National Wetlands Inventory (NWI) data where SGP-related delineation data are not available.

Issue: The SGP would remove wetlands and/or riparian resources.

Indicator:

- Acres of wetland and riparian habitat lost through construction of SGP alternative components.

Issue: The SGP may impact ecological functioning of wetlands, including high-value, unique, or uncommon wetlands, as a result of loss of wetland area.

Indicator:

- Functional units of all assessed wetlands, including high-value wetlands (i.e., Category I and II per MWAM), lost due to the SGP.

Issue: Wetlands and riparian habitat may become fragmented, isolated, and/or inaccessible to aquatic wildlife species as a result of the SGP (e.g., bisected by new road construction, water diversions, and placement of fill materials).

Indicators:

- Number of wetlands crossed by new roads.
- Total area (in acres) of wetlands that would be lost.

Issue: The SGP may affect water balance, which could reduce seasonal water input frequency and duration for wetlands adjacent to and downstream of SGP features.

Indicator:

- Acres of wetland that would be within the footprint of groundwater drawdown.

Issue: SGP-related activities may affect wetlands and riparian areas through changes to water temperature, and concentration of key contaminants.

Indicator:

- Estimated changes in water quality parameters based on predictive water modelling in wetland areas (qualitative).

4.11.1.1 Data Sources

4.11.1.1.1 AVAILABLE INFORMATION

Impacts to wetlands and riparian resources were analyzed using data collected and reports prepared for the SGP, as well as scientific literature reviews. Estimated acreages of wetlands impacted are based on the intersection of specific development footprint designs and wetland delineation and estimation data (HDR, Inc. [HDR] 2013, 2014a,b, 2015, 2016b,c) provided by Midas Gold Idaho, Inc. (Midas Gold) or NWI data for portions of the analysis area that have not yet been delineated by Midas Gold.

Wetlands within the various SGP components of the analysis area were delineated between 2012 and 2016 and were documented in wetland baseline reports that were summarized in 2017 (HDR 2017). Geographic Information Systems data associated with these reports were used for impact analyses. These reports are:

- Wetland Resources Baseline Study, Stibnite Gold Project (HDR 2013)
- Wetland Resources Baseline Study Addendum #1, Stibnite Gold Project (HDR 2014a)
- Wetland Resources Baseline Study Addendum #2, Stibnite Gold Project (HDR 2014b)
- Wetland Resources Baseline Study Addendum #3, Stibnite Gold Project (HDR 2015)
- Wetland Resources Baseline Study Addendum #4, Stibnite Gold Project (HDR 2016b)
- Wetland Resources Baseline Study for Logistics Center Site, Stibnite Gold Project (HDR 2016c)
- Summary of Project Wetland Resource Baseline Studies (HDR 2017)

Wetland functional assessments were performed for delineated wetlands in various locations in the vicinity of the SGP and documented in functional assessment reports. These reports are:

- The Stibnite Gold Project, Wetland Functional Assessment Report (HDR 2016a)
- Additional Information to Amend the 2016 HDR Wetlands Functions and Values Assessment (Tetra Tech 2018)

Other wetland-specific documents containing information referenced in this analysis are:

- Stibnite Gold Project, Valley County, Idaho, Plan of Restoration and Operations Including Appendix F, Draft Conceptual Wetland and Stream Mitigation Plan (Midas Gold 2016)
- Stibnite Gold Project Mitigation Program, Draft Restoration Ledger (Rio Applied Science and Engineering [Rio ASE] 2019)
- Conceptual Stream and Wetland Mitigation Plan (Tetra Tech 2019a)
- Technical Memorandum: Evaluation of Potential Fen Wetland Occurrence in the SGP Study Area (Tetra Tech 2019b)

4.11.1.1.2 INCOMPLETE OR UNAVAILABLE INFORMATION

Wetland delineation data are not available for the entire extent of the SGP wetland analysis area, although most of the mine site has been delineated. NWI data and aerial photo interpretation were used to fill in wetland delineation data gaps in portions of the following features: the Burntlog Route, the Cabin Creek Groomed Snowmobile Route, existing and new portions of the transmission line, and Warm Lake Road (County Road [CR] 10-579). NWI data is generally not as accurate as delineation data; therefore, potential impacts to wetlands reported in this analysis may not be as accurate where NWI data was used. In addition, aerial photo interpretation was used to estimate wetland boundaries for portions of the mine site (Tetra Tech 2018).

Wetlands also have not been delineated to the full extent of the 5th field (10-digit HUC) watersheds that compose the analysis area for SGP components outside the mine site, and therefore quantitative contextualization of wetland impacts (e.g., reporting the percentage loss of wetlands in a given watershed) is not possible in this portion of the analysis area.

In a single location in Trapper Flat, it was determined through review of delineation data that the full eastern extent of a wetland that would be impacted by the Burntlog Route under Alternatives 1, 2, and 3 had not been delineated as this area fell outside the boundary of the delineation survey area. Through review of aerial photography (ESRI 2016), it was determined that the route had been modified to avoid the delineated wetland in this area; however, based on review of the aerial photography (ESRI 2016), the actual wetland would still be impacted. Since NWI data did not indicate a wetland in this area, resource specialists used aerial imagery and Geographic Information Systems digitization to identify the eastern extension of the wetland that would be crossed by the Burntlog Route. This is the only location where delineation data were augmented through use of aerial imagery interpretation by AECOM resource specialists.

The boundaries and classification of wetlands often change over time due to climate variability, natural disturbances such as fire, changes in water flow patterns, changes in tree growth, and other factors that can affect the extent and classification of a wetland presence and classification over time. When wetland delineation reports are approved by the U.S. Army Corps of Engineers (USACE), the approval generally lasts for a 5-year period due to this potential for wetland boundaries to change over time. As such, it should be noted that the wetland acreage impacts reported in this analysis would not necessarily represent the final actual extent of wetland impacts that would occur as a result of implementation of the SGP. However, reported acreages in this analysis are based on the best currently available data and allow for a meaningful comparison among alternatives. Final impact acreages will be determined as part of the Clean Water Act (CWA) Section 404 permit application and would be agreed upon by the USACE. Special status plant habitat and occurrence information has been included in MWAM scores[2] for wetland functional units in the most recently available wetland functional assessment data (Tetra Tech 2018). However, since species-specific plant surveys have not been conducted throughout the SGP area, information regarding confirmed presence of special status plants will not be incorporated into this analysis.

Mitigation required for wetland losses is based on resource reports that have been, or will be, submitted to the USACE for review as part of the CWA Section 404 permit application. This application process is in progress, and estimated wetland losses (area and functional units) have yet to be approved and may be updated during the CWA Section 404 permit review.

[2] Wetland functional assessment form field 14b - Habitat for Plants or Animals Rated S1, S2, or S3.

4.11.2 Direct and Indirect Effects

This section presents detailed analysis of impacts to wetlands and riparian resources by issues and indicators described above. The analysis of effects associated with wetlands and riparian resources is considered within the overall context of the relative importance of these features. Most wetlands and riparian resources in the SGP area are regulated under federal and state laws, and federal forest management plans because of their important functions, including provision of clean water, flood control, and habitat for a variety of fish and wildlife species, among others. Analysis results are summarized in Section 4.11.7, Summary.

Watersheds containing SGP components are presented in **Table 4.11-1.** This table also identifies which drainage basins contribute to waters that are habitat for Endangered Species Act-listed fish species.

Table 4.11-1 Watersheds Containing SGP Features

Drainage Basin	Contains or Contributes to Waters with ESA-listed Species?	Analysis Area Portion (Figure 3.11-1)	SGP Components
Headwaters East Fork South Fork Salmon River (EFSFSR)	Yes	Mine Site Focus Area	Blowout Creek rock drain, EFSFSR diversion inlet, EFSFSR diversion outlet, embankment, exploration decline and explosives area, Fiddle DRSF, Fiddle DRSF diversion, Hangar Flats DRSF, Hangar Flats pit, Hangar Flats reclamation/stockpile area, haul roads, main ore processing area, Midnight Creek diversion, North Yellow Pine GMS, primary crusher/course ore stockpile, Worker Housing Facility, TSF, TSF and Hangar Flats DRSF diversion, West End DRSF diversion, West End pit, Yellow Pine pit
Big Creek-North Fork Payette River	Yes	Off-site Focus Area	Portions of Warm Lake Road; Stibnite Gold Logistics Facility; portions of existing, new, and widened transmission line corridors
Cascade Reservoir	No	Off-site Focus Area	Portions of existing and widened transmission line corridors
Gold Fork River	Yes	Off-site Focus Area	Portions of existing transmission line corridors
Johnson Creek	Yes	Off-site Focus Area	Portions of Burntlog Route; Cabin Creek groomed snowmobile route; VHF repeater site access road; portions of Yellow Pine Route; portions of existing, new, and widened transmission line corridors
Lake Fork-North Fork Payette River	Yes	Off-site Focus Area	Portions of existing and widened transmission line corridors
Headwaters EFSFSR	Yes	Off-site Focus Area	Portions of Burntlog Route; new segment of an off-highway vehicle trail; VHF repeater site access road; portions of Yellow Pine Route; portions of the new transmission line corridor
Headwaters South Fork Salmon River	Yes	Off-site Focus Area	Cabin Creek groomed snowmobile route; portions of Warm Lake Road; portions of existing and widened transmission line corridors

Table Source: AECOM 2020; Table prepared using watershed boundaries (U.S. Geological Survey 2016) intersected with SGP components. Species presence was reported in MWH Americas, Inc. 2017. For more details refer to Section 3.12, Fish Resources and Fish Habitat.

Table Notes:

EFSFSR = East Fork South Fork Salmon River.

DRSF = Development Rock Storage Facility.

ESA = Endangered Species Act

GMS = Growth Media Stockpile.

SGP = Stibnite Gold Project.

TSF = Tailings Storage Facility.

VHF = Very High Frequency (refers to a radio repeaters).

4.11.2.1 All Action Alternatives

Wetland and riparian resources would be altered or lost under each of the action alternatives. Loss or alteration of wetland and riparian acreages would reduce the water quality, water storage/recharge, and habitat services that existing wetlands currently provide within each of the affected watersheds. These losses would be most substantial at the mine site where each action alternative would remove approximately 31 percent of the existing wetlands within the contributing basin for the EFSFSR watershed above the Sugar Creek/EFSFSR confluence. While some wetlands at the upper periphery of the mine site contributing basin would remain, their hydrologic connectivity to downstream waters and associated vegetation would be removed or altered.

Based on a review of ecological functions provided by wetlands (Berglund and McEldowney 2008) water quality at and downstream of the mine site would not receive the same benefits from wetlands that absorb contaminants (including metals), remove excess nutrients, and filter sediments to reduce turbidity in waters. Loss or alteration of wetland and riparian acreages would reduce the water quality, water storage/recharge, habitat, and other functions that existing wetlands currently provide within each of the affected watersheds. Wetlands in valley bottoms along drainages would no longer have the potential to store high flows that are common in the late spring after rain-on-snow events, which can increase flow velocity and energy downstream. As a result, the potential for erosion and flood hazard risk would be increased. Similarly, the wetlands wouldn't store water and slowly drain to streams in a manner that supports summer base flows for fish. Numerous wetland-dependent species, including fish, amphibians, and birds would be displaced from the mine site into other areas that may or may not be available and may provide less suitable habitat.

Wetland and riparian impacts associated with off-site SGP components would have similar effects, but the watershed context is different as roads and transmission line corridors would affect a relatively small portion of the wetlands and riparian areas contained within off-site watersheds. At off-site locations, wetlands and riparian areas would be primarily affected by linear fills, altered ground/surface water paths, or vegetation removal, which may directly affect only a portion of a wetland feature. However, these linear impacts have the potential to alter flow paths for ground and surface water, which can indirectly result in larger changes to the affected watersheds.

Midas Gold has developed a Conceptual Stream and Wetland Mitigation Plan (CMP) (Tetra Tech 2019a) with mitigation measures to reduce the effects of wetland and riparian losses anticipated for all action alternatives. These include efforts to minimize the duration of losses by creating wetlands and enhancing riparian areas at the mine site concurrent with the SGP operation phase. Conceptual wetland mitigation would involve the placement of amended soils and planting of native wetland species to create wetlands in low-lying areas where water accumulates following mining-related ground disturbances. In many areas, wetlands are proposed to be created over geosynthetic liners to separate created wetlands from underlying DRSFs and TSF. The USACE is working with Midas Gold to address wetland impacts through compensatory mitigation, as described in Section 4.11.3 and **Appendix D-2**.

Midas Gold has prepared a Water Quality Management Plan (Brown and Caldwell 2020) to describe a means of protecting water quality criteria throughout operations and beyond site closure and reclamation. Similarly, they have presented plans that describe a means of accounting for lost wetland and riparian functions and plans for replacing those functions to avoid a net loss over time (**Appendix D-2**).

The following sections provide additional detail on the issues evaluated for each action alternative in order to provide context for the anticipated resource losses and required mitigation.

4.11.2.1.1 Issue: Loss of Wetland and Riparian Areas

Construction of mine site components, construction of new access roads and widening of existing access roads (even if new roads or improvements are only temporary), construction of new transmission line segments, upgrades to existing transmission lines, and construction of off-site facilities would permanently remove acres of wetland and/or riparian resources. Wetlands and riparian areas would be lost due to excavation and fill activities associated with construction of or upgrades to these features. Components such as the pits, DRSFs, and TSF, are the primary features that would result in a permanent loss of wetland and riparian resources, due to the scale and location of the disturbance footprints. These mine features would not only result in direct loss of wetlands and riparian areas, but would alter the ecological connection between headwaters wetlands and riparian areas with waters downstream of the mine site. All SGP disturbance areas would be revegetated, except for new, permanent lakes or open water channels and portions of pit highwalls that are too steep for re-vegetation. However, even with revegetation of impacted areas and compensatory wetland mitigation, impacts to all existing wetlands and riparian areas would be considered permanent as construction would remove soil and disrupt hydrology in ways that are likely to prohibit wetlands and riparian areas from reestablishing in these locations in the future.

Clearing of tall trees within 50 feet of the centerline of transmission lines also could impact wetlands and riparian areas. Clearing of trees would result in the loss of overstory components within any riparian areas and forested wetlands currently located there, which could lead to conversion to other wetland types even when reduction in total wetland acreage would not occur. Tall tree clearing would continue within existing portions of the transmission line segment after SGP closure and reclamation as these transmission line segments would remain in use by Idaho Power Company. Impacts of tall tree clearing on wetlands in these areas would be considered permanent.

In addition to contributing to a direct loss of wetland area, SGP construction (particularly road construction) could indirectly affect wetlands through increased dust deposition. Dust deposition in wetlands could alter water quality parameters and inhibit the metabolic processes of plants, which would result in impacts to individuals ranging from mild metabolic inhibition to mortality (Farmer 1993). Potential impacts of dust on vegetation are described Section 4.10.2.1.1.2, Indirect Effects, subsection Increased Potential for Dust Impacts on Plants; effects of dust on vegetation also are pertinent to wetlands and riparian areas.

Additionally, SGP construction that impacts wetlands has the potential to alter hydrological conditions (e.g., amount and direction of groundwater and surface water flow). Components of the mine such as the pits, diversions, and storm water management features, are examples of mine site developments that could result in hydrologic alterations. These alterations could affect the ability of portions of impacted wetlands outside the disturbance footprint to persist into the future. Forestry practices such as road building have been shown to alter wetland hydrology at distances greater than 328 feet (Jones 2003).

Specific reclamation designs would be developed for each wetland feature and would be incorporated into the CWA Section 404 permit application to address spatial and temporal loss of wetlands (refer to Section 4.11.3 and **Appendix D-2** for additional information).

4.11.2.1.2 Issue: Impacts on Wetland and Riparian Functions

As wetlands are lost, fragmented, or reduced in area through excavation and fill activities, their ability to serve as habitat for fish and wildlife; provide water filtration; water storage; and flow abatement, including groundwater recharge, is lost, reduced, or delayed.

Loss of riparian areas and clearing of trees in Riparian Conservation Areas (RCAs) or forested wetlands in transmission line corridors would result in reductions of shade, flood energy dissipation, organic source material, support for benthic macroinvertebrates (e.g., insects eaten by fish), and soil stability. Loss of riparian areas also would result in changes in vegetative species composition and reductions of available nesting substrate, breeding habitat, forage for migratory birds, and reductions in available habitat, including connectivity, and forage for other wildlife species (e.g., large game animals). As wetlands are lost, some of the effects would be permanent and would occur immediately at the time of disturbance (e.g., loss of available habitat) while other indirect effects would occur gradually over time, such as species composition changes, and changes to water flows.

Wetland functions were assessed for most of the wetlands within the analysis area using the MWAM. The objective of MWAM is to provide a rapid, economical, and repeatable wetland evaluation method applicable to Montana and other western states that:

- Meets the needs of local regulatory agencies in terms of rating wetland functions and values for the majority of proposed wetland disturbance-related projects and wetland mitigation projects in the state, particularly highway projects;
- Minimizes subjectivity and variability between evaluators;
- Allows for the comparison of different wetland types;
- Provides a means of rating wetlands to facilitate the prioritization of impact avoidance and minimization measures; and
- Incorporates current and relevant information on wetland functions. (Montana Department of Transportation 2008).

For this method, evaluators rank wetlands and place them into one of four categories from I (highest functional value) to IV (lowest functional value) using a standard MWAM form and referencing guidelines in the MWAM user's manual. The MWAM also summarizes various wetland functions into "functional units," which can be used to calculate units of wetland functional gains and losses. Gains would result from proposed wetland mitigation (e.g., creating new wetlands to replace those lost). The purpose of this assessment methodology is to demonstrate where functional losses are anticipated based on the total number of wetland functional units within an area. For detailed explanation of the methodology used to calculate the wetland functional units associated with a given wetland AA see Additional Information to Amend the 2016 HDR Wetlands Functions and Values Assessment, Stibnite Gold Project (Tetra Tech 2018), and for additional detail on how losses of wetland functional units associated with a given AA were calculated refer to **Appendix I-1, Table I-1-2** through **I-1-5**.

Clearing of tall trees associated with new transmission line construction would reduce functions associated with forested wetlands. While forested wetland clearing may not convert wetlands to uplands, it would diminish the wetland functions associated with the affected forested wetland, as shade and habitat structure are removed.

Road construction along existing roads (e.g., widening) that encroaches along the edge of a wetland is not likely to result in a full loss of functions for that wetland so long as the wetland extends outside the construction footprint and the wetland continues to receive sufficient water inputs. Analysis of road construction impacts on wetland wildlife species and habitat is included in Section 4.13.2, Direct and Indirect Effects for Wildlife and Wildlife Habitat.

For this analysis, losses of wetland functional units at the mine site are reported in the context of the mine site portion of the analysis area, and losses of wetland functional units from transmission line construction, transmission line right-of-way widening, access road construction, or off-site facility construction are reported in the context of the subbasins in which they occur (**Table 4.11-1**).

Due to the large number of individual wetlands impacted under each action alternative, it is not possible to present analysis of impacts to wetland functions on a wetland-by-wetland basis in this section. Refer to **Appendix I-1**, **Tables I-1-2** through **I-1-5** for extents of impacts to specific AAs under each action alternative. These tables include a summary of dominant wetland functions attributed to each impacted AA. Loss of wetland functions presented herein are limited to those wetlands that were analyzed using MWAM. Wetlands that were estimated, rather than delineated, were not analyzed using MWAM.

4.11.2.1.3 Issue: Wetland and Riparian Area Fragmentation

Fragmentation of wetlands and riparian areas would occur at the mine site and in areas where new roads or transmission line crossings are constructed or altered. As riparian corridors often provide cover for wildlife movement, these crossings could create breaks in several otherwise contiguous tree/shrub corridors. Hydrologic flows through riparian areas and wetlands would be affected by road crossings and culverts that would alter the current route of surface and subsurface flows and could reduce the delivery of woody material from riparian areas into streams. Forestry practices such as road building have been shown to alter wetland hydrology at distances greater than 328 feet (Jones 2003). New roads that would affect wetlands and riparian areas would be removed and their footprints reclaimed and revegetated after completion of the SGP; however, habitat fragmentation associated with the initial impacts to wetlands is considered permanent for the purpose of this analysis due to the duration of the SGP.

4.11.2.1.4 Issue: Alteration of Wetland and Riparian Areas due to Changes in Water Balance

The SGP may affect water balance, which could change (reduce or increase) seasonal water input frequency and duration for on-site and off-site, downstream wetlands. The Revised Final Stibnite Gold Project Hydrologic Model Proposed Action Report provides details of the hydrologic model (Brown and Caldwell 2018) and the various simulations completed to assess potential changes to the groundwater and surface water flow systems during the mine operational period.

Reduced seasonal water input is likely to result in areas that no longer support wetland soils or hydrophytic vegetation. Wetlands would be impacted by groundwater drawdown if they are within an area subject to drawdown, as this is likely to eliminate near-surface water table conditions that categorize areas as wetlands under wetland delineation methodology (i.e., inundated or saturated soils at some point during the growing season; USACE 1987).

The maximum extent of groundwater (alluvial and bedrock) drawdown under each of the alternatives was used to estimate the acres of wetlands that would be impacted by reduced seasonal water input. All of the drawdown impacts would occur within the Headwaters EFSFSR watershed. Note that climate change effects resulting from the SGP also may affect water quantity over time, as discussed in Section 4.4.2.1.4.7 (Climate Change Effects on Wetlands).

4.11.2.1.5 Issue: Alteration of Wetland and Riparian Areas due to Changes in Water Quality

SGP-related construction and operations may result in changes to water temperature, increases in concentration of key contaminants, and increases in sedimentation in surface waters. These impacts could reduce the functional capacity of wetlands and riparian areas to absorb contaminants, filter sediments, regulate water temperature, and provide clean habitat for fish and wildlife. The detailed analysis presented in Section 4.9, Surface Water and Groundwater Quality, was reviewed to inform the analysis of water quality impacts that could affect wetlands and riparian areas. This includes an assessment of the following impacts on surface water and groundwater quality:

- Effects of open pit mining, including exposed rock faces and material used to backfill open pits.

- Effects of increased metals loading due to increased flows from rapid infiltration basins and water treatment plants.
- Effects of tailings and development rock storage.
- Effects of tailings consolidation water and runoff from the proposed TSF.
- Effects of ground disturbance and potential erosion.
- Effects of dust deposition.
- Effects of treated sanitary wastewater discharge.
- Effects of accidental spills of fuels and hazardous materials.
- Effects of new access road and utility corridor stream crossings.

The Water Quality Management Plan developed for the SGP (Brown and Caldwell 2020) includes several measures aimed at maintaining and improving water quality at the mine site. The plan describes how tailings would be removed, how best management practices would be used for erosion and sediment control, how existing waters would be diverted to avoid contact with contaminated/process water, how runoff from contaminated areas would be captured and treated, and how groundwater would be used to process ore, and how a long-term water treatment program would be operated and maintained. The potential for these actions to affect hydrologically connected wetlands and riparian areas is discussed qualitatively in the analysis for Alternative 2.

4.11.2.2 Alternative 1

Construction of the TSF, DRSFs, open pits, new roads and improvements to existing roads, transmission lines and associated access roads, borrow sites, new off-site facilities, and other surface disturbances in the SGP area would require filling or excavating wetlands and riparian areas.

Alternative 1 would result in permanent impacts to wetland or riparian area acreage and associated functions as described below. Affected functions would include habitat for fish and wildlife, water filtration, and water storage and flow abatement, including groundwater recharge. Losses of wetland and riparian areas and their functions would occur throughout the construction and operation phases (refer to the Stream Functional Assessment (SFA) Ledger [Rio ASE 2019]). Habitat fragmentation, water balance, and water quality effects on wetlands as described in Section 4.11.2.1 also would occur under this alternative. The following subsections provide details of the extent of these impacts under Alternative 1.

Wetland and riparian impact area maps for Alternative 1 are provided in **Appendix I-2**.

4.11.2.2.1 ISSUE: LOSS OF WETLAND AND RIPARIAN AREAS

4.11.2.2.1.1 Mine Site Focus Area

Table 4.11-2 presents acres of wetlands and RCAs that would be lost due to SGP actions within the mine site focus area under Alternative 1. Loss of wetland acres under Alternative1 would occur to approximately 31 percent of the 429 acres of wetlands identified in the mine site analysis area (**Table 3.11-3a**). All wetland and RCA impacts at the mine site would occur within the Headwaters EFSFSR watershed.

Table 4.11-2 Losses of Wetlands and RCAs in the Mine Site Focus Area under Alternative 1

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)	Total RCAs (acres)
Blowout Creek Rock Drain	0.1	-	-	-	**0.1**	**2.7**
C-Road	<0.1	-	<0.1	-	**<0.1**	**0.9**
Disturbed Area - Other	0.1	0.3	0.4	-	**0.8**	**9.4**
EFSFSR Diversion Inlet	-	-	<0.1	-	**<0.1**	**0.8**
EFSFSR Diversion Outlet	-	-	<0.1	-	**<0.1**	**1.4**
Embankment	2.9	1.2	4.2	-	**8.4**	**17.3**
Exploration Decline and Explosives Area	0.3	-	0.1	<0.1	**0.4**	**8.6**
Facility Stormwater Pond	-	-	-	-	**-**	**0.0**
Fiddle DRSF	0.3	8.2	-	0.1	**8.6**	**72.0**
Fiddle DRSF Diversion	-	0.2	-	-	**0.2**	**2.8**
Hangar Flats DRSF	8.8	-	2.0	0.3	**11.1**	**47.7**
Hangar Flats Pit	2.8	1.1	4.1	-	**7.9**	**31.2**
Hangar Flats Reclamation/Stockpile Area	3.7	4.1	4.4	0.1	**12.3**	**51.1**
Haul Roads	0.5	0.3	1.9	<0.1	**2.7**	**61.9**
HF Pipeline Service Road	-	-	<0.1	-	**<0.1**	**0.3**
Main Ore Processing Area	1.5	0.2	0.6	-	**2.3**	**11.9**
Midnight Creek Diversion	-	-	0.1	-	**0.1**	**1.0**
Midnight GMS	-	-	-	-	**-**	**1.4**
North Yellow Pine GMS	-	-	0.2	-	**0.2**	**13.5**
Primary Crusher/Course Ore Stockpile	<0.1	-	<0.1	-	**<0.1**	**2.6**
Rapid Infiltration Basin East	-	-	-	-	**-**	**2.0**
Rapid Infiltration Basin West	-	-	-	-	**-**	**7.8**
Light Vehicle Road	-	-	-	-	**-**	**0.2**

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)	Total RCAs (acres)
Scott Haul Road	-	<0.1	<0.1	-	**0.1**	**0.3**
Worker Housing Facility	0.3	<0.1	0.7	-	**1.1**	**2.7**
Truck Shop Area	-	-	-	-	**-**	**0.7**
Truck Shop GMS	-	-	-	-	**-**	**0.1**
Truck Shop High Traffic	-	-	-	-	**-**	**<0.1**
TSF	2.1	40.0	9.8	-	**51.9**	**146.3**
TSF and Hangar Flats DRSF Diversion	0.9	6.9	1.6	0.1	**9.5**	**21.7**
West End DRSF	-	-	-	-	**-**	**41.6**
West End DRSF Diversion	<0.1	-	-	-	**<0.1**	**4.9**
West End Pit	-	-	0.6	-	**0.6**	**26.3**
Yellow Pine Pit	1.4	0.1	4.5	4.5	**10.6**	**69.4**
Access Roads within the Mine Site Analysis Area	0.2	0.5	0.4	-	**1.1**	**11.4**
Utilities within the Mine Site Analysis Area	0.1	0.1	0.1	-	**0.3**	**1.7**
Tall Tree Clearing within the Mine Site Analysis Area[1]	-	0.1	0.3	-	**0.4**	**n/a**
TOTALS	**26.0**	**63.4**	**36.4**	**5.1**	**130.9**	**675.6**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) and RCA spatial data intersected with SGP components. Total wetland acreages include only areas delineated and assessed for the SGP; National Wetlands Inventory data were not used at the mine site

Table Notes:

1 Tall tree clearing was only considered a possible impact to areas where tree species may grow (PFO and PSS wetlands). Information on tree presence in RCAs was not available at the time of analysis and therefore tree clearing in RCAs could not be quantified

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

RCA = Riparian Conservation Area.

EFSFSR = East Fork South Fork Salmon River.

DRSF = Development Rock Storage Facility.

GMS = Growth Media Stockpile.

SGP = Stibnite Gold Project.

TSF = Tailings Storage Facility.

n/a = not applicable.

4.11.2.2.1.2 Off-site Focus Area

Acres of impacts to wetlands and RCAs in the portion of the analysis area outside the mine site are shown in **Table 4.11-3**.

Table 4.11-3 Losses of Wetlands and RCAs within the Off-site Focus Area under Alternative 1

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)	RCAs (acres)
Access Roads	8.2	3.9	5.5	-	**17.6**	158.8
Utilities	7.5	0.9	1.8	0.9	**11.1**	288.9
Tall Tree Clearing[1]	n/a	2.5	9.4	n/a	**11.8**	**n/a**
Offsite Facilities	0.1	-	0.6	-	**0.8**	**5.8**
TOTALS	**15.8**	**7.2**	**17.3**	**0.9**	**41.2**	**453.5**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) and RCA data intersected with SGP components and NWI wetland data intersected with SGP components for areas where wetland delineation data were not available

Table Notes:

1 Tall tree clearing was only considered a possible impact to areas where tree species may grow (PFO and PSS wetlands). Information on tree presence in RCAs was not available at the time of analysis and therefore tree clearing in RCAs could not be quantified.

NWI = National Wetlands Inventory.

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

RCA = Riparian Conservation Area.

SGP = Stibnite Gold Project.

n/a = not applicable.

Impacts on wetlands due to construction, maintenance, and use of Burntlog Route (which includes alignment modifications and widening of existing portions and construction of new portions) would contribute the greatest proportion of impacts to wetlands due to access road construction as the proposed width of this route would be approximately four times wider than standard roads in this area. Indirect effects on wetlands and riparian areas, such as dust, changes in hydrology, and species composition could be greater on this route than would be expected on standard roads due to frequency of travel, size of equipment, and proposed use across seasons.

Burntlog Route would be near Mud Lake, which is characterized by Idaho Fish and Game as a poor fen (Idaho Fish and Game 2004). Indirect impacts of road improvements and vehicle travel (i.e., increased dust) are likely to impact this fen and degrade its function as habitat for a fen-specific special status plant (Rannoch-rush [*Scheuchzeria palustris*]; Section 4.10.2.2.5.6, Rannoch-rush).

Table 4.11-4 shows acres of impacts to wetlands and RCAs in the portion of the analysis area that is outside the mine site by HUC 10 drainage basin (i.e., watershed). The greatest extent of wetland and riparian impacts outside the mine site would occur in the Johnson Creek watershed, with lesser extents of impacts to wetlands and riparian areas in the other watersheds.

Table 4.11-4 Losses of Wetlands and RCAs within the Off-site Focus Area by Watershed under Alternative 1

Drainage Basin (HUC 10)	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	RCA (acres)
Big Creek-North Fork Payette River	1.9	-	1.8	-	**3.7**	78.1
Cascade Reservoir	2.7	-	-	-	**2.7**	4.8
Gold Fork River	0.2	-	-	0.9	**1.1**	8.5
Johnson Creek	8.5	3.9	10.7	-	**23.0**	234.7
Lake Fork-North Fork Payette River	2.4	2.1	0.2	0.0	**4.6**	4.5
Headwaters EFSFSR	0.1	1.1	0.9	-	**2.1**	41.1
Upper South Fork Salmon River	0.2	0.1	3.7	-	**4.0**	81.8
TOTALS[1]	**15.8**	**7.2**	**17.3**	**0.9**	**41.2**	**453.5**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) and RCA data intersected with SGP components and NWI wetland data intersected with SGP components for areas where wetland delineation data were not available

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

NWI = National Wetlands Inventory.

HUC = Hydrologic Unit Code.

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

RCA = Riparian Conservation Area.

SGP = Stibnite Gold Project.

4.11.2.2.2 Issue: Impacts on Wetland and Riparian Functions

An estimated total of 759.3 wetland functional units would be lost as a result of SGP construction under Alternative 1, approximately 486.1 of which would be due to impacts to high-value wetlands (**Table 4.11-5**). Impacts described generally in Section 4.11.2.1.2, would occur as a result of these losses. Refer to **Appendix I-1** (**Table I-1-2**) for impacts to acres and functions in each specific AA, and specific SGP components associated with these impacts under Alternative 1. **Figures 4.11-1a** and **4.11-1b** show the AAs impacted under Alternative 1 within the off-site focus area and the mine site focus area, respectively.

Table 4.11-5 Losses of Wetland Acreages and Functional Units under Alternative 1

Wetland Category[1]	Total Wetland Acreage (acres)[2]	Proposed Wetland Impacts (acres)[2]	Proposed Tall Tree Clearing (acres)	Proposed Percentage of AA Impact	Total Functional Units[3]	Number of Functional Units Affected[4]
II (High-value)	221.3	79.1	0.2	2.0	1,202.0	**486.1**
III and IV	501.0	51.2	0.3	7.5	2,326.9	**273.2**
TOTALS[5]	**722.4**	**130.4**	**0.4**	**9.5**	**3,528.9**	**759.3**

Table Source: AECOM 2020; Table prepared using wetland functional assessment data (HDR 2016a; Tetra Tech 2018). Refer to **Appendix I-1** (**Table I-1-1**) for AA-specific information

Table Notes:

1 Wetland categories range from I (highest functional value) to IV (lowest functional value). No Category I wetlands were documented in the analysis area. Category II wetlands are considered high-value for the purposes of this analysis.

2 Total wetland acreages and proposed wetland impact acreages include only areas delineated and assessed for the SGP; it does not include National Wetlands Inventory data or aerial photography data used to extrapolate wetland impacts for areas where wetland delineations and functional assessments were not performed.

3 Total functional units of an AA are presented in Additional Information to Amend the 2016 HDR Wetlands Functions and Values Assessment, Final Technical Memorandum (Tetra Tech 2018). Efforts to gain approval of existing wetland functional assessment scores are ongoing and may result in changes relative to the totals listed in this table (Griffith and Williams 2019).

4 Functional unit impacts were calculated based on percentage of AA impacted; this calculation assumes equal distribution of functions over the area of a wetland.

5 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

AA = Assessment Area.

4.11.2.2.3 Issue: Wetland and Riparian Area Fragmentation

Under Alternative 1, the total extent of wetland losses would be approximately 131 acres at the mine site and 41 acres outside the mine site. Losses of RCAs would occur on approximately 676 acres at the mine site and 454 acres outside the mine site. New roads would bisect 139 total individual wetlands. Fragmentation effects, as described in Section 4.11.2.1.3, could occur as a result of these impacts.

This page intentionally left blank

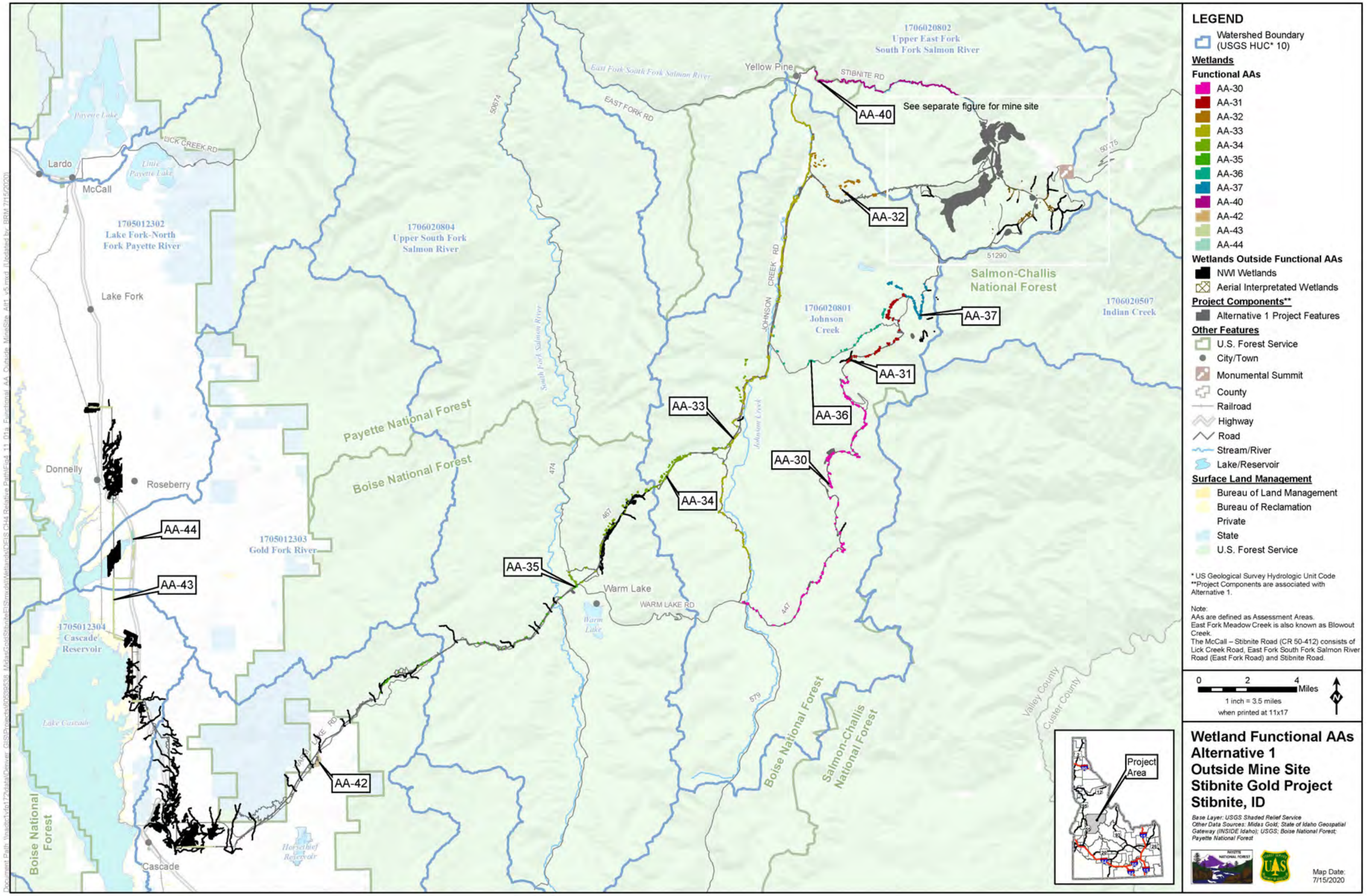


Figure Source: AECOM 2020

Figure 4.11-1a Wetland Functional AAs Alternative 1 Outside Mine Site

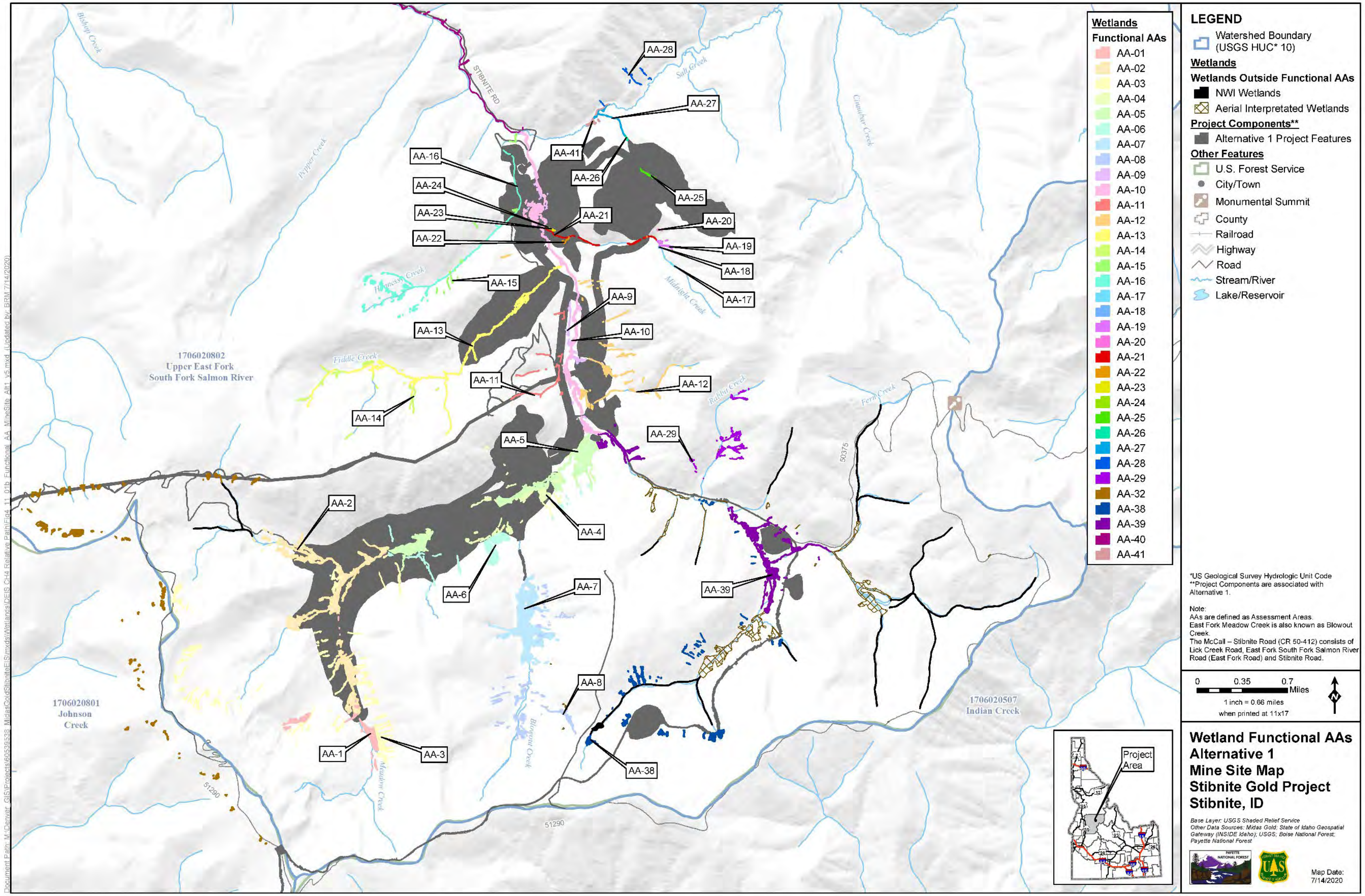


Figure Source: AECOM 2020

Figure 4.11-1b Wetland Functional AAs Alternative 1 Mine Site Map

4.11.2.2.4 Issue: Alteration of Wetland and Riparian Areas due to Changes in Water Balance

Alternative 1 would affect water balance through groundwater drawdown, which could reduce seasonal water input frequency and duration for on-site and off-site downstream wetlands. Acres of wetlands in the maximum groundwater drawdown area under Alternative 1 are presented in **Table 4.11-6**. The entirety of these wetlands also would be subject to direct impacts from alternative component construction.

Table 4.11-6 Acres and Types of Wetlands in the Maximum Drawdown Area under Alternative 1

	PEM Wetland	PFO Wetland	PSS Wetland	Open Water	Total Wetlands[1]
Acres of Wetlands	8.3	6.8	28.8	4.7	**48.6**

Table Source: AECOM 2020; Merged simulated alluvial and bedrock groundwater drawdown contour (maximum drawdown area for all SGP years combined).

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

SGP = Stibnite Gold Project.

During the post-closure phase, wetlands associated with Meadow Creek, downstream of the Hangar Flats diversion but upstream of the confluence with the East Fork South Salmon River (EFSFSR), would experience flow reductions for approximately 10 years following mining cessation, as the Hangar Flats pit lake fills (refer to Section 4.8.2.1.1, Changes in Stream Flow Characteristics for Surface Water Quantity). Flow reductions in this area would negatively impact wetland and riparian conditions downstream of the pit lake, in this segment of Meadow Creek, by reducing or temporarily eliminating hydrologic inputs into these features. These impacts may reduce or eliminate functions and values of these wetlands during low flow periods.

4.11.2.2.5 Issue: Alteration of Wetland and Riparian Areas due to Changes in Water Quality

As summarized in the Surface Water and Groundwater Quality section (Section 4.9.2.1, Alternative 1), changes to water quality parameters would occur under Alternative 1 during the construction and operation phases. Alternative 1 would improve some of the existing water quality conditions observed in Meadow Creek and the EFSFSR by removing and repurposing legacy mine wastes. However, Alternative 1 would have direct permanent impacts on water quality, as it would contribute new sources of mine waste material to the EFSFSR drainage.

Indirect effects to wetlands and riparian areas could occur under Alternative 1 if the quantity and or quality of surface and groundwater flows, including the chemical characteristics of the waters, change downstream of disturbance areas, and if those changes impact water quality or habitat conditions during active mining and after SGP closure. This could include the effects of placing DRSFs in stream valleys, which could introduce contaminants or cause temporary changes to pH and dissolved oxygen levels.

4.11.2.3 Alternative 2

Alternative 2 would result in direct effects on wetlands and riparian areas. Under Alternative 2, the 5.3-mile-long Riordan Creek segment of the Burntlog Route would route it to the southern side of the Riordan Creek drainage and cross Riordan Creek north of Black Lake. This change, relative to Alternative 1, would result in a reduction of wetland losses associated with access road construction by avoiding some wetlands. the new transmission line would be permanently retained to provide power to the Centralized Water Treatment Plant at the mine site as part of the post-closure Water Quality Management Plan under Alternative 2.

Alternative 2 would result in permanent impacts to wetland or riparian area acreage and associated functions as described below. Affected functions would include habitat for fish and wildlife, water filtration, water storage, and flow abatement, including groundwater recharge. As under Alternative 1, losses of wetland and riparian areas and their functions would occur throughout the construction and operations phases (refer to the SFA Ledger [Rio ASE 2019]). Habitat fragmentation, water balance and water quality effects on wetlands (described in Section 4.11.2 above) under this alternative also would occur. The following subsections provide details of the extent of these impacts under Alternative 2.

Wetland and riparian impact area maps for Alternative 2 are provided in **Appendix I-3**.

4.11.2.3.1 ISSUE: LOSS OF WETLAND AND RIPARIAN AREAS

4.11.2.3.1.1 Mine Site Focus Area

Table 4.11-7 presents acres of wetlands and RCAs that would be lost due to SGP actions within the mine site focus area under Alternative 2. Loss of wetland acres under Alternative 2 would occur to approximately 31 percent of the 429 acres of wetlands identified in the mine site analysis area (**Table 3.11-3a**). All wetland and RCA impacts at the mine site would occur within the Headwaters EFSFSR watershed.

Table 4.11-7 Losses of Wetlands and RCAs in the Mine Site Focus Area under Alternative 2

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands[1] (acres)	Total RCAs (acres)
Blowout Creek Rock Drain	0.1	-	-	-	**0.1**	**2.7**
C-Road	<0.1	-	<0.1	-	**<0.1**	**0.9**
Disturbed Area - Other	0.1	0.3	0.4	-	**0.8**	**3.7**
EFSFSR Diversion Inlet	-	-	<0.1	-	**<0.1**	**0.8**
EFSFSR Diversion Outlet	-	-	<0.1	-	**<0.1**	**1.4**
Embankment	2.9	1.2	4.2	-	**8.4**	**17.3**
Exploration Decline and Explosives Area	0.3	-	0.1	<0.1	**0.4**	**8.6**
Fiddle DRSF	0.3	8.2	-	0.1	**8.6**	**72.0**
Fiddle DRSF Diversion	-	0.2	-	-	**0.2**	**2.8**
Hangar Flats DRSF	8.8	-	2.0	0.3	**11.1**	**47.7**
Hangar Flats Pit	2.8	1.1	4.1	-	**7.9**	**31.2**
Hangar Flats Reclamation/Stockpile Area	3.7	4.1	4.4	0.1	**12.3**	**51.1**
Haul Roads	0.5	0.3	1.9	0.0	**2.7**	**61.0**
Hangar Flats Pipeline Service Road	-	-	<0.1	-	**<0.1**	**0.3**
Main Ore Processing Area	1.5	0.2	0.6	-	**2.3**	**11.9**
Midnight Creek Diversion	-	-	0.1	-	**0.1**	**1.0**
Midnight GMS	-	-	-	-	**-**	**1.4**
North Yellow Pine GMS	-	-	0.2	-	**0.2**	**13.5**
Primary Crusher/Course Ore Stockpile	<0.1	-	<0.1	-	**<0.1**	**2.6**
Public Access During Mining - Option 1	<0.1	<0.1	0.3	-	**0.3**	**5.9**
Public Access During Mining - Option 2	-	-	<0.1	-	**<0.1**	**1.9**
Rapid Infiltration Basin East	-	-	-	-	**-**	**2.0**
Rapid Infiltration Basin West	-	-	-	-	**-**	**7.8**
Light Vehicle Road	-	-	-	-	**-**	**0.2**
Scott Haul Road	-	<0.1	<0.1	-	**0.1**	**0.3**
Worker Housing Facility	0.3	<0.1	0.7	-	**1.1**	**2.7**
Truck Shop Area	-	-	-	-	**-**	**0.7**
Truck Shop GMS	-	-	-	-	**-**	**0.1**
Truck Shop High Traffic	-	-	-	-	**-**	**0.0**

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands[1] (acres)	Total RCAs (acres)
TSF	2.1	40.0	9.8	-	**51.9**	**146.3**
TSF and Hangar Flats DRSF Diversion	0.9	6.9	1.6	0.1	**9.5**	**21.7**
West End Pit	-	-	0.6	-	**0.6**	**26.3**
Yellow Pine Pit	1.4	0.1	4.5	4.5	**10.6**	**69.4**
Portions of Access Roads within the Mine Site Analysis Area	0.1	0.5	0.4	-	**1.1**	**11.4**
Portions of Utilities (new Transmission Line Segments) within the Mine Site Analysis Area	0.1	0.1	0.1	-	**0.3**	**1.7**
Tall Tree Clearing within the Mine Site Analysis Area[2]	-	0.1	0.3	-	**0.4**	**n/a**
TOTALS[1]	**25.9**	**63.4**	**36.8**	**5.1**	**131.2**	**630.3**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b 2015, 2016b,c) and RCA spatial data intersected with SGP components. Total wetland acreages include only areas delineated and assessed for the SGP; National Wetlands Inventory data were not used at the mine site

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

2 Tall tree clearing was only considered a possible impact to areas where tree species may grow (PFO and PSS wetlands). Information on tree presence in RCAs was not available at the time of analysis and therefore tree clearing in RCAs could not be quantified

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

RCA = Riparian Conservation Area.

EFSFSR = East Fork South Fork Salmon River.

DRSF = Development Rock Storage Facility.

GMS = Growth Media Stockpile.

SGP = Stibnite Gold Project.

TSF = Tailings Storage Facility.

n/a = not applicable.

4.11.2.3.1.2 Off-site Focus Area

Acres of impacts to wetlands and RCAs in the off-site focus area under Alternative 2 are shown in **Table 4.11-8**.

Impacts to wetlands associated with construction, maintenance, and use of Burntlog Route in the new and existing portions of this route would occur in the same manner as described for Alternative 1 (Section 4.11.2.2.1.2).

Table 4.11-9 shows acres of impacts to wetlands and RCAs in the off-site focus area by HUC 10 drainage basin. As under Alternative 1, the greatest extent of wetland and riparian impacts in areas outside the mine site would occur in the Johnson Creek watershed, with lesser extents of impacts to wetlands and riparian areas in the other watersheds.

Table 4.11-8 Losses of Wetlands and RCAs within the Off-site Focus Area under Alternative 2

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	RCAs (acres)
Access Roads	3.0	1.5	4.8	-	**9.3**	**155.8**
Utilities	5.7	0.9	1.8	1.0	**9.3**	**288.0**
Tall Tree Clearing[2]	n/a	2.5	9.4	n/a	**11.9**	**n/a**
Offsite Facilities	0.1	-	0.6	-	**0.8**	**5.8**
TOTALS[1]	**8.9**	**4.9**	**16.6**	**1.0**	**31.3**	**449.6**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) and RCA data intersected with SGP components and NWI wetland data intersected with SGP components for areas where wetland delineation data were not available

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

2 Tall tree clearing was only considered a possible impact to areas where tree species may grow (PFO and PSS wetlands). Information on tree presence in RCAs was not available at the time of analysis and therefore tree clearing in RCAs could not be quantified

NWI = National Wetlands Inventory.

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

RCA = Riparian Conservation Area.

SGP = Stibnite Gold Project.

n/a = not applicable.

Table 4.11-9 Losses of Wetlands and Riparian Conservation Areas within the Off-site Focus Area by Watershed under Alternative 2

Drainage Basin (HUC 10)	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	RCA (acres)
Big Creek-North Fork Payette River	0.7	-	1.8	0.0	**2.5**	77.6
Cascade Reservoir	2.2	-	-	-	**2.2**	4.7
Gold Fork River	0.2	-	-	0.9	**1.1**	8.5
Johnson Creek	3.2	1.5	10.1	-	**14.8**	231.6
Lake Fork-North Fork Payette River	2.4	2.1	0.2	0.0	**4.6**	4.5
Headwaters EFSFSR	0.1	1.1	0.9	-	**2.1**	40.9
Upper South Fork Salmon River	0.2	0.1	3.7	-	**4.0**	81.8
TOTALS[1]	**8.9**	**4.9**	**16.6**	**1.0**	**31.3**	**449.6**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) and RCA data intersected with SGP components and NWI wetland data intersected with SGP components for areas where wetland delineation data were not available

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

NWI = National Wetlands Inventory.

HUC = Hydrologic Unit Code.

ESA = Endangered Species Act.

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

RCA = Riparian Conservation Area.

SGP = Stibnite Gold Project.

4.11.2.3.2 ISSUE: IMPACTS ON WETLAND AND RIPARIAN FUNCTIONS

An estimated total of 761.5 wetland functional units would be lost as a result of SGP construction under Alternative 2, approximately 488.1 of which would be due to impacts to high-value wetlands (**Table 4.11-10**). Impacts described generally in Section 4.11.2.1.2 would occur as a result of these losses. Refer to **Appendix I-1** (**Table I-1-3**) for impacts to acres and functions in each specific AA and what specific SGP components would be associated with these impacts under Alternative 2. **Figures 4.11-2a** and **4.11-2b** show the AAs impacted under Alternative 2 within the off-site focus area and the mine site focus area, respectively.

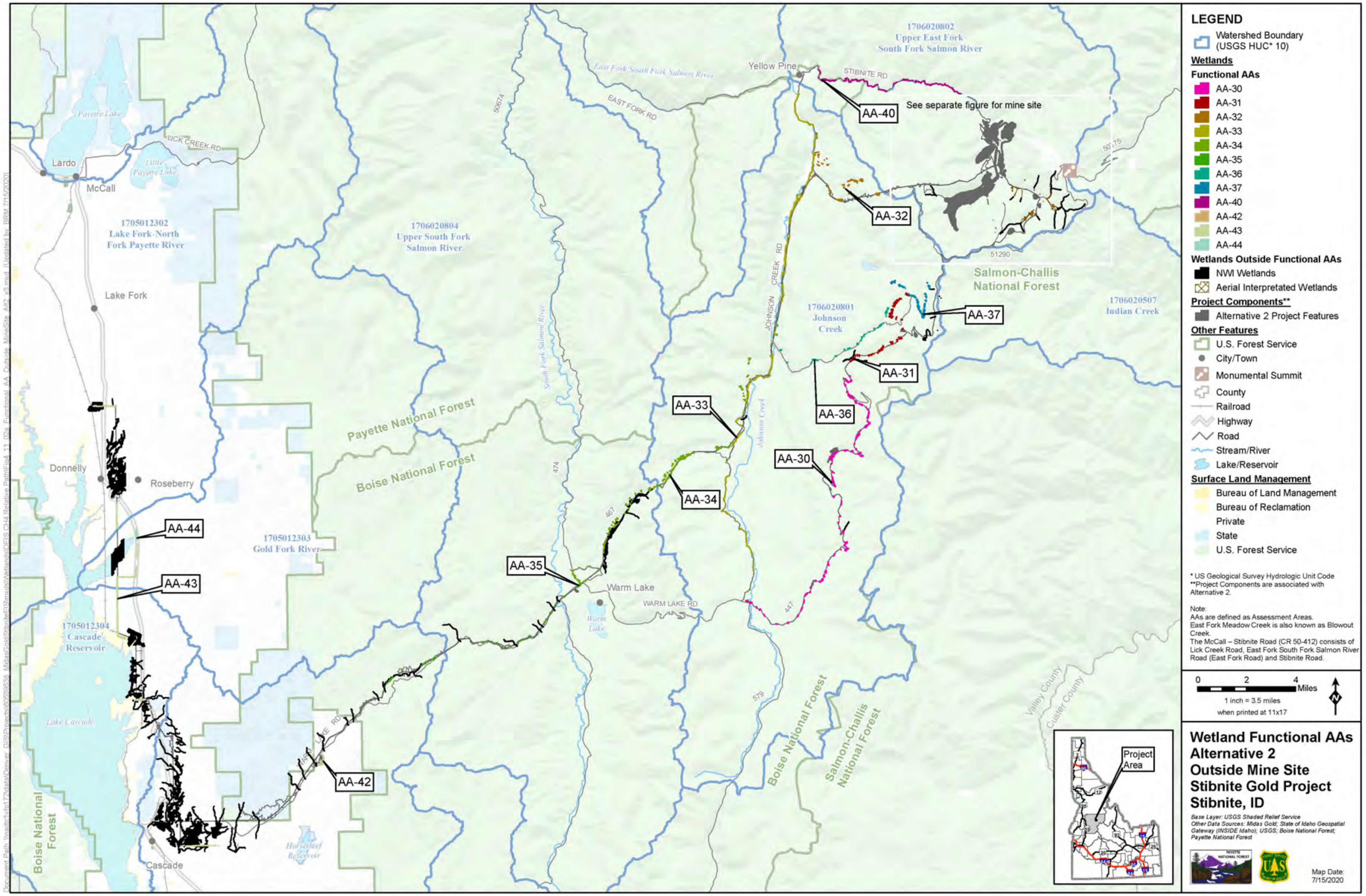


Figure Source: AECOM 2020

Figure 4.11-2a Wetland Functional AAs Alternative 2 Outside Mine Site

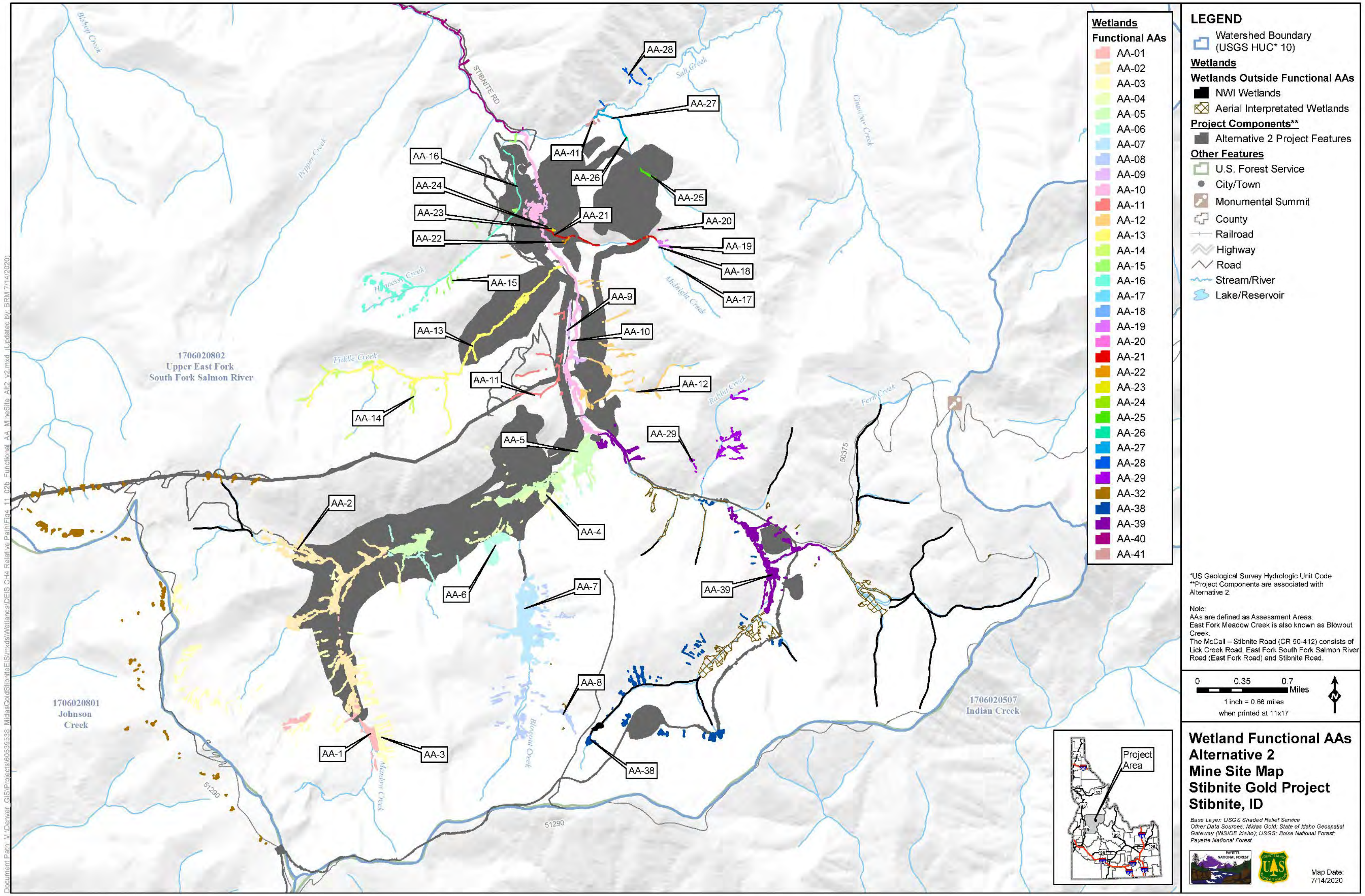


Figure Source: AECOM 2020

Figure 4.11-2b Wetland Functional AAs Alternative 2 Mine Site Map

Table 4.11-10 Losses of Wetland Acreages and Functional Units under Alternative 2

Wetland Category[1]	Total Wetland Acreage (acres)[2]	Proposed Wetland Impacts (acres)[2]	Proposed Tall Tree Clearing (acres)	Proposed Percentage of AA Impact	Total Functional Units[3]	Number of Functional Units Affected[4]
II (High-value)	221.3	79.4	0.2	2.0	1,202.0	**488.1**
III and IV	501.0	51.3	0.3	7.5	2,326.9	**273.4**
TOTALS[5]	722.4	130.7	0.4	9.5	3,528.9	**761.5**

Table Source: AECOM 2020; Table prepared using wetland functional assessment data (HDR 2016a; Tetra Tech 2018). Refer to **Appendix I-1** (**Table I-1-1**) for AA-specific information.

Table Notes:

1 Wetland categories range from I (highest functional value) to IV (lowest functional value). No Category I wetlands were documented in the analysis area. Category II wetlands are considered high-value for the purposes of this analysis.

2 Total wetland acreages and proposed wetland impact acreages include only areas delineated and assessed for the SGP; it does not include National Wetlands Inventory data or aerial photography data used to extrapolate wetland impacts for areas where wetland delineations and functional assessments were not performed.

3 Total functional units of an AA are presented in Additional Information to Amend the 2016 HDR Wetlands Functions and Values Assessment, Final Technical Memorandum (Tetra Tech 2018). Efforts to gain approval of existing wetland functional assessment scores are ongoing and may result in changes relative to the totals listed in this table (Griffith and Williams 2019).

4 Functional unit impacts were calculated based on percentage of AA impacted; this calculation assumes equal distribution of functions over the area of a wetland.

5 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

AA = Assessment Area.

4.11.2.3.3 ISSUE: WETLAND AND RIPARIAN AREA FRAGMENTATION

Under Alternative 2, the total extent of wetland losses would be approximately 131 acres at the mine site and 31 acres outside the mine site. Losses of RCAs would occur on approximately 630 acres at the mine site and 450 acres outside the mine site. New roads would bisect 86 total individual wetlands, as the Riordan Creek realignment of a section of Burntlog Route would avoid some wetlands impacted under alternatives without that realignment. Fragmentation effects, as described in Section 4.11.2.1.3, occur as a result of these actions.

4.11.2.3.4 ISSUE: ALTERATION OF WETLAND AND RIPARIAN AREAS DUE TO CHANGES IN WATER BALANCE

Alternative 2 would affect water balance, which could reduce seasonal water input frequency and duration for on-site and off-site downstream wetlands. Acres of wetlands in the maximum groundwater drawdown area under Alternative 2 are presented in **Table 4.11-11**. The entirety of these wetlands also would be subject to direct impacts from alternative component construction.

Table 4.11-11 Acres and Types of Wetlands in the Maximum Drawdown Area under Alternative 2

	PEM Wetland	PFO Wetland	PSS Wetland	Open Water	Total Wetlands[1]
Acres of Wetlands	**7.2**	**7.0**	**28.4**	**4.2**	**46.7**

Table Source: AECOM 2020; Merged simulated alluvial and bedrock groundwater drawdown contour (maximum drawdown area for all SGP years combined).

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

SGP = Stibnite Gold Project.

Under Alternative 2, Meadow Creek would continue to be routed in a lined channel around the Hangar Flats pit lake (rather than into the pit lake) after filling. The Meadow Creek liner extension, use of additional rapid infiltration recharge, and accelerated pit lake filling would reduce Meadow Creek streamflow reductions, but would not avoid them. Impacts to downstream wetlands in this area as a result of water quantity decreases during the post-closure period would be reduced by this design feature.

4.11.2.3.5 Issue: Alteration of Wetland and Riparian Areas due to Changes in Water Quality

Water quality effects on wetlands and riparian areas would generally be the same as under Alternative 1. The primary difference between these two alternatives would result from the permanent routing of Meadow Creek around, rather than through, Hangar Flats pit lake. By routing the creek around the pit lake, the water in the creek would not be diverted to a long-term treatment facility and, therefore would be available to on-site wetland reclamation areas during and after the site operational phase. Also, the on-site lime generation proposed under Alternative 2 would reduce heavy vehicle trips to the mine site by approximately 31 percent (77 vehicles per day instead of 95 vehicles per day). The reduction in heavy vehicle trips would help maintain condition of Burntlog Route, thereby limiting incremental surface water quality impacts from erosion and sedimentation on wetlands and riparian areas in the Johnson Creek watershed. Additionally, piping low flows in stream diversions around the TSF, Hangar Flats DRSF, and Hangar Flats pit during the mine operational period also would help to maintain lower stream temperatures in Meadow Creek, thereby reducing impacts to downstream wetlands and riparian areas.

4.11.2.4 Alternative 3

Under Alternative 3, the TSF and buttressing DRSF would be located in the EFSFSR drainage, requiring an approximately 3.2-mile-long segment of the Burntlog Route to be routed through

Blowout Creek Valley; the existing spent ore disposal area and Bradley tailings would not be removed and reprocessed; approximately 2.5 miles of the new transmission line would be routed through the Meadow Creek valley within the mine site; the off-highway vehicle trail from Horse Heaven/Transmission line to Meadow Creek Lookout Road (National Forest System Road 51290) would not be constructed; and approximately 7.6 miles of Meadow Creek Lookout Road, from Burntlog Route at the upper portion of Blowout Creek drainage to Monumental Summit, would be improved for public access to connect with Thunder Mountain Road.

Alternative 3 would result in permanent impacts to wetland or riparian area acreage and associated functions as described below. Affected functions would include habitat for fish and wildlife, water filtration, and water storage and flow abatement, including groundwater recharge. As under Alternative 1, losses of wetland and riparian areas and their functions would occur throughout the construction and operations phases (refer to the SFA Ledger [Rio ASE 2019]). Habitat fragmentation, water balance, and water quality effects on wetlands (described in Section 4.11.2) also would occur under this alternative. The following subsections provide details of the extent of these impacts under Alternative 3.

Wetland and riparian impact area maps for Alternative 3 are provided in **Appendix I-4**.

4.11.2.4.1 ISSUE: LOSS OF WETLAND AND RIPARIAN AREAS

4.11.2.4.1.1 Mine Site Focus Area

Table 4.11-12 presents acres of wetlands and RCAs that would be lost due to SGP actions within the mine site focus area under Alternative 3. Loss of wetland acres under Alternative 3 would occur to 31 percent of the 429 acres of wetlands identified in the mine site focus area (**Table 3.11-3a**). All wetland and RCA impacts in the mine site focus area would occur within the Headwaters EFSFSR watershed.

Table 4.11-12 Losses of Wetlands and RCAs in the Mine Site Focus Area under Alternative 3

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Total RCAs (acres)
Blowout Creek Rock Drain	0.1	-	-	-	0.1	**2.7**
C-Road	<0.1	-	<0.1	-	<0.1	**0.7**
Disturbed Area - Other	-	-	<0.1	-	<0.1	**7.8**
EFSFSR Diversion Inlet	-	-	<0.1	-	<0.1	**0.8**
EFSFSR Diversion Outlet	-	-	<0.1	-	<0.1	**1.4**
EFSFSR DRSF	2.3	1.9	2.4	-	6.6	**97.9**
EFSFSR TSF	7.1	43.7	19.0	-	69.8	**254.2**
EFSFSR TSF Haul Road	0.4	1.6	0.5	-	2.5	**20.1**
Exploration Decline and Explosives Area	0.3	-	0.1	<0.1	0.4	**6.1**

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Total RCAs (acres)
Fiddle DRSF	0.3	8.2	-	0.1	8.6	**72.0**
Fiddle DRSF Diversion	-	0.2	-	-	0.2	**2.8**
Hangar Flats Pit	2.8	1.1	4.1	-	7.9	**31.2**
Hangar Flats Reclamation/Stockpile Area	3.7	4.1	4.4	0.1	12.3	**51.1**
Haul Roads	0.5	0.3	1.9	<0.1	2.7	**61.0**
Hangar Flats Pipeline Service Road	0.1	0.3	0.4	-	0.8	**1.8**
Main Ore Processing Area	1.5	0.2	0.6	-	2.3	**11.9**
Midnight Creek Diversion	-	-	0.1	-	0.1	**1.0**
Midnight GMS	-	-	-	-	-	**1.4**
North Yellow Pine GMS	-	-	0.2	-	0.2	**13.5**
Primary Crusher/Course Ore Stockpile	<0.1	-	<0.1	-	<0.1	**2.6**
Rapid Infiltration Basin East	-	-	-	-	-	**2.0**
Rapid Infiltration Basin West	-	-	-	-	-	**7.8**
Scott Haul Road	-	<0.1	<0.1	-	0.1	**0.3**
Truck Shop Area	-	-	-	-	-	**0.7**
Truck Shop GMS	-	-	-	-	-	**0.1**
West End DRSF	-	-	-	-	-	**41.6**
West End DRSF Diversion	<0.1	-	-	-	<0.1	**4.9**
West End Pit	-	-	0.6	-	0.6	**26.3**
West Side of Yellow Pine Pit	-	-	-	-	-	**0.2**
Worker Housing Facility	2.7	-	-	-	2.7	**19.0**
Yellow Pine Pit	1.4	0.1	4.5	4.5	10.6	**69.4**
Portions of Access Roads within the Mine Site Analysis Area	0.9	0.1	1.2	-	2.1	**2.0**

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Total RCAs (acres)
Portions of Utilities (new Transmission Line Segments) within the Mine Site Analysis Area	0.1	0.9	0.2	-	1.1	**4.1**
Tall Tree Clearing within the Mine Site Analysis Area[2]	-	0.1	0.3	-	0.4	**n/a**
TOTALS[1]	**24.2**	**62.6**	**40.7**	**4.7**	**132.3**	**820.5**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) and RCA spatial data intersected with SGP components. Total wetland acreages include only areas delineated and assessed for the SGP; National Wetlands Inventory data were not used at the mine site.

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

2 Tall tree clearing was only considered a possible impact to areas where tree species may grow (PFO and PSS wetlands). Information on tree presence in RCAs was not available at the time of analysis and therefore tree clearing in RCAs could not be quantified

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

RCA = Riparian Conservation Area.

SGP = Stibnite Gold Project.

EFSFSR = East Fork South Fork Salmon River.

DRSF = Development Rock Storage Facility.

GMS = Growth Media Stockpile.

TSF = Tailings Storage Facility.

n/a = not applicable.

4.11.2.4.1.2 Off-site Focus Area

Acres of impacts to wetlands and RCAs in the off-site focus area under Alternative 3 are shown in **Table 4.11-13**.

Table 4.11-13 Losses of Wetlands and RCAs within the Off-site Focus Area under Alternative 3

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	RCAs (acres)
Access Roads	8.2	3.9	5.5	-	**17.6**	158.9
Utilities	7.5	0.9	1.8	0.9	**11.1**	307.9
Tall Tree Clearing[2]	n/a	2.5	9.4	n/a	**11.8**	n/a
Offsite Facilities	0.1	-	0.6	-	**0.8**	5.8
TOTALS[1]	**15.8**	**7.2**	**17.3**	**0.9**	**41.2**	**472.6**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) and RCA data intersected with SGP components and NWI wetland data intersected with SGP components for areas where wetland delineation data were not available.

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

2 Tall tree clearing was only considered a possible impact to areas where tree species may grow (PFO and PSS wetlands). Information on tree presence in RCAs was not available at the time of analysis and therefore tree clearing in RCAs could not be quantified

NWI = National Wetlands Inventory.

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

RCA = Riparian Conservation Area.

SGP = Stibnite Gold Project.

n/a = not applicable.

Impacts to wetlands associated with construction, maintenance, and use of Burntlog Route in the new and existing portions of this route would occur in the same manner as described for Alternative 1 (Section 4.11.2.2.1.2).

Table 4.11-14 shows acres of impacts to wetlands and RCAs in the portion of the analysis area that is outside the mine site by HUC 10 drainage basin (i.e., watershed). The greatest extent of wetland and riparian impacts in areas outside the mine site would occur in the Johnson Creek watershed, with lesser extents of impacts to wetlands and riparian areas in the other watersheds.

Table 4.11-14 Losses of Wetlands and Riparian Conservation Areas within the Off-site Focus Area by Watershed under Alternative 3

Drainage Basin (HUC 10)	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	RCA (acres)
Big Creek-North Fork Payette River	1.9	-	1.8	-	**3.7**	78.1
Cascade Reservoir	2.7	-	-	-	**2.7**	4.8
Gold Fork River	0.2	-	-	0.9	**1.1**	8.5
Johnson Creek	8.5	3.9	10.7	-	**23.0**	234.7
Lake Fork-North Fork Payette River	2.4	2.1	0.2	0.0	**4.6**	4.5
Headwaters EFSFSR	0.1	1.1	0.9	-	**2.1**	60.2
Upper South Fork Salmon River	0.2	0.1	3.7	-	**4.0**	81.8
TOTALS[1]	**15.8**	**7.2**	**17.3**	**0.9**	**41.2**	**472.6**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) and RCA data intersected with SGP components and NWI wetland data intersected with SGP components for areas where wetland delineation data were not available.

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

NWI = National Wetlands Inventory.

HUC = Hydrologic Unit Code.

ESA = Endangered Species Act.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

PEM = Palustrine emergent marsh.

RCA = Riparian Conservation Area.

SGP = Stibnite Gold Project.

4.11.2.4.2 Issue: Impacts on Wetland and Riparian Functions

An estimated total of 444.6 wetland functional units would be lost as a result of SGP construction under Alternative 3, approximately 142.5 of which would be due to impacts to high-value wetlands (**Table 4.11-15**). However, as wetland functional assessment information is not available for wetlands potentially impacted by the EFSFSR DRSF and TSF (Alternative 3-specific components), the total functional units lost under Alternative 3 is not comparable to total functional units lost under other alternatives where wetland functional assessment information is available for entirety of majority of mine site impacts.

Impacts described generally in Section 4.11.2.1.2 would occur as a result of these losses. Refer to **Appendix I-1** (**Table I-1-4**) for impacts to acres and functions in each specific AA and which specific SGP components would be associated with these impacts under Alternative 3. **Figures 4.11-3a** and **4.11-3b** show the AAs impacted under Alternative 3 within the off-site focus area and the mine site focus area, respectively.

Table 4.11-15 Losses of Wetland Acreages and Functional Units under Alternative 3

Wetland Category[1]	Total Wetland Acreage (acres)[2]	Proposed Wetland Impacts (acres)[2]	Proposed Tall Tree Clearing (acres)	Proposed Percentage of AA Impact	Total Functional Units[3]	Number of Functional Units Affected[4]
II (High-value)	221.3	21.1	0.2	1.1	1,202.0	**142.5**
III and IV	501.0	56.1	0.3	8.0	2,326.9	**302.2**
TOTALS[5]	722.4	77.3	0.4	9.1	3,528.9	**444.6**

Table Source: AECOM 2020; Table prepared using wetland functional assessment data (HDR 2016a; Tetra Tech 2018). Refer to **Appendix I-1** (**Table I-1-1**) for AA-specific information

Table Notes:

1 Wetland categories range from I (highest functional value) to IV (lowest functional value). No Category I wetlands were documented in the analysis area. Category II wetlands are considered high-value for the purposes of this analysis.

2 Total wetland acreages and proposed wetland impact acreages include only areas delineated and assessed for the SGP; it does not include National Wetlands Inventory data or aerial photography data used to extrapolate wetland impacts for areas where wetland delineations and functional assessments were not performed.

3 Total functional units of an AA are presented in Additional Information to Amend the 2016 HDR Wetlands Functions and Values Assessment, Final Technical Memorandum (Tetra Tech 2018). Efforts to gain approval of existing wetland functional assessment scores are ongoing and may result in changes relative to the totals listed in this table (Griffith and Williams 2019).

4 Functional unit impacts were calculated based on percentage of AA impacted; this calculation assumes equal distribution of functions over the area of a wetland.

5 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

AA = Assessment Area.

4.11.2.4.3 ISSUE: WETLAND AND RIPARIAN AREA FRAGMENTATION

Under Alternative 3, the total extent of wetland losses would be approximately 51 acres at the mine site and 41 acres outside the mine site. Losses of RCAs would occur on approximately 821 acres at the mine site and 473 acres outside the mine site. New roads would bisect 181 total individual wetlands. Fragmentation effects, as described in Section 4.11.2.1.3, could occur as a result of these impacts.

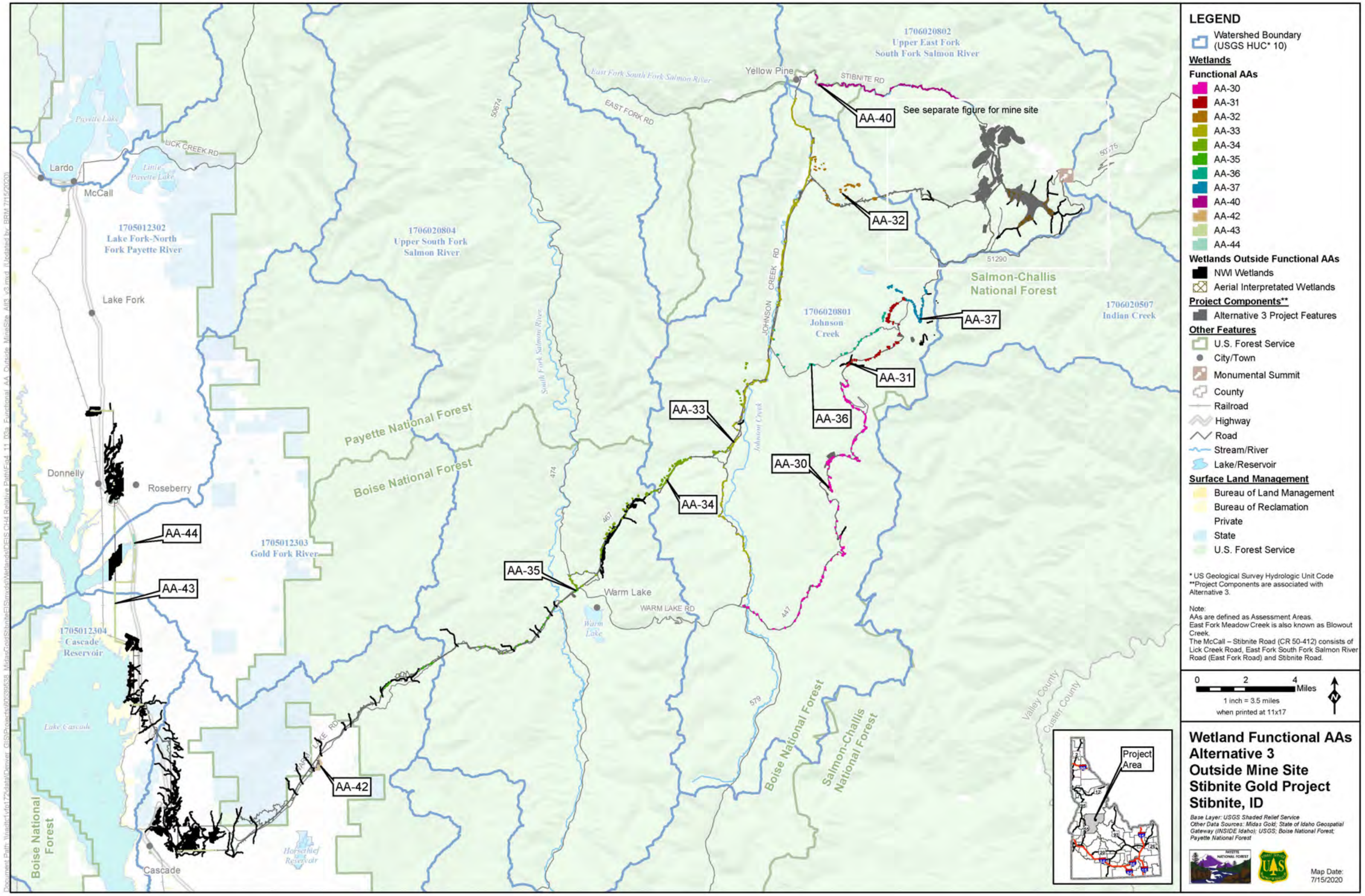


Figure Source: AECOM 2020

Figure 4.11-3a Wetland Functional AAs Alternative 3 Outside Mine Site

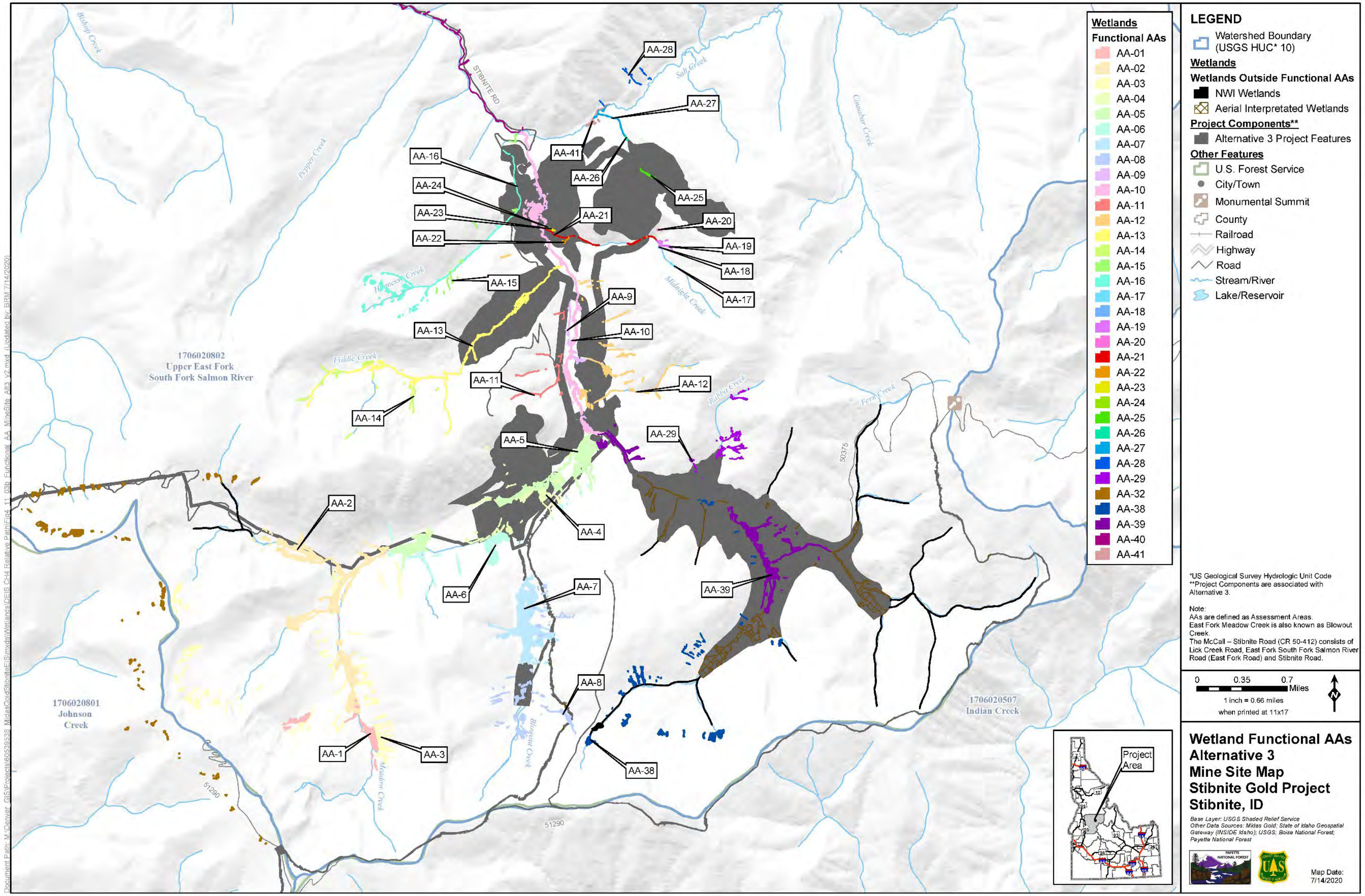


Figure Source: AECOM 2020

Figure 4.11-3b Wetland Functional AAs Alternative 3 Mine Site Map

4.11.2.4.4 Issue: Alteration of Wetland and Riparian Areas due to Changes in Water Balance

Alternative 3 would affect water balance, which could reduce seasonal water input frequency and duration for on-site and off-site downstream wetlands. Acres of wetlands in the maximum groundwater drawdown area under Alternative 3 are presented in **Table 4.11-16**. The entirety of these wetlands also would be subject to direct impacts from alternative component construction.

Table 4.11-16 Acres and Types of Wetlands in the Maximum Drawdown Area under Alternative 3

	PEM Wetland	PFO Wetland	PSS Wetland	Open Water	Total Wetlands[1]
Acres of Wetlands	**6.5**	**5.7**	**24.0**	**4.1**	**40.3**

Table Source: AECOM 2020; Merged simulated alluvial and bedrock groundwater drawdown contour (maximum drawdown area for all SGP years combined)

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

SGP = Stibnite Gold Project.

Impacts of the post-closure phase flow reductions in Meadow Creek downstream of Hangar Flats to the confluence with the EFSFSR on associated wetlands and riparian areas would be generally the same as described under Alternative 1.

4.11.2.4.5 Issue: Alteration of Wetland and Riparian Areas due to Changes in Water Quality

Water quality effects on wetlands and riparian areas would be similar to those described under Alternative 1 with slight differences due to location of SGP features (refer to Section 4.9.2.3, Alternative 3 for Surface Water and Groundwater Quality) and due to the spent ore disposal area and Bradley tailings not being removed under this alternative. By leaving these sources of potential contamination in place, downgradient wetlands and riparian areas would have a higher likelihood of receiving contaminants over time as precipitation, surface water, and shallow groundwater gradually infiltrate these areas and leach out via groundwater or surface seeps.

4.11.2.5 Alternative 4

Under Alternative 4, the mine site and utilities would be constructed and operate similarly to Alternative 1. However, the Burntlog Route would not be constructed, and the Yellow Pine Route would be upgraded for access during mine construction, operations, and closure and reclamation. The Landmark Maintenance Facility would be located on the south side of Warm Lake Road (CR 10-579) approximately 0.1 mile south of Landmark.

Alternative 4 would result in permanent impacts to wetland or riparian area acreages and associated functions as described below. Affected functions would include habitat for fish and wildlife, water filtration, and water storage and flow abatement, including groundwater recharge. Losses of wetland and riparian areas and their functions would occur throughout the construction and operations phases (refer to the SFA Ledger [Rio ASE 2019]). Habitat fragmentation, water balance, and water quality effects on wetlands (described in Section 4.11.2) also would occur under Alternative 4. The following subsections provide details of the extent of the impacts under Alternative 4.

Wetland and riparian impact area maps for Alternative 4 are provided in **Appendix I-5**.

4.11.2.5.1 ISSUE: LOSS OF WETLAND AND RIPARIAN AREAS

4.11.2.5.1.1 Mine Site Focus Area

Table 4.11-17 presents acres of wetlands and RCAs that would be lost due to SGP actions within the mine site focus area under Alternative 4. Loss of wetland acres under Alternative 4 would occur to 31 percent of the 429 acres of wetlands identified in the mine site analysis area (**Table 3.11-3a**). All wetland and RCA impacts at the mine site would occur within the Headwaters EFSFSR watershed.

Table 4.11-17 Losses of Wetlands and RCAs in the Mine Site Focus Area under Alternative 4

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Total RCAs (acres)
Blowout Creek Rock Drain	0.1	-	-	-	**0.1**	**2.7**
C-Road	<0.1	-	<0.1	-	**<0.1**	**0.9**
Disturbed Area - Other	0.1	0.3	0.4	-	**0.8**	**9.4**
EFSFSR Diversion Inlet	-	-	<0.1	-	**<0.1**	**0.8**
EFSFSR Diversion Outlet	-	-	<0.1	-	**<0.1**	**1.4**
Embankment	2.9	1.2	4.2	-	**8.4**	**17.3**
Exploration Decline and Explosives Area	0.3	-	0.1	<0.1	**0.4**	**8.6**
Facility Stormwater Pond	-	-	-	-	**-**	**0.0**
Fiddle DRSF	0.3	8.2	-	0.1	**8.6**	**72.0**
Fiddle DRSF Diversion	-	0.2	-	-	**0.2**	**2.8**
Hangar Flats DRSF	8.8	-	2.0	0.3	**11.1**	**47.7**
Hangar Flats Pit	2.8	1.1	4.1	-	**7.9**	**31.2**
Hangar Flats Reclamation/Stockpile Area	3.7	4.1	4.4	0.1	**12.3**	**51.1**
Haul Roads	0.5	0.3	1.9	0.0	**2.7**	**61.9**

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Total RCAs (acres)
Hangar Flats Pipeline Service Road	-	-	0.0	-	**0.0**	**0.3**
Main Ore Processing Area	1.5	0.2	0.6	-	**2.3**	**11.9**
Midnight Creek Diversion	-	-	0.1	-	**0.1**	**1.0**
Midnight GMS	-	-	-	-	**-**	**1.4**
North Yellow Pine GMS	-	-	0.2	-	**0.2**	**13.5**
Primary Crusher/Course Ore Stockpile	<0.1	-	<0.1	-	**<0.1**	**2.6**
Public Access Road	<0.1	<0.1	0.4	-	**0.4**	**8.9**
Rapid Infiltration Basin East	-	-	-	-	**-**	**2.0**
Rapid Infiltration Basin West	-	-	-	-	**-**	**7.8**
Light Vehicle Road	-	-	-	-	**-**	**0.2**
Scott Haul Road	-	<0.1	<0.1	-	**0.1**	**0.3**
Worker Housing Facility	0.3	<0.1	0.7	-	**1.1**	**2.7**
Truck Shop Area	-	-	-	-	**-**	**0.7**
Truck Shop GMS	-	-	-	-	**-**	**0.1**
TSF	2.1	40.0	9.8	-	**51.9**	**146.3**
TSF and Hangar Flats DRSF Diversion	0.9	6.9	1.6	0.1	**9.5**	**21.7**
West End DRSF	-	-	-	-	**-**	**41.6**
West End DRSF Diversion	0.0	-	-	-	**<0.1**	**4.9**
West End Pit	-	-	0.6	-	**0.6**	**26.3**
Yellow Pine Pit	1.4	0.1	4.5	4.5	**10.6**	**69.4**
Portions of Access Roads within the Mine Site Analysis Area	-	-	-	-	**-**	**0.7**
Portions of Utilities (new Transmission Line Segments) within the Mine Site Analysis Area	0.1	0.1	0.1	-	**0.3**	**1.3**

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Total RCAs (acres)
Tall Tree Clearing within the Mine Site Analysis Area[2]	-	0.1	0.3	-	**0.4**	**n/a**
TOTALS[1]	**25.8**	**62.9**	**36.4**	**5.1**	**130.2**	**673.4**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) and RCA spatial data intersected with SGP components. Total wetland acreages include only areas delineated and assessed for the SGP; National Wetlands Inventory data were not used at the mine site.

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

2 Tall tree clearing was only considered a possible impact to areas where tree species may grow (PFO and PSS wetlands). Information on tree presence in RCAs was not available at the time of analysis and therefore tree clearing in RCAs could not be quantified

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

RCA = Riparian Conservation Area.

EFSFSR = East Fork South Fork Salmon River.

DRSF = Development Rock Storage Facility.

GMS = Growth Media Stockpile.

TSF = Tailings Storage Facility.

SGP = Stibnite Gold Project.

n/a = not applicable.

4.11.2.5.1.2 Off-site Focus Area

Acres of impacts to wetlands and RCAs in the off-site focus area under Alternative 4 are shown in **Table 4.11-18**.

Table 4.11-18 Losses of Wetlands and RCAs Outside of the Mine Site under Alternative 4

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	RCAs (acres)
Access Roads	0.3	0.3	3.7	-	**4.3**	133.7
Utilities	7.5	0.9	1.8	0.9	**11.1**	287.5
Tall Tree Clearing[2]	-	2.5	9.4	-	**11.8**	n/a
Offsite Facilities	0.1	-	0.6	-	**0.8**	8.0
TOTALS[1]	**7.9**	**3.6**	**15.5**	**0.9**	**28.0**	**429.2**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) and RCA data intersected with SGP components and NWI wetland data intersected with SGP components for areas where wetland delineation data was not available.

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

2 Tall tree clearing was only considered a possible impact to areas where tree species may grow (PFO and PSS wetlands and RCAs). Information on tree presence in RCAs was not available at the time of analysis and therefore tree clearing in RCAs could not be quantified

NWI = National Wetlands Inventory.

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

RCA = Riparian Conservation Area.

SGP = Stibnite Gold Project.

n/a = not applicable.

Impacts to wetlands and riparian areas associated with widening, maintenance, and use of Yellow Pine Route would be similar to the wetland impacts associated with Burntlog Route, as described under Alternative 1 (Section 4.11.2.2.1.2). These include direct loss, fragmentation, and indirect effects such as dust. Wetlands and riparian areas along the Yellow Pine Route are lower (i.e., further downstream) in their respective watershed as the route is largely located along EFSFSR. Thus, the road impacts would affect wetlands and riparian areas at the confluences of several drainages that feed into EFSFSR, which would have a larger effect on the river. In comparison, the construction of Burntlog Route described in all other action alternatives would cross through several drainages but would generally be perpendicular to those waters.

Table 4.11-19 shows acres of impacts to wetlands and RCAs in the off-site focus area by HUC 10 drainage basin (i.e., watershed). The greatest extent of wetland and riparian impacts in areas outside the mine site would occur in the Johnson Creek watershed, with lesser extents of impacts to wetlands and riparian areas in the other watersheds.

Table 4.11-19 Losses of Wetlands and Riparian Conservation Areas within the Off-site Focus Area by Watershed under Alternative 4

Drainage Basin (HUC 10)	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	RCA (acres)
Big Creek-North Fork Payette River	1.9	-	1.8	-	**3.7**	78.1
Cascade Reservoir	2.7	-	-	-	**2.7**	4.8
Gold Fork River	0.2	-	-	0.9	**1.1**	8.5
Johnson Creek	0.5	0.5	8.9	-	**9.9**	208.1
Lake Fork-North Fork Payette River	2.4	2.1	0.2	0.0	**4.6**	4.5
Headwaters EFSFSR	0.1	0.9	0.9	-	**1.9**	43.4
Upper South Fork Salmon River	0.2	0.1	3.7	-	**4.0**	81.8
TOTALS[1]	**7.9**	**3.6**	**15.5**	**0.9**	**28.0**	**429.2**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) and RCA data intersected with SGP components and NWI wetland data intersected with SGP components for areas where wetland delineation data were not available

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

NWI = National Wetlands Inventory.

HUC = Hydrologic Unit Code.

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

RCA = Riparian Conservation Area.

SGP = Stibnite Gold Project.

4.11.2.5.2 ISSUE: IMPACTS TO WETLAND AND RIPARIAN FUNCTIONS

An estimated total of 756.3 wetland functional units would be lost as a result of SGP construction under Alternative 4, approximately 485.4 of which would be due to impacts to high-value wetlands (**Table 4.11-20**). Impacts described generally in Section 4.11.2.1.2 would occur as a result of these losses. Refer to **Appendix I-1** (**Table I-1-5**) for impacts to wetlands and functions in each specific AA, and specific SGP components associated with these impacts under Alternative 4. **Figures 4.11-4a** and **4.11-4b** show the AAs impacted under Alternative 4 within the off-site focus area and the mine site focus area, respectively.

Table 4.11-20 Losses of Wetland Acreages and Functional Units under Alternative 4

Wetland Category[1]	Total Wetland Acreage (acres)[2]	Proposed Wetland Impacts (acres)[2]	Proposed Tall Tree Clearing (acres)	Proposed Percentage of AA Impact	Total Functional Units[3]	Number of Functional Units Affected[4]
II (High-value)	221.3	78.9	0.2	2.0	1,202.0	**485.4**
III and IV	501.0	50.9	0.3	7.6	2,326.9	**270.8**
TOTALS[5]	722.4	129.8	0.4	9.5	3,528.9	**756.3**

Table Source: AECOM 2020; Table prepared using wetland functional assessment data (HDR 2016a; Tetra Tech 2018). Refer to **Appendix I-1** (**Table I-1-1**) for AA-specific information

Table Notes:

1 Wetland categories range from I (highest functional value) to IV (lowest functional value). No Category I wetlands were documented in the analysis area. Category II wetlands are considered high-value for the purposes of this analysis.

2 Total wetland acreages and proposed wetland impact acreages include only areas delineated and assessed for the SGP; it does not include National Wetlands Inventory data or aerial photography data used to extrapolate wetland impacts for areas where wetland delineations and functional assessments were not performed.

3 Total functional units of an AA are presented in Additional Information to Amend the 2016 HDR Wetlands Functions and Values Assessment, Final Technical Memorandum (Tetra Tech 2018). Efforts to gain approval of existing wetland functional assessment scores are ongoing and may result in changes relative to the totals listed in this table (Griffith and Williams 2019).

4 Functional unit impacts were calculated based on percentage of AA impacted; this calculation assumes equal distribution of functions over the area of a wetland.

5 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

AA = Assessment Area.

This page intentionally left blank

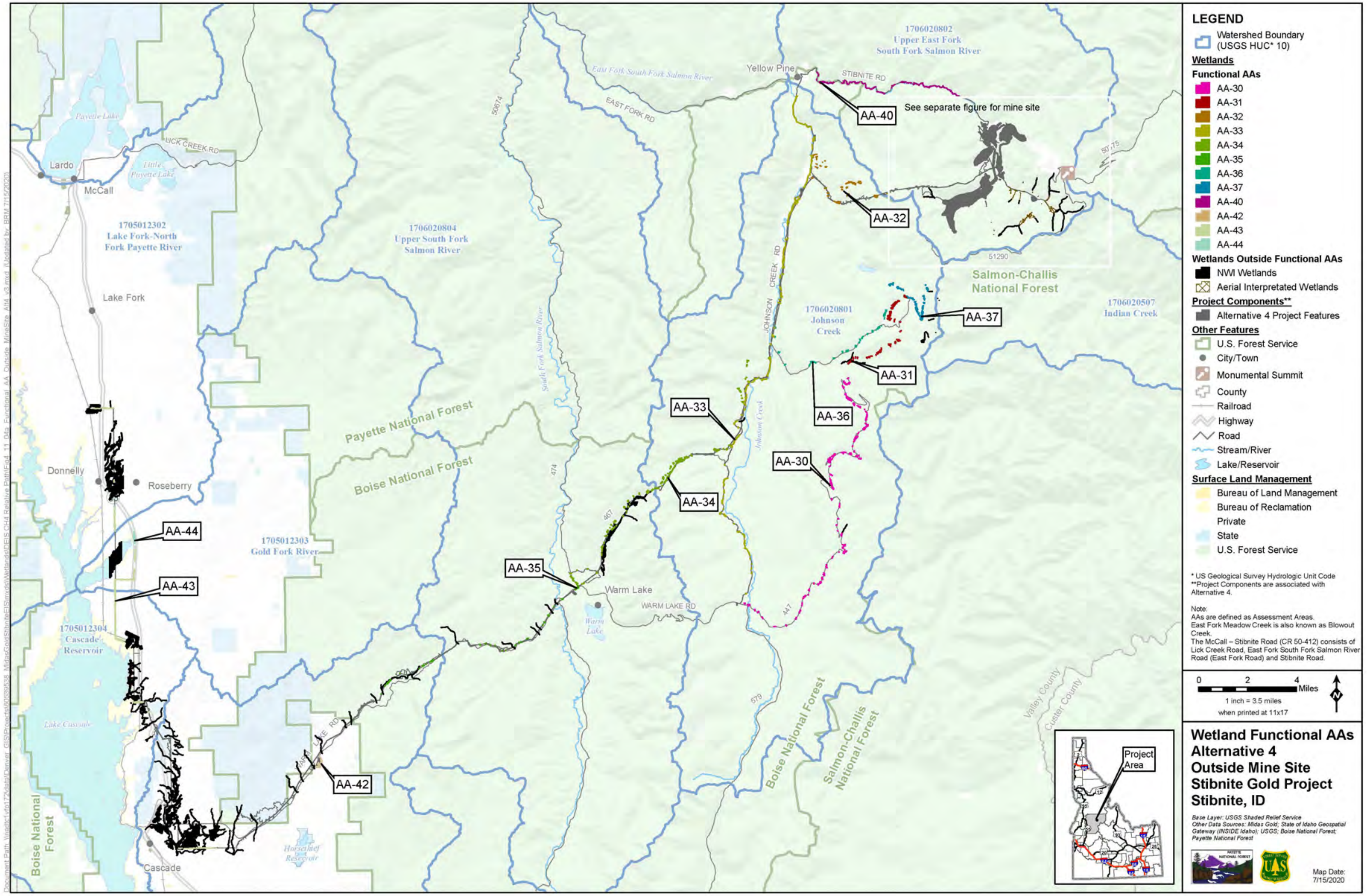


Figure Source: AECOM 2020

Figure 4.11-4a Wetland Functional AAs Alternative 4 Outside Mine Site

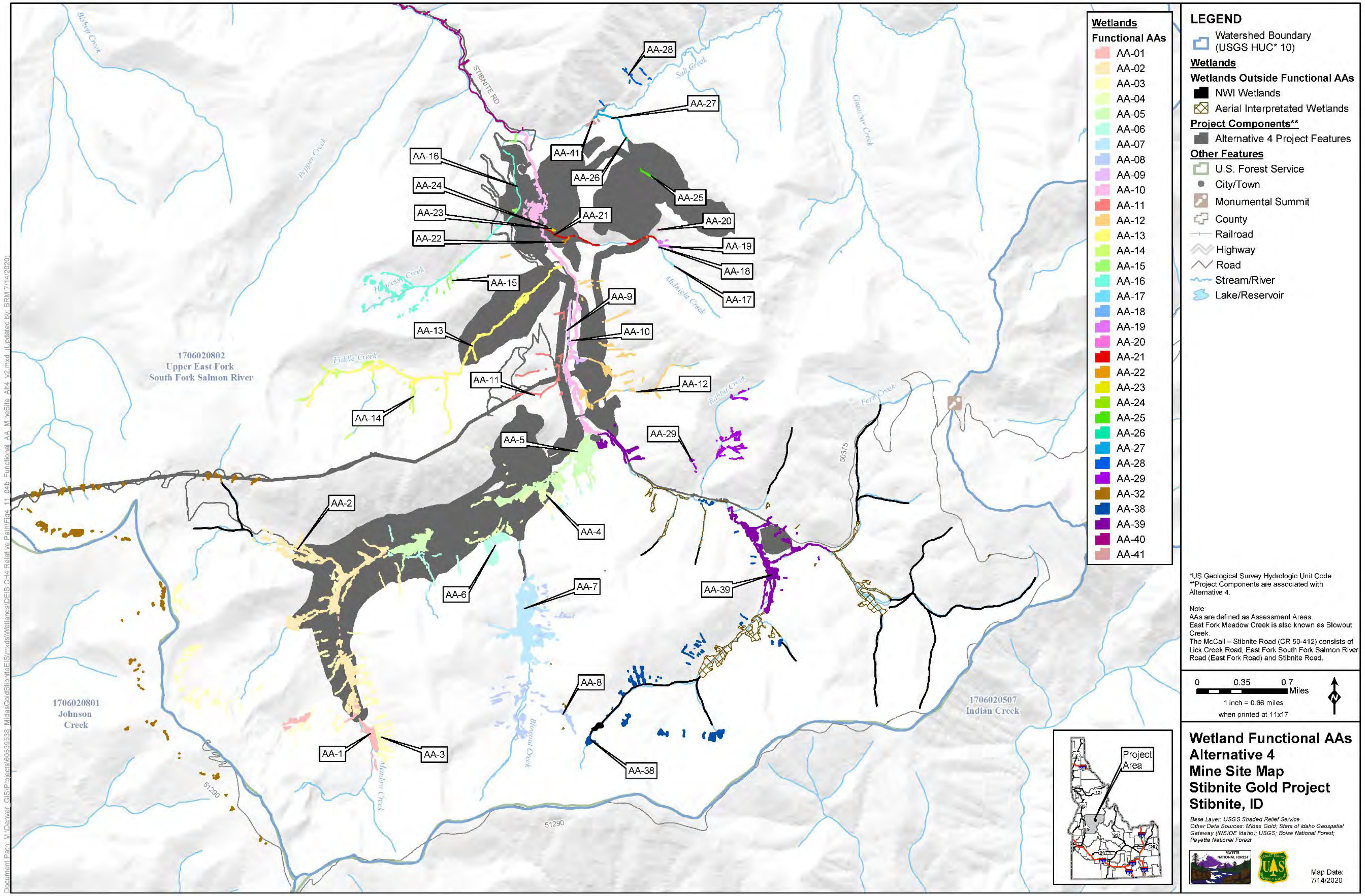


Figure Source: AECOM 2020

Figure 4.11-4b Wetland Functional AAs Alternative 4 Mine Site Map

4.11.2.5.3 Issue: Wetland and Riparian Area Fragmentation

Under Alternative 4, the total extent of wetland losses would be approximately 130 acres at the mine site and 28 acres outside the mine site. Losses of RCAs would occur on approximately 673 acres at the mine site and 429 acres outside the mine site. New roads would bisect 62 total individual wetlands. Fragmentation effects, as described in Section 4.11.2.1.3, would occur as a result of these impacts.

4.11.2.5.4 Issue: Alteration of Wetland and Riparian Areas due to Changes in Water Balance

Impacts of drawdown on wetlands under Alternative 4 would be the same as described under Alternative 1. Impacts of post-closure phase flow reductions in Meadow Creek downstream of Hangar Flats to the confluence with the EFSFSR on associated wetlands and riparian areas also would be generally the same as described under Alternative 1.

4.11.2.5.5 Issue: Alteration of Wetland and Riparian Areas due to Changes in Water Quality

Water quality effects on wetlands and riparian areas would be similar as described under Alternative 1, although the absence of construction or use of the Burntlog Route would eliminate water quality impacts in this area. However, Alternative 4 would require all mine-related traffic during construction, operations, and closure and reclamation to use the Yellow Pine Route, which would increase traffic on Yellow Pine Route during the mine operational and reclamation periods, leading to the potential for greater rutting and degradation, greater road maintenance needs, and potentially higher erosion rates from the road surface into surface waters, particularly EFSFSR and Johnson Creek, which flow parallel to the Yellow Pine Route.

4.11.2.6 Alternative 5

The SGP would not be implemented; therefore, there would be no SGP-related direct or indirect effects on wetlands or riparian areas. Wetlands and riparian areas in the mine site portion of the analysis area would continue to be affected by existing natural events such as landslides and fires and human-induced effects from existing sources of sedimentation (e.g., Blowout Creek), and contamination (e.g., legacy mining, including tailings in floodplains, and stream diversions) (**Figure 3.7-2**). Wetlands would continue to function within natural ecosystem processes that include these natural events as they have evolved with those events and are adapted to the ongoing disturbance regime. Ecological succession would continue to occur in these areas, with changes driven by disturbance and species maturation.

The approximately 244 acres of the mine site and vicinity modified by human activity and considered highly disturbed (Tetra Tech 2018) (**Figure 3.7-2**) would continue to affect wetland and waterway functions through sedimentation and erosion into wetlands and riparian areas. Blowout Creek would continue to contribute sediment and erosion to downstream waters and wetlands. Permitted exploration activities within the mine site would continue to occur and could include small, localized impacts to wetlands and riparian areas.

4.11.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.11.3.1 Compensatory Mitigation Plan

In order for the USACE to issue a permit under Section 404 of the CWA and authorize dredge or fill placement in Waters of the U.S., all unavoidable impacts to jurisdictional aquatic resources must be mitigated. The final rule for Compensatory Mitigation for Losses of Aquatic Resources (U.S. Environmental Protection Agency and USACE 2008) states a preference for achieving mitigation by first trying to find available wetland mitigation credits from an agency-approved wetland mitigation bank. When mitigation bank credits are not available, the final rule directs 404 permit applicants to seek out opportunities to use in-lieu fee programs to satisfy mitigation needs. In-lieu fee programs are generally operated by public resource agencies that accept money for wetland impacts within a specific geography and periodically use that money to fund wetland restoration, creation, or enhancement projects within that same geography. At this time, there are no agency approved mitigation banks, or in-lieu fee programs which service the SGP analysis area. The following discussion describes Midas Gold's plan to utilize Permittee Responsible Mitigation to provide required compensation for anticipated wetland losses under SGP action alternatives.

4.11.3.1.1 Compensatory Mitigation Plan under All Action Alternatives

All action alternatives include activities that would result in permanent impacts to Waters of the U.S. including Wetlands. Therefore, Midas Gold would need to submit and gain approval for a final compensatory wetland mitigation plan, and then implement and maintain the planned wetlands in coordination with the USACE, as part of their CWA 404 permit. Without this permit, work in Waters of the U.S. cannot legally commence. A CMP (Tetra Tech 2019a) that addresses compensation for lost wetland areas and functions has been provided by Midas Gold. In addition to the CMP, potential off-site compensatory mitigation opportunities as described in the Mitigation Portfolio; Off-Site Mitigation Opportunities Technical Memo (Tetra Tech 2020) also have been identified. These projects are intended to reduce the temporal loss of aquatic functions and potential risks associated with actions described in the CMP, and are primarily focused on stream and habitat enhancements. As described in the CMP, compensatory mitigation for impacts to wetlands would be accomplished by creating new wetlands and enhancing and reclaiming existing wetlands in the general vicinity of the proposed impact areas.

The current CMP describes an accounting process for tracking the various wetland impacts (losses) and associated wetland mitigation (gains). The CMP uses the MWAM functional assessment tool to determine functional units for each affected wetland assessment area. These units are based on a combination of MWAM scores and acres of wetlands. When these functional units would be lost due to development in the associated wetland those losses are considered “debits.” Conversely, the creation of new wetlands can result in “credits” by assessing and estimating the predicted functional scores (after 5 years) and area of proposed wetlands that would be created, restored, or enhanced. Using this system of accounting for wetland credits and debits, the CMP provides a ledger that itemizes debits throughout the construction and operating phases and proposed credits for conceptual wetland creation actions. This system of accounting for losses and compensatory gains is intended to demonstrate a means of ensuring that adequate mitigation would be provided regardless of the final impact area/selected action alternative. The ledger can be scaled up or down to identify the appropriate wetland credits needed to compensate for the final determination of wetland debits, which would be documented in the CWA 404 permit. Offsite Mitigation projects are primarily targeted towards riparian and stream functions and are preliminary. A unit conversion method has been proposed to address wetlands debits and credits for these activities. This methodology has not been approved by USACE (Griffith 2020).

Coordination with the USACE for approval of existing and predicted wetland functional assessment scores is ongoing and may result in changes relative to the totals listed in this section. Wetland baseline functions may be revised in a way that results in a change to baseline functional scores. Final impact acreages will be determined as part of the CWA Section 404 permit application and would be agreed upon by the USACE.

The system of accounting wetland debits and credits offers a scalable approach to documenting sufficient mitigation. For wetland and riparian mitigation to be effective in the long term, it must be self-sustainable and resilient. Demonstration of mitigation effectiveness would be achieved through performance monitoring and adaptive management, as is required for any mitigation proposal under the final mitigation rule. While the proposed liners and dams may not be sustainable in the long-term (e.g., not seismically resilient and potentially susceptible to freeze-thaw damage and root penetration over time), it would be required to rectify any failures such that compensatory mitigation goals (e.g., acreage replacement and functional improvements) are achieved and maintained. Financial assurances also would be required to ensure that financing is available to achieve mitigation goals.

The current CMP describes a plan to locate the compensatory wetland mitigation sites within the same subbasins as the associated wetland impact sites, although none of the proposed wetland creation sites are shown beyond the mine site where the majority of wetland impacts would occur. Off-site Mitigation sites may involve watershed enhancements such as fish passage barrier removals, woody debris enhancement, or the purchase of wetland mitigation bank credits (where available) (Tetra Tech 2020). The current location and configuration of mitigation sites identified in the CMP were selected based on suitable hydrology and compatibility with watershed-scale features and on the likelihood that compensatory mitigation wetlands would be sustainable within five years (Tetra Tech 2019a). The anticipated need for wetland credits was based on the wetland debits that would occur under Alternative 1. Once the Forest Service identifies a preferred alternative, final wetland impacts would be assessed, any agreed upon offsite compensatory mitigation projects would be finalized, and a final mitigation plan would be prepared, including a final assessment of functional units lost and created, and then the final credits/debits would be documented in an application for CWA Section 404 permit.

Table 4.11-21 shows general location and size of various wetland types proposed for on-site mitigation. Greater detail of the location of these wetland mitigation areas is presented in Table 9-3 of the CMP (Tetra Tech 2019a); see **Appendix D-2**.

Table 4.11-21 Extent of Various Wetland Types Proposed for Mitigation (in Acres)

Type	General Location	PAB (acres)	PEM (acres)	PFO (acres)	PSS (acres)	Totals
Valley Margin Wetlands	At the margins of the TSF and Fiddle DRSF	n/a	1.9	1.7	1.5	**5.2**
Riparian Fringe and Floodplain Wetlands	Adjacent to Meadow Creek, EFSFSR, Midnight Creek, Hennessy Creek, Blowout Creek, Fiddle Creek, and West End Creek	5.0	102.4	6.97	12.4	**126.72**
Groundwater Discharge Wetlands	At the toe of the TSF/ Hangar Flats DRSF	n/a	19.6	n/a	n/a	**19.6**
Blowout Creek Wetland Restoration	Blowout Creek	n/a	9.8	n/a	n/a	**9.8**
TOTALS[1]		**5.0**	**133.8**	**8.7**	**13.9**	**161.4**

Table Source: Tetra Tech 2019a

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

PAB = Palustrine aquatic bed.

PEM = Palustrine emergent.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

EFSFSR = East Fork South Fork Salmon River.

DRSF = Development Rock Storage Facility.

TSF = Tailings Storage Facility.

n/a = not applicable.

Monitoring of mitigation wetlands would occur for a minimum of 5 years, although longer-term monitoring would likely be required. The CMP provides detailed mitigation goals and associated performance targets and methods for monitoring the success of achieving those targets.

Onsite wetland and riparian area compensatory mitigation would occur during both the operations and closure and reclamation phases, although most of the revegetation work would occur during the closure and reclamation phase. For more detail on timing and location of reclamation of wetland and riparian areas, refer to Table 9.3 and Appendix D in the Conceptual Stream and Mitigation Plan (Tetra Tech 2019a) and the SFA Ledger (Rio ASE 2019).

Implementation of the CMP would reduce the uncertainty in the duration of wetland and riparian resource losses, including the lost spatial extent of resources as well as lost functions, by implementing restoration actions on-site, concurrent with operations or, at the earliest time practicable, throughout the analysis area. The Final CMP should explicitly demonstrate how the proposed mitigation concept provides adequate onsite mitigation for lost wetland area and function. In the event the USACE determines it insufficient, the plan would be updated to compensate adequately for all impacts before the SGP would receive its permit.

4.11.3.1.2 COMPENSATORY MITIGATION PLAN UNDER ALTERNATIVE 5

No compensatory wetland mitigation would need to occur under Alternative 5 as ongoing activities within the analysis area are not associated with the SGP.

4.11.4 Cumulative Effects

Effects of other past, present, and reasonably foreseeable future actions (RFFAs) may cumulatively impact a resource if these actions overlap spatially with the potential direct and indirect effects of a proposed project. As such, the cumulative effects analysis area for wetlands and riparian resources is the same extent as the analysis area for direct and indirect impacts to these resources, which is the watersheds containing the proposed mine site, access roads, transmission lines, and off-site facilities (**Figure 3.11-1**).

Past and present actions in the cumulative effects analysis area that have affected or are currently affecting wetlands and riparian areas are shown in **Table 4.11-22**. These actions are described in more detail in Section 4.1.5, Cumulative Effects.

Table 4.11-22 Past and Present Actions in the Wetland and Riparian Resources Cumulative Effect Analysis Area

Past or Present Action	Potential Effects on Wetland and Riparian Resources
Past and present mineral exploration and mining in the vicinity of the mine site	Vegetation has been removed and soil conditions have been altered in areas with past and present mineral exploration and mining in the vicinity of the mine site. Increased soil erosion associated with these projects have likely indirectly impacted wetlands and riparian areas in the vicinity of cleared areas.
Wildland Fire	Wildland fires have occurred in the wetlands analysis area, which has resulted in increased soil erosion in the period between fires and when vegetation has been reestablished. Fires have been both characteristic and uncharacteristic.
Removal of Firewood	Removal of firewood by the public has likely occurred in the wetland analysis area, resulting in loss of coarse woody debris and snags over time, which may have altered soil erosional patterns and the total amount of erosion material being deposited in wetlands and riparian areas.
Mineral exploration and mining activities	Exploration activities for potential future mining development have likely impacted vegetation via soil removal and compaction at drill pad sites and temporary roads, which have likely altered soil erosion patterns and amounts of soil deposited into wetlands and riparian areas. Increased fragmentation of wetlands and riparian areas also would be likely to occur with temporary road construction. These impacts are likely to continue to occur as mineral exploration and mining activities continue.
Transportation projects	Road maintenance projects (McCall-Stibnite Road [CR 50-412], Profile Gap Road [National Forest System Road 340] and the road to the Big Creek Trailhead, and the road from Yellow Pine, Idaho to Midas Gold's property) are ongoing in the analysis areas. Existing roadways impact adjacent and nearby wetlands and riparian areas through continued habitat fragmentation, deposition of dust (for unpaved roads), and water quality degradation (via deposition of pollutants from road surfaces into nearby wetlands). Maintenance projects for existing roadways will likely impact wetlands and riparian areas through dust impacts during the time of construction. Any water diversions or dewatering required during maintenance projects also would impact wetlands and riparian areas.
Infrastructure Development projects	Transmission line upgrades in the West Central Mountain Electric Plan 2014, which follows the general location SGP transmission line route, have required removal of tall trees in the right-of-way for safe operation of the transmission line. Removal of tall trees has altered understory vegetation community composition and likely reduced functions of wetlands in these areas.

RFFAs in the cumulative effects analysis area that are anticipated to impact wetlands and riparian areas are shown in **Table 4.11-23**. All RFFAs would be required to coordinate compensatory mitigation for wetland losses; as such, it is assumed that no net loss of wetland acreages or functions would occur with the implementation of these projects.

Table 4.11-23 Reasonably Foreseeable Future Actions in the Wetland and Riparian Resources Cumulative Effect Analysis Area

Project	Potential Effects on Wetland and Riparian Resources
South Fork Restoration and Access Management Plan	The numerous actions relating to watershed restoration, motorized and non-motorized access, and improvements of recreation facilities within the South Fork Salmon River watershed within a 329,000-acre project area are likely to impact wetlands and riparian resources in various ways.
East Fork Salmon River Restoration and Access Management Plan	This travel management planning would likely impact wetland and riparian resources located within the spatial extent of the East Fork Salmon River Restoration and Access Management Plan, which could include Yellow Pine, Big Creek, and Thunder Mountain within the Payette National Forest.
Wildlife Conservation Strategy EIS	This EIS would present and analyze the impacts of short- and long-term management strategies and priorities for maintaining and restoring habitats associated with terrestrial wildlife species, some of which may impact wetlands and riparian areas.
Granite Meadows	Proposed treatments include timber harvest, thinning, prescribed fire, road treatments and road decommissioning, watershed improvement and restoration treatments, and recreation improvements. Part of the intent of this project is to result in some benefit (potentially increased acreages or functioning) to wetlands and riparian areas.

As the SGP would not result in net losses of wetlands or wetland functions due to compensatory wetland mitigation required for the CWA Section 404 permit, the SGP would not contribute to net losses of wetland acres or wetland functional units from past, present, or reasonably foreseeable future actions in the cumulative effects analysis area. However, while net losses of wetlands, riparian areas, and associated ecological functions would be mitigated under each of the action alternatives at one or more consolidated mitigation sites, the increase in dispersed wetland and riparian area fragmentation within and outside the mine site would contribute to cumulative wetland and riparian area fragmentation in the cumulative effects analysis area.

4.11.4.1 Alternative 1

Alternative 1 would result in losses of approximately 130.9 acres of wetlands at the mine site (**Table 4.11-2**), 41.2 acres outside the mine site (**Table 4.11-3**), and 759.3 wetland functional units (486.1 of which would be high-value functional units) (**Table 4.11-5**). It is assumed that required compensatory wetland mitigation would replace these lost wetland acreages and functions, and therefore this alternative would not contribute to cumulative losses of wetland acreages or functions in the wetland and riparian resources cumulative effects analysis area.

Alternative 1 would reduce some of the existing water quality impacts observed in Meadow Creek and the EFSFSR by removing and repurposing legacy mine wastes. Alternative 1 also would contribute new sources of mine waste material to the EFSFSR drainage through construction and use of mine site facilities. These impacts when added to the other RFFAs would cumulatively impact wetland and riparian areas.

4.11.4.2 Alternative 2

Alternative 2 would result in losses of approximately 131.2 acres of wetlands at the mine site (**Table 4.11-7**), 31.3 acres outside the mine site (**Table 4.11-8**), and 761.5 wetland functional units (488.1 of which would be high-value functional units) (**Table 4.11-10**). It is assumed that required compensatory wetland mitigation would replace these lost wetland acreages and functions, and therefore this alternative would not contribute to cumulative losses of wetland acreages or functions in the wetland and riparian resources cumulative effects analysis area.

As under Alternative 1, Alternative 2 would contribute new sources of mine waste material to the EFSFSR drainage through construction and use of mine site facilities. During mine operations, cumulative temperature effects in Meadow Creek and adjacent wetlands would be minimized due to routing the creek around the Hangar Flats pit. This feature also would reduce some impacts of dewatering on downstream wetlands and riparian areas. Overall, this alternative when added to the other RFFAs would contribute to negative cumulative effects to wetlands and riparian areas due to new sources of mine waste material to the EFSFSR drainage to a lesser degree than Alternative 1.

4.11.4.3 Alternative 3

Alternative 3 would result in losses of approximately 132.3 acres of wetlands at the mine site (**Table 4.11-12**), 41.2 acres outside the mine site (**Table 4.11-13**), and 444.6 wetland functional units (142.5 of which would be high-value functional units) (**Table 4.11-15**). It is assumed that required compensatory wetland mitigation would replace these lost wetland acreages and functions, and therefore this alternative would not contribute to cumulative losses of wetland acreages or functions in the wetland and riparian resources cumulative effects analysis area.

Legacy mine waste material associated with the spent ore disposal area and Bradley tailings would not be removed, reused, or reprocessed under Alternative 3, and as such, potential water quality impacts from these features would be greater than under the other action alternatives where they would be removed. The absence of the Meadow Creek TSF under this alternative would likely result in lower overall cumulative water quality impacts in wetlands adjacent to Meadow Creek than under the other action alternatives.

4.11.4.4 Alternative 4

Alternative 4 would result in losses of approximately 130.2 acres of wetlands at the mine site (**Table 4.11-17**), 28.0 acres outside the mine site (**Table 4.11-18**), and 756.3 wetland functional units (485.4 of which would be high-value functional units) (**Table 4.11-20**). It is assumed that required compensatory wetland mitigation would replace these lost wetland acreages and functions, and therefore this alternative would not contribute to cumulative losses of wetland acreages or functions in the wetland and riparian resources cumulative effects analysis area.

Alternative 4 would require all mine-related traffic during construction, operations, and reclamation to use the Yellow Pine Route, which would increase traffic on Yellow Pine Route during the mine operational and reclamation period, leading to greater rutting and degradation, greater road maintenance needs, and potentially higher erosion rates from the road surface. The cumulative effect from this change could combine with other planned activities in the Johnson Creek watershed to increase the sediment load in Johnson Creek compared to other alternatives. This consideration is especially important given that Johnson Creek Road (CR 10-

413), the longest segment of Yellow Pine Route, primarily follows the course of Johnson Creek. Thus, any additional sediment or dust generated from increased traffic on the Yellow Pine Route would have a direct pathway to be deposited into Johnson Creek, thereby potentially impacting nearby wetlands and riparian areas.

4.11.4.5 Alternative 5

No new impacts to wetlands would occur under Alternative 5 from the SGP. The SGP would not contribute to cumulative effects on wetlands or riparian areas in the cumulative effects analysis area. Although no new impacts would occur, existing elevated arsenic, antimony, and mercury concentrations would continue to contribute to contaminant loading to surface water, affecting adjacent and downstream wetlands.

Under Alternative 5, Midas Gold would continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and Environmental Assessment, which includes reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices. However, as described in the Golden Meadows Environmental Assessment, the exploration and subsequent reclamation activities would have only a small direct effect on wetland and riparian resources, as the disturbance footprint is confined to exploration holes. Therefore, Alternative 5 would not present a contribution to cumulative impacts on wetland and riparian resources.

4.11.5 Irreversible and Irretrievable Commitments of Public Resources

4.11.5.1 Alternative 1

4.11.5.2 Irreversible Commitments

The loss of the wetland acres and their functions as a result of the SGP (Section 4.11.2.2) would be irreversible in their original locations. However, compensatory wetland mitigation would allow for the extent and functions of lost wetlands to be reestablished in other locations.

4.11.5.3 Irretrievable Commitments

The loss of riparian acreages, wetland acreages, and wetland functions as a result of the SGP (Section 4.11.2.2) would be irretrievable. However, compensatory wetland mitigation would allow for the acres and functions of wetlands to be reestablished in other locations.

4.11.5.4 Alternative 2

The irreversible and irretrievable commitment of wetlands and riparian areas under Alternative 2 would be similar to that described under Alternative 1.

4.11.5.5 Alternative 3

The irreversible and irretrievable commitment of wetland and riparian resources under Alternative 3 would be similar to that described under Alternative 1, except the location of the TSF and buttressing DRSF in the EFSFSR drainage rather than in Meadow Creek would change the location of impacts to these areas.

4.11.5.6 Alternative 4

The irreversible and irretrievable commitment of wetlands and riparian areas under Alternative 4 would be less than under Alternatives 1, 2, and 3 due to the Burntlog Route not being built under this alternative.

4.11.5.7 Alternative 5

Under the No Action alternative there would be no irreversible or irretrievable commitment of wetlands or riparian areas associated with the SGP.

4.11.6 Short-term Uses versus Long-term Productivity

4.11.6.1 Alternative 1

Short-term uses of wetland and riparian resources for construction and operation of the SGP would impact the long-term productivity of these resources. Construction and operation of the mine site would permanently fill more than 116 acres of wetlands under Alternative 1, resulting in a permanent loss of wetland functions and loss of long-term productivity of this resource. Compensatory mitigation would be implemented to ensure no net loss of wetland functions; however, some long-term wetland productivity loss would still occur. The time required for revegetated wetlands to return to their pre-impact functionality, or for compensatory wetlands to achieve functionality, would depend on the current condition and physical characteristics of each wetland. In general, organic soils would take much longer to return relative to mineral soils (particularly alluvial soils); forested wetland vegetation would take much longer to return relative to herbaceous vegetation; and vegetation in higher elevations would take longer to return relative to lower elevations where growing seasons are longer.

Long-term impacts on wetland productivity also could result from indirect impacts on wetlands adjacent to the mine site or new/improved access roads. Fragmentation, disruption of wetland hydrologic inputs, and changes to vegetation composition would reduce the functional capacity of remaining wetlands, which would permanently reduce wetland productivity in the area.

Construction and operation of the mine could affect long-term wetland and riparian productivity by increasing sedimentation from erosion and increasing the amount of pollutants and fine-grained sediments delivered to receiving waters (including wetlands) via surface water runoff.

Mitigation measures required by both the Forest Service and the USACE (see **Appendix D**) are expected to reduce the amount of sedimentation-caused wetland impacts. The USACE is working with Midas Gold to address wetland impacts through compensatory mitigation, as described in Section 4.11.3, Mitigation Measures.

4.11.6.2 Alternatives 2 through 4

Under Alternatives 2 through 4, the types of effects of short-term use on long-term productivity would be the same as that described for Alternative 1, although the extent of direct and indirect impacts would vary under the alternatives as presented in Section 4.11.2, Direct and Indirect Effects.

4.11.6.3 Alternative 5

Alternative 5 would not affect the short-term use or long-term productivity of wetlands or riparian areas in the analysis area.

4.11.7 Summary

This section summarizes the impacts of the action alternatives and is organized by the issues identified for wetland and riparian areas in Section 4.11.1, Effects Analysis Issues and Indicators.

4.11.7.1 Issue: Loss of Wetland and Riparian Areas

4.11.7.1.1 MINE SITE PORTION OF THE ANALYSIS AREA

4.11.7.1.1.1 Wetland Acreage Losses

Table 4.11-24 shows acres of wetlands that would be lost within the mine site focus area under each of the action alternatives, omitting areas that would result in the same acres of impacts across all action alternatives.

Alternatives 1, 2, 3, and 4 would result in approximately the same extent of loss of wetland acres at the mine site (all would impact approximately 31 percent of the 429 acres of wetlands within the mine site analysis area). The small differences in totals for each alternative are predominantly due to variations in the placement and sizes of the DRSFs and the TSF.

Table 4.11-24 Losses (in Acres) of Wetland Area by SGP Component in the Mine Site Focus Area under All Alternatives

SGP Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Disturbed Area - Other	0.8	0.8	<0.1	0.8
EFSFSR DRSF	-	-	6.6	-
EFSFSR TSF	-	-	69.8	-
EFSFSR TSF Haul Road	-	-	2.5	-
Embankment	8.4	8.4	-	8.4

SGP Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Hangar Flats DRSF	11.1	11.1	-	11.1
HF Pipeline Service Road	<0.1	<0.1	0.8	<0.1
Public Access Road	-	-	-	0.4
Public Access During Mining - Option 1	-	0.3	-	-
Public Access During Mining - Option 2	-	<0.1	-	-
Stibnite Lodge	1.1	1.1	-	1.1
Truck Shop Area	-	-	-	-
TSF	51.9	51.9	-	51.9
TSF and Hangar Flats DRSF Diversion	9.5	9.5	-	9.5
West End DRSF Diversion	<0.1	-	<0.1	<0.1
Worker Housing Facility	-	-	2.7	-
Access Roads within the Mine Site Analysis Area	1.1	1.1	2.1	-
TOTALS[1]	**130.9**	**131.2**	**132.3**	**130.2**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) intersected with SGP components.

Table Notes:

1 All totals in this table include approximately 47 acres of wetland for certain mine site components that would be the same for all action alternatives.

EFSFSR = East Fork South Fork Salmon River.

DRSF = Development Rock Storage Facility.

GMS = Growth Media Stockpile.

SGP = Stibnite Gold Project.

TSF = Tailings Storage Facility.

4.11.7.1.1.2 Riparian Acreage Losses

Table 4.11-25 shows acres of RCAs that would be lost at the mine site under each of the action alternatives, omitting areas that would result in the same acres of impacts across all alternatives.

Alternative 3 would result in the largest acreage of RCA losses at the mine site due to inclusion of the EFSFSR DRSF, TSF, and TSF haul road, though this alternative would not have the TSF and the TSF and Hangar Flats DRSF diversion that Alternatives 1, 2, and 4 would have. Alternative 2 would result in the smallest acreage of RCA losses due to the absence of the West End DRSF and associated diversion. Alternatives 1 and 4 would impact a smaller acreage of

RCAs at the mine site than Alternative 3 due to lack of the EFSFSR DRSF, TSF, and TSF haul road, although these alternatives would include the TSF and the TSF and Hangar Flats DRSF diversion.

Table 4.11-25 Losses (in Acres) of Riparian Conservation Areas within the Mine Site Focus Area under All Action Alternatives

SGP Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Blowout Creek Rock Drain	2.7	2.7	2.7	2.7
C-Road	0.9	0.9	0.7	0.9
Disturbed Area - Other	9.4	3.7	7.8	9.4
EFSFSR Diversion Inlet	0.8	0.8	0.8	0.8
EFSFSR Diversion Outlet	1.4	1.4	1.4	1.4
EFSFSR DRSF	--	--	97.9	--
EFSFSR TSF	--	--	254.2	--
EFSFSR TSF Haul Road	--	--	20.1	--
Embankment	17.3	17.3		17.3
Exploration Decline and Explosives Area	8.6	8.6	6.1	8.6
Facility Stormwater Pond	0.0	--	--	0.0
Fiddle DRSF	72.0	72.0	72.0	72.0
Fiddle DRSF Diversion	2.8	2.8	2.8	2.8
Hangar Flats DRSF	47.7	47.7		47.7
Hangar Flats Pit	31.2	31.2	31.2	31.2
Hangar Flats Reclamation/Stockpile Area	51.1	51.1	51.1	51.1
Haul Roads	61.9	61.0	61.0	61.9
HF Pipeline Service Road	0.3	0.3	1.8	0.3
Main Ore Processing Area	11.9	11.9	11.9	11.9
Midnight Creek Diversion	1.0	1.0	1.0	1.0
Midnight GMS	1.4	1.4	1.4	1.4
North Yellow Pine GMS	13.5	13.5	13.5	13.5
Primary Crusher/Course Ore Stockpile	2.6	2.6	2.6	2.6
Public Access During Mining - Option 1	--	5.9	--	--
Public Access During Mining - Option 2	--	1.9	--	--
Public Access Road	--	--	--	8.9
Rapid Infiltration Basin East	2.0	2.0	2.0	2.0

SGP Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Rapid Infiltration Basin West	7.8	7.8	7.8	7.8
Light Vehicle Road	0.2	0.2	--	0.2
Scott Haul Road	0.3	0.3	0.3	0.3
Truck Shop Area	0.7	0.7	0.7	0.7
Truck Shop GMS	0.1	0.1	0.1	0.1
Truck Shop High Traffic	0.0	0.0	--	--
TSF	146.3	146.3	--	146.3
TSF and Hangar Flats DRSF Diversion	21.7	21.7	--	21.7
W Side of YPP	--	--	0.2	--
West End DRSF	41.6	--	41.6	41.6
West End DRSF Diversion	4.9	--	4.9	4.9
West End Pit	26.3	26.3	26.3	26.3
Worker Housing Facility	2.7	2.7	19.0	2.7
Yellow Pine Pit	69.4	69.4	69.4	69.4
Portions of Access Roads within the Mine Site Focus Area	11.4	11.4	2	0.7
Portions of Utilities (new Transmission Line Segments) within the Mine Site Focus Area	1.7	1.7	4.1	1.3
TOTALS	**675.6**	**630.3**	**820.5**	**673.4**

Table Source: AECOM 2020; Table prepared using Riparian Conservation Area spatial data intersected with SGP components

Table Notes:

1 Totals in this row incorporate acreages for losses associated with features that would be the same for all alternatives.

EFSFSR = East Fork South Fork Salmon River.

DRSF = Development Rock Storage Facility.

GMS = Growth Media Stockpile.

SGP = Stibnite Gold Project.

TSF = Tailings Storage Facility.

4.11.7.1.2 OFF-SITE FOCUS AREA

4.11.7.1.2.1 Wetland Acreage Losses

Table 4.11-26 shows acres of wetlands that would be lost within the off-site focus area under each of the action alternatives by SGP component. Losses of wetland acreages outside the mine site would be highest under Alternatives 1 and 3. Losses of wetland acreages outside the mine site would be lower under Alternative 2 predominantly due to realignment of a portion of the Burntlog Route. Losses of wetland acreages outside the mine site would be lowest under Alternative 4 predominantly due to the absence of the Burntlog Route under this alternative.

Table 4.11-26 Losses (in Acres) of Wetland Area by Major SGP Component within the Off-site Focus Area under All Action Alternatives

SGP Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Access Roads	17.6	9.3	17.6	4.3
Utilities	11.1	9.3	11.1	11.1
Tall Tree Clearing	11.8	11.9	11.8	11.8
Off-site Facilities	0.8	0.8	0.8	0.8
TOTALS[1]	**41.2**	**31.3**	**41.2**	**28.0**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) intersected with SGP components and NWI data intersected with SGP components for areas where wetland delineation data were not available

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

SGP = Stibnite Gold Project.

Table 4.11-27 shows acres of wetlands that would be lost within the off-site focus area under each of the action alternatives by watershed. The same extent of impacts to wetlands would occur under all action alternatives in the Gold Fork River, Lake Fork-North Fork Payette River, and Upper South Fork Salmon River. In the Big Creek-North Fork Payette River and Cascade Reservoir watersheds, Alternatives 1, 3, and 4 would result in the largest extent and Alternative 2 would result in the smallest extent of wetland impacts. In the Johnson Creek watershed, Alternatives 1 and 3 would result in the largest and Alternative 4 would result in the smallest extent of wetland impacts. In the Headwaters EFSFSR watershed, Alternatives 1, 2, and 3 would impact the largest extent and Alternative 4 would impact the smallest extent of wetland impacts.

Table 4.11-27 Losses (in Acres) of Wetland Area by Watershed within the Off-site Focus Area under All Action Alternatives

Drainage Basin (HUC 10)	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Big Creek-North Fork Payette River	3.7	2.5	3.7	3.7
Cascade Reservoir	2.7	2.2	2.7	2.7
Gold Fork River	1.1	1.1	1.1	1.1
Johnson Creek	23.0	14.8	23.0	9.9

Drainage Basin (HUC 10)	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Lake Fork-North Fork Payette River	4.6	4.6	4.6	4.6
Headwaters EFSFSR	2.1	2.1	2.1	1.9
Upper South Fork Salmon River	4.0	4.0	4.0	4.0
TOTALS[1]	**41.2**	**31.3**	**41.2**	**28.0**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) intersected with SGP components and NWI wetland data intersected with SGP components for areas where wetland delineation data were not available

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

SGP = Stibnite Gold Project.

4.11.7.1.2.2 Riparian Acreage Losses

Table 4.11-28 shows acres of RCAs that would be lost within the off-site focus area under each of the alternatives. Losses of RCA acreages outside the mine site would be highest under Alternatives 1 and 3. Losses of RCA acreages outside the mine site would be lower under Alternative 2 than under Alternatives 1 or 3 predominantly due to realignment of a portion of the Burntlog Route. Losses of RCA acreages outside the mine site would be lowest under Alternative 4 predominantly due to the absence of the Burntlog Route and a different location for the utilities structure work area under this alternative.

Table 4.11-28 Losses (in Acres) of Riparian Conservation Areas within the Off-site Focus Area by Major SGP Component under All Alternatives

SGP Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Access Roads	158.8	155.8	158.9	133.7
Utilities	288.9	288	307.9	287.5
Off-site Facilities	5.8	5.8	5.8	8.0
TOTAL[1]	**453.5**	**449.6**	**472.6**	**429.2**

Table Source: AECOM 2020; Table prepared using Riparian Conservation Area data intersected with SGP components

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

SGP = Stibnite Gold Project.

Table 4.11-29 shows acres of RCAs that would be lost within the off-site focus area under each of the alternatives, by watershed. The same extent of impacts to RCAs would occur under all action alternatives in the Gold Fork River, Lake Fork-North Fork Payette River, and Upper South

Fork Salmon River. In the Big Creek-North Fork Payette River and Cascade Reservoir watersheds, the extent of impacts is similar for all alternatives with Alternative 2 resulting in slightly more impact area (0.6 acre) than the other action alternatives. In the Johnson Creek watershed, Alternatives 1 and 3 would result in the largest and Alternative 4 would result in the smallest extent of RCA impacts. In the Headwaters EFSFSR watershed, Alternative 4 would impact the largest extent and Alternatives 1, 2, and 3 would impact the smallest extent of RCA impacts.

Table 4.11-29 Losses of Riparian Conservation Areas within the Off-site Focus Area by Watershed under All Action Alternatives

Drainage Basin (HUC 10)	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)
Big Creek-North Fork Payette River	78.1	77.6	78.1	78.1
Cascade Reservoir	4.8	4.7	4.8	4.8
Gold Fork River	8.5	8.5	8.5	8.5
Johnson Creek	234.7	231.6	234.7	208.1
Lake Fork-North Fork Payette River	4.5	4.5	4.5	4.5
Headwaters EFSFSR	41.1	40.9	60.2	43.4
Upper South Fork Salmon River	81.8	81.8	81.8	81.8
TOTALS[1]	**453.5**	**449.6**	**472.6**	**429.2**

Table Source: AECOM 2020; Table prepared using Riparian Conservation Area data intersected with SGP components

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

SGP = Stibnite Gold Project.

4.11.7.2 Issue: Impacts on Wetland and Riparian Functions

The analysis of losses of wetland functional units by action alternative is summarized in **Table 4.11-30**. Overall, losses of wetland functional units would be fairly consistent across all action alternatives. Note that the lower number of total functional units lost under Alternative 3 is due to the limited functional assessment data available for the estimated wetlands located in the EFSFSR drainage for Alternative 3. This lower number in not indicative of a reduced impact; rather a lack of available data for comparison purposes. However, the availability of wetland functional assessment data for Alternatives 1, 2, and 4 provides for accurate comparison in **Table 4.11-30**. For those portions of Alternative 3 that have been assessed for ecological functions, the information is still informative where it identifies high-value wetlands and principal functions provided by associated AAs.

Causes for variations in wetland functional unit losses between Alternatives 1, 2, and 4 would be the same as described for losses of wetland acreages (predominantly, rerouting of a portion of the Burntlog Route under Alternative 2 and lack of the Burntlog Route under Alternative 4).

Table 4.11-30 Losses of Wetland Functional Units under All Action Alternatives

Wetland Category[1]	Alternative 1	Alternative 2	Alternative 3[3]	Alternative 4
II (High-value)	486.1	488.1	142.5	485.4
III and IV	273.2	273.4	302.2	270.8
TOTALS[2]	**759.3**	**761.5**	**444.6**	**756.3**

Table Source: AECOM 2020; Table prepared using wetland functional assessment data (HDR 2016a; Tetra Tech 2018). Refer to **Appendix I-1** (**Table I-1-1**) for Assessment Area-specific information

Table Notes:

1 Wetland categories range from I (highest functional value) to IV (lowest functional value). No Category I wetlands were documented in the analysis area. Category II wetlands are considered high-value for the purposes of this analysis.

2 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

3 As wetland functional assessment information is not available for wetlands potentially impacted by the EFSFSR DRSF and TSF (Alternative 3-specific components), the total functional units lost under Alternative 3 is not comparable to total functional units lost under other alternatives where wetland functional assessment information is available for the majority of mine site impacts.

4.11.7.3 Issue: Wetland and Riparian Area Fragmentation

The results of analysis of habitat fragmentation potential by alternative are summarized in **Table 4.11-31**. Overall, Alternative 3 would have the highest potential increase in wetland and riparian area fragmentation, while Alternative 4 would have the lowest potential. Causes for variations in fragmentation metrics between alternatives would be the same as described for losses of wetland acreages (predominantly, rerouting of a portion of Burntlog Route under Alternative 2, variations in the placement and sizes of DRSFs and the TSF under Alternative 3, and lack of the Burntlog Route under Alternative 4). Alternative 2 would result in fewer individual wetlands crossed by new roads than under Alternatives 1 or 3 due to the Riordan Creek realignment segment within the proposed Burntlog Route.

Table 4.11-31 Habitat Fragmentation Metrics in the Analysis Area under All Action Alternatives (Tables 4.11-31a – 4.11-31c)

Table 4.11-31a Habitat Fragmentation Metrics in the Analysis Area under All Action Alternatives - Number of Wetlands Crossed by New Roads

SGP Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Number of Individual Wetlands Bisected by New Roads	**139**	**86**	**181**	**62**

Table Source: AECOM 2020

Table 4.11-31b Habitat Fragmentation Metrics in the Analysis Area under All Action Alternatives - Wetland Losses (acres)

SGP Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Total Wetland Losses in the Mine Site Focus Area	130.9	131.2	132.3	130.2
Total Wetland Losses in the Off-Site Focus Area	41.2	31.3	41.2	28.0
TOTALS[1]	**172.2**	**162.5**	**173.4**	**158.3**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) intersected with SGP components and NWI wetland data intersected with SGP components for areas where wetland delineation data were not available

Table 4.11-31c Habitat Fragmentation Metrics in the Analysis Area under All Action Alternatives - Riparian Conservation Area Losses (acres)

SGP Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Total Acres of Riparian Area Losses in the Mine Site Focus Area	676.2	630.8	821.1	673.8
Total Acres of Riparian Area Losses in the Off-Site Focus Area	364.8	362.5	364.8	341.5
TOTALS[1]	**1,041.0**	**993.3**	**1,185.9**	**1,015.3**

Table Source: AECOM 2020; Table prepared using wetland delineation data (HDR 2013, 2014a,b, 2015, 2016b,c) intersected with SGP components and NWI wetland data intersected with SGP components for areas where wetland delineation data were not available

4.11.7.4 Issue: Alteration of Wetland and Riparian Areas due to Changes in Water Balance

Acreages of wetlands in the maximum drawdown extent under the action alternatives are presented in **Table 4.11-32**. Alternatives 1 and 4 would have the greatest amount of groundwater drawdown, which would result in the greatest potential to convert wetland to upland in areas where near-surface water tables would be lowered by drawdown. Alternative 3 would have the smallest spatial extent of groundwater drawdown and therefore the smallest extent of impacts to wetlands. The entirety of wetlands within drawdown areas also would be subject to direct impacts from alternative component construction under all action alternatives; the effects of drawdown would only result in the earlier loss of wetland functions.

Table 4.11-32 Acres and Types of Wetlands in the Maximum Drawdown Area under the Action Alternatives

Wetland Types	Alternative 1	Alternative 2	Alternative 3	Alternative 4
PEM Wetlands	8.3	7.2	6.5	8.3
PFO Wetlands	6.8	7.0	5.7	6.8
PSS Wetlands	28.8	28.4	24.0	28.8
Open Water	4.7	4.2	4.1	4.7
TOTALS[1]	**48.6**	**46.7**	**40.3**	**48.6**

Table Source: AECOM 2020; Simulated Alluvial contour 10-foot buffer for groundwater drawdown in maximum drawdown area for all SGP years combined

Table Notes:

1 Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

PEM = Palustrine emergent marsh.

PFO = Palustrine forested.

PSS = Palustrine scrub-shrub.

SGP = Stibnite Gold Project.

4.11.7.5 Issue: Alteration of Wetland and Riparian Areas due to Changes in Water Quality

All the action alternatives would have direct permanent impacts on water quality due to contributions of new sources of mine waste material to the EFSFSR drainage. Indirect effects to wetlands and riparian areas could occur under all the action alternatives if the quantity and or quality of surface and groundwater flows, including the chemical characteristics of the waters, change downstream of disturbance areas, and if those changes disrupt water quality or habitat conditions during active mining and after SGP closure. These would include the effects of placing DRSFs in stream valleys, which could cause introduction of contaminants or temporary changes to pH and dissolved oxygen levels. Removal and repurposing of legacy mine wastes would occur under Alternatives 1, 2, and 4, thereby improving some existing water quality conditions observed in Meadow Creek and the EFSFSR; under Alternative 3 the spent ore disposal area and Bradley tailings would not be removed and would therefore have the potential to contaminate downstream restoration areas. As such, anticipated wetland and riparian improvements would be less extensive under this alternative.

The on-site lime generation proposed under Alternative 2 would reduce heavy vehicle trips to the mine site by approximately 31 percent compared to Alternative 1, thereby limiting incremental surface water quality impacts from erosion and sedimentation from use of Burntlog Route on wetlands and riparian areas in the Johnson Creek watershed. Additionally, piping low flows in stream diversions around the TSF, Hangar Flats DRSF, and Hangar Flats pit during the mine operational period under Alternative 2 also would maintain lower stream temperatures in Meadow Creek compared to the other action alternatives, thereby reducing impacts to downstream wetlands and riparian areas.

Under Alternative 4, water quality effects on wetlands and riparian areas would be similar as described under Alternative 1, although the absence of construction or use of Burntlog Route would eliminate water quality impacts in this area as compared to Alternative 1. However, Alternative 4 would require all mine-related traffic during construction, operations, and reclamation to use the Yellow Pine Route, which would increase traffic on Yellow Pine Route during the mine operational and reclamation period, leading to the potential of greater rutting and degradation, greater road maintenance needs, and potentially higher erosion rates from the road surface into surface waters. As Yellow Pine Route is parallel and near EFSFSR along much of its route, these effects would be concentrated in this river, whereas the Burntlog Route would cross several drainages resulting in less impact on any one drainage. Higher erosion rates in this area under Alternative 4 would impact wetlands and riparian areas adjacent and downstream of Yellow Pine Route to a greater degree than under Alternative 1.

Wetlands and riparian areas would be impacted to varying degrees under all action alternatives. Alternative 1 would result in the greatest loss of wetland acreages and wetland functions, and the greatest degree of indirect effects to these features. Alternative 3 would result in the second highest overall impacts to wetlands and riparian areas due to losses of acreages and water quality impacts, although impacts to wetland functions would be the lowest under this alternative compared to the other action alternatives. Alternative 2 would result in fewer losses of wetland acres and functions as compared to Alternative 1 due to various alterations to SGP components, including some that that would improve streamflow downstream of the mine site. Alternative 4 would result in the lowest acreage of wetland and riparian area losses due to the absence of construction and use of the Burntlog Route, although water quality impacts would be increased along the Yellow Pine Route.

Table 4.11-33 provides a summary comparison of wetlands and riparian resources impacts by issue and indicators for each alternative.

This page intentionally left blank

Table 4.11-33 Comparison of Wetlands and Riparian Resources Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Loss of wetland and riparian areas.	***Within the mine site focus area-*** Acres of wetland and riparian habitat lost through construction of SGP alternative components – within the mine site	There are 429 acres of wetlands delineated in the mine site focus area (**Table 3.11-3a**). Figures of these features and impacts under the alternatives are in **Appendix I**.	130.9 acres of wetlands would be lost at the mine site (31% of wetlands at the mine site) 675.6 acres of riparian areas would be lost at the mine site	131.2 acres of wetlands would be lost at the mine site (31% of wetlands at the mine site) 630.3 acres of riparian areas would be lost at the mine site	132.3 acres of wetlands would be lost at the mine site (31% of wetlands at the mine site) 820.5 acres of riparian areas would be lost at the mine site	130.2 acres of wetlands would be lost at the mine site (31% of wetlands at the mine site) 673.4 acres of riparian areas would be lost at the mine site	None.
	Within the off-site focus area - Acres of wetland and riparian habitat lost through construction of SGP alternative components.	Figures of these features and impacts under the alternatives are in **Appendix I**.	41.2 acres of wetlands would be lost within the off-site focus area 453.5 acres of riparian areas would be lost within the off-site focus area	31.3 acres of wetlands would be lost within the off-site focus area 449.6 acres of riparian areas would be lost within the off-site focus area	41.2 acres of wetlands would be lost within the off-site focus area 472.6 acres of riparian areas would be lost within the off-site focus area	28.0 acres of wetlands would be lost within the off-site focus area 429.2 acres of riparian areas would be lost within the off-site focus area	None.
Impacts on wetland and riparian functions.	Functional units of wetlands, including high-value wetlands (i.e., Category I and II per MWAM), lost due to SGP construction.	Existing Wetland Functions and Values of AAs assessed for the SGP are presented in **Appendix I** (**Table I-1-1**).	759.3 functional units would be lost, including 486.1 high-value functional units.	761.5 functional units would be lost, including 488.1 high-value functional units.	Based on partial availability of functional assessment data, 444.6 functional units would be lost, including 142.5 high-value functional units. However, as wetland functional assessment information is not available for wetlands potentially impacted by the EFSFSR DRSF and TSF (Alternative 3-specific components), the total functional units lost under Alternative 3 is not comparable to total functional units lost under other action alternatives.	756.3 functional units would be lost, including 485.4 high-value functional units.	None.
Wetland and riparian area fragmentation.	Number of wetlands crossed by new roads.	Figures of these features and impacts under the alternatives are in **Appendix I**.	139 wetlands would be crossed by new roads.	86 wetlands would be crossed by new roads.	181 wetlands would be crossed by new roads.	62 wetlands would be crossed by new roads.	None.
	Total area (in acres) of wetlands that would be lost.	Extents of wetlands and riparian resources are presented in Chapter 3 (**Table 3.11-3a** through **Table 3.11-3e**). Figures of these features and impacts under the alternatives are in **Appendix I**.	172.2 wetland acres lost.	162.5 wetland acres lost.	173.4 wetland acres lost.	158.3 wetland acres lost.	None.
Alteration of wetland and riparian areas due to changes in water balance.	Wetland acres within indirect impact area that would be affected by groundwater drawdown (maximum extent of drawdown under all years)	Extents of wetlands are presented in Chapter 3. Figures of simulated alluvial drawdown at years 6, 7 and 12 are presented in Section 4.8 (**Figures 4.8-23** to **4.8-25**).	48.6 acres of wetlands would be affected by drawdown. The entirety of these wetlands also would be subject to direct impacts from alternative component construction.	46.7 acres of wetlands would be affected by drawdown. The entirety of these wetlands also would be subject to direct impacts from alternative component construction.	40.3 acres of wetlands would be affected by drawdown. The entirety of these wetlands also would be subject to direct impacts from alternative component construction.	48.6 acres of wetlands would be affected by drawdown. The entirety of these wetlands also would be subject to direct impacts from alternative component construction.	None.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Alteration of wetland and riparian areas due to changes in water quality.	Quantitative analysis of estimated changes in water quality parameters based on predictive water modelling in areas coincident with wetlands within the indirect impact area.	Refer to Surface Water and Groundwater Quality section (Section 4.9) for anticipated baseline and predicted water quality parameters.	The SGP would impact water quality, which would in turn impact wetlands and RCAs. See Surface Water and Groundwater Quality section (Section 4.9).	Water quality effects on wetlands and riparian areas would be similar as under Alternative 1 though design features would minimize water quality impacts.	Water quality effects on wetlands and riparian areas would be similar to as described under Alternative 1 with slight differences due to location of SGP features. Alternative 3 would experience greater impacts to water quality from the lack of reprocessing of spent ore disposal area and Bradley tailings.	Water quality effects on wetlands and riparian areas would be similar as under Alternative 1, though no construction or use of Burntlog Route would eliminate water quality impacts in that area, but would increase the impacts along the Yellow Pine Route that is parallel and near EFSFSR and Johnson Creek.	None.

4.12 Fish Resources and Fish Habitat

4.12.1 Effects Analysis Issues and Indicators and Methodology of Analysis

The analysis of effects on fish resources and fish habitat includes the following identified issues and indicators:

Issue: The Stibnite Gold Project (SGP) may cause changes in fish habitat in the analysis area that may affect aquatic species, including federally listed fish species and aquatic habitat (e.g., critical habitat) and Management Indicator Species within and downstream of the SGP area.

Indicators:

- Length (in kilometers [km]) of stream and lake habitat directly impacted by channel removal.
- Change in amount of total useable Chinook salmon Intrinsic Potential (IP) habitat in km.
- Direct loss of Chinook salmon Critical Habitat (km).
- Change in total useable steelhead IP habitat.
- Length of bull trout habitat (km).
- Bull trout occupancy probability.
- Change in access to bull trout lake habitat.
- Direct loss of bull trout critical habitat.
- Length of westslope cutthroat trout habitat (km)
- Westslope cutthroat trout occupancy probability
- Changes in stream peak and baseflow (cubic feet per second [cfs]).
- Changes in water temperature (degrees Celsius [°C]).
- Changes in water chemistry (analysis criteria).

Issue: The SGP may affect fish species by degrading water quality in waterways adjacent to access roads.

Indicators:

- Amount of increased traffic (average daily traffic).

Issue: The SGP may affect fish populations through establishment of fish access upstream of the Yellow Pine pit.

***Indicators**:*

- Changes in migratory patterns of fish.
- Length of suitable habitat upstream of the Yellow Pine pit lake (km).

Issue: The SGP may affect fish health through hazardous material spills at the mine site or along the access roads.

***Indicators**:*

- Length of important fish habitat within 91 meters of access routes.

4.12.2 Direct and Indirect Effects

The following analysis of effects associated with fish resources and fish habitat is considered within the overall context that resident and anadromous fish species could be affected, including three species listed as threatened under the Endangered Species Act (ESA), and one U.S. Forest Service (Forest Service) sensitive species, the westslope cutthroat trout. The mine site is designated as critical habitat and Essential Fish Habitat (EFH) for Chinook salmon, and many of the area streams also are designated as critical habitat for steelhead trout and/or bull trout. Nearly the entire length of streams adjacent to both access routes (Burntlog Route and Yellow Pine Route) is within designated critical habitat for Chinook salmon, steelhead trout, and bull trout. Bull trout are listed as threatened by the U.S. Fish and Wildlife Service (USFWS) and as a Management Indicator Species (MIS) by the Payette National Forest (PNF) and the Boise National Forest. While these listed and sensitive species are the focus of the analyses, the effects described are expected to be similar for all fish species in the analysis area.

The descriptions of effects are organized as follows for each alternative: direct impact-causing activities (i.e., physical stream channel changes) and the Direct Effects to Individuals section, are discussed first because those activities would have the greatest potential to impact fish and fish habitat at the mine site. Habitat changes are described next (Habitat Elements/Watershed Condition Indicators), and separated into two subsections (mine site and off-site). This is followed by more detailed descriptions of impacts to each of the four main species (Chinook salmon, steelhead trout, bull trout, and westslope cutthroat trout), and then a brief description of impacts to all other fish species that may be found in the analysis area. It is important to note that most of the effects discussions are presented under Alternative 1. The descriptions of effects under the other action alternatives (i.e., Alternatives 2, 3, and 4) is limited to effects that would differ from those described under Alternative 1, such as changes in duration, magnitude, location, and timing.

4.12.2.1 Incomplete and Unavailable Information

Several assumptions regarding physical, biological, and chemical conditions were made to address incomplete information at the time of this analysis.

Reach-specific fish spatial distribution (i.e., presence/absence) data were not available for all streams potentially affected by the action alternatives, especially the streams outside the mine site. Population estimates were not available; as described in the Aquatic Resources 2016 Baseline Study Report Addendum (GeoEngineers 2017), the results of the multiple years of diver-based snorkel surveys are limited and variable.

Some habitat conditions could not be quantitatively evaluated due to a lack of available data or a suitable site-specific model (e.g., impacts of stream flow reductions on overwintering fish, and a site-specific streamflow/productivity model). Other examples include lack of modeling of existing habitat for many fish at multiple life stages. There is a lack of a site-specific, two-dimensional hydraulic-based habitat suitability model. The nearest sites where data have been collected and modeling performed are on several streams in the Upper East Fork of the Salmon River (Sugar Creek, Tamarack Creek, Profile Creek, Quartz Creek, and the East Fork South Fork Salmon River [EFSFSR]).

4.12.2.2 Assumptions

To analyze impacts on fish resources and fish habitat the following assumptions were made:

- The proposed EFSFSR fish tunnel under Alternatives 1, 2, and 3 would provide passage for all four special status fish species. This assumption is based on professional judgment and review of other similar or longer tunnels that have been documented to be fish passable (Gowans et al. 2003; Rogers and Cane 1979; Wollebaek et al. 2011). This analysis also includes a brief description of the effects if the tunnel does not provide passage as planned (USFWS 2019).
- The constructed and enhanced stream reaches would perform as described in the Stream Design Report (Rio Applied Science and Engineering [Rio ASE] 2019).
- The stream temperature analysis is based on the duration of SGP phases as: construction – 3 years; mining - 12 years; closure and reclamation - 5 years; and post-closure to Mine Year 112.
- The stream flow analysis within the combined stream and pit water temperature models (Stream and Pit Lake Network Temperature [SPLNT] models, Brown and Caldwell 2018, 2019b,c) accurately reflect future conditions, which is based on historic conditions.

Much of the fish habitat modeling and analysis presented in this section is based on the hydrologic and site-wide water chemistry modeling performed by Midas Gold Idaho, Inc (Midas Gold) or its consultants. Predictions generated by groundwater and hydrologic models (Brown and Caldwell 2019a,e) are associated with a degree of uncertainty and can be limited in their predictive power. See Section 4.8.8, Surface Water and Groundwater Quantity – Model Uncertainty; and Section 4.9.8, Surface Water and Groundwater Quality – Model Uncertainty, for a description of these uncertainties.

4.12.2.3 Alternative 1

4.12.2.3.1 Physical Stream Channel Changes – Alternative 1

Table 4.12-1 and **Figure 4.12-1** depict the physical changes to fish habitat at the mine site throughout all SGP phases (construction, operation, closure and reclamation). **Table 4.12-1** also presents the timing of the stream channel changes at the mine site by Mine Year. The general changes, and the SGP phase, that would affect fish and fish habitat include:

- Construction and Operations: fish bearing streams would be diverted into ditched channels, enhancements would occur in some stream channels, existing barriers to natural fish movement would be removed, and new barriers would be created.
- Closure and Reclamation: streams would be constructed either close to existing locations or on top of the tailings storage facility (TSF) or development rock storage facilities (DRSFs). Streams on the tops of the TSF or DRSFs would be inaccessible to natural upstream and downstream migration.

Midas Gold timelines used in this section and in supporting documents for this section are based on a timeline that starts with construction Mine Years listed as -3, -2, -1 for the construction period counting down to Mine Year 1, which is the first operational year. This timeline does not match the timeline described in Chapter 2, Alternatives Description, and used throughout many sections of the environmental impact statement (EIS). However, in this section the timelines have been modified to Midas Gold timeline to match the fish modeling done by Midas Gold (Midas Gold 2016) and its contractors. A brief description of the timeline described in Chapter 2 follows in order to provide a crosswalk to the Mine Years used throughout this section. The SGP description in Chapter 2 assumes Year 1 is the first year of any type of disturbance associated with the SGP. Years 1 through 3 are associated with the Midas Gold Years (i.e., Mine Years) -3, -2, -1 which represent construction; Years 4 through 15 are associated with Midas Gold Years 1 through 12 which represent operations; and Years 16 and beyond are associated with Midas Gold Year 13 and beyond and represent closure and reclamation.

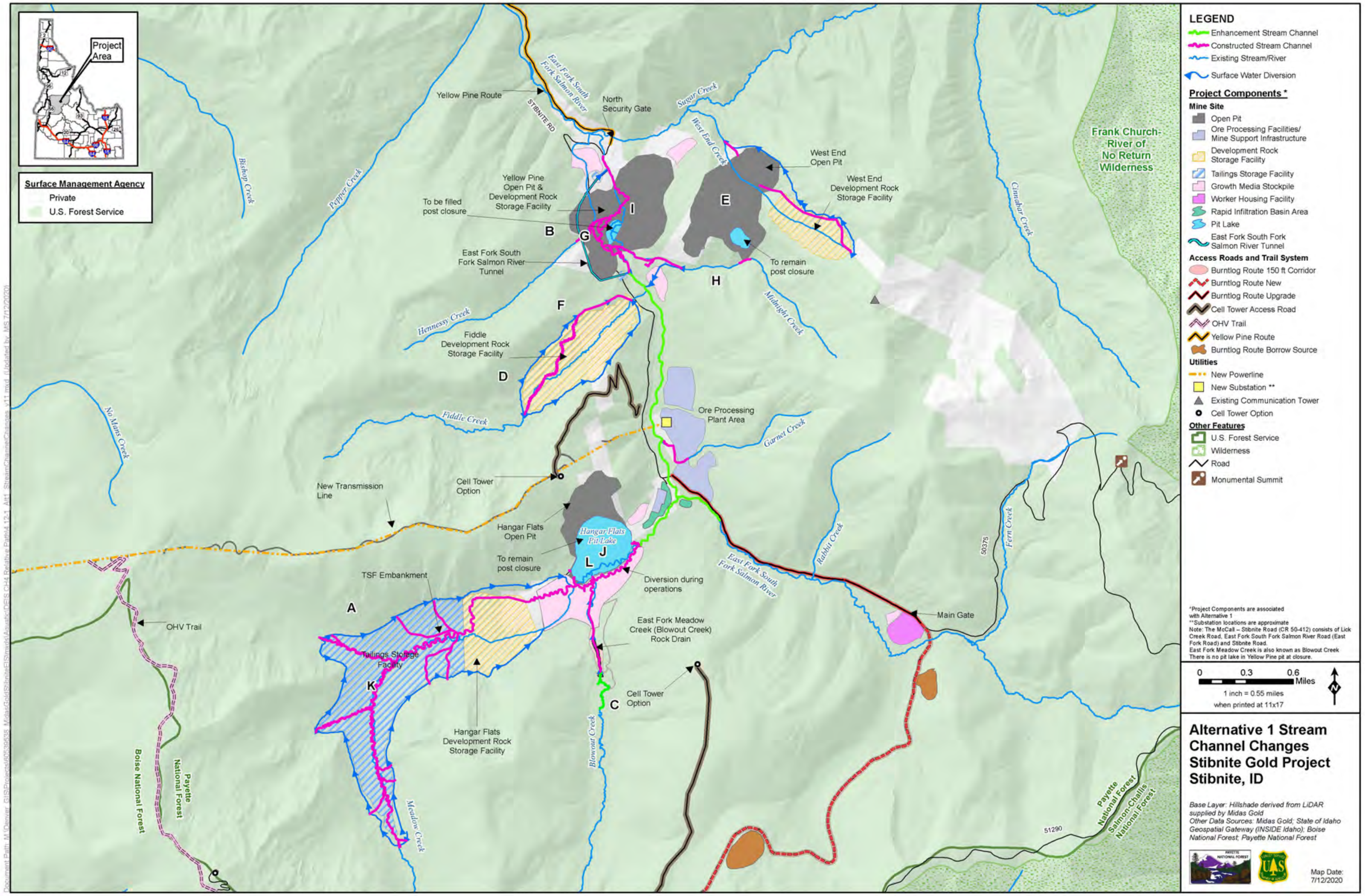


Figure Source: AECOM 2020

Figure 4.12-1 Alternative 1 Stream Channel Changes (Map Code Locations A-K Shown in Table 4.12-1)

This page intentionally left blank

Table 4.12-1 Timing of Mine Site Stream Channel Changes for Alternative 1

Map Code[1]	Midas Gold Mine Year	In-Stream Mining-related Work	In-Stream Enhancements
A	Negative (Neg) 2 (-2)	Meadow Creek and tributaries diverted around both sides of TSF and Hangar Flats DRSF. EFSFSR tunnel construction begins but no water diverted.	None proposed
B	-1	EFSFSR tunnel completed and water diversion initiated, Hennessy Creek and Midnight Creek diverted into EFSFSR tunnel. Meadow Creek constructed around Hangar Flats pit. East Fork Meadow Creek (Blowout Creek) engineered channel/rock drain, and West End diversion completed. Yellow Pine pit lake dewatered. West End Creek diverted around West End DRSF and West End pit. Sediment control and rock drain constructed on East Fork Meadow Creek. Divert Meadow Creek into a reclaimed channel around Hangar Flats pit footprint.	Enhancement in EFSFSR (excluding Yellow Pine pit) to remove obstructions to natural upstream fish passage and add pools with cover for adult resting and isolated rearing habitat. Upstream of Meadow Creek: -Remove obstructions to upstream fish passage -Add pools with cover for adult resting and isolated rearing habitat Upstream of Yellow Pine pit: -Add individual habitat logs and boulders throughout the reach to force scour pools, provide cover, sort gravel, provide hydraulic variability, improve habitat. - Strategic placement of logs and whole-tree large woody debris (LWD) to leverage existing large boulders (over 6-foot diameter) in three locations. - Place alternating rock and/or wood barbs in plane-bed stream segments to force thalweg (i.e., deeper/gully) development and pools. -Excavate and/or create large backwater pool immediately upstream of proposed tunnel south portal transition channel. Use high-flow boulder and/or LWD constriction to maintain pool. Downstream of Yellow Pine pit: Excavate/create backwater pool immediately downstream of proposed EFSFSR tunnel north portal transition channel outlet; boulder constriction to maintain pool -Add individual habitat logs and boulders throughout the reach to force scour pools, provide cover, sort gravel, provide hydraulic variability, improve habitat. -Enhancement in Meadow Creek from location of Hangar Flats pit lake downstream to the confluence with EFSFSR.

Map Code[1]	Midas Gold Mine Year	In-Stream Mining-related Work	In-Stream Enhancements
			-Addition of in-stream LWD and rock structures to increase hydraulic complexity, sort sediment, scour and maintain pools, and provide in-stream habitat cover.
C	1	Rapid infiltration basins (RIBs) (Hangar Flats) initiated. Enhance East Fork Meadow Creek (Blowout Creek) upper meadow.	Blowout Creek: enhancements in meadow channel upstream of boulder chute.
D	2	Fiddle Creek diverted around Fiddle DRSF.	None proposed
None	3-6	No significant stream channel changes.	None proposed
E	7	West End DRSF surface preparation for stream liner and placement of floodplain material and growth media. West End Creek constructed on top of West End DRSF (earliest possible timing).	None proposed
F	8	Fiddle Creek construction (earliest possible timing); flow not yet directed into constructed channel.	None proposed
None	9	Divert portion of Fiddle Creek flow into constructed channel to allow riparian vegetation development.	None proposed
None	10	All flow diverted into constructed Fiddle Creek channel.	None proposed
G, H, and I	11	Hennessy Creek (G), Midnight Creek (H), and EFSFSR (I) construction begins but no flow diverted. Hangar Flats pit lake begins to fill.	None proposed
None	12	Portion of flow diverted into EFSFSR, Hennessy Creek, and Midnight Creek constructed channels. A portion of flow directed into the reclaimed EFSFSR, Hennessy Creek, and Midnight Creek over the Yellow Pine DRSF to allow riparian vegetation development. Hangar Flats pit lake continues to fill.	None proposed
J	13	All flow diverted in EFSFSR, Hennessy Creek, and Midnight Creek constructed channels. Hangar Flats pit lake continues to fill. Entrance and exit channels constructed connecting Meadow Creek and East Fork Meadow Creek (Blowout Creek) to Hangar Flats pit lake.	None proposed

Map Code[1]	Midas Gold Mine Year	In-Stream Mining-related Work	In-Stream Enhancements
		Construct East Fork Meadow Creek (Blowout Creek) from upper meadow to confluence with Meadow Creek. West End Rock chute constructed. EFSFSR diversion tunnel deactivated, but available as needed for adaptive management of EFSFSR reclamation.	
None	14	No significant stream channel changes. Hangar Flats pit lake filled.	None proposed
L	15	EFSFSR Tunnel decommissioned. Garnett Creek culvert removal and channel reclamation. Meadow Creek and East Fork Meadow Creek (Blowout Creek) permanently routed into Hangar Flats pit lake.	None proposed
None	16	No significant stream channel changes.	None proposed
K	17	Meadow Creek constructed on TSF and DRSF. Portion of flow diverted intro constructed channel.	None proposed
None	18	All flow diverted into Meadow Creek constructed channels on TSF and DRSF.	None proposed
None	19	No significant stream channel changes.	None proposed
None	20	Same configuration as Mine Year 19 – Same channel configuration as Post/Closure Reclamation (on Figure 3.3 of SPLNT Model and Proposed Action Report- Brown and Caldwell 2019a).	None proposed

Table Source: Brown and Caldwell 2019a; Rio ASE 2018, 2019

Table Notes:

1 map codes (A-K) are shown on **Figure 4.12-1**.

Table 4.12-2a presents the length of stream channel changes, which includes changing existing stream reaches into constructed diversions and stream enhancements. Enhancements would include improvements to physical channel processes and habitat largely within the existing stream channel. This would be accomplished by selectively installing LWD and rock structures, eliminating fish passage barriers, creating pools, enabling improved sediment sorting, and generally increasing hydraulic and habitat diversity. Enhancement efforts also may include floodplain reconnection and establishment of riparian vegetation, achieved by excavation of legacy fill material down to bankfull level (Rio ASE 2018).

Table 4.12-2a Alternative 1 Stream Channel Changes

Streams	Length of Existing Channel Removed (km)	Length (km) and Duration of Diversion (years)	Length of Enhancements (km)
EFSFSR	1.6 km (also 1.9 hectares of Yellow Pine pit)	2.1 km for the re- routing of the EFSFSR tunnel (14 years)	3.27
Fiddle Creek	1.8 km	1.8 km for 8 years	None
Meadow Creek	5.6 km	2.4 km for 16 years	0.72
East Fork of Meadow Creek (Blowout Creek)	1.8 km	No diversion	0.61
TOTAL	10.8 km	6.3 km	4.6 km

Table Source: AECOM 2020

Table Notes:

km = kilometer (1 km = 0.62 mile).

The following subsections describe the physical stream channel changes in greater detail by stream reach and SGP phase.

4.12.2.3.1.1 Stream Reach 1 EFSFSR and Tributaries from Sugar Creek Upstream to Meadow Creek

Stream Reach 1 includes the EFSFSR and its tributaries from Sugar Creek to Meadow Creek (**Figure 3.12-2**), Section 3.12.4.7.3.3, East Fork South Fork Salmon River Watershed Baseline, provides additional description of Stream Reach 1. This reach supports Chinook salmon, steelhead trout, bull trout, and westslope cutthroat trout (cutthroat trout) and is designated ESA critical habitat and EFH for Chinook salmon and ESA critical habitat for bull trout. Stream channel changes that would occur in this stream reach, include mining the Yellow Pine pit and constructing the EFSFSR tunnel to redirect flow around the west side of the Yellow Pine pit during mining.

A summary of activities throughout the construction, operation, and closure and reclamation phases that would affect fish or fish habitat in Stream Reach 1 is presented below. The duration of the stream diversions and the associated impacts would vary depending on the stream being diverted, related mining activities in or near the diversions, and reclamation schedule for the diversion. The proposed diversion construction and reclamation years are provided in **Table 4.12-1**. Changes in stream channels directly altered would be permanent.

Construction and Operations

- Tunnel construction would begin in Midas Gold Mine Year (Mine Year) -2 and the EFSFSR would be diverted into a tunnel during Mine Year -1, the diversion would continue until Mine Year 13 (duration 14 years). In Mine Year 14, the tunnel would be decommissioned, and a channel established (including diverted inputs from tributaries) with an alignment that transverses the backfilled Yellow Pine pit.
- Fiddle Creek would be diverted around the perimeter of the proposed Fiddle DRSF in a channel to prevent surface water from running into the DRSF. This portion of Fiddle Creek would be lost as fish habitat during Mine Years 2 through 9. In Mine Year 10, Fiddle Creek would be established in a channel constructed on top of the reclaimed DRSF but would remain inaccessible to upstream migration due to the gradient barrier caused by the DRSF.
- Construction of the post-closure channels of the EFSFSR, Hennessy, and Midnight creeks would begin in Mine Year 11 (before the completion of the operations phase), with portions of flow redirected to the post-closure channels in Mine Year 12, and full flow redirected in Mine Year 13.

Prior to diverting stream channels or dewatering the Yellow Pine pit, fish exclusion barriers and trap and transfer activities would be used to minimize fish mortality.

Closure and Reclamation

- The EFSFSR channel would be constructed to flow over the backfilled Yellow Pine pit (Rio ASE 2019). Stream connectivity would be established across the backfilled Yellow

Pine pit and natural fish passage would be available to the upper EFSFSR (Rio ASE 2019).

- A channel for Fiddle Creek would be constructed on top of the reclaimed Fiddle Creek DRSF (Rio ASE 2019).
- The impacted segment of Hennessy Creek would be constructed and routed over the Yellow Pine pit highwall, with rocks placed at the toe of the waterfall to dissipate the energy and would then connect to the constructed EFSFSR within the backfilled Yellow Pine pit. The steep gradient would be a barrier to upstream fish passage.
- Midnight Creek channel would be constructed to its approximate pre-mining configuration, connecting to the EFSFSR at the upstream end of the reclaimed Yellow Pine pit and allowing fish access.
- Proposed enhancement activities in Stream Reach 1 would consist of habitat enhancement through placement of LWD; regrading of the channel (limited to the addition of constructed riffles, alcoves, side channels, and deep pool fish habitat for improved rearing and refuge during summer and winter extremes); and floodplain regrading (Rio ASE 2019).

4.12.2.3.1.2 Stream Reach 2: Meadow Creek and Blowout Creek

Stream Reach 2 includes Meadow Creek and Blowout Creek (**Figure 3.12-2**), Section 3.12.4.7.3.3, East Fork South Fork Salmon River Watershed Baseline, provides additional description of Stream Reach 2. Stream Reach 2 currently supports Chinook salmon, bull trout and cutthroat trout. Chinook salmon adults are periodically translocated to this reach from the South Fork Salmon River to supplement spawning. It is designated critical habitat for Chinook salmon and bull trout, and EFH for Chinook salmon.

Construction and Operations

The following enhancements would occur during construction and operations:

- Habitat and riparian enhancement would be conducted in lower Meadow Creek, downstream to the EFSFSR confluence in Mine Year -1. These would consist of the addition of in-stream LWD and rock structures to increase hydraulic complexity, sort sediment, scour and maintain pools, and provide in-stream habitat cover; regrading of the Meadow Creek channel (limited to the addition of constructed riffles, alcoves, side channels, and deep pool fish habitat for improved rearing and refuge during summer and winter extremes); and floodplain regrading.
- At East Fork Meadow Creek (Blowout Creek), fill would be placed over the French drain within the eroded gully, the gully side slopes would be laid back to a stable angle, a surface channel and riparian wetlands would be created, and the laid-back side slopes revegetated in Mine Year -1.
- Meadow Creek would be diverted for the construction of the TSF and Hangar Flats DRSF. These stream diversions would begin during Mine Year -2 with temporary

channel construction that would divert water around the TSF and Hangar Flats DRSF areas until approximately Mine Year 18 (duration 20 years). The north diversion would be the main channel.

Meadow Creek below the TSF and Hangar Flats DRSF would be diverted around the Hangar Flats pit during Mine Year -1. A low-permeability liner would be placed under the streambed material to prevent loss of water into the adjacent pit. Meadow Creek would be diverted around the TSF and Hangar Flats DRSF in surface water diversions with the main channel on one side and a smaller channel on the other side (**Figure 4.12-1**). The routing of Meadow Creek into two diversion channels would create a fish passage barrier due to the steep gradient necessary for the transition from the valley bottom to the location of the main diversion channel approximately 400 feet above.

Closure and Reclamation

- Depending upon the time for tailings to consolidate, the upper Meadow Creek channel construction could begin as soon as Mine Year 17. A portion of Meadow Creek flow would be directed into the meandering channel to allow riparian vegetation development. All Meadow Creek flow would be directed into the channel constructed on top of the TSF by Mine Year 18. At the downstream end of the channel, Meadow Creek would be routed down the outslope of the Hangar Flats DRSF. Due to the high gradient (great than [>] 20 percent), this channel would require a continuous series of step-pool structures, constructed of large, keyed-in boulders. Natural upstream fish passage would be blocked due to the steep gradient.
- Meadow Creek would be constructed as a sinuous to meandering channel from the toe of the Hangar Flats DRSF downstream to the inflow point of the Hangar Flats pit lake. A similar channel would connect the pit lake outflow to the existing lower Meadow Creek channel.

4.12.2.3.1.3 Stream Reach 3: EFSFSR Upstream of Meadow Creek

Stream Reach 3 includes the EFSFSR upstream of Meadow Creek (**Figure 3.12-2**), Section 3.12.4.7.3.3, East Fork South Fork Salmon River Watershed Baseline, provides additional description of Stream Reach 3. This reach contains Chinook salmon and is designated critical habitat and EFH; bull trout and is designated critical habitat; and westslope cutthroat trout.

Construction and Operations

The physical changes in this stream reach would be limited to enhancement activities, which would occur during Mine Year -1. Activities would consist of removing obstructions to upstream fish passage and adding pools with cover for adult resting and isolated rearing habitat.

Closure and Reclamation

There would be no physical stream channel changes in this reach during closure and reclamation.

4.12.2.3.1.4 Stream Reach 4: EFSFSR from Sugar Creek to Profile Creek

Stream Reach 4 includes the EFSFSR downstream of Sugar Creek (**Figure 3.12-2**), Section 3.12.4.7.3.3, East Fork South Fork Salmon River Watershed Baseline, provides additional description of Stream Reach 4. It contains: Chinook salmon and is designated critical habitat and EFH; bull trout and is designated critical habitat; steelhead trout and is designated critical habitat and EFH; and westslope cutthroat trout.

There would be no physical stream channel changes in this reach.

4.12.2.3.1.5 Stream Reach 5: Headwaters EFSFSR Subwatershed

Physical stream channel changes within the subwatershed are described in the previous subsections for Stream Reaches 1, 2, and 3.

4.12.2.3.1.6 Stream Reach 6: Sugar Creek

Stream Reach 6 consists of Sugar Creek (**Figure 3.12-2**), Section 3.12.4.7.3.3, East Fork South Fork Salmon River Watershed Baseline, provides additional description of Stream Reach 6. Stream Reach 6 contains Chinook salmon and is designated critical habitat and EFH; bull trout and is designated critical habitat; steelhead trout and is designated critical habitat and EFH; and westslope cutthroat trout. There would be no physical stream channel changes as part of the SGP in this stream reach.

4.12.2.3.2 Direct Effects To Individuals – Alternative 1

Implementation of the SGP has the potential to cause disturbance, injury, or mortality to fish and other aquatic life in the analysis area through a variety of activities that have both direct and indirect impacts. Physical stream channel changes would require fish handling during salvage and relocation activities for dewatering. These activities could cause injury or mortality to individuals. Past fish collection activities in the Yellow Pine pit (Brown and Caldwell 2019b) demonstrated a low mortality rate (example provided later in section), and the best management practices (BMPs) that Midas Gold has committed to (Brown and Caldwell 2019c) are expected to reduce the risk of injury to fish or mortality of fish (see **Appendix D**, Mitigation Measures).

Other potential effects include, but may not be limited to, injury or mortality resulting from blasting, entrainment by in-stream activities or manmade features, disturbance and interference in behavior and life processes as a result of increased noise and vibration, and from hazardous material spills into fish-bearing waters.

Injury or mortality also may be caused by flow reductions, water temperature changes, change in habitat structure, water quality changes, and reduced access to suitable habitat. These effects are described in the following sections.

The potential impacts discussions are organized first by SGP component (mine site, access roads, utilities, and off-site facilities), and then by mechanism of impact (i.e., dewatering, blasting, changes in access, and spill risk).

4.12.2.3.2.1 Mine Site

Dewatering, Fish Salvage, and Relocation

It is assumed that all fish-bearing stream reaches to be diverted or otherwise altered with in-water work would require fish salvage, and that enhancements also may require limited areas of dewatering/salvage. The length of stream channels to be altered and; therefore, dewatered requiring fish salvage is provided in **Table 4.12-2a**.

These activities could cause injury or mortality to fish that get caught in screens, or during removal activities (traps, dip nets, seine nets, electrofishing).

Once fish are captured, they could suffer injury or mortality during transport to the relocation site (not yet identified), which would be located somewhere downstream of all SGP activities. Injuries or mortality also could occur at or near the relocation site from predation, lack of food or suitable habitat, disorientation, or competition. In addition, fish currently residing near the relocation site would be affected by the introduction of the salvaged fish, increasing competition for potentially limited resources in that section of the stream.

Because of the difficulty in removing all fish from the isolated stream segments, there would be a risk of some smaller fish remaining in the area during the dewatering. Individuals remaining in the area would likely die if they are not captured and relocated. Fish left in small pools of water could die from elevated water temperatures, a reduction in the amount of dissolved oxygen, and/or predation.

In general, capturing and relocating fish is stressful and has the potential to cause mortality. For example, two juvenile Chinook salmon and "several" smaller juvenile mountain whitefish were killed during the 2018 Yellow Pine pit sampling study (Brown and Caldwell 2019b). The two juvenile Chinook salmon and juvenile mountain whitefish died apparently due to the stress of being captured in a seine net that had accumulated algae. There were no mortalities of bull trout or steelhead trout. Of the 53 Chinook salmon that were captured, 2 died, which corresponded to a 4 percent mortality rate. The number of mountain whitefish captured was recorded as "several hundred," so with "several" mortalities, the mortality rate, for this event, was estimated to be less than 1 percent. No injuries were recorded, so an injury rate cannot be estimated.

To protect fish species, a standard procedure for channel reach isolation, dewatering, fish salvage, and fish relocation during dewatering or maintenance of natural stream and diversion channels would be developed, based on the USFWS Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards (USFWS 2012). Fish salvage and relocation details are currently being developed in coordination with Idaho Department of Fish and Game, the USFWS, and National Oceanic and Atmospheric Administration (NOAA

Fisheries) and will become part of the SGP Environmental Monitoring and Management Program (Brown and Caldwell 2019c).

Trapping and transportation of fish also may be necessary if the EFSFSR tunnel does not pass fish upstream and/or downstream. Truck and haul operations would be implemented as a management measure if needed. If this occurs, it could negatively affect some individuals during trapping activities, transportation, or release previously described.

Information on the estimated number and type of fish present within streams at the mine site that could be directly impacted by dewatering, fish salvage, and translocation is provided below.

Stream Channels

Table 3.12-17 summarizes the linear densities at snorkel survey sites within the mine site for each of the four special status salmonids. Using the estimates of existing stream channel removed, diverted, or enhanced (**Table 4.12-2a**), the number of fish potentially subject to dewatering, salvage, and relocated was estimated. **Table 4.12-2b** presents estimates of the number of fish that might be present, and thus potentially impacted, during salvage operations.

Table 4.12-2b Estimated Fish Linear Densities and Salvage Numbers at Fish Sampling Sites Near or Within the Stream Channels to be Dewatered Under Alternative 1

Stream	Length of Existing Channel Removed (km)	Site Identification and Location	Mean Fish Linear Density – fish/m[1,2]			
			Chinook Salmon	Steelhead/Rainbow Trout	Bull Trout	Westslope Cutthroat Trout
Downstream of the Yellow Pine Pit and Upstream of Sugar Creek						
EFSFSR	1.6	MHWH-30 Upstream of Sugar Creek	0.561 (898)	0.631 (1,009)	0.093 (148)	0.125 (200)
Upstream of the Yellow Pine Pit						
EFSFSR	1.6	MWH-22 Upstream of Midnight Creek	4.707 (7,531)	Not Present	Not Present	0.073 (116)
Fiddle Creek	1.8	MWH-023 Lower Reach	Not Present	Not Present	Not Present	0.181 (326)
Fiddle Creek	1.8	MWH-024 Middle Reach	Not Present	Not Present	Not Present	0.430 (773)
Meadow Creek	5.6	MWH-031 Upstream of the East Fork Confluence	7.407 (41,477)	Not Present	0.015 (86)	0.267 (1495)
Meadow Creek	5.6	MWH-014 Stibnite Mine Site	4.020 (22,512)	Not Present	Not Present	0.090 (504)

Stream	Length of Existing Channel Removed (km)	Site Identification and Location	Mean Fish Linear Density – fish/m[1,2]			
			Chinook Salmon	Steelhead/Rainbow Trout	Bull Trout	Westslope Cutthroat Trout
Meadow Creek	5.6	MWH-015 Downstream of DRSF	0.023 (130)	Not Present	0.028 (156)	0.167 (935)
Meadow Creek	5.6	MWH-047 Upper DRSF	0.072 (403)	Not Present	0.009 (50)	0.189 (1,058)
Meadow Creek	5.6	MWH-016 Tailings Storage Facility	Not Present	Not Present	0.018 (104)	0.654 (3,663)
Meadow Creek	5.6	MWH-034 Upper Reach	Not Present	Not Present	0.013 (76)	0.236 (1323)
EFMC	1.8	MWH-028 Lower Reach	6.175 (11,115)	Not Present	Not Present	0.097 (175)
EFMC	1.8	MWH-027 Upper Reach	Not Present	Not Present	Not Present	0.044 (79)

Table Sources: A**ppendix J-10**

Table Notes:

1 (Total Fish Numbers/Length of Channel Removed).

2 Daytime surveys only – all fish size classes combined.

Fish/m = number of fish per meter of stream.

km = kilometer (1 km = 0.62 mi).

m = meter 1 (m = 3.28 ft).

DRSF = Development Rock Storage Facility.

EFMC = East Fork Meadow Creek.

Different sampling locations yield a range of estimates, except for steelhead. For example, 1.6 km of channel modifications to the EFSFSR yield a range in fish numbers potentially affected for Chinook salmon from 898 fish to 7,531 fish, based on the two fish sampling locations within this reach (i.e., MWH-30 and MWH-22). For the six locations sampled in Meadow Creek, the numbers of juvenile fish ranged from none (MWH-016) to 41,477 (MWH-031). Meadow Creek Chinook salmon juvenile fish estimates may seem high; however, Meadow Creek and nearby EFSFSR are Chinook salmon translocation areas for surplus adults from South Fork Salmon River. Translocations vary from year-to-year and may explain the high estimates of observed juvenile fish based on the snorkeling survey data (MWH Americas, Inc. 2017). Estimates of the number of non-salmonid fish are not available.

Yellow Pine Pit Lake

Estimates of the number of salmonids occupying the Yellow Pine pit lake (1.9 hectares) were made in 2018 and 2019 (Brown and Caldwell 2019a, 2020). These estimates are presented in

Tables 3.12-18 and **3.12-19** in Section 3.12.4.6. Fish Density, Section 3.12.4.6.2.2, Yellow Pine Pit Lake Estimates. Depending on the year and month, the number of juvenile Chinook salmon ranged from none to 48. Similarly, the number of bull trout present ranged from 45 to 104, and the number of westslope cutthroat trout ranged from 33 to 101.

Mountain whitefish were noted in the hundreds of fish in 2018, suggesting a large population may be present.

Blasting

Explosives may be used to fracture rock during construction and mine operations. Explosives detonated near water produce shock waves that may be lethal or damaging to fish, fish eggs, or other aquatic organisms. Outside of the zone of lethal or harmful shock waves, the vibrations caused by drilling and blasting have the potential to disturb fish causing stress or altering behavior. Most of the blasting required at the mine site would be in and near the Yellow Pine, Hangar Flats, and West End pits. Some blasting may be required for construction of stream diversions at the TSF, Yellow Pine pit, and Hangar Flats, Fiddle, and West End DRSFs. Such blasting would generally occur on hillsides and at higher elevations, with considerable distance between streams and the origin of the blasts.

Wright and Hopky (1988) describe the effects of blasting on fish and fish eggs:

> *"The detonation of explosives in or near water produces post-detonation compressive shock waves characterized by a rapid rise to a high peak pressure followed by a rapid decay to below ambient hydrostatic pressure. The latter pressure deficit causes most impacts on fish. The primary site of damage in finfish is the swimbladder, the gas-filled organ that permits most pelagic fish to maintain neutral buoyancy. The kidney, liver, spleen, and sinus venous also may rupture and hemorrhage. Fish eggs and larvae also may be killed or damaged (Wright 1982). Studies (Wright 1982) show that an overpressure in excess of 100 kPa will result in these effects. The degree of damage is related to type of explosive, size and pattern of the charge(s), method of detonation, distance from the point of detonation, water depth, and species, size and life stage of fish. Vibrations from the detonation of explosives may cause damage to incubating eggs (Wright 1982, Wright in prep.). Sublethal effects, such as changes in behavior of fish, have been observed on several occasions as a result of noise produced by explosives. The effects may be intensified in the presence of ice and in areas of hard substrate (Wright 1982, Wright in prep.)."*

Safe setback distances for blasting in or near water for the protection of fish have been established (Dunlap 2009; Kolden and Aimone-Martin 2013; Timothy 2013; Wright and Hopsky 1998). Midas Gold (2019a, b) has committed to comply with blasting standards set forth in Wright and Hopky (1998), and Timothy (2013). These standards have been shown to minimize the risk of injury or mortality to all life stages of fish.

As part of the SGP Environmental Monitoring and Management Plan, an Explosives and Blasting Management Plan would be developed that would ensure compliance with the blasting requirements of the Mine Safety and Health Administration, 30 Code of Federal Regulations 56, Subpart E – Explosives and 30 Code of Federal Regulations 57, Subpart E – Explosives. The blasting plan would include the setback distances and other BMPs.

As described in the Fisheries and Aquatic Resources Mitigation Plan (Brown and Caldwell 2019d), a spreadsheet tool was developed to compute the required setback distances from fish-bearing streams and lakes. The results indicate that a 425-foot blasting setback from the closest point in the blast field to stream and lake habitats should be protective in most cases, assuming a 40-foot bench height. These findings were used to examine likely areas where blasting would be near streams or lakes. For a 20-foot bench height, the examination indicated that a 239-foot blasting setback could be met everywhere within the mine plan. Considering a 40-foot bench, blasts may encroach on the 425-foot blasting setback in limited areas adjacent to the Yellow Pine pit lake near the EFSFSR tunnel and adjacent to the Hangar Flats pit where Meadow Creek is closest to the pit. In those areas where blasting is nearer to streams and lakes and impacts may occur, it is possible that the bench heights could be adjusted to 20 feet, reducing the required setback.

In addition to protective setbacks and bench height, Midas Gold may employ other methods when warranted, such as using controlled blasting techniques following industry BMPs, modifying blasting variables including charge size, and vibration and overpressure monitoring.

Because all blasting would be conducted in compliance with applicable regulations and standards (Brown and Caldwell 2019c), little to no effects to fish are expected from blasting at the mine site.

Spill Risk

Hazardous material spills at the mine site could injure or kill individual fish through direct contact with contaminants. Section 4.7.2, Hazardous Materials - Direct and Indirect Effects, describes the materials, potential mechanism of spills, and BMPs that would be in place to prevent or manage a spill. Additional discussion regarding hazardous materials, chemicals, and other consumables to be used at the mine site can be found in Section 2.3.5.18, Materials, Supplies, Chemical Reagents, and Wastes, including a list of the major consumables to be used at the mine site (**Table 2.3-6**, Proposed Materials, Supplies, and Reagents). **Table 4.7-1**, List of Hazardous Materials lists the amount of hazardous materials that would be stored at the mine site.

For additional detail on the risk of spills and the impacts from spills at the mine site and off-site facilities refer to Section 4.7.2.6.4, Spills at Mine Site and Off-site Facilities – Alternative 1. Impacts specific to fish and fish habitat from hazardous materials spills at the mine site are discussed further below.

Spills of hazardous materials could negatively affect fish and fish habitat. Strict regulatory controls and SGP emergency response procedures would be expected to limit the extent of any incidents. However, the duration of spill risk, and the potential to negatively impact fish and fish habitat, would be long-term because it would exist throughout the life of the SGP. The effect would generally be localized, though spills to flowing water could spread contaminants downstream of the spill site quickly if containment of the spill is delayed or the spill cannot be contained because of the fast-moving nature of the stream/river. Some materials that are highly toxic (e.g., diesel fuel) could result in greater impacts to a localized area. The type of impact could range from habitat loss through displacement from contaminated habitat to direct mortality from a spill. Spills occurring in the winter may be easier to contain because spilled material may not penetrate frozen ground as readily as unfrozen ground, and snow would absorb some spilled material; however, winter conditions also may slow the rate of the response.

4.12.2.3.2.2 Access Roads, Utilities, and Offsite Facilities

Dewatering, Fish Salvage, and Relocation

Dewatering, fish salvage, and relocation would be necessary for culvert replacement, new culvert installation, and potentially for bridge maintenance, and could cause injury or mortality to fish in the immediate vicinity or during relocation activities if required. The standard procedures to be developed for dewatering at the mine site also would be used for activities in all other SGP areas; therefore, the number of injuries or mortalities is expected to be minimized. Approximately 64 water crossings would be required for access roads, and a number of these would cross fish-bearing waterbodies. Stream crossings along access roads, utilities, and off-site facilities are discussed below.

Blasting

Blasting would occur during construction of portions of the Burntlog Route and the new transmission line. As discussed above, blasting can cause serious injury or mortality to fish; however, these activities would follow applicable regulations and standards. Therefore, little to no effects to fish or fish habitat are expected from blasting along portions of the Burntlog Route.

Changes in Fish Access

Under Alternative 1, SGP activities include replacing culverts, which may change fish access. Some culvert replacements may increase or re-establish access where it has been reduced or blocked (Rio ASE 2018). The potential re-establishment of access upstream of these culverts could affect the composition of the aquatic community. Changes in types of fish present and the abundance of fish could increase the risk of injury and mortality for some species. For instance, additional habitat could benefit some species, while the presence of additional fish in previously inaccessible reaches would introduce competition for resources. These changes may affect the distribution and relative abundance of fish populations in affected streams.

Furthermore, establishing or increasing access could allow non-native species to access upstream habitat that is currently blocked, such as brook trout. Brook trout are known to compete with bull trout for resources and habitat (USFWS 2008). Brook trout also are known to hybridize with cutthroat trout, which has the potential to negatively impact the genetic integrity, and/or result in negative changes to the local population of cutthroat trout (USFWS 2008). Where the two species currently co-exist or where brook trout are absent, changes in access are likely to have little effect with respect to species hybridization.

Spills

This section focuses on the risk of spills associated with transportation of hazardous materials, including fuels and antimony concentrate, on access roads adjacent to streams and important fish habitat. To evaluate the risk of spills during the transportation and handling of hazardous materials, several factors were assessed, including: past fuel hauling accidents (Section 3.7.3.3, Past Releases, Remediation, and Mitigation), length of roads traveled within 91 meters (300 feet) from road centerline of important fish habitat, number and timing of hazardous material trips, and mitigation measures. **Table 4.7-1**, List of Hazardous Materials, lists the amount of hazardous materials that would be stored at the mine site and transported along the access roads, including 5,800,000 gallons of diesel fuel that would be transported to the mine site annually.

Most of the streams that occur within 91 meters (i.e., the area in which potential impacts to fish habitat from a spill may reasonably occur) of the Yellow Pine and Burntlog routes support Chinook salmon, steelhead trout, bull trout, and cutthroat trout. **Table 4.12-3** provides a summary of the important fish habitat within 91 meters of each of the access routes and Warm Lake Road (County Road [CR] 10-579), which is included separately because this road would be used for both access routes. The Yellow Pine Route would be used for all deliveries for the first 1 to 2 years (Mine Years -3 through -2) of the SGP while the Burntlog Route is constructed. For the remainder of the SGP, access would be via the Burntlog Route. Therefore, the location of the spill risk would transition from the Yellow Pine Route to the Burntlog Route as the SGP progresses, which has less critical habitat for bull trout, steelhead, and intrinsic potential habit for Chinook salmon. Johnson Creek and the portion of the EFSFSR between Landmark and the mine site would be at risk during the first 1 to 2 years of the SGP when the Yellow Pine Route would be used as the access route. For the remainder of the SGP, until mine site closure and reclamation activities are complete and the Burntlog Route is reclaimed, the waterbodies adjacent to the Burntlog Route would be at greater risk.

Table 4.12-3 Alternative 1 Total Length of Important Fish Habitat within 91 meters of Yellow Pine Route, Burntlog Route, and Warm Lake Road

Fish Habitat within 91 meters	Yellow Pine Route	Burntlog Route	Warm Lake Road
Bull Trout Critical Habitat	33.74 km	8.87 km	9.05 km
Steelhead Critical Habitat	32.30 km	1.62 km	4.06 km
Chinook Salmon Intrinsic Potential Habitat	35.99 km	7.30 km	9.17 km
TOTAL	102.0 km	17.8 km	22.41 km

Table Source: AECOM 2020

Table Notes:

km = kilometers (1 km = 0.62 mi).

Both Routes would use the Warm Lake Road (CR 10-579) from its intersection with State Highway 55 to its intersection with Johnson Creek Road (CR 10-413). The risk of spills would be lower on Warm Lake Road because it is a paved and generally wider with lower grades (except near Warm Lake area). At the intersection of Warm Lake Road and Johnson Creek Road the two routes diverge, with the Yellow Pine Route turning north along Johnson Creek Road and the Burntlog Route continuing east onto Burnt Log Road (National Forest System Road [FR] 447). The transport of fuel and other materials (e.g., antimony concentrate) along both these routes put fish in these adjacent streams at risk from impacts of a spill.

Table 4.12-3 shows that the amount of important fish habitat that would be at risk along the Yellow Pine Route is higher (102 km) compared to the Burntlog Route (17.8 km). The Yellow Pine Route includes approximately 24.8 km more bull trout critical habitat, 30.7 km more steelhead trout critical habitat, and 28.7 km more Chinook salmon IP habitat than the Burntlog Route. A spill on the Yellow Pine Route could affect a much higher number of fish compared to a spill along the Burntlog Route.

Past accident records indicate that of all the substances to be transported, diesel fuel may pose the highest risk to fish and fish habitat. This is because large quantities of diesel fuel are transported in each load, numerous trips are made each year, and the substance is a liquid that rapidly flows down gradient toward nearby streams.

The intensity of the impact of a hazardous materials spill on fish and fish habitat could be high; as a large diesel spill could kill 100 percent of the Chinook salmon juveniles, adults, alevins, and eggs for a considerable distance (several miles) downstream of the accident (National Marine Fisheries Service [NMFS] 1995). In terms of toxicity to water-column organisms, diesel is one of the most acutely toxic oil types. Fish, invertebrates, and aquatic vegetation that come in direct contact with a diesel spill may be killed (U.S. Environmental Protection Agency [EPA] 2019). The severity of the impact would depend on the timing, size, and location of the spill. Small spills in deep open waters are expected to rapidly dilute; however, fish kills have been reported for small spills in confined, shallow water (EPA 2019).

As an example, schools of adult Chinook salmon (20 to 100 individuals) have been seen in the EFSFSR and Johnson Creek. Thus, a large spill could potentially kill a substantial number of adult salmon depending on various factors (NMFS 1995). A spill in the fall could kill all the 1-year old juveniles and zero age eggs/alevins, thus eliminating 2 years of Chinook salmon progeny. Diesel from a spill could mix with spawning gravels and sand and be retained in the stream substrate for a year or more, and thereby negatively affect salmon eggs, alevins, and juveniles for several years (Korn and Rice 1981; Moles et al. 1981).

It is expected the risk associated with a spill large enough to negatively affect fish or aquatic habitat would generally be low. This varies depending on the substance that is spilled but considers typical substances that would be transported. An exception may be when materials are transported during inclement weather conditions, this could increase the risk to moderate. Spills during the winter would be easier to contain because spilled material wouldn't penetrate frozen ground as readily as unfrozen ground, and snow could absorb the spilled material. However, areas that are harder to access (e.g., remote or in a canyon) may increase the time it takes to access and cleanup a spill, creating the potential for fish or fish habitat to be in contact with a hazardous material longer and could impact more fish or fish habitat.

The duration of spill risks would extend throughout the SGP. The geographic extent of impacts would depend on the location and size of the spill and the effectiveness of the response. The extent of the spill risk was limited to streams within 91 meters of the access roads - and downstream of spill locations.

While the likelihood of a spill is low to moderate, the magnitude of impacts could be high to individuals exposed to harmful concentrations of hazardous materials. The duration of the risk of impacts would extend throughout the SGP.

Stream Crossings Along Access Roads, Utilities, and Off-site Facilities

Stream crossings are another potential place where hazardous spills could enter waterways. Access roads, including those necessary for access to the transmission line and off-site facilities, cross streams in the analysis area. Although not all waterbodies crossed via culvert are fish-bearing, spills into any waterway could travel downstream to fish-bearing waters.

Based on the analysis in the subsections above, and the short length of each crossing, it is expected that the risk of a spill large enough to negatively affect fish or aquatic habitat would be low. The duration of the risk of impacts would extend throughout the SGP. The geographic extent of impacts would depend on the location and size of a spill and the effectiveness of the response.

4.12.2.3.2.3 Summary of Direct Effects to Individuals

The magnitude of an injury or mortality could be high to individual fish impacted by activities at specific locations throughout the SGP, such as dewatering and translocation activities. These activities include dewatering, fish salvage, relocation, blasting, changes in access, or hazardous material spills. However, the percentage of populations affected is expected to be small and population-level impacts are not expected. The duration of the risk of injury or mortality would persist throughout the SGP, although certain activities would be riskier than others, (e.g., higher risk during dewatering/salvage operations).

The geographic extent of the impact would be limited to the streams within the mine site and those adjacent to, or crossed by, the access roads.

4.12.2.3.3 HABITAT ELEMENTS/WATERSHED CONDITION INDICATORS

Watershed Condition Indicators (WCIs) are used to evaluate stream function by measuring elements that reflect water quality, habitat access, channel conditions and dynamics, flow and hydrology, and watershed conditions. As discussed in 3.12.4.7.3.3, East Fork South Fork Salmon River Baseline in the subsection titled Mine Site Watershed Condition Indicators Described in Detail, not all WCI indicators summarized for baseline conditions are of equal value in determining the potential impacts of the proposed SGP within the analysis area. Six WCIs (i.e., key WCIs) were identified for detailed analysis in Section 4.12. The six WCIs that are addressed in this section are:

(1) Water Temperature;

(2) Sediment/Turbidity;

(3) Physical Barriers;

(4) Chemical Contaminants;

(5) Change in Peak/Base Flows; and

(6) Integration of Species/Habitat Conditions.

A Stream Functional Assessment (SFA) (Rio ASE 2019) was developed to model the predicted changes in the WCIs from baseline through construction, operations, closure and reclamation and the mine site. Several other methods also were used and are described in Section 3.12.4.7.3.3, East Fork South Fork Salmon River Watershed Baseline - Mine Site Watershed Condition Indicator Described in Detail.

Trends in the WCIs (i.e., changes to functional scores) by SGP phase are shown in **Table 4.12-4** (Mine Site) and **Table 4.12-9** (Off-site).

Table 4.12-4 Summary of Key Watershed Condition Indicator Changes at the Mine Site by Operational Phase

Watershed Condition Indicator	Applicable Stream Reaches[1]	Reference Condition Change from Baseline			
		Baseline	Construction (Mine Years -3 to -1)	Operations and Closure and Reclamation (Mine Years 1 to 20)	Post- closure (Mine Years 20+)
Water Temperature	1	FR	FR (-)	FUR (-)	FUR (-)
	2	FR	FUR (-)	FUR (-)	**FR (*)**
Sediment/Turbidity	1	FUR	FR (+)	FR (+)	**FR (+)**
	5	FUR	FR (+)	FR (+)	**FR (+)**
Physical Barriers	1	FUR	FR (+)	FR (+)	**FR (+)**
	2	FUR	FA (-)	FUR (+) average; FR (+) years 1 to 13	**FR (+)**
	3	FUR	FUR (+) average for years -3 to -1; FA (+) for year -1	FA (+)	**FA (+)**
	5	FUR	FUR (+) average; FR (+) year 1	FR (+)	**FR (+)**
Chemical Contamination and/or Nutrients	2	FR	FR (*)	FR (+)	**FR (+)**
Change in Peak/Base Flows	1	FA	FA (*)	FA (-) average; FR (-) years 13 to 17	**FA (+)**
	2	FA	FA (*)	FA (-) years 1 to 6; FR (-) Mine Years 7 to 20	FR (-)
Integration of Species/Habitat	None	FR	FR (*)	FR (*)	**FR (*)**

Table Source: Rio ASE 2019

Table Notes:

1 The Applicable Stream Reaches column only contains Stream Reaches where the model predicts a change, see description of changes to stream reaches in Section 4.12.2.3.1, Physical Stream Channel Changes – Alternative 1.

Change from baseline: + positive, increase from baseline Functional Index (FI); - negative, decrease from baseline FI; * negligible or no change from baseline FI Functional Index: Functioning Appropriately (FA); Functioning at Risk (FR); Functioning at Unacceptable Risk (FUR).

Bold indicates equal or improved FI from baseline conditions post-closure (Mine Year 20+).

4.12.2.3.3.1 Changes to Watershed Condition Indicators Analyzed in Detail at the Mine Site – Alternative 1

WCIs analyzed in detail at the mine site are included in **Table 4.12-4** to show general trends with additional analysis of impacts described in the following sections.

Water Temperature – Alternative 1

Water temperatures are expected to rise because of activities proposed at the mine site under Alternative 1. Predicted future temperature increases resulting from the SGP were evaluated using a SPLNT model developed by Brown and Caldwell (2019a). See Section 3.12.4.7.3.3, East Fork South Fork Salmon River Watershed Baseline - Mine Site Watershed Condition Indicators Described in Detail - Water Temperature, for additional detail on the methods and results of the model. In addition, the modeling results are described in greater detail for Alternative 1 in Section 4.9.2.1.2.1, Surface Water and Groundwater Quality – Mine Site Temperature – Alternative 1. The fish species of greatest management concern considered in this analysis that would be impacted by the SGP are all salmonids that are adapted to a cold-water thermal regime (generally less than 20°C); meaning that they require comparatively colder water temperatures than cool and warm-water fish species to survive and complete their life cycles. These life cycle processes are impeded and may risk survivability if life history functions are impaired by increases in water temperatures greater than the tolerance limits for the species.

Table 4.9-11 in Section 4.9.2.1.2.1, Surface Water and Groundwater Quality – Mine Site Temperature – Alternative 1, summarizes the projected temperatures for selected years for the predicted maximum weekly summer condition, average weekly summer condition, maximum weekly fall condition, and average weekly fall temperatures for several stream reaches throughout the mine site (Brown and Caldwell 2019b). Alternative 1 would result in water temperature increases for all simulated stream reaches during the mine operational and post-closure periods. As shown in **Table 3.12-22** and **Figure 3.12-12**, all six stream reaches within the mine site have baseline summer-season (June 1 through August 31) water temperatures that are in the “functioning at risk” WCI range for Chinook salmon, steelhead trout, and bull trout.

Table 4.12-5 provides a summary of predicted water temperatures under Alternative 1 for five different time periods: Baseline, End of Mine Year (EOY) 6, EOY 12, EOY 18, and post-closure (EOY 112). EOY 6 is approximately halfway through mining operations, EOY 12 is near the end of operational mining, and EOY 18 is at the beginning of closure and reclamation. A post-closure timeline (EOY 112) also was simulated to represent how the mine site would function after the mine facilities and permitted discharges have been removed, dewatering and mining have been discontinued, and the channels and vegetation have been fully reclaimed.

Table 4.12-5 Maximum Weekly Summer and Fall Stream Temperatures Simulated for Alternative 1

SPLNT Model Stream Reach	Season	Baseline Condition (°C)	EOY 6 (°C)	EOY 12 (°C)	EOY 18 (°C)	EOY 112 (°C)	Change from Baseline to EOY 112 (°C)
Upper EFSFSR immediately upstream of Meadow Creek	Summer	13.4	13.9	13.8	13.7	13.9	0.5
	Fall	11.1	11.5	11.4	11.4	11.4	0.3
Meadow Creek upstream of East Fork Meadow Creek	Summer	17.9	23.7	23.8	26.2	19.9	2.0
	Fall	15.1	18.8	18.7	19.8	14.6	-0.5[1]
Meadow Creek downstream of East Fork Meadow Creek	Summer	19.8	22.9	23.4	21.2	21.2	1.4
	Fall	16.2	17.7	17.6	17.3	17.8	1.6
Middle EFSFSR (between Meadow and Fiddle creeks)	Summer	17.4	19.3	18.9	20	20	2.6
	Fall	14.0	15.1	14.8	16.2	15.1	1.1
Lower EFSFSR (between Fiddle and Sugar creeks)	Summer	17.4	20.1	21.7	22.3	21.6	4.2
	Fall	14.0	15.6	16.5	17.5	15.9	1.9
EFSFSR downstream of Sugar Creek	Summer	14.9	18.0	19.3	19.7	19.3	4.4
	Fall	11.9	14.0	14.9	15.6	14.4	2.5

Table Sources: Brown and Caldwell (2019b: Table C-19); Payette National Forest Land and Resource Management Plan (2003), Appendix B, Table B-1

Table Notes:

1 Negative (-) indicates a decrease in temperature from baseline.

Temperatures in °C=Celsius.

EOY = End of Mine Year.

Table 4.9-11 in Section 4.9.2.1.2.1, Surface Water and Groundwater Quality – Mine Site Temperature – Alternative 1, summarizes the temperatures for selected years for the predicted maximum weekly summer condition, average weekly summer condition, maximum weekly fall condition, and average weekly fall temperatures for several stream reaches throughout the mine site (Brown and Caldwell 2019b). Alternative 1 would result in water temperature increases for all simulated stream reaches during the mine operational and post-closure periods. As shown in **Table 3.12-22** and **Figure 3.12-12**, all six stream reaches within the mine site have baseline summer-season (June 1 through August 31) water temperatures that are in the "functioning at risk" WCI range for Chinook salmon, steelhead trout, and bull trout.

The following discussion provides an overview of the predicted water temperature changes that would affect fish and fish habitat to varying degrees depending on the timing, magnitude, duration, and frequency of exposure to the temperature tolerance thresholds for each species and life history function (e.g., spawning, juvenile rearing). The discussion is organized by the stream reaches shown in **Table 4.12-5**. The species-specific temperature analysis discussion is found in the Chinook salmon, steelhead trout, bull trout, and cutthroat trout subsections.

It should be noted the SPLNT models (Brown and Caldwell 2018, 2019a,b,c) used for the temperature predictions in **Table 4.12-5** do not account for changes to stream temperatures caused by changing climate conditions. This means that modeled future water temperatures (e.g., EOY 112) assumed that without Alternative 1, stream temperatures would be similar to the historic water temperature data (Brown and Caldwell 2018). In reality, water temperatures would likely be higher if climate change had been incorporated into the model. For additional information regarding potential climate change impacts to water temperatures see Section 3.12.4.7.3.3, East Fork South Fork Salmon River Watershed Baseline Conditions – Water Temperature.

Water temperatures at the mine site would be increased primarily by two activities: the decrease in streamflow caused by the use of water for mining activities, and the change in stream habitat structure to longer and flatter meandering channels, which initially would have less shade due to riparian vegetation having been removed by general SGP disturbances including construction and operations activities.

Upper EFSFSR Immediately Upstream of Meadow Creek

This reach contains the headwaters of the EFSFSR and, as such, has predicted water temperatures that are colder and more suitable for the four special status salmonids during the summer period. At the end of Mine Year -1, both the Yellow Pine pit barrier cascade and the remnant box culvert would have been removed to allow for natural upstream fish passage by both resident and anadromous species. Chinook salmon and steelhead trout could once again access the headwaters of the EFSFSR to spawn and rear during favorable environmental conditions. Of all modelled stream reaches, this reach would be the most consistently favorable to cold water fish during the life of the mine. Nonetheless, at EOY 112, water temperatures are predicted to be slightly warmer than baseline conditions.

Meadow Creek (both Upstream and Downstream of East Fork Meadow Creek)

During the summer season, SPLNT modeling predicts that even under baseline conditions average maximum weekly water temperatures have the potential to reach less-than-optimum levels for salmonids. At the beginning of the post-closure period (EOY 18), Meadow Creek upstream of the East Fork Meadow Creek is predicted to have a maximum summer temperature of 26.2°C, which is more than 8 degrees greater than the baseline condition (**Table 4.12-5**). The main reason for the predicted high temperature is the limited vegetation regrowth that would occur during the first six years post-closure, and the relatively low flows that would persist in Meadow Creek until the new creek channel is constructed.

During the life of the mine and irrespective of other environmental constraints in Meadow Creek, maximum water temperatures have the potential during the summer season to exceed temperatures that are known to be stressful and even lethal to all the special status salmonids. For example, **Appendix J-2**, Table 1, indicates that a 7-day exposure to 21°C or more could be lethal to Chinook salmon. Meadow Creek downstream of the East Fork Meadow Creek would have potential water temperatures that are lethal to Chinook salmon during the summer in perpetuity. Under such circumstances, Meadow Creek would have a WCI rating for salmonids during the summer of functioning at risk at best, and potentially functionally unacceptable for much of the time.

EFSFSR from Meadow Creek Downstream to Sugar Creek (Middle and Lower EFSFSR in **Table 4.12-5**)

Baseline water temperature conditions in this reach are predicted to be less than optimum during the summer season with the potential for the maximum temperatures to reach sublethal and even lethal levels as discussed for Meadow Creek. Even at EOY 112, the EFSFSR has the potential to reach lethal levels during the summer. At temperatures greater than 21°C, Chinook salmon migratory blockages to spawning locations could occur (**Appendix J-2**, Table 1). Given that Chinook salmon (spring/summer-run) generally migrate from mid-June to late August and spawn in August, the water temperature in a given year, if too high, may impede movement to the upper EFSFSR watershed where spawning conditions are more favorable from a temperature perspective.

Water temperatures in this reach during the summer have the potential to adversely impact all four salmonid species and result in WCI ratings that are at best functioning at risk, and at worst functioning unacceptably.

EFSFSR Downstream of Sugar Creek

In the EFSFSR downstream of Sugar Creek, summer and fall stream temperatures are predicted to increase during the mine operational period and early post-closure period to reach a maximum at the EOY 18. After that time, average and maximum temperatures would remain stable or gradually decrease as riparian vegetation is established. However, maximum summer (19.3°C) and fall (14.4°C) temperatures and average summer temperatures (13.2°C) are still predicted to be as much as 4.8 degrees greater than baseline 100 years into the post-closure period (**Table 4.12-5**).

Sediment and Turbidity – Alternative 1

As described in Section 4.9.2.1.2.1, Surface Water and Groundwater Quality – Mine Site Sediment – Alternative 1, surface disturbance under Alternative 1 would cause erosion of soil and overburden material. These eroded sediments could affect surface water quality if the sediment is washed or blown into adjacent streams. Erosion and sedimentation effects on surface water quality are indicated primarily by changes in turbidity and total suspended solids in the receiving environment.

Proposed activities at the mine site would result in some erosion and sedimentation within Meadow Creek, Sugar Creek, and the EFSFSR during active surface material disturbance associated with mine construction, operations, closure and reclamation, with the greatest potential for in-stream impacts occurring during times of higher overland flow, such as spring snow thaw and large rainfall events.

The effect to surface water quality from sedimentation and erosion would be limited by applicable mitigation strategies and control techniques, limited duration of active surface disturbing activities, and by the adaptability of the receiving environment (as indicated by the typically low baseline levels of total suspended solids and turbidity with seasonally variable spikes at times of higher overland flow).

Surface water quality also could be impacted during construction, operations, closure and reclamation by fugitive dust from vehicles and heavy equipment that settles into adjacent water bodies. Reduction of these potential impacts would be achieved through fugitive dust control at the mine site. In dry months, water would be sprayed on mine haul roads as necessary to mitigate dust emissions.

Sedimentation effects from erosion and fugitive dust would be concentrated at the mine site; however, due to the nature of sediment transport by streams, the geographic extent of the impact could extend farther downstream in the EFSFSR depending on site- and event-specific factors. The duration of traffic-related dust and erosion/sedimentation would last throughout the SGP; however, the potential for these effects would incrementally decrease during closure and reclamation because the amount of dust and chance for erosion/sedimentation would be reduced as the amount of activity at the mine site is reduced.

SGP construction, operations, and closure and reclamation activities could result in increased risk of erosion and sediment at the mine site. The construction, operations, and closure and reclamation activities near or in-water that carry the risk of sediment release are consistent over all action alternatives, as each would require road upgrade and construction, water crossings, increased traffic, vegetation removal, dewatering, etc.

Roads are often chronic sources of sediment delivery from cutslopes and ditches. Roads can intercept subsurface flows, concentrate flows in ditches and through culverts and bridges, and act as direct conduits for sediment delivery to stream channels (Beschta 1978).

The number of stream crossings is used in this analysis as a metric for potential increases in erosion and sedimentation.

Table 4.9-13 in Section 4.9.2.1.2.2, Access Roads, presents the number of stream crossings by access roads under Alternative 1. During the first two years of construction, the mine site would be accessed via the Yellow Pine Route, which would involve a total of 43 stream crossings (**Table 4.9-13**).

During the operations phase, mine site access would be via the Burntlog Route, which would involve 21 streams crossings (**Table 4.9-13**).

The number of vehicle trips per day also is used in this analysis as a metric for potential increases in erosion and sedimentation. Traffic volumes under Alternative 1 are presented in Section 4.16.2.1, Access and Transportation - Alternative 1. A total of 65 vehicle trips per day would occur during the construction phase (**Table 4.16-1**), 68 vehicle trips per day would occur during the operations phase (**Table 4.16-2**), 25 vehicle trips per day would occur during closure and reclamation (**Table 4.16-3**), and 6 vehicle trips per day during the post-closure period (**Table 4.16-3**).

During construction of and upgrades to access roads, the potential exists for increased runoff, erosion, and sedimentation as a result of localized vegetation removal and excavation of soil, rock, and sediment, which could result in increased sediment load in streams. Expected permit stipulations from Idaho Department of Water Resources (IDWR), and Idaho Department of Environmental Quality (IDEQ) would ensure streambank vegetation would be protected except where its removal is necessary. New cut or fill slopes not protected with some form of stabilization measures would be seeded and planted with native vegetation to prevent erosion. Use of temporary erosion and sediment control BMPs also would be employed.

Existing or new culverts or bridges would be replaced or built at stream crossings along the Johnson Creek Road (CR 10-413), the Stibnite Road portion of McCall-Stibnite (CR 50-412), and Burnt Log Road (FR 447). Existing bridges and culverts along Warm Lake Road (CR 10-579) would remain. If not properly designed, constructed, and maintained, culverts and bridges could alter natural streamflow, velocity, and morphology leading to an increased risk of scour and erosion at the structure outlet and inlet. Erosion of the streambed and/or banks could result in downstream sedimentation, a change in the morphology of the stream, change in water quality, and/or a change to the aquatic habitat. As such, the Forest Service would require stream crossings on lands administered by the Forest Service to be designed to accommodate a 100-year flood recurrence interval, unless site-specific analysis using calculated risk tools or another method determines a more appropriate recurrence interval. Additionally, SGP activities would be required to comply with specific design requirements as part of the IDWR Stream

Channel Alteration Permit, such as line of approach, minimum bridge clearance and minimum culvert size per length, and anchoring on steep slopes.

During bridge and culvert construction the potential exists for increased runoff, erosion, and sedimentation as a result of localized vegetation removal and excavation of soil, rock, and sediment. Expected permit stipulations from IDWR and IDEQ would ensure that preparation of culvert bedding or bridge footing installations do not create unnecessary turbidity or stream channel disturbance; that streambank vegetation would be protected except where its removal is absolutely necessary; and use of temporary erosion and sediment control BMPs. Bridges and culverts would be maintained to allow proper drainage and limit sediment delivery to area streams.

During construction, operations, and closure and reclamation, dust from vehicles using access roads could become airborne, settle, and impact surface waterbodies. Wear and tear of the access roads, especially by heavy vehicles, could cause rutting and other types of damage to the road surface, which could convey stormwater in a manner that creates rills, and facilitates erosion and sedimentation.

Many impacts would be minimized through proper road design, construction, grade control, fugitive dust control and, in the winter months, snow removal and “sanding” using gravel and coarse sand with minimal fines to avert slippery conditions and reduce offsite sedimentation during the spring runoff season.

During winter months, Burntlog Route would be plowed for snow removal and sanded for winter driving safety. To protect surface water, snow removal standards of performance would include depositing snow and ice away from stream channels; maintaining appropriate snow floor depth to protect the roadway; clearly marking culverts and stream crossings; and no use of ice and snow removal chemicals.

The duration for traffic-related dust and erosion/sedimentation would last throughout the SGP. However, the potential for these effects would be incrementally reduced during closure and reclamation as there would be less traffic to and from the mine site. Due to the nature of airborne dust and sediment transport by streams, the geographic extent of the impact could be hundreds of feet to miles, depending on many site- and event-specific factors.

Fish could be affected by sedimentation occurring during the SGP. Many of the mine site streams are currently “functioning at risk” for sediment. Sediment can impact fish, habitat, and aquatic organisms in variety of ways; sedimentation impacts are well documented:

- Fish behavior and movement (Barrett et al. 1992; Cavanagh et al. 2014);
- Foraging and predator-prey interactions - reduced feeding (De Robertis et al. 2003; Harvey and White 2007); and
- Fish physiology and direct physical stress - lethal and sublethal (Ryan 1991; Wood and Armitage 1997).

Sedimentation can cause decreased growth rates and changes in community structure and population sizes (Kemp et al. 2011). Moreover, sedimentation is known to affect the quality and quantity of aquatic habitat. Fine sediments in streams are associated with degradation of salmonid spawning habitat quality and can affect the survival of incubating eggs; inhibit fry emergence; reduce instream cover and overwintering refuge for juvenile fish; reduce overall fish-carrying capacity; and decrease food availability (Limpinsel et al. 2017).

Elevated turbidity in streams from sediments also can have negative impacts on fish and other aquatic organisms through several mechanisms, such as reduced foraging efficiency of drift-feeding fish, elevated water temperature through increased light absorption, reduced primary production, and damage to gill membranes under conditions of severe turbidity (Bash et al. 2001; Newcombe and Jensen 1996).

The baseline WCI rating for sediment in the mine site stream reaches ("functioning at unacceptable risk") is likely to remain the same under Alternative 1 due to increased potential for erosion and sedimentation under this alternative compared to baseline.

Species-specific potential impacts or change in risk to habitat features and species per action alternative are further discussed in species and habitat-specific subsections.

Barriers – Alternative 1

Fish passage barriers can negatively impact fish population dynamics by reducing, or completely blocking, available habitat during certain life stages. Fish passage barriers within the mine site (Upper EFSFSR upstream of the confluence with Sugar Creek) were identified and mapped by BioAnalysts (BioAnalysts 2019). Fish passage barriers are identified as either complete - no species can move upstream or downstream at any time of year; or partial - the barrier may not exist at high flows but at certain flows (i.e., low flows) some fish may not be able to pass. Passage barriers are further categorized by natural - not caused by human action, such as a rock dam, log jam, and steep slopes; or artificial - caused by human action, such as culverts, stream alteration, and surface water diversions (BioAnalysts 2019).

Table 4.12-6 provides a summary of the existing fish barriers and expected future barriers within the mine site. Existing and predicted fish passage barriers resulting from SGP activities under Alternative 1 are shown in **Figure 4.12-2**.

This page intentionally left blank

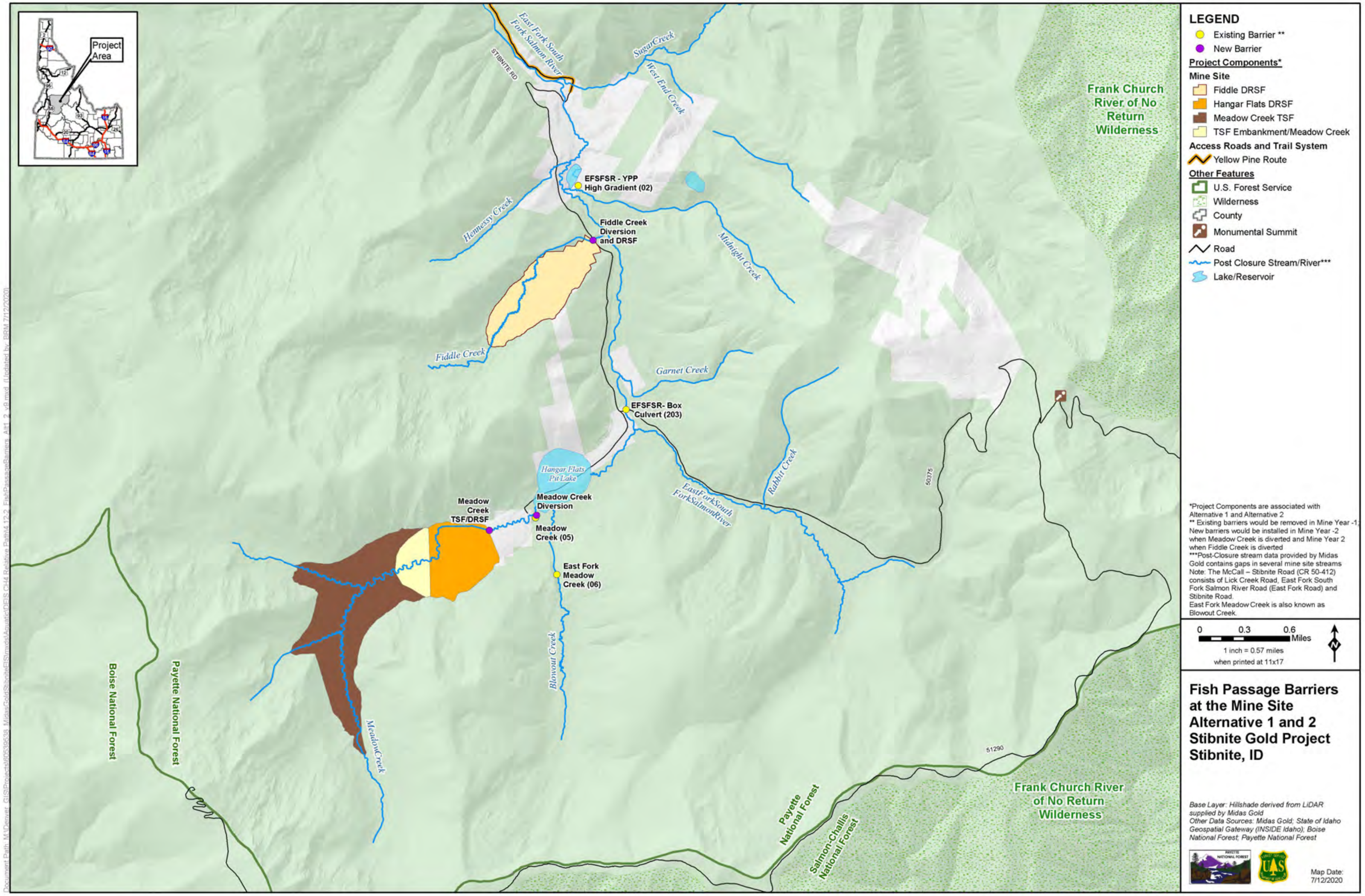


Figure Source: AECOM 2020

Figure 4.12-2 Fish Passage Barriers at the Mine Site Alternative 1 and 2

This page intentionally left blank

Table 4.12-6 Existing and Expected Future Fish Passage Barriers in Mine Site Area Streams under all Alternatives

Stream (Location Number)	Type	Status	Mine Year Removed/Added Alt 1	Mine Year Removed/Added Alt 2	Mine Year Removed/Added Alt 3	Fish Habitat Upstream of Blockage (km)
Existing Barriers						
EFSFSR Yellow Pine pit High Gradient (02)	Artificial	Complete	-1	-1	-1	39.74
EFSFSR Box Culvert (203)	Artificial	Partial	-1	-1	-1	31.57
Hennessy Creek (01)	Artificial	Complete	12	12	-1	1.05
Hennessy Creek (199)	Artificial	Complete	12	12	-1	1.05
Hennessy Creek (202)	Artificial	Complete	12	12	-1	1.05
Midnight Creek (03)	Artificial	Complete	12	12	-1	0
Fiddle Creek (04)	Artificial	Complete	12	12	12	4.14
Fiddle Creek (200)	Artificial	Complete	12	12	12	4.14
Garnet Creek (201)	Artificial	Partial	15	15	15	0.52
Rabbit Creek (204)	Artificial	No Barrier	NR	NR	NR	0
Fern Creek (205)	Artificial	No Barrier	NR*	NR*	NR*	0.17
Fern Creek Tributary (206)	Artificial	Complete	NR	NR	NR	0
Meadow Creek (05)	Artificial	Partial	-2	-2	NA	9.64
East Fork Meadow Creek (06)	Natural	Partial	-1	-1	-1	2.40

Stream (Location Number)	Type	Status	Mine Year Removed/Added Alt 1	Mine Year Removed/Added Alt 2	Mine Year Removed/Added Alt 3	Fish Habitat Upstream of Blockage (km)
Created Barriers						
Hennessey Creek (waterfall)	Artificial	Complete	13	13	13	0.36
Fiddle Creek diversion and DRSF	Artificial	Complete	2	2	2	3.95
Meadow Creek diversion*/	Artificial	Complete	-1	-1	N/A	1.92
Meadow Creek TSF/DRSF**	Artificial	Complete	17	17	N/A	9.25
Upper EFSFSR TSF/DRSF***	Artificial	Complete	N/A	N/A	17	1.93

Table Source: **Appendix J-3**, Barriers Technical Memorandum

Table Notes:

Alternative 4 is the same as Alternative 1.

* - Temporary barrier blocks habitat until Mine Year 17.

** - Permanent barrier blocks habitat and remains post mine life Alternatives 1 and 2.

*** - Permanent barrier blocks habitat and remains post mine life Alternative 3.

NR - Not Removed.

N/A - Not applicable.

km = kilometers (1 km = 0.62 mi).

Species-specific impacts to fish habitat resulting from passage barriers were assessed for Chinook salmon, steelhead trout, bull trout, and cutthroat trout (further detailed in species-specific subsections) by quantifying the extent (km of habitat) of fish habitat upstream of each barrier (i.e., how much fish habitat is blocked by the barrier). The Barriers Technical Memorandum includes methods and complete results (**Appendix J-3**).

The SGP is expected to alter the existing barriers at the mine site during different phases. These alterations may increase, maintain (neutral), or decrease natural access to habitat for resident and migratory fish. In Mine Year -1, Meadow Creek would be placed in diversions that would create gradient barriers to upstream movement (**Figure 4.12-2**). In Mine Year 2 Fiddle Creek would be placed into a diversion that would remain in place until Mine Year 10 when the Fiddle Creek DRSF would be completed and would continue to prevent access into Fiddle Creek in perpetuity. In Mine Year 17 the Meadow Creek TSF and Hangar Flats DRSF would be complete and would continue to prevent upstream access into upper Meadow Creek in perpetuity.

Table 4.12-6 summarizes the amount of fish habitat that is above each barrier at baseline conditions and the predicted change in barriers. At baseline, approximately 41.7 km of fish habitat is available in the mine site streams. The Yellow Pine pit cascade currently blocks natural upstream access to 39.7 km (95 percent) of this habitat (**Table 4.12-6**). The Meadow Creek (05) barrier hinders access to approximately 9.6 km (23 percent) of existing fish habitat in the mine site (**Table 4.12-6**). The Fiddle Creek diversion and then DRSF would block 3.95 km of fish habitat. The Meadow Creek diversions would block 1.92 km of fish habitat and then the TSF/DRSF would block 9.25 km of fish habitat.

Generally, the positive impacts of removing passage barriers would outweigh the potential negative impacts. Removal of some barriers allows for free movement and access to habitat for both upstream and downstream fish and, in turn, can improve genetic diversity of isolated populations, improve overall productivity by increasing access to critical habitat, and improve access to feeding and refuge areas. Establishing access by removing artificial barriers may facilitate reclamation of upstream habitat and biodiversity. However, the removal of natural barriers to access can have negative results as well. These include changes to established food webs, increased competition for resources between fish species and life stages, introduction of or increase in predation, and/or the introduction of invasive species such as brook trout. These potential impacts are further discussed in species-specific sections.

Chemical Contaminants – Alternative 1

Under Alternative 1, SGP-related activities could change various chemical contaminant levels, which could impact fish habitat. This section analyzes the changes in five constituents of concern (COC): aluminum, copper, antimony, arsenic, and mercury and what that means to fish and fish habitat. The section also discusses, in general, other changes to water quality that could affect the COCs.

The Site-wide Water Chemistry (SWWC) modeling predicted pH values in surface waters at all nodes would range from 7.2 to 8.4 during mine operations, with similar levels (7.1 to 8.4) at mine closure (SRK Consulting [SRK] 2018). These pH levels are considered approximately neutral ("circum- neutral") to slightly alkaline and meet the aquatic life use standards for pH of 6.5 to 9.0 in the State of Idaho (IDEQ 2017). The distribution of pH values in the mine site is one of several important site-specific factors that affect metal toxicity to aquatic life. Most metals are more toxic to aquatic life in the dissolved form, and acidic water (lower pH values) has greater capacity for dissolving metals.

Broadly speaking, metal contamination and exposure has been shown to influence simple migratory behavior and avoidance mechanisms in fish populations (Farag et al. 2003; Goldstein et al. 1999; Hansen et al. 1999; Sandahl et al. 2004). For example, Goldstein et al. (1999) found Chinook salmon will avoid tributaries with high metals concentrations.

Numerous studies have shown how exposure to toxic contaminants in surface waters can impact fish olfaction which is used in mating, locating prey, and avoiding predators (Tierney et al. 2010).

Additional studies indicate that salmonids exposed to sublethal levels of metals are susceptible to increasing levels of fish pathogens due to stressed immune responses and metabolisms (Peplow and Edmonds 2005; Spromberg and Meador 2005). Copper and aluminum also can accumulate in sediments and become toxic to organisms contacting or feeding on stream bottom substrates (Johnson et al. 2008).

Mining activities would alter the mine site geochemistry by exposing development rock in the pit walls, and by generating mine waste in the form of tailings and development rock that would be disposed locally at the mine site (SRK 2018).

The SGP also would lead to the removal of legacy mine materials from the Meadow Creek valley, such as the spent ore disposal area and Bradley tailings (Midas Gold 2016). The removal, reprocessing, and proper disposal of these legacy materials are predicted by SRK (2018) to gradually reduce existing concentrations of arsenic, manganese (not described in this section), and antimony in alluvial groundwater, which would in turn reduce water quality impacts to water bodies that receive discharge from this aquifer.

To analyze the effects of water quality changes on fish and aquatic habitat, the predicted changes (during and after mining) were compared to analysis criteria and described in terms of exceedances and what that means to fish and fish habitat. **Table 4.12-7** shows operational and post-closure predicted exceedances for the five COCs analyzed for fish resources and fish habitat. The description of exceedances is followed by a summary of how the potential exceedances could impact fish and fish habitat, organized by the five COCs.

Table 4.12-7 Exceedance of Analysis Criteria, Operations and Post-Closure, for Assessment Nodes and Hangar Flats Pit Lake, Alternative 1

Constituent of Concern		Aluminum[1]	Copper[2]	Antimony[3]	Arsenic[4]	Mercury[5]
Analysis Criteria		0.36 mg/L	0.0024 mg/L	0.0056 mg/L	0.010 mg/L	2.0E-06 mg/L (total mercury)
Node	**Stream**	**Exceedances During Operations (Highest Concentration)[6]**				
YP-T-27	Meadow Creek	None	None	None	None	None
YP-T-22	Meadow Creek	None	None	None	None	None
YP-SR-10	EFSFSR	None	None	Seasonal peaks above baseline and analysis criteria throughout operations years 8 through 10 (0.0304)	Mine Years 7 through 10 (0.085)	Mine Years 7 through 10 (4.2E-06)
YP-SR-8	EFSFSR	None	None	None	Mine Years 7 through 10 (0.028)	Seasonal peaks above baseline and analysis criteria increase during operations years 8 through 10 (4.9E-06)
YP-SR-6	EFSFSR	None	None	None	Mine Years 7 through 10 (0.081)	None
YP-SR-4	EFSFSR	None	None	Throughout operations (0.06)	Throughout operations, with highest concentrations in Mine Years 8 through 10 (0.152)	None
YP-SR-2	EFSFSR	None	None	None	Mine Years 7 and 8 (0.09)	None
YP-T-11	Fiddle Creek	None	None	None	None	None
YP-T-6	West End Creek	None	None	None	None	Throughout operations (7.9E-06)
YP-T-1	Sugar Creek	None	None	None	None	None
Hangar Flats pit lake	Hangar Flats pit lake[7]	N/A	N/A	N/A	N/A	N/A

Constituent of Concern		Aluminum[1]	Copper[2]	Antimony[3]	Arsenic[4]	Mercury[5]
Analysis Criteria		0.36 mg/L	0.0024 mg/L	0.0056 mg/L	0.010 mg/L	2.0E-06 mg/L (total mercury)
Node	**Stream**	**Exceedances Post-Closure (Highest Concentration)[6]**				
YP-T-27	Meadow Creek	None	Post-closure years 10 through 15 (0.018)	Post-closure years 10 through 15 (0.22483)	Post-closure years 10 through 15 (0.3073)	Post-closure years 10 through 15 (2.20E-03)
YP-T-22	Meadow Creek	None	Post-closure years 10 through 20 (0.0073)	None	Post-closure years 10 through 20 (0.2689)	Post-closure years 10 through 20 (1.10E-03)
YP-SR-10	EFSFSR	None	Post-closure year 10 (0.00468)	None	Post-closure years 10 through 30 (0.1532)	Post-closure years 10 through 30 (5.4E-04)
YP-SR-8	EFSFSR	None	Exceeds analysis criteria in post-closure year 10 (0.00467)	None	Post-closure years 10 through 30 (0.162)	Post-closure years 10 through 30 (6.1E-04)
YP-SR-6	EFSFSR	None	Post-closure years 10 through 15 (0.0046)	None	Post-closure years 10 through 30 (0.1532)	Post-closure years 10 through 30 (5.6E-04)
YP-SR-4	EFSFSR	None	post-closure years 10 through 15 (0.0036)	Throughout post-closure (0.051)	Concentrations exceed analysis criteria throughout post-closure, with highest concentrations in post-closure years 10 through 20 (0.245)	Post-closure years 10 through 30 (4.3E-04)
YP-SR-2	EFSFSR	None	None	None	Post-closure years 10 through 30 (0.142)	Post-closure years 10 through 30 (2.4E-04)
YP-T-11	Fiddle Creek	None	None	None	Exceedance of baseline and analysis criteria throughout post-closure, highest in post-closure years 2 through 5 (0.79)	Exceedance of baseline and analysis criteria throughout post-closure, highest in post-closure years 2 through 5 (1.4E-04)

Constituent of Concern		Aluminum[1]	Copper[2]	Antimony[3]	Arsenic[4]	Mercury[5]
Analysis Criteria		0.36 mg/L	0.0024 mg/L	0.0056 mg/L	0.010 mg/L	2.0E-06 mg/L (total mercury)
Node	**Stream**	**Exceedances Post-Closure (Highest Concentration)[6]**				
YP-T-6	West End Creek	None	None	None	None	Throughout post-closure (9.0E-06)
YP-T-1	Sugar Creek	None	None	None	None	None
Hangar Flats pit lake	Hangar Flats pit lake	None	None	None	Highest in post-closure year 15, returns to below analysis criteria in year 50, then at analysis criteria in years 75 and 100 (0.067)	Highest in post-closure year 10, remains above analysis criteria until year 50 (3.9E-04)

Table Source: SRK 2018, Brown and Caldwell 2020

Table Notes:

1 Aluminum: Lowest predicted for the SGP area based on Recommended Aquatic Life Criteria (EPA 2018); The same water quality data as in the Biotic Ligand Model were used (Brown and Caldwell 2020a)

2 Copper analysis criteria was derived using the Biotic Ligand Model per guidance contained in IDEQ (2017). A conservative chronic copper analysis criteria was estimated by applying the lowest of the 10th percentile chronic criteria based on regional classifications for the Salmon River Basin, Idaho Batholith, and third order streams. Per the SGP Water Quality Management Plan (Brown and Caldwell 2020b), preliminary calculations using the Biotic Ligand Model and site-specific data have produced similar values to the standard derived using these regional classifications.

3 Antimony does not have a specified NMFS or USFWS standard and is based on EPA's human health chronic criterion for consumption of water and organisms is 0.0056 mg/L.

4 Arsenic: NMFS (2014) and USFWS (2015) both determined jeopardy for the chronic criterion proposed by EPA for Idaho Water Quality Standards (0.150 mg/L). NMFS (2014) directed EPA to promulgate or approve new aquatic life criterion. In the interim, NMFS directed EPA to ensure the 0.010 mg/L human health criterion applied in all National Pollutant Discharge Elimination System permits. USFWS (2015) directed EPA to ensure that the 10 µg/L recreational use standard is applied in all Water Quality Based Effluent Limitations (WQBELs) and Reasonable Potential to Exceed Calculations using the human health criteria and the current methodology for developing WQBELs to protect human health.

5 Mercury: NMFS (2014) and USFWS (2015) both determined jeopardy for the chronic criterion proposed by EPA for Idaho Water Quality Standards (0.000012 mg/L total mercury). NMFS (2014) directed EPA to promulgate or approve a new criterion. In the interim, implement the fish tissue criterion that IDEQ adopted in 2005. Where fish tissue is not readily available, then NMFS specified application of a 0.000002 mg/L criteria (as total mercury) in the interim. USFWS (2015) directed EPA to use the 2001 EPA/2005 Idaho human health fish tissue criterion of 0.3 milligram per kilogram wet weight for WQBELs and reasonable potential to exceed criterion calculations using the current methodology for developing WQBELs to protect human health.

6 Predicted future concentrations are reported on a monthly basis. Concentrations in some locations vary naturally on a seasonal basis and, therefore, exceed baseline in certain months (usually Spring) and are lower than baseline in other months. Exceedances reported in this table are only those interpreted to be a result of mining activity, and not due to natural seasonal variability.

7 The Hangar Flats pit lake does not currently exist and so there are no baseline water quality data and there would be no pit lake until post-closure.

mg/L = milligrams per liter; N/A = not applicable.

Operations

As detailed in Section 4.9.2.1.2, Surface Water Quality subsection 4.9.2.1.2.1 Mine Site, geochemical model predictions for the mine site facilities, including the DRSFs, TSF, pit lakes, and Yellow Pine backfilled pit have been made for both the operations period and post-closure. The water quality predictions represent the results associated with Alternative 1 and do not include potential water management and/or treatment measures.

Without appropriate management and/or treatment, antimony and arsenic are anticipated to exceed the strictest available surface water standard or would be above baseline conditions (SRK 2018). During mine operations, other constituents simulated by SRK (2018) are predicted to be below surface water quality standards at the farthest downstream monitoring point on the EFSFSR in the mine site area (YP-SR-2) including pH, aluminum, copper, mercury, and total dissolved solids, or lower than average measured baseline concentrations at that monitoring point (antimony and arsenic for operational years 1 through 6 and 11 through 12).

The following is a description of the predicted exceedances in chemical contaminant levels by node, followed by a summary of the potential reasons (i.e., SGP activity) they would occur (**Table 4.12-7**).

YP-T-27, Located at confluence of Meadow Creek and Blowout Creek, at base of Hangar Flats pit lake:

- No exceedances in aluminum, copper, or mercury concentrations;
- Antimony and arsenic concentrations during operations would be highest through Mine Year 6, then would be lower through Mine Year 12; however, the concentrations never exceed baseline or applicable criteria concentrations.

YP-T-22, Located in lower Meadow Creek above the confluence with EFSFSR and below YP-T-27:

- No exceedances in aluminum, copper, or mercury concentrations;
- Antimony and arsenic concentrations during operations are highest in Mine Years 8 through 10, then are lower through Mine Year 12; however, the concentrations never exceed baseline concentrations.

YP-SR-10, Located on EFSFSR just below confluence with Meadow Creek, just below YP-T-22:

- No exceedances seen in aluminum, copper, or mercury concentrations;
- Seasonal peaks in antimony and arsenic concentrations during operations are highest in Mine Years 8 through 10, then are lower through Mine Year 12. Almost all concentrations are above the applicable standard.

YP-SR-8, Located on EFSFSR above Fiddle Creek, below YP-SR-10:

- No exceedances seen in aluminum or copper concentrations;

- Seasonal peaks in antimony and arsenic concentrations during operations increase starting in Mine Year 7 and continue through Mine Year 10, then are lower through Mine Year 12. Almost all concentrations throughout operation are above the applicable standard;
- Seasonal variation in mercury concentrations matches that of antimony and arsenic, with the annual spring peak being higher starting in Mine Year 7, and then declining through Mine Year 12.

YP-T-11, Located in Fiddle Creek just above confluence with EFSFSR:

- No exceedances are predicted for any of the five contaminant concentrations.

YP-SR-6, Located on EFSFSR below Fiddle Creek, below both YP-SR-8 and YP-T-11:

- No exceedances predicted for aluminum or copper concentrations;
- Seasonal peaks in antimony and arsenic concentrations during operations increase starting in Mine Year 7 and continue through Mine Year 10, then are lower through Mine Year 12. Almost all concentrations are above the applicable standard;
- Seasonal variation in mercury concentrations matches that of antimony and arsenic, with the annual spring peak being higher starting in Mine Year 7, and then declining through Mine Year 12.

YP-SR-4, Located on EFSFSR just above confluence with Sugar Creek:

- No exceedances predicted for aluminum or copper concentrations;
- Seasonal peaks in antimony and arsenic concentrations during operations increase starting in Mine Year 7 and continue through Mine Year 10, then are lower through Mine Year 12. Almost all concentrations are above the applicable standard;
- Seasonal variation in mercury concentrations matches that of antimony and arsenic, with the annual spring peak being higher starting in Mine Year 7, and then declining through Mine Year 12.

YP-T-6, Located at confluence of West End Creek and Sugar Creek:

- No exceedances predicted for any of the five COC concentrations reviewed.

YP-T-1, Located on Sugar Creek above confluence with EFSFSR:

- No exceedances predicted for any of the five COC concentrations reviewed.

YP-SR-2, Located on EFSFSR below confluence with Sugar Creek. Farthest downstream site:

- No exceedances predicted for aluminum or copper concentrations;

- The increase in seasonal peaks in antimony, arsenic, and mercury concentrations starting in Mine Year 7 is visible, but much more subtle than the same observation in locations further upstream;
- As described in Section 4.9.2.1.2, Surface Water Quality subsection 4.9.2.1.2.1 Mine Site - Mine Construction and Operations – Alternative 1, these changes would occur primarily due to impacted groundwater from the RIBs flowing into the EFSFSR. During this time, water infiltrating the RIBs would primarily originate from dewatering of the Hangar Flats pit and would include groundwater that has been impacted by legacy mining activities.

Post-Closure

Information from Section 4.9.2.1.2.1, 4.9.2.1.2, Surface Water Quality, is summarized below as it relates to the five COCs analyzed for fish and fish habitat effects. The results of the post-closure SWWC model indicate that surface waters at the mine site are predicted to be circum-neutral to moderately alkaline, with predicted pH between 7.1 and 8.4.

Despite improvements to water quality as a result of the removal and reclamation of legacy mine wastes, exceedances of water quality standards are anticipated to extend indefinitely post-closure (SRK 2018). Several metals are predicted to exceed the strictest water quality standards for an indefinite period of time post-closure (SRK 2018).

The following is a description of the predicted exceedances of chemical contaminants by node post-closure.

YP-T-27, Located at confluence of Meadow Creek and Blowout Creek, at base of Hangar Flats Pit Lake:

- No exceedances predicted for aluminum concentrations;
- A peak in antimony, arsenic, copper, and mercury concentrations begins in post-closure year 10, then declines to below baseline and/or applicable standard concentration by post-closure year 20.

YP-T-22, Located in lower Meadow Creek above the confluence with EFSFSR, below YP-T-27:

- No exceedances predicted for aluminum concentrations;
- A peak in arsenic, copper, and mercury concentrations begins in post-closure year 10, then declines to below baseline and/or standard concentration by post-closure year 20;
- Antimony concentrations are higher in post-closure years 1-3, then decline. They are not predicted to reach baseline or standard concentrations.

YP-T-11, Located in Fiddle Creek just above confluence with EFSFSR:

- No exceedances predicted for aluminum, antimony, or copper concentrations;

- A peak in arsenic and mercury concentrations begins in post-closure year 1, increases into post-closure year 2, then declines and flattens for the remainder of the post-closure period.

YP-SR-6, Located on EFSFSR below Fiddle Creek, below both YP-SR-8 and YP-T-11:

- No exceedances predicted for in aluminum or antimony concentrations;
- A peak in arsenic, copper, and mercury concentrations begins in post-closure year 10, then declines to below baseline and/or standard concentration by post-closure year 30.

YP-SR-4, Located on EFSFSR just above confluence with Sugar Creek:

- No exceedances predicted for aluminum or antimony concentrations;
- A peak in arsenic, copper, and mercury concentrations begins in post-closure year 10, then declines to below baseline and/or standard concentration by post-closure year 30.

YP-T-6, Located at confluence of West End Creek and Sugar Creek:

- No exceedances predicted for any concentrations.

YP-T-1, Located on Sugar Creek above confluence with EFSFSR:

- No exceedances predicted for any concentrations.

YP-SR-2, Located on EFSFSR below confluence with Sugar Creek. Farthest downstream site:

- No exceedances predicted for aluminum or antimony concentrations;
- The peak in arsenic, copper, and mercury concentrations beginning in post-closure year 10 is still seen but is more subtle than that of locations further upstream.

YP-SR-8, Located on EFSFSR above Fiddle Creek, below YP-SR-10:

- No exceedances predicted for aluminum or antimony concentrations;
- A peak in arsenic, copper, and mercury concentrations begins in post-closure year 10, then declines to below baseline and/or standard concentration by post-closure year 30.

As described in Section 4.9. 2.1.2.1 Mine Site – Mine Closure and Reclamation, these changes would occur primarily due to the following sources, summarized below by stream.

Meadow Creek water quality would be influenced by formation of the Hangar Flats pit lake and management of TSF consolidation water. Fiddle Creek water quality would be influenced by toe seepage from the Fiddle DRSF.

The EFSFSR would receive solute loading from TSF runoff, DRSF toe seepage, groundwater discharge, and pit lake outflows.

The following paragraphs summarize the potential effects on fish from the levels predicted in the mine site streams for aluminum, copper, antimony, arsenic, and mercury from the SGP. These metals were analyzed because their concentrations are expected to change from the SGP and because they are known to affect fish.

Aluminum

The aquatic life recommended criteria for aluminum for a site are based on site-specific conditions of pH, total hardness, and dissolved organic carbon. As shown in **Table 4.12-7** no exceedances of this criteria are predicted at any nodes or in the Hangar Flats pit lake during operations or post-closure. As such, no impacts to fish or fish habitat from aluminum are expected because levels would remain the same over the life of the SGP.

Copper

As shown in **Table 4.12-7** exceedances of the copper criteria are predicted for several nodes in the EFSFSR and Meadow Creek during post-closure. The Biotic Ligand Model-based criteria are preliminary and do not encompass the range of monitoring nodes and the range of variability required for Biotic Ligand Model implementation (Brown and Caldwell 2020a). As described in Section 3.12.4.7.3.3, East Fork South Fork Salmon River Watershed Baseline under the Chemical Contaminants subsection, copper and copper compounds are acutely toxic to fish and other aquatic life at low parts per billion levels (Eisler 1991, 2000; Hamilton and Buhl 1990). The effects can range from avoidance to mortality and include behavioral changes that reduce fitness (McIntyre et al 2020 and Morris et al. 2019). Brown and Caldwell (2020a) developed Biotic Ligand Model-based preliminary copper criteria for the surface waters in the SGP area. These criteria were developed for planning purposes but do not include sufficient duration of data collection as required by the Biotic Ligand Model guidance. The input datasets included surface water data from June 2018 to May 2019 at three monitoring locations on the EFSFSR (Stations YP-SR-2, YP-SR-8, and YP-SR-13). The Biotic Ligand Model-based acute criteria range 0.00248 mg/L– 0.01812mg/L dissolved copper, and the chronic criteria range 0.001540– 0.01126 mg/L dissolved copper (see Table 2 in Brown and Caldwell 2020a). During operations, maximum predicted copper concentrations are 0.00032 mg/L, approximately 5 times below the lowest preliminary criterion of 0.001540 mg/L (**Table 4.12-7**). During closure; however, the maximum predicted post-closure copper concentrations in EFSFSR and Meadow Creek, 0.00265 mg/L and 0.005 mg/L, respectively, exceed the lowest preliminary criterion of 0.001540 mg/L and the corresponding baseline concentrations. Hence, post-closure impacts to fish cannot be ruled out.

Overall, evaluations of copper toxicity on behavior and chemo/mechanosensory responses (i.e., responses based on an odor) in fish indicate inhibitory concentrations as low as 0.0007 mg/L (as dissolved copper) depending on species, life stage, exposure duration, and water chemistry (Tierney et al. 2010). Furthermore, hardness-based criteria and Biotic Ligand Model-based criteria are generally protective against aquatic toxicity of copper, but they may not be protective for specific behavior and olfactory responses under specific conditions (such as low hardness).

Antimony

As shown in **Table 4.12-7** exceedances of this criteria are predicted for several nodes in the EFSFSR and Meadow Creek during operations and post-closure.

The predicted antimony concentrations indicate that impacts on fish, particularly through the aqueous exposure and bioaccumulation, are not likely (Obiakor et al. 2017). However, uncertainty remains as regulatory guidance and criteria have not yet been established for the protection of aquatic life.

Arsenic

As shown in **Table 4.12-7** exceedances of this criteria are predicted for several nodes in the EFSFSR and Meadow Creek during operations and post-closure; however, the maximum concentrations predicted for arsenic is 0.09 mg/L during post-closure in the EFSFSR, which is lower than the aquatic life chronic criterion of 0.15 mg/L. This concentration is expected to be protective of 95 percent of aquatic species, including fish and invertebrate species that fish may prey upon.

Mercury

As shown in **Table 4.12-7,** exceedances of the analysis criteria are predicted for several nodes in the EFSFSR, Meadow Creek, and Fiddle Creek during post-closure. Mercury concentrations in macroinvertebrates also were found to be substantially elevated in Sugar Creek, relative to concentrations at other sites—particularly those on Meadow Creek and Tamarack Creek (MWH Americas, Inc. 2017).

“When levels in fish tissue from any water body exceed the criterion, there is the potential for lifetime exposure above what is considered safe, and the water is listed as impaired for recreational use, which presumes the opportunity to catch and safely eat any fish present” (IDEQ 2015). Although the water column-based aquatic life chronic criterion for mercury remains 0.000012 mg/L in Idaho, the preferred value used for interpreting risks of mercury contamination to aquatic life is the fish tissue criterion of 0.3 milligram per kilogram wet weight, the same value used for protection of human health (IDEQ 2018).

Predatory species in the food web concentrate the highest amounts of mercury in their tissues, a process called biomagnification. Fish in the streams and rivers of Idaho are the dominant predator species and can concentrate mercury at levels several times that of prey species, such as algae, aquatic insects, and fish that do not feed exclusively on other fish.

Neurotoxicity and reduced reproductive success generally describe the most significant subtle toxic effects to fish related to mercury contamination, which include changes to predator-prey avoidance behaviors, impaired feeding behaviors, impaired gonadal development, reduced spawning success, reduced egg hatching, and reduced embryo-larval survival (IDEQ 2005). Negative effects of mercury on fish can arise from exposure of fish eggs to water column methylmercury (MeHg), MeHg maternal transfer to developing eggs, fish tissue bioaccumulation of MeHg, and circulatory levels of MeHg in fish (IDEQ 2005). The greatest source of MeHg exposure to developing eggs is through maternal transfer.

Although water column concentrations are predicted to exceed the standard for mercury, results of tissue sampling in the SGP area indicate risk to both human health and aquatic life, including fish, may be minimal, as the 0.3 milligram per kilogram MeHg threshold was not met or exceeded at sites where tissues were collected in the SGP area (MWH Americas, Inc. 2017). Idaho's water quality criterion of 0.000012 mg/L for mercury is based on a human health criterion derived by EPA from a fish tissue concentration and conservative bioaccumulation factors. The EPA's current recommended ambient water quality criterion that is considered protective of the aquatic life, including invertebrates and fish is 0.00077 mg/L and was updated in 1997 (EPA 1997). But this criterion does not account for exposure via bioaccumulation. Therefore, with respect to incremental bioaccumulation that may occur in fish species, potential impacts of predicted post-closure increases in water column mercury concentrations beyond baseline conditions is uncertain but would likely include some if not all the potential impacts described above.

Summary of Chemical Contaminant Impacts to Fish

Despite activities that would improve water quality for fish from the removal and reclamation of legacy mine wastes, exceedances of the NMFS and USFWS and other applicable criteria for antimony, arsenic, copper, and mercury are anticipated to extend indefinitely post-closure. Impacts due to aluminum, antimony, and arsenic are not anticipated. The impacts associated with exceeding copper and mercury levels may be minimal; however, there is some uncertainty. For copper, the Biotic Ligand Model-based criteria are preliminary and do not encompass the range of monitoring nodes and the range of variability required for Biotic Ligand Model implementation (see Brown and Caldwell 2020a). For mercury, while the predicted concentrations do not exceed the aquatic life criterion, it is uncertain whether incremental change in concentrations beyond baseline would cause fish tissue concentrations to exceed the tissue-based criterion.

Streamflows – Alternative 1

Changes in streamflow can impact fish and fish habitat. Impacts to fish from changes to streamflow were assessed using simulated monthly discharge for the August to March low-flow period for Mine Years -1 through post-closure. The potential effects of these changes in stream flow on fish and fish habitat are discussed below.

Table 4.12-8 shows predicted (simulated) monthly streamflows during the August to March low flow period at five gaging stations and one SFA reach in mine site streams (see **Figure 3.12-14** for their locations) and predicted change from average baseline low flow period streamflows. **Figure 4.12-3** shows the percent change in simulated streamflows graphically. See Section 4.9.2.1.1.1, Changes in Stream Flow Characteristics, for additional details regarding the potential for the SGP to result in changes to baseline water quantities in mine site waterbodies.

Table 4.12-8 Alternative 1 Simulated Monthly Discharge during the August-March Low Flow Period at USGS Gaging Stations and One SFA Reach (MC-6)

	EFSFSR above Meadow Creek (Gaging station 13310800)		EFSFSR at Stibnite (13311000)		EFSFSR above Sugar Creek (13311250)		Sugar Creek (13311450)		Meadow Creek (13311850)		Meadow Creek (MC-6)	
Mine Year	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline
-1	4.3 cfs	4.3 cfs (-0.1%)	9.1 cfs	8.1 cfs (-10.8%)	13.6 cfs	12.6 cfs (-7.3%)	10.2 cfs	10.3 cfs (+1.1%)	2.8 cfs	0.2 cfs (-91.9%)	4.6 cfs	3.6 cfs (-22.3%)
1	4.1 cfs	4.1 cfs (+1.2%)	8.5 cfs	8.9 cfs (+4.8%)	13.0 cfs	10.8 cfs (-16.7%)	9.6 cfs	9.9 cfs (+3.5%)	2.5 cfs	0.2 cfs (-93.0%)	4.2 cfs	3.7 cfs (-12.3%)
2	6.4 cfs	6.4 cfs (+0.8%)	13.6 cfs	14.0 cfs (+3.1%)	18.9 cfs	15.8 cfs (-16.6%)	14.2 cfs	14.5 cfs (+2.1%)	3.6 cfs	1.5 cfs (-59.6%)	6.8 cfs	6.2 cfs (-8.7%)
3	4.3 cfs	4.4 cfs (+1.3%)	8.9 cfs	9.3 cfs (+4.7%)	13.6 cfs	10.0 cfs (-26.8%)	10.1 cfs	10.4 cfs (+3.8%)	2.7 cfs	0.2 cfs (-92.5%)	4.4 cfs	3.9 cfs (-10.9%)
4	5.2 cfs	5.2 cfs (+1.1%)	10.9 cfs	11.4 cfs (+4.5%)	15.9 cfs	12.2 cfs (-23.1%)	11.8 cfs	12.2 cfs (+3.5%)	3.0 cfs	0.8 cfs (-73.6%)	5.4 cfs	4.9 cfs (-9.4%)
5	4.7 cfs	4.8 cfs (+1.8%)	9.8 cfs	10.9 cfs (+11.5%)	14.7 cfs	11.2 cfs (-23.7%)	11.0 cfs	11.4 cfs (+3.6%)	2.8 cfs	0.4 cfs (-85.6%)	4.8 cfs	4.4 cfs (-8.7%)
6	4.7 cfs	4.7 cfs (+1.9%)	9.6 cfs	10.9 cfs (+13.3%)	14.5 cfs	11.1 cfs (-23.8%)	10.8 cfs	11.2 cfs (+3.7%)	2.7 cfs	0.4 cfs (-86.1%)	4.7 cfs	4.3 cfs (-8.2%)
7	5.2 cfs	5.4 cfs (+4.1%)	10.9 cfs	12.7 cfs (+16.5%)	16.1 cfs	13.1 cfs (-18.6%)	12.0 cfs	12.4 cfs (+3.4%)	3.0 cfs	0.7 cfs (-77.4%)	5.4 cfs	3.3 cfs (-39.4%)

	EFSFSR above Meadow Creek (Gaging station 13310800)		EFSFSR at Stibnite (13311000)		EFSFSR above Sugar Creek (13311250)		Sugar Creek (13311450)		Meadow Creek (13311850)		Meadow Creek (MC-6)	
Mine Year	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline
8	7.5 cfs	7.8 cfs (+4.1%)	16.0 cfs	18.2 cfs (+13.6%)	22.1 cfs	19.5 cfs (-12.0%)	16.2 cfs	16.4 cfs (+1.8%)	4.8 cfs	2.5 cfs (-47.8%)	8.1 cfs	5.0 cfs (-37.7%)
9	4.7 cfs	4.9 cfs (+4.8%)	9.7 cfs	10.3 cfs (+5.8%)	14.7 cfs	11.3 cfs (-22.9%)	11.0 cfs	11.4 cfs (+3.8%)	2.8 cfs	0.4 cfs (-87.2%)	4.8 cfs	1.7 cfs (-64.8%)
10	5.1 cfs	5.3 cfs (+3.6%)	10.9 cfs	10.5 cfs (-3.8%)	15.6 cfs	12.2 cfs (-21.8%)	11.7 cfs	12.0 cfs (+2.8%)	3.0 cfs	0.7 cfs (-75.7%)	5.5 cfs	2.1 cfs (-62.1%)
11	6.1 cfs	6.3 cfs (+3.2%)	12.9 cfs	12.4 cfs (-3.6%)	18.0 cfs	14.8 cfs (-18.2%)	13.2 cfs	13.7 cfs (+3.3%)	3.7 cfs	1.4 cfs (-62.1%)	6.4 cfs	2.9 cfs (-54.1%)
12	8.6 cfs	8.8 cfs (+3.0%)	18.1 cfs	18.8 cfs (+4.1%)	24.4 cfs	22.1 cfs (-9.6%)	17.7 cfs	18.5 cfs (+4.5%)	5.0 cfs	2.7 cfs (-46.6%)	8.9 cfs	5.1 cfs (-42.3%)
13	5.4 cfs	5.4 cfs (+0.3%)	11.3 cfs	6.6 cfs (-41.5%)	16.6 cfs	9.4 cfs (-43.0%)	12.7 cfs	10.6 cfs (-16.1%)	3.3 cfs	0.4 cfs (-86.6%)	5.6 cfs	1.1 cfs (-79.7%)
14	4.5 cfs	4.5 cfs (-0.1%)	9.6 cfs	5.0 cfs (-47.5%)	13.9 cfs	8.6 cfs (-38.3%)	10.7 cfs	9.6 cfs (-10.6%)	2.9 cfs	0.2 cfs (-92.2%)	4.9 cfs	0.6 cfs (-88.0%)
15	6.5 cfs	6.5 cfs (-0.1%)	13.8 cfs	9.7 cfs (-30.1%)	18.8 cfs	14.1 cfs (-25.3%)	14.2 cfs	13.4 cfs (-5.5%)	4.0 cfs	1.2 cfs (-70.7%)	7.0 cfs	3.1 cfs (-56.0%)
16	4.8 cfs	4.8 cfs (-0.1%)	9.8 cfs	6.5 cfs (-33.6%)	14.7 cfs	10.3 cfs (-29.7%)	11.3 cfs	10.0 cfs (-11.7%)	2.9 cfs	0.3 cfs (-90.5%)	4.8 cfs	1.8 cfs (-63.0%)

	EFSFSR above Meadow Creek (Gaging station 13310800)		EFSFSR at Stibnite (13311000)		EFSFSR above Sugar Creek (13311250)		Sugar Creek (13311450)		Meadow Creek (13311850)		Meadow Creek (MC-6)	
Mine Year	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline	No Action (Baseline)	Alternative 1 and Change from Baseline
17	4.0 cfs	4.0 cfs (-0.2%)	8.4 cfs	6.1 cfs (-27.1%)	12.8 cfs	9.5 cfs (-25.9%)	9.8 cfs	8.7 cfs (-11.3%)	2.5 cfs	0.1 cfs (-95.0%)	4.1 cfs	2.0 cfs (-51.9%)
18	4.5 cfs	4.5 cfs (-0.7%)	9.4 cfs	7.9 cfs (-16.4%)	14.0 cfs	11.5 cfs (-17.8%)	10.9 cfs	10.1 cfs (-7.0%)	2.6 cfs	0.2 cfs (-91.4%)	4.6 cfs	3.1 cfs (-33.5%)
19	4.4 cfs	4.4 cfs (+0.0%)	9.6 cfs	8.6 cfs (-9.8%)	13.3 cfs	12.0 cfs (-9.8%)	10.0 cfs	9.7 cfs (-2.7%)	2.8 cfs	0.3 cfs (-90.6%)	4.9 cfs	3.9 cfs (-21.1%)
20	4.5 cfs	4.5 cfs (+0.0%)	9.3 cfs	9.5 cfs (+2.0%)	13.7 cfs	13.0 cfs (-5.2%)	10.4 cfs	9.5 cfs (-8.7%)	2.8 cfs	0.3 cfs (-90.9%)	4.6 cfs	4.8 cfs (+3.2%)
Post-closure	5.0 cfs	5.0 cfs (-0.2%)	10.6 cfs	10.7 cfs (+1.3%)	15.4 cfs	14.7 cfs (-4.5%)	11.7 cfs	11.3 cfs (-3.5%)	3.1 cfs	0.5 cfs (-83.1%)	5.3 cfs	5.4 cfs (+1.5%)

Table Source: data from Rio-ASE spreadsheet: Modflow_Alternatives_Summary_08192019.xls

Table Notes:

USGS = U.S. Geological Survey.

cfs = cubic feet per second.

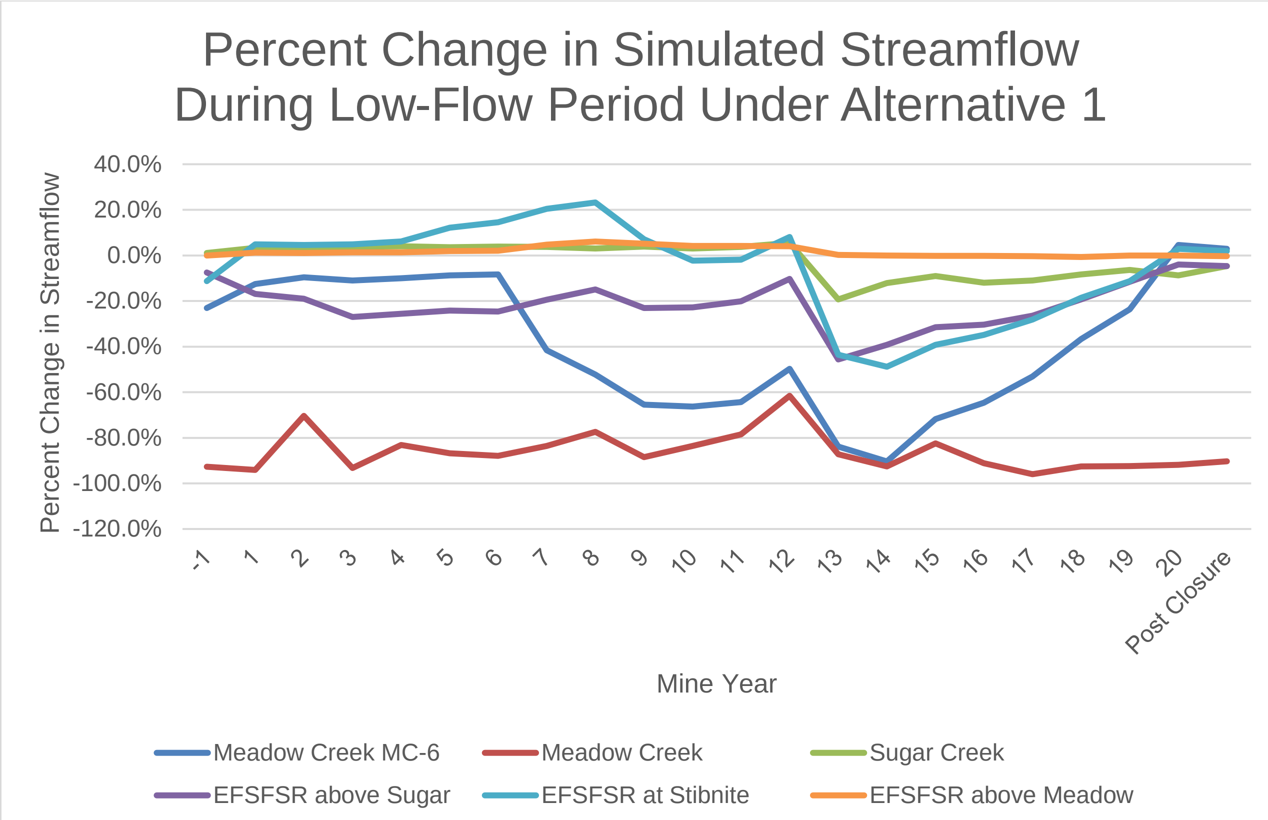


Figure Source: Appendix J-1, Supplemental Information

Figure 4.12-3 Alternative 1 Percent Change in Simulated Streamflow During Low-Flow Period (August to March)

The greatest predicted changes to streamflow under Alternative 1 would be in the EFSFSR and in Meadow Creek in the vicinity of the TSF/DRSF. While most of the streams would return to at or near baseline flows post-closure (post-closure flows represent an average of the predicted flows from Mine Years 21 through 112), the Meadow Creek location would be just downstream of the TSF/DRSF and flows would be greatly reduced at this location (by 90.4 percent in perpetuity due to the change in the post-closure stream channel location) (Brown and Caldwell 2019a). The EFSFSR flows would recover post-closure. Flow increases at some nodes are due to the RIBs, reductions during operations are due to dewatering and subsequent filling of the Hangar Flats pit, dewatering of the Yellow Pine pit, and tunnel bypass.

As described in Section 3.12.4, Fish Resources and Fish Habitat - Affected Environment, several fish species either overwinter in mine site streams or have eggs incubating in stream substrate during the winter months. The decreased winter flows under Alternative 1 may affect these species. The following is a brief summary of the types of impacts that could occur during over-wintering. There were no models developed or used to analyze the potential impacts to fish that over-winter in the SGP area.

The scientific literature on salmonids indicate that a multitude of physical and biological factors affect the survival of overwintering salmonids, including flow regime, the presence of cover, ice breakup, and stream temperatures. There is substantial uncertainty in the prediction of impacts of flow reductions from a lack of understanding of the relationship between flow and fish populations and site and time-specific variations in how aquatic organisms react to habitat changes (Bradford and Heinonen 2008). The changing winter conditions could cause changes in fish behavior patterns; fish currently wintering in mine site area streams could move out of the area if flow reductions make the habitat unsuitable. Flow reductions also could cause a loss of bank habitat for concealment, which could reduce survival of fry or juveniles. Bank habitat that provides concealment habitat is critical to the winter survival of age-0 river salmonids. When flows are reduced, the amount of area for concealment or predator avoidance purposes may decrease.

The largest impact could be on eggs or fry because they are not able to relocate when conditions change. Reduced winter flows could cause mortality of eggs if they are exposed to open air, are frozen in ice, become deficient in dissolved oxygen, or are fed on by predators. Fish also could become stranded in isolated pools and/or suffocate with potential decline in dissolved oxygen in frozen conditions or isolated pools.

4.12.2.3.3.2 Changes to WCIs outside the Mine Site – Alternative 1

Detailed projection of changes to WCIs were developed for the mine site only. **Table 4.12-9** provides a summary qualitative assessment of the potential impacts to the FI score for baseline conditions in watersheds outside the mine site that may be impacted by new access roads, water crossing installation, replacement and/or repair of culverts/bridges, increased traffic on existing access roads, and borrow sites; and construction and operation of transmission line and substation, communication towers, and maintenance and logistic facilities.

Table 4.12-9 Predicted Changes to WCIs Related to Off-site Facilities

WCI	Baseline Functional Index (FI)			Potential Changes to Baseline WCI – Qualitative Discussion
	Johnson Creek	Upper EFSFSR	Upper South Fork Salmon River	
Bull Trout Local Population Size	FR	FR	FR	Negative impacts to current bull trout population are not anticipated. Physical changes to habitat (i.e., diversions, etc.) are limited to new water crossing (culverts, bridges) installations on new access roads. Alteration or loss of critical habitat features (i.e., spawning, rearing, etc.) to a degree that would impact current populations is not expected. Furthermore, repair/replacement of any existing culverts that are currently impeding fish passage can allow access to upstream habitat for bull trout and potentially increase productivity.
Bull Trout Growth and Survival	FR	FR	FR	Negative impacts to current bull trout life processes are not anticipated. Physical changes to habitat (i.e., diversions, etc.) are limited to new water crossing (culverts, bridges) installations on new access roads. Furthermore, repair/replacement of any existing culverts that are currently impeding fish passage can allow access to upstream habitat for bull trout.
Bull Trout Diversity and Isolation	FR	FR	FR	Potential improvements to fish passage where existing culverts that impede fish passage may be repaired or replaced would improve access to upstream and downstream habitat. However, should a situation exist where bull trout reside upstream of an existing barrier, and invasive brook trout occur downstream, reclaiming passage could introduce brook trout to isolated populations of bull trout where the bull trout are susceptible to hybridization and competition for resources from the brook trout.
Bull Trout Persistence and Genetic Integrity	FR	FR	FR	Generally reclaimed access to habitat with the removal of passage barriers is an improvement for fish. However, where non-native brook trout are present downstream of a barrier, reclaimed access to habitat upstream also can increase the potential for brook trout to migrate to previously-inaccessible bull trout habitat and hybridize with bull trout.
Water Temperature (CH / ST)	FA	FR	FR	Outside of the mine site in-stream work or changes is limited to water crossing installation, repair and/or replacement. Changes to water temperature are not expected to occur as a result.
Water Temperature (BT)	FA	FR	FR	Outside of the mine site in-stream work or changes is limited to water crossing installation, repair and/or replacement. Changes to water temperature are not expected to occur as a result.

WCI	Baseline Functional Index (FI)			Potential Changes to Baseline WCI – Qualitative Discussion
	Johnson Creek	Upper EFSFSR	Upper South Fork Salmon River	
Fine Sediment	FR	FR	FR	A decline in FI from Baseline conditions is likely to occur as a result of offsite activities during construction and operations, such as increased traffic, disturbed or unstable soils and slopes, and water crossings. A decline in FI for fine sediment is anticipated.
Chemical Contaminants	FR	FR	FR	An increase in traffic and activity increases the potential for spills of deleterious substances. Accidental spills in the soil or directly into waterbodies are likely to decrease the FI, from large-scale spills or an accumulation from small, incidental spills. Furthermore, reaches downstream of the mine site could be exposed to contaminant inputs from the mine site itself. A decline in FI is anticipated.
Physical Barriers	FR	FUR	FR	An increase or no change to the FI is expected. Where existing culverts are present and require repair or replacement to facilitate SGP traffic, the repairs or replacements would be designed to allow for fish passage. Where existing culverts are impeding fish passage, this would be reclaimed and thereby increasing the FI.
Substrate Embeddedness	FUR	FA	FR	A decline in FI from Baseline conditions is likely to occur as a result of increased sediment from offsite activities during construction and operations, such as increased traffic, disturbed or unstable soils and slopes, and water crossings.
Large Woody Debris	FR	FA	FUR	Changes to Baseline FI are not expected or would be negligible. The physical in-stream changes are limited to water crossing installation. The change in FI is expected to be none or negligible.
Pool Frequency (CH / ST)	FA	FR	FR	Changes to baseline FI are not expected or would be negligible. The physical in-stream changes are limited to water crossing installation. There is the potential for an increase in FI with the creation of plunge pools where new water crossings are required.
Pool Frequency (BT)	FA	FR	FR	Changes to Baseline FI are not expected or would be negligible. The physical in-stream changes are limited to water crossing installation. There is the potential for an increase in FI with the creation of plunge pools where new water crossings are required.
Pool Quality	FA	UR	FR	Changes to Baseline FI are not expected or would be negligible. The physical in-stream changes are limited to water crossing installation. There is the potential for an increase in FI with the creation of plunge pools where new water crossings are required.

WCI	Baseline Functional Index (FI)			Potential Changes to Baseline WCI – Qualitative Discussion
	Johnson Creek	Upper EFSFSR	Upper South Fork Salmon River	
Off Channel Habitat	FA	FR	FR	Changes to Baseline FI are not expected or would be negligible. The physical in-stream changes are limited to water crossing installation. There is the potential for an increase in FI with the creation of plunge pools where new water crossings are required.
Refugia	FR	FR	FR	Changes to Baseline FI are not expected or would be negligible. The physical in-stream changes are limited to water crossing installation. There is the potential for an increase in FI with the creation of plunge pools where new water crossings are required.
Width/Depth Ratio	FR	FA	FR	Changes to Baseline FI are not expected or would be negligible. The physical in-stream changes are limited to water crossing installation. There is the potential for an increase in FI with the creation of plunge pools where new water crossings are required.
Streambank Condition	FR	FA	FR	Changes to Baseline FI are likely to be negligible. The physical in-stream changes are limited to water crossing installation. There would be a minimal loss of riparian vegetation and alteration to the stream banks within the footprint of the water crossing, but these changes would be localized to these areas.
Floodplain Connectivity	FUR	FR	FUR	Changes to Baseline FI are not expected or would be negligible. The physical in-stream changes are limited to water crossing installation.
Change in Peak / Base Flows	FR	FA	FR	Changes to Baseline FI are not expected. The physical in-stream changes are localized to the footprint of the water crossing. With proper water crossing design, no changes in peak or base flow are expected.
Drainage Network	FR	FA	FUR	Potential changes to surface water drainage patterns. Surface flows may be diverted from natural pathways to ditches or other surface water management measures. Surface water management meant to project the structural integrity and safety of access roads, facilities and minimize the risk of erosion. Though surface flow paths may be altered, the flow inputs to waterbodies are not likely to be altered or would be negligible.
Road Density and Location	FR	FUR	FR	A decline in FI is expected with the construction of new access roads and upgrades to existing.
Disturbance History	FR	FR	FUR	Construction, operation and post-closure activities would result in increased disturbance, and therefore decline in FI.

WCI	Baseline Functional Index (FI)			Potential Changes to Baseline WCI – Qualitative Discussion
	Johnson Creek	Upper EFSFSR	Upper South Fork Salmon River	
Riparian Conservation Areas	FR	FR	FUR	There would be a loss of riparian habitat within the footprint of new and extended water crossings. Though there would be a decline, the change in FI is anticipated to be negligible, as the changes to riparian habitat would be localized to within the footprint of the water crossings and roadway.
Disturbance Regime	FR	FR	FR	Construction, operation and post-closure activities would result in increased disturbance, and therefore decline in FI.
Integration of Species and Habitat	FUR	FR	FR	Where culvert replacement or repairs are required, new or upgraded structures would be designed to allow for the free movement of fish. The reinstatement of fish passage in these areas would increase the amount of available habitat for fish. The FI is expected to increase. However, in the event that an existing barrier is preventing the movement of invasive brook trout to bull trout habitat upstream, reinstating this access could result in competition for resources and hybridization between the two species.

Table Source: AECOM 2020

Table Notes:

Functioning Appropriately (FA); Functioning at Risk (FR); Functioning at Unacceptable Risk (FUR).

4.12.2.3.4 CHINOOK SALMON SPECIFIC IMPACTS – ALTERNATIVE 1

The following five subsections summarize the impacts of the SGP on Chinook salmon and habitat. These discussions summarize the analyses performed to disclose potential impacts of Alternative 1 on Chinook salmon and its habitat, and include descriptions of potential impacts to Intrinsic Potential, Streamflow/Productivity, Water Temperature, and Critical Habitat; followed by Integration of Species/Habitat Effects, which includes a summary of the potential impacts to the species from the SGP. The species-specific analysis focuses on potential impacts that could occur at the mine site, where most of the impacts are likely to occur, and where modeling was completed. Potential impacts outside the mine site are discussed as appropriate.

4.12.2.3.4.1 Intrinsic Potential Modeling – Alternative 1

The following section summarizes the IP modeling results and analyzes the potential impact to Chinook salmon habitat at the mine site under Alternative 1. Please refer to Section 3.12.4.2.5, Intrinsic Potential Modeling, and the Intrinsic Potential Technical Memoranda provided in **Appendix J-4** for more detail on the model and analysis performed. The potential changes in IP associated with the SGP at the mine site would be primarily the result of changes in model parameters for stream gradient, wetted width, and bankfull width. Valley bottom width changes has a lesser effect on IP ratings. The analysis was performed on segments that were 30 meters in length, then combined and summarized by the larger stream reaches defined in Section 3.12.1, Introduction, Scope of Analysis, and Terminology. The analysis was performed on the Upper EFSFSR and Sugar Creek subwatersheds and on an approximately 1,100-meter section of the EFSFSR downstream of the confluence with Sugar Creek.

Results are presented as the length of stream with usable IP per Mine Year from construction through closure and reclamation in selected Mine Years (**Table 4.12-10**). The IP results are summarized from construction through closure and reclamation (Baseline, and Mine Year -2 through Mine Year 20) for all stream reaches (1-6) within the mine site area in **Appendix J-4.** For Chinook salmon the IP was rated as high, medium, low, and negligible. “Useable” habitat is defined as all of these classes combined (usable = high + medium + low + negligible). Percent change per Mine Year is based on the difference between that year and baseline conditions (e.g., percent [%] Change = [Mine Year 20 – Baseline]/Baseline).

All activities that would affect Chinook IP (e.g., change in slope, wetted width, etc.) occur in the Upper EFSFSR subwatershed; therefore, results for the Upper EFSFSR subwatershed are presented. **Figure 4.12-4** illustrates the loss or gain of IP habitat per selected Mine Year for the only Upper EFSFSR above Sugar Creek Reach because this is the segment that would experience changes to IP based on SGP activities. This figure also illustrates when natural and artificial barriers would be removed or added because of the SGP. Refer to **Table 4.12-1** for a timeline of the corresponding activities and stream channel changes that are expected to result in changes to Chinook salmon IP.

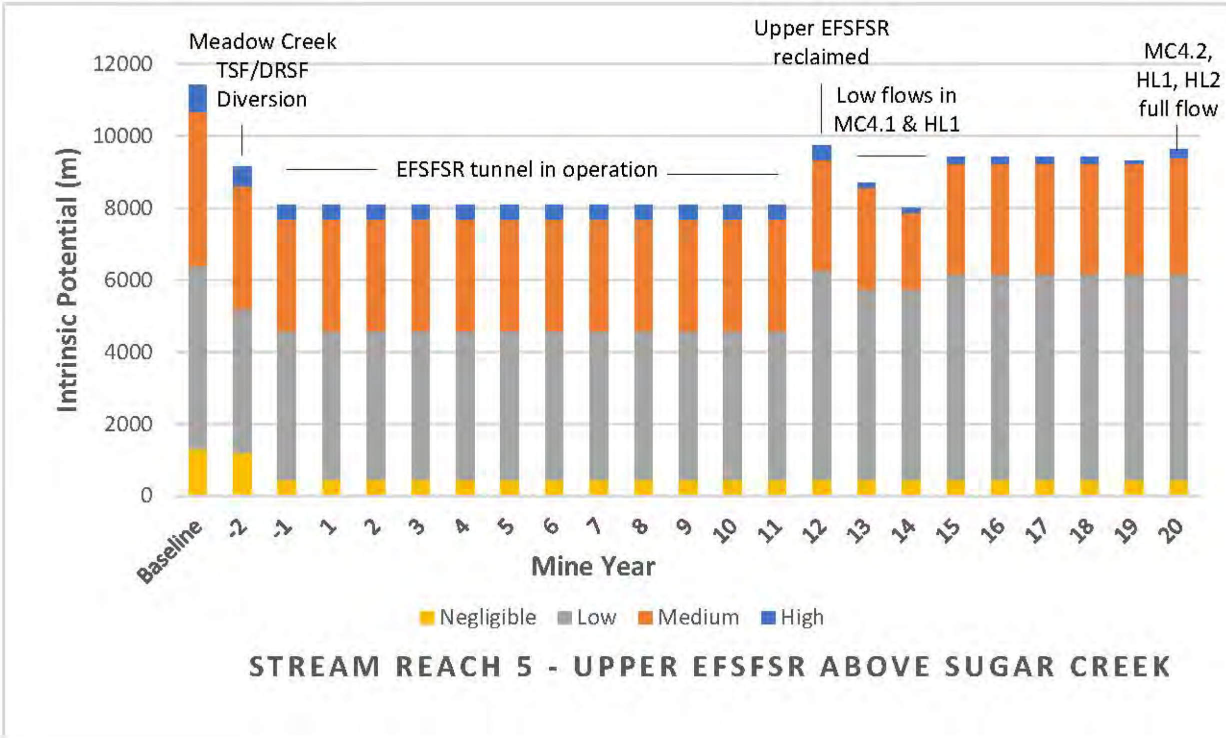


Figure Source: **Appendix J-4**, Intrinsic Potential Technical Memoranda, with modifications.

Figure Notes:

MC4.1 & MC4.2= Meadow Creek SFA reaches upstream of Hangar Flats pit lake; HL1 and HL2 = Meadow Creek SFA reaches through the Hangar Flats pit lake. “None” IP rating not included in the figure.

Figure 4.12-4 Changes to Chinook Salmon IP Habitat

Table 4.12-10 Alternative 1 – Chinook Salmon Length of Stream Habitat per IP Rating and Percent Change Between Baseline and Mine Year 20 for Entire IP Model Analysis Area

	Length of Stream (km) During Mining, Closure and Reclamation[1]						Permanent Change (EOY 20 - Baseline)[2]	
Intrinsic Potential Habitat Rating[3]	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20	Loss/Gain (km)[4]	Percent (%) Change[4]
High	0.84	0.65	0.53	0.53	0.28	0.35	-0.49	-58.3
Medium	7.29	6.42	6.07	6.07	6.07	6.22	-1.06	-14.6
Low	8.74	8.74	7.79	9.45	9.36	9.36	+0.61	+7
Negligible	1.74	1.65	0.90	0.90	0.90	0.90	-0.84	-48.3
Total IP Habitat	18.61	17.47	15.29	16.95	16.61	16.83	-1.78	-9.6

Table Source: **Appendix J-4**, Intrinsic Potential Modeling Technical Memoranda

Table Notes:

1 Results are presented as the length (km) of IP habitat per selected Mine Year during mining, and closure and reclamation.

2 The permanent change in IP is presented as the loss or gain (in km) of IP rated streams and percent change per Mine Year is based on the difference between that year and baseline conditions (% Change = [Mine Year 20 – baseline]/baseline).

3 For Chinook salmon the IP is rated as high, medium, low, and negligible. "Total" IP habitat is defined as all of these classes combined (useable = high + medium + low + negligible) and does not consider whether the IP habitat is naturally available. "None" indicates that there is no intrinsic potential to provide habitat for the species and is not shown in this table.

4 Change in IP habitat for both "Loss/Gain" and "Percent Change" is shown as negative (-) for loss of IP and positive (+) as a gain in IP.

IP = Intrinsic Potential; EOY = end of Mine Year.

km = kilometers (1 km = 0.62 mi).

Most changes to IP occur within the Upper (Headwaters) EFSFSR subwatershed. **Table 4.12-10** includes the entire analysis area (i.e., Upper EFSFSR and Sugar Creek subwatersheds and additional segment of EFSFSR downstream of confluence with Sugar Creek). **Figure 4.12-4** shows changes in IP in the Upper EFSFSR subwatershed and illustrates the following summary.

- Upper Meadow Creek would be diverted around the TSF/DRSF footprint in EOY -2, resulting in a loss of approximately 2 kilometers of IP habitat.
- The EFSFSR Tunnel would go into service and Meadow Creek would be diverted around Hangar Flats pit footprint in EOY -1, which would result in a further reduction of IP habitat, but also would result in natural fish passage available to all IP habitat above the current Yellow Pine pit lake cascade barrier and below the Meadow Creek diversion.
- Conditions stay generally the same until EOY 12 when the EFSFSR Tunnel would be decommissioned and reclaimed channels are wetted through the reclaimed Yellow Pine pit, resulting in an increase of usable IP habitat to nearly 10 km.
- Starting in EOY 13, the filling of Hangar Flats pit lake causes low flows in lower Meadow Creek, decreasing usable IP.
- At EOY 20, stream channels and flows would be at, or close to, their long-term (permanent) condition. IP would increase slightly due to more IP habitat in lower Meadow Creek.

Temporary impacts on IP (during operations through closure and reclamation) would be greater than long-term, permanent impacts. Post-closure, IP habitat would be permanently reduced to 16.83 km, which is a loss of 1.78 km. However, all the IP habitat would be naturally accessible to migratory fish, while under baseline conditions 10.21 km above the Yellow Pine pit lake cascade barrier is not currently available to migrating fish. Resident fish upstream of barriers (existing or new) may have access to habitat upstream of barrier, such as released Chinook salmon.

4.12.2.3.4.2 Streamflow/Productivity Analysis – Alternative 1

The effects of flow changes on Chinook salmon were analyzed using a flow-productivity model developed by NOAA Fisheries (NMFS 2018). The flow-productivity model examines Chinook salmon productivity based on predicted streamflow changes under each action alternative (**Appendix J-5**). It is based on flow data at USGS gaging stations at the mine site; however, regression equations were derived from detailed data collected on Johnson Creek. The flow-productivity relationships used within the model reflect those that have been observed on Johnson Creek. Consequently, the model results are a predicted change in productivity that provides a relative measure (rather than precise estimates) of the effect of modified stream flows on Chinook salmon productivity.

This stand-alone analysis predicts changes in productivity based solely on streamflow changes and it does not factor in the other habitat changes that also would occur in the analysis area (e.g., direct loss of habitat, water temperature changes, etc.). The numbers help to show the relative impact of flow modifications on Chinook salmon productivity. Chinook salmon productivity was assessed at the six reaches shown on **Figure 3.12-2** and the locations shown on **Figure 3.12-4**. The results of the flow/productivity modeling for Chinook salmon are provided in **Table 4.12-11**. The values represent the predicted annual percent change in productivity from baseline. Negative numbers mean a loss of productivity and the positive numbers an increase. Refer to **Table 4.12-1** for timeline of mine site activities that coincide with changes in flow/productivity for additional information.

Table 4.12-11 Alternative 1 Predicted Amount of Change (in percent) in Chinook Salmon Productivity from Baseline Conditions by Mine Year and Location (USGS Gaging Stations and MC-6)

Alternative 1		Location					
Period	Mine Year	EFSFSR above Meadow Creek (13310800)	EFSFSR at Stibnite (1331100)	EFSFSR above Sugar Creek (13311250)	Sugar Creek (13311450)	Meadow Creek (13311850)	Meadow Creek MC-6
Mine Life (-2 to 20)	-2	0.0	-7.2	-5.1	0.0	-100	-12.7
	-1	0.4	-4.8	-9.2	1.6	-100	-16.2
	1	1.5	6.9	-17.2	4.3	-100	-11.0
	2	1.0	4.0	-18.0	2.0	-100	-9.2
	3	1.6	6.5	-23.7	4.8	-100	-10.5
	4	1.6	9.3	-21.7	3.9	-100	-9.1
	5	2.1	15.9	-21.6	4.1	-100	-8.5
	6	3.5	24.1	-20.1	4.2	-100	-15.0
	7	5.9	31.6	-16.6	4.0	-100	-33.9
	8	6.3	20.5	-17.0	3.6	-100	-38.4
	9	5.2	3.8	-20.6	3.9	-100	-43.3
	10	5.0	-1.2	-19.6	3.3	-100	-43.6
	11	4.7	4.6	-15.9	4.9	-100	-41.1
	12	2.8	-6.2	-19.4	-4.9	-100	-38.2
	13	0.0	-34.3	-31.8	-12.8	-100	-49.6
	14	-0.1	-36.0	-30.9	-11.1	-100	-50.8
	15	-0.1	-31.2	-25.4	-9.5	-100	-42.9
	16	-0.1	-24.5	-24.5	-10.5	-100	-41.1
	17	-0.3	-21.3	-21.3	-10.1	-100	-35.6
	18	-0.5	-16.1	-16.1	-8.9	-100	-26.5
	19	0.5	-4.6	-4.6	-6.1	-100	-2.7
	20	-0.2	-5.7	-5.7	-8.7	-100	3.3

Alternative 1		Location					
Period	Mine Year	EFSFSR above Meadow Creek (13310800)	EFSFSR at Stibnite (1331100)	EFSFSR above Sugar Creek (13311250)	Sugar Creek (13311450)	Meadow Creek (13311850)	Meadow Creek MC-6
Mine Life (-2 to 20) Sum	Max	6.3	31.6	-4.6	4.9	-100	3.5
	Mean	1.9	-2.8	-17.9	-1.9	-100	-24.9
	Min	-0.5	-36.0	-31.8	-12.8	-100	-50.8
Post Closure (from Mine Year 21 to 118)	Mean	-0.2	2.3	-4.6	-4.9	-100	3.5

Table Source: **Appendix J-5**, Chinook Salmon Streamflow/Productivity Technical Memorandum

Table Notes:

The Post-closure Value Represents an Average Annual Percent Change in Productivity for Mine Years 21 through 118.

Under Alternative 1, the largest impacts to productivity would be to Upper Meadow Creek, where the model predicts a 100 percent reduction from baseline productivity throughout all phases of the SGP, including post-closure. At this site (13311850) Meadow Creek would be routed into diversion channels around the TSF/DRSF by Mine Year -2 and would eventually be buried under the TSF/DRSF during operations and through closure and reclamation. All habitat upstream of Hangar Flats DRSF would be lost because it would be inaccessible to fish.

Chinook salmon productivity in Lower Meadow Creek (MC-6) would be reduced by an average of approximately 25 percent from Mine Year -2 to 20 (**Table 4.12-11**) because of the changes in flows and the activities described above. At the EFSFSR Upstream of Sugar Creek location (13311250), Chinook salmon productivity would be reduced by an average of 18 percent over the same timeframe. At the EFSFSR at Stibnite site (1331100), in Mine Years 1 through 9 and Mine Year 11 would have increased Chinook salmon productivity, due to increased flows as a result of the construction and use of the RIBs, while all other Mine Years would have decreased productivity (with an average productivity decrease of approximately 2.8 percent over the mine life period of EOY -2 to 20).

Average annual changes in Chinook salmon productivity would be less than five percent (gain or loss) for all sites during the post-closure time period (Mine Years 21 to 118, **Table 4.12-11**). In general, from construction to post-closure, there is a predicted decrease in Chinook salmon productivity as a function of flow. As an exception, the EFSFSR upstream of Meadow Creek would see a slight increase. The predicted changes from baseline for each location, would be no more than 5 percent gain or loss.

4.12.2.3.4.3 Water Temperature Changes – Alternative 1

The effects of stream temperature changes on the four salmonid species that occur in the SGP mine site area were analyzed in a technical memorandum titled Stream Temperature Impacts on Fish, provided as **Appendix J-2**. The technical memorandum presents quantification of baseline habitat availability (in relation to stream temperature) for these species and analyzes the likely effects of changes to stream temperatures on available habitat as a result of implementation of the SGP. The following is a summary of the analysis and potential impacts from water temperature changes in streams at the mine site.

The four fish species, Chinook salmon, steelhead trout, bull trout, and cutthroat trout, each have different thermal requirements and/or limitations for their various life stages. The accepted stream temperature thresholds/ranges for life stages of each species were compiled from regulatory standards and other relevant literature and are presented in Tables 1 through 4 in **Appendix J-2**. The highest modeled temperatures (i.e., maximum weekly summer temperatures) from SPLNT modeling (Brown and Caldwell 2019a) for a stream reach were compared to accepted stream temperature thresholds/ranges to determine the baseline length of available habitat. Predicted stream temperatures from SPLNT modeling were used to forecast the potential changes to the amount of available habitat for each life stage and by EOYs 6, 12, 18, and post-closure year 112[1] for each of the action alternatives. Note that the SPLNT model did not consider the effects of climate change; modeled temperature results would likely be higher if climate change had been a factor in the model.

Table 4.12-12 presents the length of streams within selected relevant baseline temperature threshold categories for Chinook salmon life stages as well as at certain intervals throughout the SGP (Mine Years 6, 12, 18, and 112 [i.e., post-closure]). Detailed data for Chinook salmon under Alternative 1 is presented in Table 6 of **Appendix J-2**.

Table 4.12-12 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 1 – Chinook Salmon

Chinook Salmon Temperature Threshold Categories	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Adult Migration - Lethal (1-week exposure)	0.00 km	1.83 km (+1.83 km)	3.06 km (+3.06 km)	3.99 km (+3.99 km)	2.65 km (+2.65 km)
Adult Spawning - Field Observed Spawning Temperature	16.72 km	9.36 km (-7.36 km)	11.50 km (-5.22 km)	9.97 km (-6.75 km)	11.09 km (-5.63 km)
Incubation/Emergence - Optimal	4.99 km	3.08 km (-1.91 km)	2.88 km (-2.11km)	2.88 km (-2.11 km)	7.57 km (+2.58 km)

[1] As per Brown and Caldwell (2019a), EOY 6 is approximately halfway through mining operations, EOY 12 and EOY 18 are the start and end of full build-out at the end of active mining, and EOY 112 is the beginning of the post-closure timeline (after the mine facilities and permitted discharges have been removed, dewatering and mining have been discontinued, and the channels and vegetation have been fully reclaimed).

Chinook Salmon Temperature Threshold Categories	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Juvenile Rearing - Optimal	16.72 km	9.36 km (-7.36 km)	8.98 km (-7.74 km)	5.65 km (-11.07 km)	7.67 km (-9.05 km)
Common Summer Habitat Use - Optimal	16.72 km	4.37 km (-12.35 km)	3.10 km (-13.62 km)	5.65 km (-11.07 km)	7.67 km (-9.05 km)
Total Available Habitat	16.72 km	8.03 km (-8.69 km)	12.49 km (-4.23 km)	12.70 km (-4.02 km)	12.70 km (-4.02 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).
Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

The data presented in **Table 4.12-12** is summarized below.

- There would be a net increase in available habitat with lethal one-week exposure temperatures during operations and at post-closure.
- There would be a net decrease in available habitat within the optimal temperature range for spawning during operations and post-closure.
- There would be a net decrease in available habitat within the optimal temperature range for incubation/emergence during operations, but a net increase at post-closure.
- There would be a net decrease in available habitat within the optimal temperature range for juvenile rearing during operations and at post-closure.
- There would be a net decrease in available habitat within the optimal temperature range for common summer use during operations and at post-closure.
- Total available habitat for Chinook salmon decreases to varying degrees at points throughout the SGP and is anticipated to be lower than baseline at post-closure.

4.12.2.3.4.4 Critical Habitat – Alternative 1

Chinook salmon critical habitat at the mine site (shown in **Figure 3.12-6**) would be impacted by various activities from the SGP under Alternative 1, such as stream diversions around TSF/DRSF and pit footprints. The impacts would be related to physical stream channel changes, accidental hazardous material spills, and changes in WCIs – most importantly barriers, stream flow, and water temperature. Chinook salmon critical habitat outside the mine site also would be directly affected by culvert installations and would be at risk of accidental hazardous materials spills in the streams adjacent to the access roads.

Barriers to Chinook salmon critical habitat were evaluated in **Appendix J-3** at the mine site. At baseline natural access to Chinook salmon critical habitat is blocked by four fish passage barriers found within the analysis area (**Figure 3.12-13** and **Table 4.12-13**).

Table 4.12-13 Alternative 1 Length of Chinook Salmon Critical Habitat Above Each Fish Passage Barrier

Block ID	Chinook Salmon - Critical Habitat Blocked (km)					
	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20
EFSFSR Yellow Pine pit (02)	26.49	19.70	NB	NB	NB	NB
EFSFSR Box Culvert (203)	22.96	16.16	NB	NB	NB	NB
Fern Creek (205)	0.17	0.17	0.17	0.17	0.17	0.17
Meadow Creek (05)	6.80	NB	NB	NB	NB	NB
Meadow Creek TSF/DRSF	NB	5.51	5.51	5.51	5.51	5.51

Table Source: **Appendix J-3**, Barriers Technical Memorandum

Table Notes:

NB = barrier does not exist during that Mine Year.

km = kilometers (1 km = 0.62 mi).

EOY = End of Mine Year

Chinook salmon cannot currently migrate beyond the Yellow Pine pit lake cascade barrier (02). The Yellow Pine pit cascade barrier currently blocks approximately 26.5 km of the 27.7 km (95 percent) total available Chinook salmon critical habitat at baseline. The Yellow Pine pit barrier would be removed in Mine Year -1 with the construction of the EFSFSR tunnel opening up 19.70 km of naturally accessible Chinook salmon critical habitat. Similarly, the EFSFSR box culvert barrier also would be removed in Mine Year -1. By the end of Mine Year -1 the only remaining barrier hindering natural access to Chinook salmon critical habitat would be in Fern Creek (**Table 4.12-13**). By EOY -2, and continuing in perpetuity, with the diversion of Meadow Creek and then the subsequent construction of the TSF/DRSF, approximately 5.5 km of Chinook salmon critical habitat would be blocked and completely unusable even for translocated fish (**Table 4.12-13**).

4.12.2.3.4.5 Integration of Species/Habitat Effects for Chinook Salmon – Alternative 1

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs (e.g., temperature, streamflow) would negatively impact Chinook salmon and habitat in the analysis area under Alternative 1. SGP activities that would potentially cause these impacts include, but are not limited to, new road construction, transportation of hazardous materials, stream diversions, and construction and operation activities at the mine site. These effects may cause injury or mortality to individuals and temporarily or permanently displace

Chinook salmon from several mine site streams during certain periods when habitat conditions become unsuitable. This would cause a temporal loss of habitat.

A summary of the overall net impacts to Chinook salmon habitat and specific points regarding the impacts are provided below.

- **Net loss of IP habitat for Chinook salmon.** Post-closure, there would be a net loss of approximately 1.78 km (9.6 percent) of useable habitat. This is a change from approximately 18.61 km at baseline to 16.83 km in Mine Year 20.
- **Loss in Chinook salmon productivity as a result of changes to baseline streamflows.** In general, from construction of the mine to post-closure, there would be a decrease in Chinook salmon productivity as a function of water flow, except for EFSFSR upstream of Meadow Creek, which would see a slight increase. The predicted changes from baseline for each location, would be no more than 5 percent gain or loss. The largest impacts to productivity would be to Upper Meadow Creek where the model predicts a 100 percent reduction from baseline productivity throughout all phases of the SGP, including post-closure because Meadow Creek would be diverted around Hangar Flats pit footprint and then the TSF/DRSF would be constructed on top of this location.
- The Yellow Pine pit barrier would be removed in Mine Year -1 with the construction of the EFSFSR tunnel opening up 19.70 km of naturally accessible Chinook critical habitat. While existing fish passage barriers would be removed in Mine Year -1, two new barriers would be constructed in Mine Years 2 (Fiddle Creek DRSF diversion) and -2 (Meadow Creek TSF and Hangar Flats DRSF and Meadow Creek diversion) preventing upstream volitional passage.
- The increase in stream temperatures would result in a reduction in the amount of habitat with suitable water temperatures for both adult and juvenile Chinook salmon. Post-closure the amount of habitat with temperatures within the “Common summer habitat use – optimal” threshold would be reduced by 9.0 km, from 16.7 km at baseline to 7.7 km at Mine Year 112. The amount of habitat with optimal temperature for spawning would decrease during operations by up to 7.36 km and post-closure would remain 5.63 km below baseline. The amount of habitat with optimal temperatures for incubation/emergence would decrease during operations by up to 2.11 km, but would increase above baseline at closure, with a net gain of 2.58 km. The amount of habitat with optimal temperatures for juvenile rearing would decrease during operations, by up to 11.07 km, and at post-closure would remain 9.05 km below baseline.

Following closure and reclamation, the overall net effect from the SGP would be a loss of both quantity and quality of habitat for Chinook salmon.

The Forest Service has preliminarily determined that Alternative 1 will adversely affect Chinook salmon and their critical habitat. Informal Section 7 ESA consultation is ongoing with the NMFS.

4.12.2.3.5 STEELHEAD TROUT SPECIFIC IMPACTS − ALTERNATIVE 1

The following narrative summarizes the potential impacts to steelhead trout and habitat at the mine site from activities associated with the SGP. The following sections summarize the modeling and analysis complete for: IP habitat; water temperature changes; and critical habitat, and presents a summary of the effects (Integration of Species/Habitat Effects for Steelhead Trout) to steelhead trout and habitat.

4.12.2.3.5.1 Intrinsic Potential Modeling – Alternative 1

The following section summarizes the IP modeling results for steelhead trout. The full technical memorandum is provided as **Appendix J-4**.

Results are presented as the length of useable IP habitat per Mine Year and the percent change from baseline conditions for each Mine Year. For steelhead trout the habitat is rated as high, medium, and low. Percent change per Mine Year is based on the difference between that year and baseline conditions (% Change = [Mine Year 20 – baseline]/baseline). Useable habitat is defined as the combination of high, medium, and low.

Table 4.12-14 presents the IP modeling results for steelhead trout and **Figure 4.12-5** depicts the results graphically.

Table 4.12-14 Alternative 1 – Steelhead Trout Length of Stream Habitat per IP Rating and Percent Change between Baseline and Mine Year 20

	Length of Stream[1]							Change (EOY 20 - Baseline)[2]	
Intrinsic Potential Habitat[3]	Baseline	EOY -2	EOY -1	EOY 6	EOY 12	EOY 17	EOY 20	Loss/Gain (km)[4]	Change (%)[4]
High	8.04	7.11	8.76	8.76	10.17	11.48	10.89	+2.84	+35.3
Medium	0.60	0.445	0.42	0.41	0.41	1.69	1.50	+0.90	+149.6
Low	9.25	8.50	6.67	6.67	6.92	6.92	6.92	-2.33	-25.2
Total Usable	17.90	16.06	15.84	15.84	17.50	20.07	19.30	+1.41	+7.9

Table Source: **Appendix J-4**, Intrinsic Potential Modeling Technical Memoranda

Table Notes:

1 Results are presented as the length (km) of IP habitat per Mine Year during life of mine and post-closure.

2 The permanent change in IP is presented as the loss or gain (in km) of IP rated streams and the percent change per Mine Year is based on the difference between that year and baseline conditions (% Change = [Mine Year 20 – baseline]/baseline).

3 For Steelhead trout the IP is rated as high, medium, and low. ”Total Usable” IP habitat is defined as all of these classes combined (useable = high + medium + low) and does not consider whether the IP habitat is naturally available (i.e., migratory fish can use). ”None” indicates that there is no intrinsic potential to provide habitat for the species and is not shown in this table.

4 Change in IP habitat for both “Loss/Gain” and “Percent Change” is shown as negative (-) for loss of IP and positive (+) as a gain in IP.

IP = intrinsic potential; EOY = End of Mine Year.

km = kilometer (1 km = 0.62 mi).

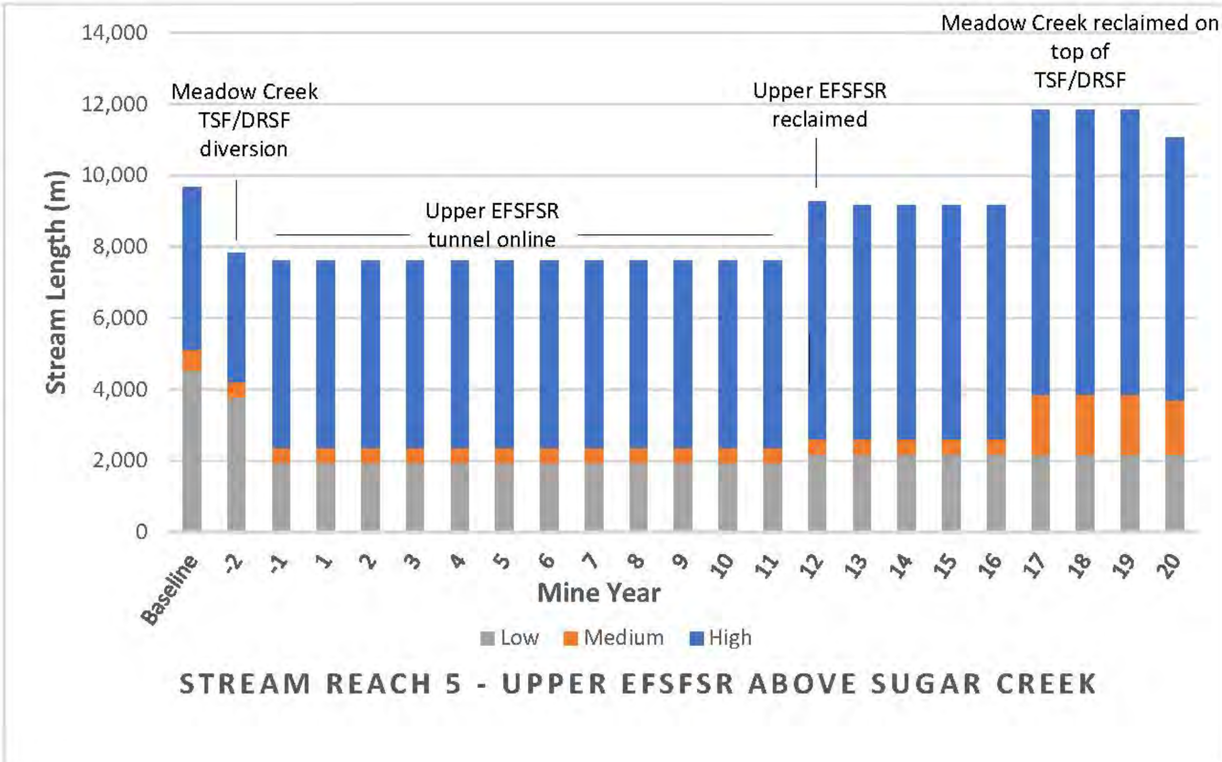


Figure Source: Appendix J-4, Intrinsic Potential Technical Memoranda, with modification.
Figure Notes: “None” IP rating not included in the figure.

Figure 4.12-5 Steelhead Trout Intrinsic Potential Habitat within the Study Area and per IP Rating for 22 Mine Years (Mine Year -2 to Mine Year 20)

As shown in **Table 4.12-14** and **Figure 4.12-5** there would be a decrease in low-quality IP habitat, and an increase in useable medium, and high-quality IP habitat when combined for steelhead trout from Mine Year 17 through post-closure.

Under baseline conditions IP habitat for steelhead trout are impeded by three fish passage barriers (**Table 3.12-25** and **Figure 3.12-13**). The EFSFSR box culvert and the Meadow Creek barrier are “partial” barriers indicating that these barriers may not exist at all flows. Therefore, steelhead trout IP habitat may not be blocked by these barriers as they spawn when flows are higher within the analysis area. The Yellow Pine pit lake cascade barrier currently blocks nearly 9 km of steelhead trout IP habitat at baseline. The Yellow Pine pit barrier would be removed in Mine Year -1 with the construction of the EFSFSR tunnel and similarly, the EFSFSR box culvert barrier also would be removed in Mine Year -1. By the end of Mine Year -1 no IP habitat would be blocked by barriers within the mine site.

There would be a net gain in available high-quality IP habitat (35.3 percent), and an increase in available medium-quality IP habitat (149.6 percent) post-closure for a total gain of 1.41 km of available IP habitat. Furthermore, the removal of existing passage barriers to volitional fish, specifically the gradient barrier at the Yellow Pine pit, would allow for access to habitat that is currently blocked.

4.12.2.3.5.2 Streamflow/Productivity Changes – Alternative 1

There was an attempt to complete a similar modeling analysis for streamflow productivity as was done for Chinook salmon (Section 4.12.2.3.4.2). An effort was made to recreate the streamflow-productivity analysis performed by NOAA in the Big Creek Diversion Biological Opinion (NMFS 2013). However, the results could not be replicated for steelhead trout and therefore the modeling has not been completed for this EIS.

4.12.2.3.5.3 Water Temperature Changes – Alternative 1

The effects of stream temperature changes on fish were analyzed and reported in a technical memorandum titled Stream Temperature Impacts on Fish, provided as **Appendix J-2**. Analysis methods used in this memorandum are summarized in Section 4.12.2.3.4.3, Water Temperature Changes – Alternative 1 (Chinook Salmon). The following is a summary of the analysis and results for steelhead trout under Alternative 1.

Table 4.12-15 presents the length of streams within selected relevant baseline temperature threshold categories (i.e., life stages) for steelhead trout predicted under Alternative 1, as well as certain intervals throughout the SGP (Mine Years 6, 12, 18, and 112 [i.e., post-closure]), which represent meaningful changes in length of available habitat. Complete data for steelhead trout under Alternative 1 are presented in Table 7 of **Appendix J-2**.

Table 4.12-15 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 1 – Steelhead Trout

Steelhead Trout Temperature Threshold Categories	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Juvenile Rearing - Optimal	2.13 km	9.36 km (+7.23 km)	8.98 km (+6.85 km)	5.65 km (+3.52 km)	7.67 km (+5.54 km)
Common Summer Habitat Use - Optimal	2.13 km	5.88 km (+3.75 km)	8.98 km (+6.85 km)	6.31 km (+4.18 km)	7.67 km (+5.54 km)
Total Available Habitat	2.13 km	11.19 km (+9.06 km)	12.49 km (+10.36 km)	12.7 km (+10.57 km)	12.7 km (+10.57 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).

Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

It is anticipated that water temperature increases under Alternative 1 would result in a net increase in suitable habitat for steelhead trout.

Specifically, **Table 4.12-15** shows the following:

- A net increase in habitat within the optimal temperature ranges for juvenile rearing and common summer habitat use during operations and at post-closure; and
- Total habitat availability for this species increases to varying degrees throughout the SGP and is anticipated to be higher than baseline at post-closure.

4.12.2.3.5.4 Critical Habitat – Alternative 1

As shown on **Figure 3.12-8**, there is no steelhead trout critical habitat at the mine site; however, impacts from SGP activities at the mine site and those caused by the access roads, transmission lines, or off-site facilities could impact steelhead critical habitat. Sugar Creek is not part of the mine site analysis area.

Access road culvert replacements and new culverts would cause temporary disturbances of critical habitat and increase the risk of erosion and sedimentation. The transportation of hazardous materials on access roads and throughout the mine site would increase the risk of spills adjacent to critical habitat or in streams/rivers that flow into critical habitat in the EFSFSR, Johnson Creek, and streams adjacent to Warm Lake Road (CR 10-579). A total of 102 km of steelhead trout critical habitat along the Yellow Pine Route would be at risk as compared to 18 km along the Burntlog Route. The waterways along the Yellow Pine Route would be at the highest risk until the completion of the Burntlog Route, approximately 2 years, when the risk would shift to the Burntlog Route.

Culvert and/or bridge work would be required for both the Yellow Pine Route and Burntlog Route. New structures would be installed on the Burntlog Route and structure repair or replacement would occur on existing roads (i.e., Yellow Pine Route). New culverts would be designed to maintain fish passage and access to upstream habitat. Where existing structures are upgraded or replaced, they also would be designed to allow for fish passage and could therefore be establishing access for steelhead trout to upstream habitat.

The gradient barrier at the Yellow Pine pit lake cascade is currently restricting access for steelhead trout to habitat upstream. However, no critical habitat is identified for steelhead trout upstream of the barrier. The removal of the Yellow Pine pit barrier at Mine Year -1, would provide access to fish to naturally move upstream. This would create a gain in quantity and quality of available habitat regardless of the lack of identified critical habitat for steelhead trout upstream of the Yellow Pine pit barrier.

A complete list of existing and anticipated complete and partial barriers is provided in **Table 4.12-6**.

4.12.2.3.5.5 Integration of Species/Habitat Effects for Steelhead Trout – Alternative 1

The combination of physical stream channel changes (e.g., diversions and new construction), direct effects to individuals, and changes to many of the WCIs (e.g., water temperature, streamflow) would affect steelhead trout and habitat in the analysis area. Certain potential negative effects to fish and fish habitat are expected to be less intense for steelhead trout than those anticipated for Chinook salmon, or in some cases improve future habitat conditions to better than the baseline conditions. Despite some improvement to access, there remains potential effects which may cause injury or mortality to individuals and temporary displacement of steelhead trout from several mine site streams during certain periods when habitat conditions become unsuitable. This would cause a temporal loss of habitat.

Following closure and reclamation, the net effect would be an increase in both the quantity and quality of habitat for steelhead trout.

- **Net gain for steelhead trout IP habitat:** There would be a gain of useable IP habitat of 1.4 km (7.9 percent) from 17.9 km at baseline to 19.3 km at EOY 20.
- By Mine Year -1, steelhead trout would gain access to naturally move upstream to 8.53 km of habitat that is currently blocked by barriers. However, also occurring in Mine Year -1, access to 1.91 km of steelhead trout IP habitat in upper Meadow Creek would be blocked by a diversion and in-perpetuity by the TSF/DRSF.
- The predicted increase in stream temperatures would result in an increase in the amount of available habitat with stream temperatures suitable to support the life processes of both adult and juvenile steelhead trout. Post-closure the amount of useable habitat with temperatures within the “Common summer habitat use – optimal” threshold also would be increased by 5.4 km, from 2.13 km at baseline to 7.67 km post-closure.

The Forest Service has preliminarily determined that Alternative 1 will adversely affect steelhead trout and their critical habitat. Informal Section 7 ESA consultation is ongoing with the NMFS.

4.12.2.3.6 BULL TROUT SPECIFIC IMPACTS – ALTERNATIVE 1

The following narrative summarizes the mine site-specific impacts of the SGP on bull trout. These narratives address: occupancy modeling (OM), streamflows, water temperature changes, loss of lake habitat, critical habitat, and presents a summary of the effects (Integration of Species/Habitat for Bull Trout – Alternative 1).

4.12.2.3.6.1 Occupancy Modeling – Alternative 1

An OM was developed to quantify potential habitat for bull trout and cutthroat trout. See Section 3.12.4.4.5, Occupancy Modeling – Bull Trout, for a summary description of the OM methodology and baseline conditions. The full technical memorandum for the OM is provided as **Appendix J-7**.

The following subsections summarize the results of the OM for bull trout under Alternative 1 for selected mine years.

Occupancy Probabilities

The OM calculates occupancy probabilities based on the combination of three independent variables important to bull trout: stream flow, stream temperature, and channel slope. The continuous range of occupancy probabilities are represented in percentages, from 0 percent to 100 percent for each reach. **Table 4.12-16** presents the OM-derived distance-weighted average occupancy probabilities for bull trout by stream reach under Alternative 1 for five different time periods: Baseline, EOY 6, EOY 12, EOY 18, and EOY 112. EOY 6 is approximately halfway through mining operations, EOY 12 is near the end of operational mining, EOY 18 is at the beginning of closure and reclamation, and EOY 112 is post-closure. Stream Reach 4 (EFSFSR between Sugar Creek and Profile Creek) and Stream Reach 6 (Sugar Creek) were not included in this analysis because it focuses on changes or impacts at the mine site.

Table 4.12-16 Distance Weighted Average Bull Trout Occupancy Probabilities for Selected Modeled Mine Years in Each Stream Reach under Alternative 1

Stream Reach	Baseline	EOY 6	EOY 12	EOY 18	EOY 112
Stream Reach 1 (EFSFSR upstream of Sugar Creek to Meadow Creek)	9.51%	10.63%	9.52%	6.91%	8.40%
Stream Reach 2 (Meadow Creek Watershed)	6.27%	5.66%	5.17%	3.61%	4.76%
Stream Reach 3 (EFSFSR upstream of Meadow Creek)	9.34%	8.71%	8.57%	8.67%	8.81%
Stream Reach 5 (Headwaters of EFSFSR watershed)	8.31%	8.42%	8.19%	6.43%	7.27%

Table Source: **Appendix J-7**, Occupancy Modeling Technical Memoranda

Table Notes:

EOY = End of Mine Year.

Stream channel alterations described in Section 4.12.2.3.1, Physical Stream Channel Changes – Alternative 1, would impact occupancy probabilities for bull trout in the OM model area. The largest reduction in bull trout occupancy probability would occur in Stream Reach 1 and Stream Reach 2 in EOY 18 following the construction of the channel on top of the TSF/DRSF when Meadow Creek flows would be re-routed from the diversion to the channel and to the Hangar Flats pit lake.

Length of Available Habitat

Table 4.12-17 presents the length of available habitat for bull trout from baseline select modeled years by stream reaches.

Table 4.12-17 Average Length of Available Bull Trout Habitat for Selected Modeled Mine Years in Each Stream Reach under Alternative 1

Stream Reach	Baseline (km)	EOY 6 (km)	EOY 12 (km)	EOY 18 (km)	EOY 112 (km)
Stream Reach 1 (EFSFSR upstream of Sugar Creek to Meadow Creek)	10.45	6.15	10.30	10.43	10.43
Stream Reach 2 (Meadow Creek Watershed)	15.10	6.61	6.61	14.61	14.61
Stream Reach 3 (EFSFSR upstream of Meadow Creek)	16.15	16.15	16.15	16.15	16.15
Stream Reach 5 (Headwaters of EFSFSR watershed)	41.70	28.91	33.07	41.19	41.19

Table Source: **Appendix J-7**, Occupancy Modeling Technical Memoranda

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).

The largest decreases of available potential habitat for bull trout are projected to occur from baseline to Mine Year 6 in Stream Reach 1 and Stream Reach 2. During this period the main activities that contribute to the loss of potential habitat in these areas are the diversion of Meadow Creek around the TSF/DRSF footprint, the construction of the French drain on Blowout Creek and the EFSFSR tunnel, and dewatering of the Yellow Pine pit lake; all occurring in Mine Year -1. The length of available habitat in these areas would increase at EOY 18 following construction of Meadow Creek on top of the TSF/DRSF.

Mine actions (e.g., EFSFSR tunnel), stream enhancement, and restoration implemented by Mine Year 18 would result in all major fish passage blockages being removed by that time. Major barriers associated with the Yellow Pine pit and the box culvert would be removed by Mine Year 6, barriers that restrict access to Hennessey Creek and Fiddle Creek would be removed by Mine Year 12. Any remaining available habitat blockages would occur only in non-enhanced reaches (Fern Creek) and TSF/DRSF (Meadow Creek and Fiddle Creek) high-gradient areas where fish cannot naturally access the available habitat. These two areas, Fiddle Creek (approximately 4 km) and Upper Meadow Creek (approximately 10 km), would remain blocked in perpetuity due to the high-gradient stream segments flowing off the TSF/DRSF or Fiddle DRSF.

Based on the current known extent of bull trout occupancy, bull trout may be extirpated from the reaches upstream of the TSF/DRSFs when the reaches within the footprint would be dewatered and flow would be diverted into the diversions that route water around the facilities. With no evidence that bull trout occur in small headwater streams upstream of the proposed TSF, and the gradient barriers that would be created on the TSF/DRSF, there would be no mechanism by which bull trout would be able to volitionally (i.e., naturally) recolonize the reaches on top of the TSF/DRSF.

Access for bull trout to available habitat is further discussed in the associated technical memorandum provided in **Appendix J-3,** Barriers Technical Memorandum.

4.12.2.3.6.2 Stream Flows (Physical Habitat Simulation [PHABSIM]) – Alternative 1

The potential effects of stream flow changes to bull trout and bull trout habitat were assessed using Physical Habitat Simulation System (PHABSIM) data collected by the Forest Service on several streams in the EFSFSR near the mine site in the late 1980s and early 1990s as part of the Snake River Adjudication (Fifth Judicial District, State of Idaho 2014). The following section summarizes the results for Alternative 1. The full technical memorandum, including methods and complete results, is provided as **Appendix J-8,** PHABSIM Technical Memorandum. For a summary of the model methodology see Section 3.12.4.4.6, Stream Flows (Physical Habitat Simulation (PHABSIM).

PHABSIM is a specific model designed to calculate an index of the amount of microhabitat available for target organisms and life stages at different flow levels, incorporating two major analytical components: stream hydraulics and organism/life stage-specific habitat requirements. The habitat parameters are water depth, water velocity, and stream substrate, which are used to quantify habitat for multiple fish life stages. The habitat output measure is Weighted Usable Area (WUA).

Because the SGP-associated flow impacts are focused on the low-flow period (for this analysis defined as August-March), the three lowest flows were utilized, as they most closely represent reduction from baseflow, which is when the SGP would have its largest flow impacts (based on percentage of flow). The percent change in modeled flows associated with the alternatives were then summarized for selected mine site locations.

The quantification of potential SGP impacts on bull trout habitat, as defined by WUA, is dependent on several factors. One important factor is the predicted change in baseline flows that would occur in the various mine site stream reaches. Unique changes would occur in each reach throughout the SGP life. Another factor is the non-linear relationship between flow and WUA for each fish life stage. The PHABSIM model predicts separate habitat values for all species and all life stages of interest for several stream flow rates, which when viewed graphically, represent a non-linear relationship. To simplify the WUA-based impact assessment, two adjustments were made to the available information. First, the analysis centered on the low-flow period of the year (defined as the months of August-March) under the assumption that SGP-induced changes in streamflow would have their greatest effect on fish habitat during this period. Secondly, as shown in **Table 4.12-18**, the WUA for different life stages of bull trout were determined for three key flows that were representative of discharge rates in low-flow period: the mean discharge rate, a lower rate close to the minimum discharge rate value for the period, and a mid-point rate. For each of the three discharge rates and Stream Index, **Table 4.12-18** provides the WUA value for four bull trout life stages, along with a percentage reduction in WUA relative to the mean discharge rate WUA value.

Each mine site Stream Reach was assigned to an index:

Index 1: Stream Reach 3: EFSFSR upstream of Meadow Creek
Stream Reach 2: Meadow Creek and East Fork Meadow Creek;

Index 2: Stream Reach 1: EFSFSR between Sugar Creek and Meadow Creek
Stream Reach 6: Sugar Creek;

Index 3: Stream Reach 4: EFSFSR between Sugar Creek and Profile Creek.

Table 4.12-18 Bull Trout WUA for the Mean Low-Flow-Period Discharge Rate and Two Lower Discharge Rates, at Three Representative Stream Index Sites and Sugar Creek

Stream Index	Discharge		Weighted Usable Area (WUA)[1]							
	cfs[2]	% Change	Adult	% Change	Fry	% Change	Juvenile	% Change	Spawning	% Change
1: Summit Creek	7.8[3]	--	2505	--	ND	N/A	5940	--	0	N/A
	4.4	-44	1451	-42	ND	N/A	3524	-41	0	N/A
	1.0	-87	261	-90	ND	N/A	635	-89	0	N/A
2: Sugar Creek	9.9	--	1176	--	ND	N/A	2709	--	2127	--
	5.4	-46	746	-37	ND	N/A	1811	-33	1443	-32
	1.0	-90	144	-88	ND	N/A	351	-87	66	-97
2: Five Stream Means	12	--	1059	--	ND	N/A	2490	--	2544	--
	6.5	-47	644	-40	ND	N/A	1563	-39	1600	-33
	1.0	-91	76	-94	ND	N/A	185	-94	48	-98
3: EFSFSR below Sugar Creek	63	--	2184	--	ND	N/A	4900	--	0	N/A
	44	-30	1846	-15	ND	N/A	4340	-11	0	N/A
	25	-60	1108	-49	ND	N/A	2690	-45	0	N/A

Table Source: **Appendix J-8**, PHABSIM Technical Memorandum

Table Notes:

1 WUA = Weighted Usable Average, is defined as the sum of stream surface area within a study site, weighted by multiplying area by habitat suitability variables (most often velocity, depth, and substrate or cover), which range from 0.0 to 1.0 each, and normalized to square units (either feet or meters) per 1000 linear units.

2 Discharge is measured in cfs.

3 The underlined value is the mean low-flow-period discharge rate.

Five Representative Streams for Index 2: Monumental, Sugar, Tamarack, Quartz, and Profile creeks.

cfs = cubic feet per second; ND: No data were available from the PHABSIM study; N/A: not applicable.

The data summarized in the **Table 4.12-18** for the representative index streams represent a simplification of the streamflow versus WUA dynamics that can be used to infer general changes in bull trout WUA resulting from changes in discharge rates in the mine site stream reaches. For example, Meadow Creek and the EFSFSR upstream of Meadow Creek are represented by Stream Index 1, both of which are similar to the Summit Creek site of the PHABSIM study. The mean low-flow period discharge rate for Summit Creek is 7.8 cfs. Using this same example, discharge rates of 4.4 and 1 cfs represent a 44 percent and 87 percent reduction in flow, respectively. The corresponding reduction in adult WUA associated with these discharge rate reductions there is an expected reduction in WUA of 42 percent and 90 percent, respectively. By comparison, juvenile WUA would be reduced by 41 and 89 percent, respectively.

Given the general relationships between stream discharge and bull trout habitat provided in **Table 4.12-18** impacts can be inferred from changes in discharge at the mine site stream reaches. **Table 4.12-19** presents the percentage in modeled flows for the low-flow period for selected locations within the mine site under Alternative 1.

Table 4.12-19 Alternative 1 Change in Streamflow for the Low-Flow Period for Active Mine Years and Post-closure

Mine Year	EFSFSR Upstream of Sugar Creek (Index 2 Stream) %	Sugar Creek (Index 2 Stream) %	EFSFSR Upstream of Meadow Creek (Index 1 Stream) %	Meadow Creek (Index 1 Stream) %
-1	-7.5	1.1	-0.1	-23.0
1	-16.9	3.3	1.3	-12.6
2	-19.0	2.5	1.1	-9.6
3	-26.9	3.7	1.3	-11.0
4	-25.6	4.0	1.3	-10.0
5	-24.2	3.6	1.8	-8.7
6	-24.7	3.8	2.1	-8.3
7	-19.4	3.7	4.7	-41.6
8	-14.9	3.0	6.1	-52.3
9	-23.1	3.9	5.1	-65.5
10	-22.8	3.0	4.1	-66.3
11	-20.1	3.7	4.1	-64.3
12	-10.2	5.5	4.0	-49.7
13	-45.6	-19.3	0.2	-83.9
14	-39.3	-12.1	-0.1	-90.4
15	-31.5	-9.0	-0.1	-71.7
16	-30.4	-11.9	-0.1	-64.6
17	-26.4	-11.0	-0.3	-53.1

Mine Year	EFSFSR Upstream of Sugar Creek (Index 2 Stream) %	Sugar Creek (Index 2 Stream) %	EFSFSR Upstream of Meadow Creek (Index 1 Stream) %	Meadow Creek (Index 1 Stream) %
18	-19.3	-8.4	-0.7	-36.7
19	-11.6	-6.3	0.0	-23.7
20	-4.0	-8.8	0.0	4.6
Post-Closure	-2.1	-0.4	-0.3	2.8

Table Source: **Appendix J-8**, PHABSIM Technical Memorandum

Table Notes:

The Low-Flow Period for Post-closure is defined as average of Mine Years 21 through 118. Numbers represent percent change in streamflow; negative numbers indicate a reduction in streamflow while positive numbers indication an increase in streamflow. Sugar Creek is summarized by itself because data were available for Sugar Creek. There is a relationship between percent change in flow and the amount of available habitat per species and life stage.

Table 4.12-19 shows that the changes in discharge during the low-flow period in the different mine site reaches under Alternative 1 varies as a function of Mine Year and the SGP activities occurring during those years. The most common changes are reductions in discharge, which are generally associated with the use of surface water for mining purposes, including the filling of the Hangar Flats pit in the Meadow Creek subwatershed (Mine Years 12 through 14). There also are years when stream reaches at the mine site would experience increases in discharge rate, largely due to groundwater pumping to provide water for the worker housing facility and other mining activities. According to the modeled PHABSIM habitat data, as stream discharge declines so does bull trout useable habitat for the various life history stages evaluated.

The largest change in streamflow is expected to occur at Meadow Creek between Mine Year 7 and Mine Year 19, a 13-year period when discharges are predicted to decrease because of several activities including the diversion of Upper Meadow Creek around the footprint of the TSF/DRSF and Hangar Flats pit and the operation (i.e., filling) of the TSF/DRSF. These decreases would occur in the lower portion downstream of the Meadow Creek TSF/DRSF. For Stream Index 1, representing Stream Reach 2 and 3, the PHABSIM results predict a roughly 40 percent to 90 percent reduction in adult and juvenile WUA for bull trout. Bull trout habitat reductions during the 13-year period would negatively affect the bull trout in Meadow Creek. After mining activities are complete in Mine Year 20, Meadow Creek flows and adult/juvenile bull trout WUA are expected to rise by a small amount.

More moderate changes in streamflow are expected in Stream Reach 1, the EFSFSR between Meadow Creek and Sugar Creek. For this reach, the 2 years with the greatest reductions in flow under Alternative 1 would be Mine Year 13 and 14, which would experience 47 percent and 39 percent reductions, respectively. This is likely for the same reasons described above (e.g., filling of Hangar Flats pit lake). The PHABSIM model predicted a roughly 40 percent reduction in adult and juvenile bull trout WUA during these 2 years. Very low reductions in WUA are expected post-closure.

The two stream reaches in the mine site that are not expected to experience meaningful reductions in bull trout useable habitat under Alternative 1 are Sugar Creek and the EFSFSR upstream of Meadow Creek. This is likely because there are no expected SGP activities within this reach that would impact stream flows.

4.12.2.3.6.3 Water Temperature Changes – Alternative 1

The following is a summary of the analysis and results for bull trout from the Stream Temperature Impacts on Fish Technical Memorandum, provided as **Appendix J-2**. Analysis methods used in this memorandum also are summarized in Section 4.12.2.3.4.3, Water Temperature Changes – Alternative 1 (Chinook Salmon).

It is anticipated that water temperature increases under Alternative 1 would result in a net decrease in suitable habitat for bull trout life stages during mine operations and post-closure. **Table 4.12-20** presents the length of streams within selected relevant baseline temperature threshold categories for bull trout life stages under Alternative 1 as well as at certain intervals throughout the SGP (Mine Years 6, 12, 18, and 112 [i.e., post-closure]). Detailed data for bull trout under Alternative 1 is presented in Table 9 of **Appendix J-2**.

Table 4.12-20 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 1 – Bull Trout

Bull Trout Temperature Threshold Categories	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Adult Spawning – Functioning Appropriately (FA)	1.61 km	0.00 km (-1.61 km)	0.00 km (-1.61 km)	0.00 km (-1.61 km)	0.00 km (-1.61 km)
Adult Spawning - Functioning at Risk (FR)	8.69 km	3.08 km (-5.61 km)	5.45 km (-3.24 km)	3.67 km (-5.02 km)	4.41 km (-4.28 km)
Adult Spawning - Functioning at Unacceptable Risk (FUR)	18.69 km	10.25 km (-8.44 km)	11.72 km (-6.97 km)	12.42 km (-6.27 km)	11.68 km (-7.01 km)
Incubation/Emergence - FUR	28.99 km	13.33 km (-15.66 km)	17.17 km (-11.82 km)	16.09 km (-12.90 km)	16.09 km (-12.9 km)
Juvenile Rearing - FA	13.66 km	6.41 km (-7.25 km)	6.41 km (-7.25 km)	5.86 km (-7.80 km)	5.86 km (-7.80 km)
Juvenile Rearing - FR	12.89 km	0.83 km (-12.06 km)	3.81 km (-9.08 km)	1.61 km (-11.28 km)	2.58 km (-10.31 km)

Bull Trout Temperature Threshold Categories	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Juvenile Rearing - FUR	2.44 km	6.09 km (+3.65 km)	6.95 km (+4.51 km)	8.62 km (+6.18 km)	7.65 km (+5.21 km)
Common Summer Habitat Use - Spawning Initiation	8.66 km	6.41 km (-2.25 km)	6.41 km (-2.25 km)	5.86 km (-2.80 km)	5.86 km (-2.80 km)
Total Available Habitat	28.99 km	13.33 km (-15.66 km)	17.17 km (-11.82 km)	16.09 km (-12.9 km)	16.09 km (-12.9 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).

Temperatures are in °C.

Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

Specifically, **Table 4.12-20** shows:

- A net decrease in habitat within the "functioning appropriately" category for adult spawning and juvenile rearing;
- A net decrease in habitat within the "functioning at risk" category for adult spawning and juvenile rearing;
- A net decrease in habitat within the "functioning at unacceptable risk" category for adult spawning and incubation/emergence;
- A net increase in habitat within the "functioning at unacceptable risk" category for juvenile rearing;
- A net decrease in habitat within the optimal temperature range for spawning initiation; and
- Total habitat availability for this species decreases to varying degrees at points along the timeline of the SGP and is anticipated to be lower than baseline at post-closure.

4.12.2.3.6.4 Loss of Lake Habitat for Bull Trout – Alternative 1

Lake habitat available to bull trout in the South Fork Salmon River (SFSR) watershed would be affected by the proposed actions under Alternative 1. **Appendix J-9**, Bull Trout Use of Lake Habitat Technical Memorandum, provides a detailed summary and analysis of the current use of lake habitat by bull trout at the mine site and a comparison of the Yellow Pine pit lake to the Hangar Flats pit lake.

The existing bull trout habitat in the Yellow Pine pit lake would be permanently lost, as the lake would be dewatered, the pit mined, and backfilled in post-closure. The EFSFSR stream channel would be constructed over the top of this area in its place. There would be a loss of lake habitat for bull trout at the mine site for approximately 20 years, from Mine Year -1 when the diversion through the EFSFSR tunnel begins to Mine Year 20 when it is estimated that the Hangar Flats pit lake would become useable habitat.

The USFWS determined that the SFSR watershed contains approximately 1,220 km of streams and 260 hectares of lakes that are critical habitat for bull trout, including 52 km of the EFSFSR, including the Upper EFSFSR and Meadow Creek (USFWS 2010). The critical habitat does not include the Yellow Pine pit lake. The Yellow Pine pit lake supports the adfluvial and fluvial life history patterns of bull trout (Brown and Caldwell 2019b; Burns et al. 2005; Hogen and Scarnecchia 2006). Spatial and temporal patterns of bull trout were assessed in the EFSFSR in 2006 (Hogen and Scarnecchia 2006), which found only 8.1 percent of bull trout overwintered in the Yellow Pine pit lake, with most of the bull trout migrating downstream to the larger river to overwinter in pools and deep runs. Bull trout that overwintered in the Yellow Pine pit lake migrated to smaller tributaries to spawn and returned to the lake afterwards. The Yellow Pine pit lake is used by bull trout primarily for general use (feeding, refugia) and overwintering.

Hangar Flats pit lake would be created by routing flow from Meadow Creek into the pit. The new pit lake, expected to be filled between Mine Years 17 and 18, would have connectivity to EFSFSR watershed and would be available lake habitat for bull trout. **Table 4.12-21** summarizes the differences between Hangar Flats and Yellow Pine pit lake habitat.

Table 4.12-21 Comparison of Hangar Flats Pit Lake and Yellow Pine Pit Lake

Habitat Feature	Yellow Pine Pit Lake	Hangar Flats Pit Lake[1]
Water Temperature (°C)	Spring: 5.8 – 5.9 Summer: 11.4 – 13 Fall: 6.3 – 7.8	Summer: 16.9[2] Fall: 13.2[2]
Surface Area (hectares)	2	27.4
Maximum Depth (m)	13.7	179.8
Upstream available fish habitat (km)	39.48	10[3]
Connectivity to Streams	Connected at the outlet to EFSFSR year-round (late summer-fall base flow +/- 12 cfs); no upstream fish passage	Periodic stream connectivity for both inflow and outflow (discharge estimates of 0-1.9 cfs in summer and 0 and 0.84 cfs in fall)

Table Source: **Appendix J-9**, Bull Trout Use of Lake Habitat Technical Memorandum

Table Notes:

1 Predicted information for Hangar Flats pit lake.

2 Mean maximum.

3 There would be 10 km of available fish habitat above Hangar Flats pit lake; however, most of it (just upstream of the pit lake) would not naturally accessible to fish because of the steep gradient barrier at the TSF/DRSF.

cfs = cubic feet per second.

Temperatures are in °C; m = meters (1 m = 3.28 ft); km = kilometers (1 km = 0.62 mi); 1 hectare = 2.71 acres.

After approximately 20 years of no available lake habitat, lake habitat would be accessible for at least part of the year at the Hangar Flats pit lake. Under the final configuration at post-closure, Meadow Creek would flow into the Hangar Flats pit lake and the lake would discharge into lower Meadow Creek, therefore it is expected that bull trout would have access to the Hangar Flats pit lake.

The depth of Hangar Flats pit lake would be deeper than the Yellow Pine pit lake, though the mean water temperatures would be warmer. At depths greater than 9.8 meters the temperature profile of Hangar Flats pit lake would be cold enough to support bull trout year-round post-closure.

Modeled water temperatures at the outflow of Hangar Flats pit lake are predicted to be between the mean maximum 16.9°C during the summer period and between 13.2°C during the fall. These model results indicate that surface temperatures in Hangar Flat pit lake would exceed the temperature guidelines for bull trout during both periods. The unsuitable surface water temperatures at the outflow at certain times of the year would likely impede movement for bull trout to and from Hangar Flats pit lake.

The expected flow discharge also may restrict migration into and out of the Hangar Flats pit lake during some periods, unlike the Yellow Pine pit lake, as the EFSFSR has a larger discharge throughout the year compared to Meadow Creek. Research done on bull trout use of the Yellow Pine pit lake (Brown and Caldwell 2019a) indicated they are highly migratory and move in and out of the Yellow Pine pit lake during the summer and fall periods. If water temperatures and flow rates restrict this movement, the utilization of Hangar Flats pit lake by adfluvial bull trout may be limited.

Forage conditions at the Hangar Flats pit lake also are expected to be different than at the Yellow Pine pit lake. Adult bull trout are highly piscivorous (i.e., fish eating) and the availability of suitable prey species affects the quality of lake habitat for large adult bull trout. Based on the results of Occupancy Modeling (**Appendix J-7**), there would be 10 km of available fish habitat upstream of Hangar Flats pit lake for prey species of bull trout to reside in; however, most of this would be blocked to upstream and downstream fish movement by the high gradient at the TSF/DRSF. Some of these fish may still move down the face of the TSF/DRSF either voluntarily or involuntarily. The amount of habitat upstream of the Hangar Flats pit lake is relevant as it would affect the quantity of food (prey) available to adult bull trout.

The Yellow Pine pit lake fish sampling conducted in 2018 and 2019 found a large population of mountain whitefish, which are a likely prey fish for adult bull trout (Brown and Caldwell 2019b). With the closure of the Yellow Pine pit lake and creation of the Hangar Flats pit lake, there also would be a loss of this food base for adult bull trout unless a comparable mountain whitefish population is established through natural migration and colonization.

Though the quantity of lake habitat available to bull trout would be greater than baseline conditions, the expected changes to stream flow, water temperature, access to habitat, and prey species input would result in a decline of the quality of habitat available for bull trout.

4.12.2.3.6.5 Critical Habitat – Alternative 1

Bull trout critical habitat at the mine site would be affected by the physical stream channel changes and changes in WCIs – most importantly barriers, flow, and water temperature.

Critical habitat outside of the mine site also would be directly affected by culvert installations and would be at risk of accidental hazardous materials spills in the streams adjacent to the access roads. A total of 33.7 km of bull trout critical habitat would be at risk along the Yellow Pine Route; and a total of 5.7 km of bull trout critical habitat would be at risk along the Burntlog Route.

Access to critical habitat was evaluated in the technical memorandum provided in **Appendix J-6**. Fish habitat changes were compared to baseline conditions for EOY -2, -1, 12, 17, and 20 (**Table 4.12-22**).

Table 4.12-22 Alternative 1 Length of Bull Trout Critical Habitat Available Above Each Fish Passage Barrier

Barrier Block ID	Bull Trout - Critical Habitat Blocked (km)					
	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20
EFSFSR Yellow Pine Pit (02)	17.11	11.71	NB	NB	NB	NB
EFSFSR Box Culvert (203)	13.78	9.12	NB	NB	NB	NB
Meadow Creek (05)	5.39	NB	NB	NB	NB	NB
Meadow Creek diversion and TSF/DRSF	NB	NB	4.67	4.67	4.67	4.67

Table Source: **Appendix J-3**, Barriers Technical Memorandum

Table Notes:

km = kilometer (1 km = 0.62 mi); EOY = End of Mine Year; NB = No Barrier

Most notably, the gradient barrier at Yellow Pine pit lake blocks over 17.1 km of the 18.4 km (93 percent) total available habitat for migratory bull trout. However, the Yellow Pine pit gradient barrier would be removed in Mine Year -1 with the construction of the EFSFSR tunnel.

With the diversion and subsequent construction of Meadow Creek on top of the TSF/DRSF starting at Mine Year -1, a would be created at the point of diversion and then at the embankment of the TSF/DRSF. These new barriers would permanently block access upstream to 4.67 km of critical habitat (**Table 4.12-22**). This barrier also would represent a barrier to downstream movement of fish as well. At post-closure, there would a small net gain of critical habitat for bull trout of 1.37 km.

4.12.2.3.6.6 Integration of Species/Habitat Effects for Bull Trout – Alternative 1

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs would negatively affect bull trout in the analysis area. Some SGP activities may improve access to habitat from baseline conditions. Despite some improvement to access, there remain some potential effects associated with Alternative 1 that may cause injury or mortality to individuals and permanent displace bull trout from the analysis area.

Post-closure, a net decrease in quality and quantity of bull trout habitat would occur despite removal of passage barriers and an increase of lake habitat for bull trout including:

- The largest decreases of available potential habitat for bull trout are projected to occur from baseline to Mine Year 6 in Stream Reach 1 (10.45 km at baseline to 6.15 EOY 6) and Stream Reach 2 (15.10 km at baseline to 6.61 EOY 6). The main activities that contribute to the loss of potential habitat in these areas are the diversion of Meadow Creek around the TSF/DRSF footprint, the construction of the French drain on Blowout Creek and the EFSFSR tunnel, and dewatering of the Yellow Pine pit lake; all occurring in Mine Year -1. The length of available habitat in these areas would increase at EOY 18 following construction of Meadow Creek on top of the TSF/DRSF; however it would remain approximately 0.5 km less than baseline.
- The largest change in streamflow (PHABSIM results) is expected to occur at Meadow Creek between Mine Year 7 and Mine Year 19, a 13-year period when discharges are predicted to decrease because of several activities including the diversion of Upper Meadow Creek around the footprint of the TSF/DRSF and Hangar Flats pit and the operation (i.e., filling) of the TSF/DRSF. These decreases would occur in the lower portion downstream of the Meadow Creek TSF/DRSF. After mining activities are complete in Mine Year 20, Meadow Creek flows and adult/juvenile bull trout WUA are expected to rise by a small amount.
- The increase in stream temperatures would result in a net loss of suitable habitat for bull trout adults and juveniles, particularly in Meadow Creek. Post-closure the amount of habitat with temperatures within the “Common summer habitat use – spawning initiation” threshold would be reduced by 2.8 km. The amount of habitat with temperatures “functioning acceptably” for juvenile rearing would be reduced by 7.8 km.
- In Mine Year -1 access to 4.67 km of bull trout critical habitat in upper Meadow Creek would be blocked in-perpetuity by the diversion of Meadow Creek around the TSF/DRSF footprint and then by the completion of the TSF/DRSF, which would become a gradient barrier to upstream and downstream fish passage.

The Forest Service has preliminarily determined that Alternative 1 will adversely affect bull trout and their critical habitat. Informal Section 7 ESA consultation is ongoing with the USFWS.

4.12.2.3.7 Cutthroat Trout Specific Impacts – Alternative 1

The following narrative summarizes the mine site-specific impacts of the SGP on cutthroat trout. These narratives address: OM, streamflows, water temperature changes, and presents a summary of the effects (Integration of Species/Habitat for Cutthroat Trout – Alternative 1).

4.12.2.3.7.1 Occupancy Modeling – Alternative 1

The following subsections summarize the results of the OM for cutthroat trout under Alternative 1. See Section 3.12.4.4.5, Occupancy Modeling (Bull Trout), for a description of the OM methodology and Section 3.12.4.5.3, Occupancy Modeling (Westslope Cutthroat Trout) baseline conditions, and refer to **Table 3.12-13** for baseline OM data. The full technical memorandum for the OM is provided as **Appendix J-7**.

Occupancy Probabilities

Table 4.12-23 presents the OM-derived distance-weighted average occupancy probabilities for cutthroat trout by stream reach under Alternative 1 for five different time periods.

Table 4.12-23 Distance Weighted Average Cutthroat Trout Occupancy Probabilities for Selected Modeled Mine Years in Each Stream Reach under Alternative 1

Stream Reach	Baseline	EOY 6	EOY 12	EOY 18	EOY 112
Stream Reach 1 (EFSFSR upstream of Sugar Creek to Meadow Creek)	63.73%	64.22%	65.02%	63.25%	64.40%
Stream Reach 2 (Meadow Creek Watershed)	64.06%	63.77%	63.61%	60.41%	62.90%
Stream Reach 3 (EFSFSR upstream of Meadow Creek)	63.59%	63.65%	63.65%	63.66%	63.65%
Stream Reach 5 (Headwaters of EFSFSR watershed)	63.79%	63.80%	64.07%	62.40%	63.57%

Table Source: **Appendix J-7**, Occupancy Modeling Technical Memoranda

Table Notes:

EOY = End of Mine Year.

Stream channel alterations described in Section 4.12.2.3.1, Physical Stream Channel Changes – Alternative 1, and **Table 4.12-1** would impact occupancy probabilities for cutthroat trout in the OM model area. The largest reduction in cutthroat trout occupancy probability would occur in Stream Reach 2 in EOY 18 following the construction of the channel on top of the TSF/DRSF when flows would be re-routed from the diversion to this channel and then to Hangar Flats pit lake.

Length of Available Habitat

The length of available habitat for cutthroat trout habitat during baseline and selected modeled years for each stream reach is the same as shown for bull trout in **Table 4.12-17**. As is the case for bull trout, the largest decreases of available potential habitat for cutthroat trout are projected to occur from baseline to Mine Year 6 in Stream Reach 1 and Stream Reach 2. During this period, the main activities that contribute to the loss of habitat in these areas are the diversion of Meadow Creek for the creation of the TSF/DRSF, the construction of the French drain on Blowout Creek, the EFSFSR tunnel, and dewatering of the Yellow Pine pit lake all happening by Mine Year -1. The length of available habitat in these areas would increase following construction of Meadow Creek on top of the TSF/DFSR during post-closure.

Passage barriers to cutthroat trout habitat as a result of SGP activities under Alternative 1 would be the same as for bull trout (Section 4.12.2.3.6.1, Occupancy Modeling – Alternative 1).

4.12.2.3.7.2 Streamflows (PHABSIM) – Alternative 1

As described previously for bull trout, results from the Snake River Basin Adjudication PHABSIM study (Fifth Judicial District, State of Idaho 2014) provide relevant information about the general relationship between stream discharge rate and habitat. Section 4.12.2.3.6.2, Streamflows – Bull Trout, provides an explanation of the process by which the previous PHABSIM study was used for this analysis. The PHABSIM modeled habitat results for cutthroat trout are summarized in **Table 4.12-24**.

Table 4.12-24 Cutthroat Trout WUA for the Mean Low-Flow-Period Discharge Rate and Two Lower Discharge Rates, at Three Representative Stream Index Sites and Sugar Creek

Stream Index	Discharge		Weighted Usable Area (WUA)							
	CFS[1]	% Change	Adult	% Change	Fry	% Change	Juvenile	% Change	Spawning	% Change
1: Summit Creek	7.8[2]	--	2007	--	14320	--	9084	--	0	N/A
	4.4	-44	891	-56	13111	-8	5989	-34	0	N/A
	1.0	-87	8	-99	7117	-50	1589	-83	0	N/A
2: Sugar Creek	9.9	--	1687	--	7338	--	5849	--	2958	--
	5.4	-46	794	-53	6896	-6	4256	-27	2139	-28
	1.0	-90	20	-99	3997	-46	1270	-78	428	-86
2: Five Stream Means	12	--	1510	--	8419	--	6029	--	3695	--
	6.5	47	549	-66	8036	-1	4547	-24	2845	-23
	1.0	91	8	-99	4829	-37	1088	-82	520	-85
3: EFSFSR below Sugar C.	63	--	9788	--	13345	--	16220	--	0	N/A
	44	-30	6640	-32	14644	10	15254	-6	0	N/A
	25	-60	3196	-67	15272	14	12393	-24	0	N/A

Table Source: **Appendix J-8**, PHABSIM Technical Memorandum

Table Notes:

1 Discharge is measured in cfs.

2 The underlined value is the mean low-flow-period discharge rate.

Five Representative Streams for Index 2: Monumental, Sugar, Tamarack, Quartz, and Profile creeks.

ND: No data were available from the PHABSIM study; N/A: not applicable.

The data summarized in the **Table 4.12-24** for the representative index streams represents a simplification of the streamflow versus WUA dynamics, which can be used to infer changes in cutthroat trout WUA resulting from changes in discharge rates in mine site stream reaches. For example, the EFSFSR above Meadow Creek and Meadow Creek itself are Stream Index 1 streams, both of which are similar to the Summit Creek site of the PHABSIM study. The mean low-flow period discharge rate for Summit Creek is 7.8 cfs. Discharge rates of 4.4 and 1 cfs represent a 44 percent and 87 percent decline, respectively. The expected corresponding reduction in adult cutthroat trout WUA associated with these flow rate reductions is 56 and 99 percent, respectively. Juvenile habitat would be reduced by similar percentages, but fry habitat would be reduced by 8 percent and 50 percent, respectively. These lower reductions in fry habitat result from the fry life stage of cutthroat trout having a higher preference for low velocity water than the juvenile and adult life stage.

Given the general relationships between stream discharge and cutthroat trout habitat provided in **Table 4.12-24,** impacts can be inferred from changes in discharge at the different stream reaches of the mine site. **Table 4.12-24** shows that the changes in discharge in the different mine site reaches under Alternative 1 vary as a function of site and Mine Year. The largest change in streamflow would be at Meadow Creek between Year 7 and Year 19, a 13-year period when discharges are predicted to decrease between 24 percent and 90 percent because of several activities including the diversion of upper Meadow Creek around the footprint of the TSF/DRSF and Hangar Flats pit and the filling of Hangar Flats pit lake. For Summit Creek, the Stream Index 1 representative site, the PHABSIM results predict a 99 percent and 83 percent reduction in WUA for adult and juvenile life stages associated with an 87 percent reduction in discharge rate. At these predicted levels of habitat reduction, it is possible these would adversely affect the cutthroat trout population in Meadow Creek. Outside of the 13-year period, habitat reductions are expected to be less severe, at around 10 percent. After mining activities are complete in Year 20, Meadow Creek flows and adult/juvenile WUA for cutthroat trout are expected to rise by a small increment.

More moderate changes in streamflow are expected in Stream Reach 1, which encompasses the EFSFSR between Meadow and Sugar creeks. For this reach, the 2 years with the greatest reductions in flow under Alternative 1 would be Year 13 and 14, which would experience 46 and 39 percent reductions, respectively. This is likely for the same reasons described above (e.g., filling of Hangar Flats pit lake). For the five streams that represent Index 2 streams, the PHABSIM model predicts a range of WUA reductions associated with a 47 percent reduction in discharge rates. Adult cutthroat trout would experience a 66 percent reduction in WUA, while juvenile and spawning life stages would both experience a 24 percent reduction. Fry would experience a very small increment of change.

The two stream reaches in the mine site that are not expected to experience meaningful reductions in useable habitat under Alternative 1 are Sugar Creek and the EFSFSR upstream of Meadow Creek. This is likely because there are no expected SGP activities within these reaches that would impact stream flows.

4.12.2.3.7.3 Water Temperature Changes – Alternative 1

The effects of stream temperature changes on fish under the action alternatives were analyzed and reported in a technical memorandum titled Stream Temperature Impacts on Fish, provided as **Appendix J-2**. Analysis methods used are summarized in Section 4.12.2.3.4.3, Water Temperature Changes – Alternative 1 (Chinook Salmon). The following is a summary of that analysis followed by the results for cutthroat trout under Alternative 1.

It is anticipated that water temperature increases under Alternative 1 would result in a net loss of overall stream lengths able to sustain optimal water temperatures for cutthroat trout life stages during mine operations and at post-closure. **Table 4.12-25** presents the length of streams within selected relevant baseline temperature threshold categories for cutthroat trout life stages under Alternative 1 as well as at certain intervals over the timeline of the SGP (Mine Years 6, 12, 18, and 112 [i.e., post-closure]). Detailed data for cutthroat trout under Alternative 1 presented in Table 8 of Appendix J-2.

Table 4.12-25 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 1 – Cutthroat Trout

Cutthroat Trout Temperature Threshold Categories	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Adult Spawning - Field Observed Spawning Temperature	0.85 km	0.89 km (+0.04 km)	0.52 km (-0.33 km)	0.52 km (-0.33 km)	0.52 km (-0.33 km)
Juvenile Rearing - Functioning Appropriately	5.01 km	2.29 km (-2.72 km)	2.29 km (-2.72 km)	2.37 km (-2.64 km)	2.37 km (-2.64 km)
Juvenile Rearing - Functioning at Risk	15.10 km	7.32 km (-7.78 km)	7.32 km (-7.78 km)	5.81 km (-9.29 km)	8.09 km (-7.01 km)
Juvenile Rearing - Functioning at Unacceptable Risk	8.87 km	6.34 km (-2.53 km)	10.18 km (+1.31 km)	20.12 km (+11.25 km)	17.84 km (+8.97 km)
Total Available Habitat	28.98 km	15.95 km (-13.03 km)	19.79 km (-9.19 km)	28.30 km (-0.68 km)	28.30 km (-0.68 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).

Temperatures are in °C.

Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

Specifically, **Table 4.12-25** shows the following:

- A net decrease in habitat within the optimal field-observed spawning temperature range during operations and at post-closure;
- A net decrease in habitat within the “functioning appropriately” and “functioning at risk” temperature range for juvenile rearing during operations and at post-closure;
- A net increase in habitat within “functioning at unacceptable risk” temperature range for juvenile rearing during operations and at post-closure;
- Total habitat availability for this species decreases to varying degrees at points along the timeline of the SGP and is anticipated to be lower than baseline at post-closure.

4.12.2.3.7.4 Integration of Species/Habitat Effects for Cutthroat Trout – Alternative 1

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs would negatively affect cutthroat trout in the analysis area through the loss of suitable habitat. Despite some improvement to access, there remain potential effects which may cause injury or mortality to individuals and/or displacement of cutthroat trout.

Following reclamation, the net effect would be a minor loss of both quantity and quality of habitat for cutthroat trout including:

- Slight decrease (0.34 percent) in projected occupancy potential and a decrease of 510 meters of available stream length of habitat post-closure;
- The mean results of the PHABSIM analysis indicate a decline in suitable habitat for cutthroat trout adults and juveniles (note that this change is in relation to streamflow changes only during low flow periods) with a predicted increase in suitable habitat for fry in the EFSFSR;
- The predicted increase in stream temperatures would result in a net loss of habitat able to sustain water temperatures suitable to support cutthroat trout adults and juveniles. The increase in stream temperatures would result in a net loss of suitable habitat for cutthroat trout adults and juveniles. Post-closure the amount of habitat with temperatures within the “Field observed spawning temperature” threshold would be reduced by 0.33 km.

Alternative 1 may indirectly impact Westslope cutthroat trout individuals but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

4.12.2.3.8 Impacts To Other Fish Species – Alternative 1

Other fish species in the analysis area would be affected by the same types of activities and have similar impacts as those described for Chinook salmon, steelhead trout, bull trout, and cutthroat trout. For example, the relocation of fish in the Yellow Pine pit would include hundreds of mountain whitefish (Brown and Caldwell 2019b). The risk of injury or mortality of smaller species such as sculpin and longnose dace would be greater than larger species due to the difficulty in finding and capturing them prior to and during the dewatering.

Construction and operations would have a direct impact on fish and aquatic habitat, which may result in displacement of fish from portions of the mine site streams during certain periods. Fish and other aquatic species in the vicinity of the mine site would experience habitat changes, streamflow changes, water temperature changes, water quality changes, habitat access changes, risk of hazardous materials spills, and risk of injury/mortality during the SGP.

The streams adjacent to the access roads would be affected by small amounts of habitat alteration during the culvert and bridge installations. No changes in streamflow or water temperature are expected; however, water quality may be temporarily degraded. Fish access would be improved at several streams, increasing available habitat. Fish in streams adjacent to access roads may experience increased sedimentation and would be at risk from hazardous materials spills due to the increased traffic and transportation of hazardous materials to and from the mine site. Following closure and reclamation the streams would no longer be at increased risk of SGP-induced sedimentation or hazardous materials spills.

4.12.2.4 Alternative 2

Alternative 2 includes modifications to the proposed activities described in Alternative 1 (Brown and Caldwell 2019d). Alternative 2 components were developed to potentially avoid or minimize impacts to aquatic resources, wetlands, ESA-listed and candidate species habitat, among others.

The modifications that could minimize the effects on fish and fish habitat include changes to:

- The handling and storage of development rock involving elimination of one DRSF (West End) and backfilling of two additional open pits (partial backfill of Hangar Flats pit, and backfill of Midnight pit);
- The diversion of Meadow Creek, Hennessey Creek, and West End Creek during operations;
- The diversion of Meadow Creek channel would become permanent and Meadow Creek would not be routed through Hangar Flats pit;
- The geosynthetic liner would be extended and additional 320 meters downstream within the Meadow Creek diversion channel;
- Modified TSF liner;
- Generating lime and limestone at the mine site using development rock from the West End pit;

- Implementation of a Water Quality Management Plan (Brown and Caldwell 2020b) as described in Section 4.9.2.2.2.1, Surface Water Quality – Mine Site; and
- Outside of the mine site, rerouting a segment of the Burntlog Route.

Access to the mine site via the Burntlog Route would be provided as described in Alternative 1 except for an approximately 8.5-km section in the Riordan Creek drainage (**Figure 2.4-3**). This segment of the Burntlog Route would be relocated to the south side of the Riordan Creek drainage and cross Riordan Creek north of Black Lake. This change would shorten the Burntlog Route by approximately 2.2 km.

In addition, a Water Quality Management Plan (Brown and Caldwell 2020b) has been developed to address potential water quality impacts associated with Alternative 2. Impacts from the Water Quality Management Plan and the associated Water Treatment Plant on fish resources and fish habitat, including fish passage, water quality, stream flows, and water temperature are described at the end of the Alternative 2 discussions (Section 4.12.2.4.9, Alternative 2 Water Quality Management Plan).

4.12.2.4.1 Physical Stream Channel Changes – Alternative 2

Under Alternative 2 surface water management at the mine would differ from Alternative 1 at West End Creek, Hennessey Creek, and Meadow Creek. However, under Alternative 2, the amount of stream channel disturbance would be the same as under Alternative 1 (shown in **Table 4.12-2a**). The enhancement length in the EFSFSR and Meadow Creek would be longer under Alternative 2 (0.73 km longer in the EFSFSR [4 km] and 0.36 km longer in Meadow Creek [1.08 km]). The length of the enhancements in the EFMC would be the same as under Alternative 1 (0.61 km).

Figure 4.12-6 depicts the physical changes to aquatic habitat throughout the SGP phases under Alternative 2.

The West End Creek diversion channels would be the same design as described for Alternative 1 and would divert flows around the West End pit; however, the West End Creek diversion inlet would be located further downgradient in the existing stream channel due to the elimination of the West End DRSF.

Meadow Creek would not be routed through the Hangar Flats pit; rather, the operational diversion of Meadow Creek around the Hangar Flats pit would be retained as the post-closure channel. This would result in several changes in available habitat during the SGP. Beneficial changes include an increase in the amount of habitat suitable for Chinook salmon and lower water temperatures downstream. Negative effects would include the loss of connection to lake habitat, which would reduce habitat for bull trout and other fish species. If connectivity occurred during high flows, it could result in entrainment as fish move into the pit lake and may not be able to get out if flow levels change.

Hennessy Creek would be diverted around the Yellow Pine pit rather than conveyed into the EFSFSR tunnel via boreholes. Under Alternative 2, the diversion would be an approximately

1.67-km surface diversion channel with capacity to convey a 25-year storm event. Hennessy Creek is a small densely vegetated shallow creek that flows in a constructed ditch alongside Stibnite Road (CR 50-412) before flowing under the adjacent waste rock dump then dropping down a very high gradient into the EFSFSR. This high-gradient segment is currently a barrier to fish passage and efforts to survey the creek were unsuccessful because it was so shallow, steep, and narrow (HDR, Inc. 2017a). Therefore, it remains unknown whether this creek supports any fish. Alternative 2 would have a low probability of negative impact on this creek and would likely have a low risk of injury or mortality of any resident fish.

As described for Alternative 1, the Meadow Creek diversion channel would be lined with a low-permeability geosynthetic liner to prevent loss of flow to the alluvial groundwater. Under Alternative 2, the geosynthetic liner would be extended 320 meters downstream within the Meadow Creek diversion channel. The additional liner length would reduce the magnitude of streamflow reduction impacts in Meadow Creek.

During mine operation, low streamflows in Meadow Creek diversion channels around the TSF and Hangar Flats DRSF would be piped underground to prevent water temperature increases. Pipes (0.2- to 0.3-meter diameter) would be installed under the diversion channels or the adjacent access road to carry low flows. The pipe would be sized to convey August baseflow, and buried either in the riprap channel lining or installed parallel to the diversion channel. Streamflow would enter the pipe through inlets where the stream is diverted into the channel.

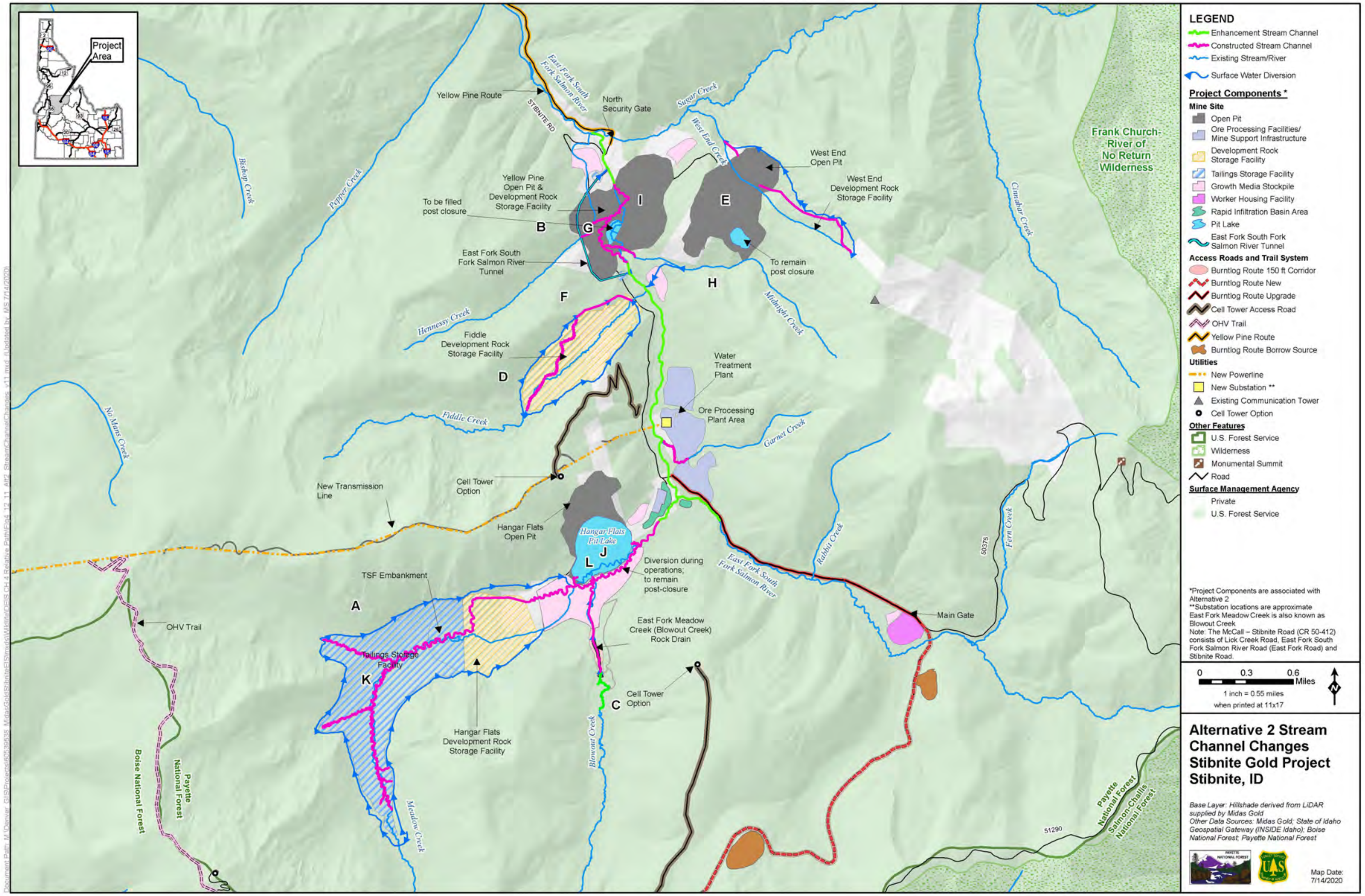


Figure Source: AECOM 2020

Figure 4.12-6 Alternative 2 Stream Channel Changes

This page intentionally left blank

4.12.2.4.2 DIRECT EFFECTS TO INDIVIDUALS - ALTERNATIVE 2

Direct effects to individuals under Alternative 2 would be the same as described for Alternative 1 in Section 4.12.2.3.2, Direct Effects to Individuals – Alternative 1, except that the risk of chemical spills under Alternative 2 would be reduced because the production of lime onsite would reduce lime and limestone deliveries to the mine site. As such, overall truck traffic would be reduced to an average of 50 vehicles a day as compared to the other action alternatives (68 vehicles per day). The water treatment plant would require an additional 40 trucks per year to deliver chemicals for water treatment under Alternative 2, which would not lead to a noticeable increase in vehicles per day.

Table 4.12-26 presents lengths of important fish habitat within 91 meters of the two access routes (Yellow Pine Route and Burntlog Route) under Alternative 2.

Table 4.12-26 Alternative 2 Length of Important Fish Habitat within 91 meters of the Two Access Routes (Yellow Pine Route and Burntlog Route)

Fish Habitat within 91 meters of access roads	Yellow Pine Route	Burntlog Route
Bull Trout Critical Habitat	33.74 km	7.67 km
Steelhead Trout Critical Habitat	32.30 km	1.23 km
Chinook Salmon IP Habitat	35.99 km	5.91 km
TOTAL LENGTH	102.03 km	14.81 km

Table Source: AECOM 2020

Table Notes:

km = kilometers (1 km = 0.62 mi).

The approximately 8.3 km Riordan Creek road segment that would be constructed as part of the Burntlog Route under Alternative 2 would have 12 stream crossings, 3 of which would be over perennial streams. This segment would cross Riordan Creek, which provides habitat for Chinook salmon, steelhead trout, bull trout, and cutthroat trout. Construction of this road segment would result in crossing 14.8 km of important fish habitat within 91 meters of the Burntlog Route under Alternative 2 (**Table 4.12-26**). The Riordan Creek road segment would avoid two unnamed creeks (tributaries to Riordan Creek) and would cross Riordan Creek at a different location and at a higher elevation in the watershed than under Alternatives 1 and 3.

Potential injury and mortality to fish under Alternative 2 from streamflow and water temperature reductions are expected to be low. All other injury and mortality causing activities would be the same as described for Alternative 1 (refer to Section 4.12.2.3.2, Direct Effects to Individuals – Alternative 1).

4.12.2.4.2.1 Mine Site – Dewatering, Fish Salvage, and Relocation

Under Alternative 2, the amount of stream channel and Yellow Pine pit lake disturbance would be the same as under Alternative 1 (shown in **Table 4.12-2a**). The estimated total salvage numbers for each stream and by salmonid species are summarized in **Table 4.12-2b.**

4.12.2.4.3 HABITAT ELEMENTS/WATERSHED CONDITION INDICATORS – ALTERNATIVE 2

4.12.2.4.3.1 Changes to WCIs at the Mine Site – Alternative 2

The WCIs that would be affected by the SGP are shown graphically in **Appendix J-1** and summarized herein. Note that only those WCIs that experience changes are discussed; the WCIs not discussed would not change as a result of the SGP.

Water Temperature – Alternative 2

As described in Section 4.9.2.2.2.1, Surface Water Quality – Mine Site, **Table 4.9-19**, actions under Alternative 2 would result in water temperature increases for each simulated stream reach during the mine operational and post-closure period.

Table 4.12-27 provides a summary of predicted maximum weekly summer and fall water temperatures under Alternative 2 in the six stream reaches within the mine site for five different time periods.

Table 4.12-27 Maximum Weekly Summer and Fall Stream Temperatures Simulated for Alternative 2

Area	Simulated Daily Temperature Statistic	Existing Condition/No Action (°C)	EOY 6 (°C)	EOY 12 (°C)	EOY 18 (°C)	EOY 112 (°C)	Change from Baseline to EOY 112 (°C)
Upper EFSFSR immediately upstream of Meadow Creek	Summer	13.4	13.8	13.8	13.9	13.9	0.5
	Fall	11.1	11.5	11.5	11.4	11.4	0.3
Meadow Creek upstream of East Fork Meadow Creek	Summer	17.9	14.6	14.6	24.2	22.7	4.8
	Fall	15.1	12.7	12.7	18.3	15.7	0.6
Meadow Creek downstream of East Fork Meadow Creek	Summer	19.8	20.1	20.1	23.1	22.4	2.6
	Fall	16.2	16.8	16.8	17.0	16.0	-0.2
Middle EFSFSR (between Meadow and Fiddle creeks)	Summer	17.4	18.9	18.6	20.1	19.8	2.4
	Fall	14.0	15.1	15.0	15.7	15.1	1.1
Lower EFSFSR (between Fiddle and Sugar creeks)	Summer	17.4	19.3	21.7	21.5	20.7	3.3
	Fall	14.0	15.2	16.7	16.9	15.7	1.7
EFSFSR downstream of Sugar Creek	Summer	14.9	17.7	19.2	19.4	19.0	4.1
	Fall	11.9	13.7	14.9	15.7	14.5	2.6

Table Source: Brown and Caldwell 2019b, Table B-47

Table Notes:

Temperatures in °C.

EOY = End of Mine Year.

The impacts of predicted water temperature changes under Alternative 2 would be similar to under Alternative 1 (refer to Section 4.12.2.3.3.1, Changes to Watershed Condition Indicators Analyzed in Detail at the Mine Site – Alternative 1); however, the following actions under Alternative 2 are expected to reduce the magnitude of impacts from increased water temperatures in mine site streams as compared to those reported for Alternative 1.

- Low flows in Meadow Creek stream diversions around the Hangar Flats DRSF and TSF would be piped. Modeling shows that water temperatures would increase in open channels during low flows potentially impacting fish downstream. Piping stream diversions could reduce the potential for warming.
- The operational diversion of Meadow Creek would be retained as the final post-closure channel. Maintaining the operational diversion of Meadow Creek could reduce potential impacts to water temperature and associated impacts to aquatic resources, which could occur if Meadow Creek was routed through the Hangar Flats pit lake. As such, simulated average water temperatures in lower Meadow Creek would be improved compared to Alternative 1, but the simulated maximum temperatures in lower Meadow Creek would be increased due to the buffer effect of Hangar Flats pit lake on diurnal water temperature variation.
- At the EFSFSR downstream of Sugar Creek, summer and fall stream temperatures would increase during the mine operational period and early post-closure period to reach a maximum at the EOY 18 (Brown and Caldwell 2019d). After that time, average and maximum water temperatures would remain stable or gradually decrease as riparian vegetation is established. However, maximum summer and fall water temperatures and average summer water temperatures are still predicted to be as much as 4.5°C higher than baseline 100 years into the post-closure period. This finding demonstrates that projected water temperature increases associated with SGP activities under Alternative 2 would extend downstream in the EFSFSR past Sugar Creek and persist for at least 112 years after mining is initiated.

Sediment and Turbidity – Alternative 2

Potential impacts to surface water quality from erosion and sedimentation under Alternative 2 would generally be the same as Alternative 1, except sediment inputs to upper West End Creek under Alternative 2 may be lower due to reduced surface disturbance from eliminating the West End DRSF.

Table 4.9-20 in Section 4.9.2.2.2.2, Surface and Groundwater Quality - Access Roads, presents the number of stream crossings by access roads under Alternative 2. The number of stream crossings is used in this analysis as a metric for potential increases in erosion and sedimentation along roads. The Yellow Pine Route, used for access during mine construction, would involve 43 streams crossings (**Table 4.9-20**). During the mining and ore processing operations phase (approximately 12 years), mine site access would utilize the Burntlog Route, which would involve 35 stream crossings (**Table 4.9-20**).

The number of vehicle trips per day also is used in this analysis as a metric for potential increases in erosion and sedimentation. Traffic volumes under Alternative 2 would be the same as under Alternative 1 except that 50 vehicle trips per day, instead of 68, would occur during the operations phase (**Table 4.16-4**) and an additional 40 truck trips per year, which leads to a negligible increase in vehicle trips per day, would be required during the operations and closure and reclamation phases (refer to Section 4.16.2.2, Alternative 2).

The baseline WCI rating for sediment in the mine site stream reaches (“functioning at unacceptable risk”) is likely to remain the same under Alternative 2 due to increased potential for erosion and sedimentation under this alternative compared to baseline.

Barriers – Alternative 2

Under Alternative 2 the existing and created barriers would be the same as those described under Alternative 1 (shown in **Figure 4.12-2**).

Chemical Contaminants – Alternative 2

See Section 4.12.2.3.31, Changes to WCIs Analyzed in Detail at the Mine Site - Chemical Contaminants, for the analysis of changes and the impacts on all fish under Alternative 1. Under Alternative 2, the following differences are expected to improve water quality in mine site streams:

- Changes in the mining sequence to mine the West End pit after the Yellow Pine pit would allow for West End development rock, generated later in the SGP, to be backfilled directly into the Midnight pit and placed into Hangar Flats pit as partial backfill. Elimination of West End DRSF could benefit water quality;
- Discharge from the Midnight pit lake would negatively affect water quality in Midnight Creek; this would be avoided by backfilling the Midnight pit and grading the backfill to prevent ponding of water;
- Changes to the TSF liner would include placement of a leak detection and collection system for monitoring leakage from the TSF. This would allow for quicker identification of leaks and reduce the risk of negative impacts to water quality; and
- Diverting Hennessey Creek into Fiddle Creek in an open channel. The open channel would be easier to maintain, would eliminate the introduction of additional sediment into the EFSFSR tunnel and would allow for streamflow to be routed away from existing legacy disturbances, rather than through these disturbances, potentially improving water quality.

Brown and Caldwell (2019c) revised the SWWC model for Alternative 2 based on these changes and reported the following:

- Groundwater and surface water quality in Meadow Creek valley is predicted to improve in comparison to Alternative 1 due to the placement of a synthetic liner on a portion of the Hangar Flats DRSF and an extended period of tailings consolidation water management;

- Groundwater and surface water quality in the Meadow Creek Valley is predicted to improve due to reclamation activities associated with the spent ore disposal area and Bradley tailings compared to baseline;
- Extending the liner in Meadow Creek by 320 meters downstream requires less dewatering water to be infiltrated in the RIBs. The reduced RIB infiltration results in lower metals concentrations in Meadow Creek and the EFSFSR;
- Routing Meadow Creek around (rather than through) the Hangar Flats pit would result in increased contaminant concentrations in the pit lake; however, the discharge from the pit is lower and the increased concentrations in the pit do not result in higher concentrations in Meadow Creek and the EFSFSR;
- Under Alternative 2, surface water in Fiddle Creek would be improved due to the placement of a synthetic liner on the Fiddle DRSF and inclusion of a long-term passive treatment system, resulting in reduction in infiltration and improvement in toe seepage chemistry. Water quality at the most downgradient node in the EFSFSR would essentially be the improved over existing conditions during both operations and closure due to the long-term (in-perpetuity) water treatment;
- Section 4.9.2.2.2, Surface Water Quality, provides more details regarding changes to water quality; Section 4.12.2.4.9, Alternative 2 Water Quality Management Plan, provides a summary of potential effects on fish. Potentially exceedances of the analysis criteria at the assessment nodes are disclosed below. The impacts to fish would be the same as those described in Section 4.12.2.3.3.1, Changes to WCIs Analyzed in Detail at the Mine Site - Chemical Contaminants - Chemical Contaminants.

Operations

- See **Table 4.12-7** for analysis criteria for the five COCs reviewed in the fish analysis. During operations: YP-SR-10, YP-SR-8, and YP-SR-6 seasonally exceed antimony and mercury analysis criteria even with active water treatment. YP-SR-4 seasonally exceeds the antimony criteria.

Post-Closure

- During post-closure YP-SR-4 seasonally exceeds the analysis criteria for antimony, arsenic, and mercury with water treatment continuing in perpetuity. YP-SR-2, YP-T-11, and YP-T-6 exceed the analysis criteria for mercury.

Streamflows – Alternative 2

Impacts to fish from changes to streamflow were assessed using simulated monthly discharge for the August to March low-flow period for Mine Years -1 through post-closure. The potential effects of these changes in stream flow on fish and fish habitat are discussed below.

Table 4.12-28 shows predicted monthly streamflows during the August-March low flow period at five gaging stations and one SFA reach in mine site streams for Mine Years -1 through 112 and predicted change from average baseline low flow period streamflows during the same time period. **Figure 4.12-7** shows the percent change in simulated streamflows graphically. See Section 4.8.2.1.1.1, Changes in Stream Flow Characteristics, for additional details regarding the potential for the SGP to result in changes to baseline water quantities in mine site waterbodies.

Table 4.12-28 Alternative 2 Predicted Monthly Discharge August-March Low Flow Period at USGS Gaging Stations and One SFA Reach (MC-6)

	EFSFSR above Meadow Creek (Gaging station 13310800)		EFSFSR at Stibnite (13311000)		EFSFSR above Sugar Creek (13311250)		Sugar Creek (13311450)		Meadow Creek (13311850)		Meadow Creek (MC-6)	
Mine Year	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline
-1	4.3 cfs	4.4 cfs (+1.9%)	9.1 cfs	8.2 cfs (-9.7%)	13.6 cfs	12.8 cfs (-5.3%)	10.2 cfs	10.5 cfs (+2.7%)	2.8 cfs	0.2 cfs (-91.9%)	4.6 cfs	3.2 cfs (-30.7%)
1	4.1 cfs	4.2 cfs (+3.1%)	8.5 cfs	9.0 cfs (+6.2%)	13.0 cfs	11.0 cfs (-15.4%)	9.6 cfs	10.0 cfs (+4.8%)	2.5 cfs	0.2 cfs (-93.0%)	4.2 cfs	3.1 cfs (-26.1%)
2	6.4 cfs	6.5 cfs (+2.1%)	13.6 cfs	14.2 cfs (+4.3%)	18.9 cfs	16.1 cfs (-15.1%)	14.2 cfs	14.7 cfs (+3.2%)	3.6 cfs	1.5 cfs (-59.6%)	6.8 cfs	5.0 cfs (-26.3%)
3	4.3 cfs	4.4 cfs (+2.9%)	8.9 cfs	9.5 cfs (+6.4%)	13.6 cfs	10.3 cfs (-24.7%)	10.1 cfs	10.5 cfs (+4.4%)	2.7 cfs	0.2 cfs (-92.5%)	4.4 cfs	3.3 cfs (-24.8%)
4	5.2 cfs	5.3 cfs (+2.6%)	10.9 cfs	11.6 cfs (+6.2%)	15.9 cfs	12.5 cfs (-21.2%)	11.8 cfs	12.3 cfs (+4.3%)	3.0 cfs	0.8 cfs (-73.6%)	5.4 cfs	4.0 cfs (-25.8%)
5	4.7 cfs	4.9 cfs (+3.6%)	9.8 cfs	11.1 cfs (+13.5%)	14.7 cfs	11.6 cfs (-21.1%)	11.0 cfs	11.5 cfs (+4.5%)	2.8 cfs	0.4 cfs (-85.6%)	4.8 cfs	3.7 cfs (-23.7%)
6	4.7 cfs	4.8 cfs (+3.7%)	9.6 cfs	11.1 cfs (+15.4%)	14.5 cfs	11.4 cfs (-21.3%)	10.8 cfs	11.3 cfs (+4.6%)	2.7 cfs	0.4 cfs (-86.1%)	4.7 cfs	3.6 cfs (-23.7%)
7	5.2 cfs	5.5 cfs (+5.3%)	10.9 cfs	13.4 cfs (+22.7%)	16.1 cfs	13.9 cfs (-13.4%)	12.0 cfs	12.4 cfs (+3.8%)	3.0 cfs	0.7 cfs (-77.4%)	5.4 cfs	3.8 cfs (-29.4%)

	EFSFSR above Meadow Creek (Gaging station 13310800)		EFSFSR at Stibnite (13311000)		EFSFSR above Sugar Creek (13311250)		Sugar Creek (13311450)		Meadow Creek (13311850)		Meadow Creek (MC-6)	
Mine Year	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline
8	7.5 cfs	8.0 cfs (+5.9%)	16.0 cfs	18.9 cfs (+18.4%)	22.1 cfs	20.4 cfs (-7.7%)	16.2 cfs	16.7 cfs (+3.3%)	4.8 cfs	2.5 cfs (-47.8%)	8.1 cfs	5.9 cfs (-27.4%)
9	4.7 cfs	4.9 cfs (+5.6%)	9.7 cfs	10.6 cfs (+9.3%)	14.7 cfs	11.8 cfs (-19.8%)	11.0 cfs	11.4 cfs (+4.2%)	2.8 cfs	0.4 cfs (-87.2%)	4.8 cfs	3.1 cfs (-36.9%)
10	5.1 cfs	5.3 cfs (+4.4%)	10.9 cfs	10.9 cfs (-0.1%)	15.6 cfs	12.7 cfs (-18.6%)	11.7 cfs	12.0 cfs (+2.5%)	3.0 cfs	0.7 cfs (-75.7%)	5.5 cfs	3.3 cfs (-38.8%)
11	6.1 cfs	6.3 cfs (+3.5%)	12.9 cfs	12.9 cfs (+0.2%)	18.0 cfs	15.3 cfs (-15.1%)	13.2 cfs	13.3 cfs (+0.8%)	3.7 cfs	1.4 cfs (-62.1%)	6.4 cfs	4.1 cfs (-36.1%)
12	8.6 cfs	8.9 cfs (+3.9%)	18.1 cfs	19.4 cfs (+7.4%)	24.4 cfs	22.7 cfs (-7.0%)	17.7 cfs	18.0 cfs (+1.3%)	5.0 cfs	2.7 cfs (-46.6%)	8.9 cfs	6.0 cfs (-32.2%)
13	5.4 cfs	5.5 cfs (+2.0%)	11.3 cfs	10.1 cfs (-10.8%)	16.6 cfs	14.3 cfs (-13.5%)	12.7 cfs	10.8 cfs (-14.7%)	3.3 cfs	0.4 cfs (-86.6%)	5.6 cfs	4.2 cfs (-25.4%)
14	4.5 cfs	4.6 cfs (+1.7%)	9.6 cfs	9.1 cfs (-5.7%)	13.9 cfs	13.1 cfs (-5.6%)	10.7 cfs	9.7 cfs (-9.0%)	2.9 cfs	0.2 cfs (-92.2%)	4.9 cfs	3.7 cfs (-23.1%)
15	6.5 cfs	6.6 cfs (+1.4%)	13.8 cfs	14.1 cfs (+2.1%)	18.8 cfs	18.8 cfs (-0.2%)	14.2 cfs	13.6 cfs (-4.3%)	4.0 cfs	1.2 cfs (-70.7%)	7.0 cfs	6.7 cfs (-4.0%)
16	4.8 cfs	4.8 cfs (+1.9%)	9.8 cfs	10.1 cfs (+2.9%)	14.7 cfs	14.9 cfs (+1.3%)	11.3 cfs	10.2 cfs (-10.0%)	2.9 cfs	0.3 cfs (-90.5%)	4.8 cfs	4.9 cfs (+0.8%)

	EFSFSR above Meadow Creek (Gaging station 13310800)		EFSFSR at Stibnite (13311000)		EFSFSR above Sugar Creek (13311250)		Sugar Creek (13311450)		Meadow Creek (13311850)		Meadow Creek (MC-6)	
Mine Year	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline	No Action (Baseline)	Alternative 2 and Change from Baseline
17	4.0 cfs	4.1 cfs (+1.7%)	8.4 cfs	8.6 cfs (+3.1%)	12.8 cfs	13.1 cfs (+2.0%)	9.8 cfs	8.9 cfs (-9.6%)	2.5 cfs	0.1 cfs (-95.0%)	4.1 cfs	4.2 cfs (+0.9%)
18	4.5 cfs	4.6 cfs (+0.9%)	9.4 cfs	9.6 cfs (+1.9%)	14.0 cfs	14.1 cfs (+1.1%)	10.9 cfs	10.3 cfs (-5.5%)	2.6 cfs	0.2 cfs (-91.4%)	4.6 cfs	4.6 cfs (+0.1%)
19	4.4 cfs	4.5 cfs (+1.3%)	9.6 cfs	9.7 cfs (+1.8%)	13.3 cfs	13.7 cfs (+2.9%)	10.0 cfs	9.8 cfs (-1.5%)	2.8 cfs	0.3 cfs (-90.6%)	4.9 cfs	4.9 cfs (-0.2%)
20	4.5 cfs	4.6 cfs (+1.9%)	9.3 cfs	9.6 cfs (+3.3%)	13.7 cfs	13.9 cfs (+1.8%)	10.4 cfs	9.7 cfs (-7.0%)	2.8 cfs	0.3 cfs (-90.9%)	4.6 cfs	4.7 cfs (+1.8%)
Post-closure	5.5 cfs	5.6 cfs (+1.9%)	11.5 cfs	11.8 cfs (+2.5%)	16.5 cfs	16.8 cfs (+1.7%)	12.6 cfs	12.5 cfs (-0.9%)	3.4 cfs	0.7 cfs (-78.6%)	5.8 cfs	5.8 cfs (+0.1%)

Table Source: data from Rio-ASE spreadsheet: Modflow_Alternatives_Summary_08192019.xls

Table Notes:

USGS = U.S. Geological Survey.

cfs = cubic feet per second.

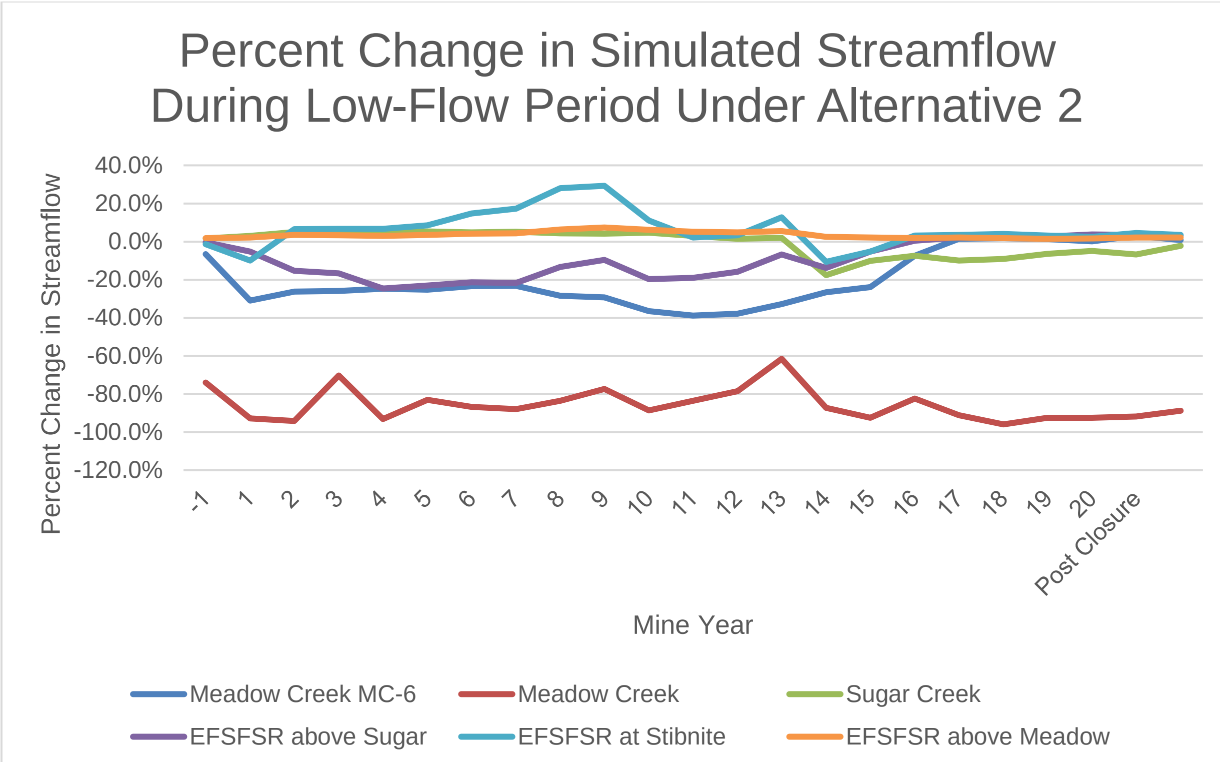


Figure Source: Appendix J-1, Supplemental Information

Figure 4.12-7 Alternative 2 Percent Change in Simulated Streamflow During Low-Flow Period (August to March)

The greatest change in streamflows over the timeline of the SGP would be in Meadow Creek, where reductions in stream flows of between 47.8 percent and 95.0 percent would occur throughout construction and operations and a 78.6 percent reduction in streamflows compared to baseline would remain in perpetuity (Brown and Caldwell 2019d). Under Alternative 2, peak flows (>5 cfs) from the combined flows of Meadow Creek and Blowout Creek would be diverted to the Hangar Flats pit lake to shorten the duration to fill Hangar Flats pit. This would reduce the low flow in Meadow Creek SFA reach MC-6 and the EFSFSR at Stibnite during Mine Year 11 through Mine Year 15.

As described in Section 4.8.2.2.1.1, Changes in Stream Flow Characteristics, the model-predicted potential effects to streamflow under the Alternative 2 are similar to those predicted for Alternative 1, indicating that implementing Alternative 2 also would affect streamflows relative to existing conditions (baseline). Upstream of Sugar Creek (USGS 13311250), the simulated streamflows for the EFSFSR are lower than baseline conditions with a simulated 14 percent decrease in seasonal monthly average low flows. Alternative 2 would result in an average monthly flow reduction of 32 percent relative to the existing conditions during Mine Years 7 through 12. The predicted increased streamflow at this location is a direct result of extending the Meadow Creek liner and supplying additional dewatering flows to the RIBs (Brown and Caldwell

2019d). Under Alternative 2 the predicted streamflows for Meadow Creek downstream of Hangar Flats pit to the confluence with the EFSFSR under Alternative 2 would be are lower than under the existing conditions scenario during the low-flow season by up to approximately 2.5 cfs in the later mine operations period.

As described in Section 4.12.2.3.3.1 Changes to Watershed Condition Indicators Analyzed in Detail at the Mine Site - Alternative 1 subsection Streamflows – Alternative 1, flow reductions may affect the suitability of over-wintering habitat in the mine site streams. Under Alternative 2, reductions in streamflows during the winter months would still occur, although at a lower magnitude compared to Alternative 1, but would likely cause similar effects on over-wintering fish.

4.12.2.4.3.2 Changes to WCIs outside the Mine Site – Alternative 2

Under Alternative 2, changes to WCIs outside the mine site would be the same as described under Alternative 1 (Section 4.12.2.3.3.2, Changes to WCIs Outside the Mine Site – Alternative 1).

4.12.2.4.4 CHINOOK SALMON SPECIFIC IMPACTS – ALTERNATIVE 2

4.12.2.4.4.1 Intrinsic Potential for Chinook Salmon – Alternative 2

The following section summarizes the IP modeling results for Alternative 2. See Section 3.12.4.2.5, Intrinsic Potential Modeling, for a description of the IP methodology and baseline conditions and **Appendix J-4** for additional information regarding analysis of alternatives.

The results are summarized from mine site construction through closure and reclamation (i.e., baseline and Mine Year -2 through Mine Year 20) for all Stream Reaches.

Results are presented as the length of IP habitat per Mine Year and the percent change from baseline to Mine Year 20. Chinook salmon habitat is rated as High, Medium, Low, and Negligible. **Figure 4.12-8** and **Table 4.12-29** present the results for the IP modeling (**Appendix J-4**).

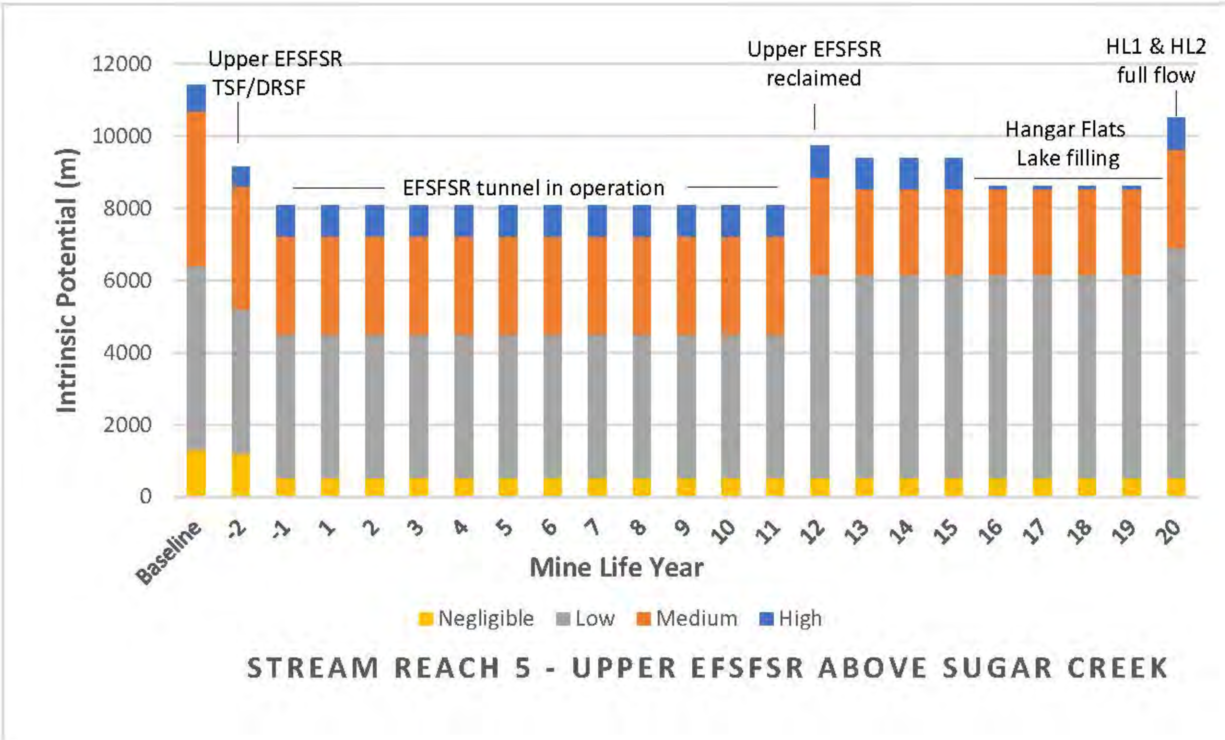


Figure Source: **Appendix J-4**, Intrinsic Potential Technical Memoranda

Figure Notes:

HL1 and HL2 = Meadow Creek SFA reaches through the Hangar Flats pit lake. “None” IP rating not included in the figure.

Figure 4.12-8 Alternative 2 Study Area IP Habitat for Chinook Salmon from Baseline to Mine Year 20

Table 4.12-29 Alternative 2 Analysis Area Comparison of Chinook Salmon IP Habitat at Baseline to Mine Year 20

IP Rating	Baseline Length (km)	Mine Year 20 Length (km)[1]	Loss/Gain (km)[2,4]	Change (%)[2,4]
High	0.84	0.99	+0.156	+18.6
Medium	7.29	5.70	-1.587	-21.8
Low	8.74	10.00km	+1.25	+14.3
Negligible	1.74	0.99	-0.75	-43.1
Total Useable[3]	18.61	17.68	-0.93	-5.0

Table Source: **Appendix J-4**, Intrinsic Potential Modeling Technical Memoranda

Table Notes:

1 Results are presented as the length (km) of IP habitat per Mine Year 20.

2 The permanent change in IP is presented as the loss or gain (in km) of IP rated streams and percent change per is based on the difference between that Mine Year 20 and baseline conditions (% Change = [Mine Year 20 – baseline]/baseline).

3 For Chinook salmon the IP is rated as high, medium, low, and negligible. ”Total Useable” IP habitat is defined as all of these classes combined (useable = high + medium + low + negligible) and does not consider whether the IP habitat is naturally available to migrating fish. ”None” indicates that there is no intrinsic potential to provide habitat for the species and is not shown in this table.

4 Change in IP habitat for both “Loss/Gain” and “Percent Change” is shown as negative (-) for loss of IP and positive (+) as a gain in IP.

IP = Intrinsic Potential; EOY = end of Mine Year; km = kilometers (1 km = 0.62 mi).

Useable habitat is expected to decrease 5.0 percent over the life of the mine, a loss of over 1.50 km. Reductions in Chinook salmon IP habitat occur in Mine Years -2 (Meadow Creek diversions), EFSFSR tunnel operation (Mine Years -1 through 12), and during the filling of Hangar Flats pit lake (Mine Years 13 through 20).

4.12.2.4.4.2 Streamflow Changes – Alternative 2

Under Alternative 2, the following changes are expected to reduce the impacts from streamflow changes in mine site streams, although streamflow reductions could still occur (see Section 4.8.2.2.1.1, Changes in Stream Flow Characteristics).

- With the elimination of the West End DRSF, additional storage of development rock is needed. Placement in the Hangar Flats pit as partial backfill would decrease the time required for the Hangar Flats pit lake to fill. Reducing the time needed to fill the pit lake would reduce the overall impacts to streamflow throughout closure.
- Meadow Creek and Blowout Creek flows above 5 cfs would be diverted into the Hangar Flats pit lake to accelerate filling of the pit lake and minimize potential impacts from loss of surface water flows to groundwater during filling and potentially reduce the associated impacts to downstream aquatic resources from lower surface water flows.

- The Yellow Pine pit dewatering wells would continue to operate and send water to the RIBs during seasonal low flows until the Hangar Flats pit lake is filled. The continued use of the RIBs would help maintain alluvial groundwater levels and prevent loss of surface water to the alluvial groundwater during pit lake filling and potentially reduce associated impacts to downstream aquatic resources from lower surface water flows.

Brown and Caldwell (2019c) revised the hydrologic model based on these changes and reported that simulations predict that Meadow Creek streamflow would likely increase and mitigate streamflow impacts in both the operations and post-closure periods. These improvements would be a direct result of the Meadow Creek liner extension, partial backfilling of the Hangar Flats pit, and acceleration of Hangar Flats pit lake filling.

The simulations predict reductions in Hangar Flats pit dewatering rates and associated RIB recharge during Mine Years 7 through 12 because of the reduction in stream loss due to the Meadow Creek liner extension and reduction of simulated dewatering rates due to higher pit bottom elevation because of the partial backfilling of the Hangar Flats pit.

Reducing the time to fill the Hangar Flats pit lake would help recover the overall hydrologic system faster in the Meadow Creek drainage to a long-term equilibrium state (Brown and Caldwell 2019d).

Effects of Streamflow Changes on Chinook Salmon Productivity

The effects of flow changes on Chinook salmon were analyzed using a flow-productivity model developed by NOAA Fisheries **Appendix J-5**).

Table 4.12-30 shows the predicted amount of change in Chinook salmon productivity from baseline conditions for all Mine Years and several USGS gaging station locations and SFA reach MC-6.

Table 4.12-30 Alternative 2 Predicted Amount of Change (%) in Chinook Salmon Productivity from Baseline Conditions by Mine Year and Location

Alternative 2		Location					
Timeframe	Mine Year	EFSFSR above Meadow 13310800	EFSFSR at Stibnite 1331100	EFSFSR above Sugar 13311250	Sugar Creek 13311450	Meadow Creek 13311850	Meadow Creek MC-6
Mine Life Timeframe	-2	2.3	-5.4	-2.3	2.2	-100	-13.2
	-1	2.9	-3.3	-8.1	3.7	-100	-25.0
	1	4.2	9.5	-15.6	6.2	-100	-23.5
	2	2.7	5.8	-16.5	3.3	-100	-22.1
	3	4.1	9.5	-21.7	6.3	-100	-23.0
	4	4.2	12.6	-19.6	5.3	-100	-22.2
	5	4.8	19.8	-19.3	5.6	-100	-21.8

Alternative 2		Location					
Timeframe	Mine Year	EFSFSR above Meadow 13310800	EFSFSR at Stibnite 1331100	EFSFSR above Sugar 13311250	Sugar Creek 13311450	Meadow Creek 13311850	Meadow Creek MC-6
	6	5.6	33.2	-16.6	4.9	-100	-22.4
	7	8.1	45.1	-11.2	5.1	-100	-25.2
	8	7.7	27.7	-13.3	4.8	-100	-27.0
	9	6.4	8.3	-18.0	4.9	-100	-30.6
	10	5.5	3.8	-16.6	1.8	-100	-30.9
	11	6.2	11.7	-12.2	1.8	-100	-29.7
	12	4.8	3.9	-10.1	-7.8	-100	-27.7
	13	2.5	-12.5	-13.2	-11.1	-100	-27.3
	14	1.6	-4.3	-4.8	-9.8	-100	-21.3
	15	2.6	4.8	2.3	-7.7	-100	0.2
	16	2.4	-18.4	2.2	-8.6	-100	0.4
	17	2.1	4.2	4.2	-8.1	-100	3.7
	18	1.3	2.1	2.1	-7.4	-100	0.2
	19	2.8	6.7	6.7	-4.3	-100	3.7
	20	2.2	3.0	3.0	-6.7	-100	2.3
Post Closure	20+	2.3	4.0	3.4	-2.5	-100	1.5
Mine Life Maximum	N/A	8.1	45.1	6.7	6.3	-100	3.7
Mine Life Mean	N/A	3.9	7.5	-8.5	-0.8	-100	-16.5
Mine Life Minimum	N/A	1.3	-18.4	-21.7	-11.1	-100	-30.9

Table Source: **Appendix J-5**, Chinook Salmon Streamflow/Productivity Technical Memorandum

Table Notes:

The Numbers Represent Annual Percent Change in Productivity from Baseline.

The Post-closure Value Represents an Average Annual Percent Change in Productivity for Mine Years 21 through 118.

The results of the modeling for Alternative 2, show that the greatest effects on productivity would be in Meadow Creek. The average decrease in productivity over the life of the mine is projected to be 16.5 percent under Alternative 2 (**Table 4.12-30**).

The model predicts the reach from the confluence of Meadow Creek (Reach 2) and the EFSFSR to Sugar Creek would increase in productivity at the top of the reach but decrease in productivity towards the bottom for the first half of the mine life. Under Alternative 2, both the top and bottom of this reach show an increase in productivity during the second half of the mine life, with a few exceptions (e.g., Mine Year 13).The filling of the Yellow Pine pit and construction of the EFSFSR tunnel followed by a new channel being created over the current the Yellow Pine pit location further complicate this reach's productivity. Like Alternative1, the EFSFSR upstream of Meadow Creek is predicted to have an increase in productivity over the mine life.

The average increase in productivity over the mine life would be 3.95 percent. Like Alternative 1, Sugar Creek follows the pattern of the EFSFSR at Stibnite with increases in productivity in the first half of the mine life and decreases in productivity in the second half (with a lower average percent decrease in productivity over the life of the mine). Note that the changes in streamflows associated with the Water Quality Management Plan were not included in this analysis as they were not available at the time the analysis was completed.

4.12.2.4.4.3 Water Temperature Changes – Alternative 2

The effects of water temperature changes on fish under the action alternatives were analyzed and reported in a technical memorandum titled Stream Temperature Impacts on Fish, provided as **Appendix J-2**. Analysis methods used in this memorandum are summarized in Section 4.12.2.3.4.3, Water Temperature Changes – Alternative 1 (Chinook Salmon). The following is a summary of the analysis and results for Chinook salmon under Alternative 2.

Table 4.12-31 presents the length of streams within selected relevant baseline temperature threshold categories for Chinook salmon life stages under Alternative 2 as well as at certain intervals over the timeline of the SGP (Mine Years 6, 12, 18, and 112 [i.e., post-closure]). Detailed data for Chinook salmon under Alternative 2 is presented in Table 10 of **Appendix J-2**.

Table 4.12-31 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 2 – Chinook Salmon

Chinook Salmon (Spring/Summer-Run) Temperature Threshold Categories	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Adult Migration - Lethal (1-week exposure)	0.00 km	0.00 km (0.00 km)	1.23 km (+1.23 km)	1.83 km (+1.83 km)	0.00 km (0.00 km)
Adult Migration - Optimal Adult Swimming Performance	2.44 km	3.54 km (+1.1 km)	6.2 km (+3.76 km)	7.13 km (+4.69 km)	7.13 km (+4.69 km)
Adult Spawning - Field Observed Spawning Temp	16.72 km	11.19 km (-5.53 km)	12.96 km (-3.76 km)	9.49 km (-7.23 km)	12.12 km (-4.6 km)
Incubation/Emergence - Optimal	4.99 km	4.41 km (-0.58 km)	3.08 km (-1.91 km)	4.41 km (-0.58 km)	4.41 km (-0.58 km)
Juvenile Rearing - Optimal	16.72 km	11.19 km (-5.53 km)	11.28 km (-5.44 km)	6.54 km (-10.18 km)	10.29 km (-6.43 km)
Common Summer Habitat Use - Optimal	16.72 km	11.19 km (-5.53 km)	3.1 km (-13.62 km)	6.54 km (-10.18 km)	10.29 km (-6.43 km)
Total Available Habitat	16.72 km	11.19 km (-5.53 km)	12.96 km (-3.76 km)	13.5 km (-3.22 km)	12.12 km (-4.6 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).

Temperatures are in °C.

Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

Predicted higher water temperatures under Alternative 2 would result in a net decrease in habitat in the optimal temperature range for Chinook salmon spawning, incubation/ emergence, juvenile rearing, and common summer habitat use, however; there would be a net increase in habitat in the optimal temperature range for adult swimming performance.

Specifically, **Table 4.12-31** shows the following:

- A net increase in habitat within the optimal temperature range for adult swimming performance during operations and at post-closure; from 2.44 km at baseline to a predicted 7.13 km at EOY 112;
- A net decrease in habitat within the range for field observed spawning during operations and at post-closure from 16.72 km at baseline to 12.12 km at EOY 112;

- A net decrease in habitat within the optimal temperature range for incubation/emergence, juvenile rearing, and common summer habitat use performance during operations and at post-closure; from 4.99 km at baseline to 4.41 km at EOY 112;
- Total available habitat for Chinook salmon decreases to varying degrees at points along the timeline of the SGP and is anticipated to be lower than baseline at post-closure; from 16.72 km at baseline to 12.12 km at EOY 112.

4.12.2.4.4.4 Critical Habitat – Alternative 2

Alternative 2 would have the same type of effects on Chinook salmon critical habitat at the mine site that are described under Alternative 1; however, the magnitude of the changes in flow and water temperature could be reduced by the changes in water management at the mine site (e.g., partial backfilling of Hangar Flats pit and quicker filling of Hangar Flats pit lake, and additional lining in Meadow Creek).

The effects on Chinook salmon critical habitat outside the mine site would be the same as those described under Alternative 1 because there would be no changes to access roads or off-site facilities (Section 4.12.2.3.4.4, Critical Habitat – Chinook Salmon – Alternative 1).

Under Alternative 2, the Meadow Creek diversion (Mine Year -1) and then the TSF/DRSF would permanently block approximately 5.5 km of Chinook salmon critical habitat (**Table 4.12-32**) to natural fish movement both upstream and downstream.

Table 4.12-32 Alternative 2 Length of Chinook Salmon Critical Habitat Blocked Above Each Fish Passage Barrier

Block ID	Chinook Salmon - Critical Habitat Blocked (km)					
	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20
EFSFSR Yellow Pine pit (02)	26.49	19.70	NB	NB	NB	NB
EFSFSR Box Culvert (203)	22.96	16.16	NB	NB	NB	NB
Fern Creek (205)	0.17	0.17	0.17	0.17	0.17	0.17
Meadow Creek Diversion TSF/DRSF	NB	NB	5.51	5.51	5.51	5.51

Table Source: **Appendix J-3**, Barriers Technical Memorandum

Table Notes:

km = kilometers (1 km = 0.62 mi).

EOY = End of Mine Year.

NB = No Barrier.

4.12.2.4.4.5 Integration of Species/Habitat Effects for Chinook Salmon – Alternative 2

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs under Alternative 2 would negatively affect Chinook salmon in the analysis area. These effects may cause injury or mortality to individuals and temporary displacement from several mine site streams during certain periods when habitat conditions become unsuitable. This would cause a temporal loss of habitat. Following reclamation, the net effect would be a loss of both quantity and quality of habitat for Chinook salmon at the mine site.

Effects on Chinook salmon outside the mine site would be the same as described under Alternative 1.

A summary of the overall impacts to Chinook salmon habitat and specific points regarding the impacts are provided below.

- **Net loss of IP habitat for Chinook salmon.** Useable habitat would decrease 5.0 percent over the life of the mine, a loss of approximately 1.5 km. Reductions in Chinook salmon IP habitat would likely occur in Mine Years -2 (Meadow Creek diversions), EFSFSR tunnel operation (Mine Years -1 through 12), and during the filling of Hangar Flats pit lake (Mine Years 13 through 20).
- **Loss in Chinook salmon productivity as a result of changes to baseline streamflows.** The results of the modeling for Alternative 2, show that the greatest effects on productivity would be in Meadow Creek. The average decrease in productivity over the life of the mine would be 16.5 percent under Alternative 2.
- The Yellow Pine pit barrier would be removed in Mine Year -1 with the construction of the EFSFSR tunnel providing 19.7 km of naturally accessible Chinook critical habitat. While most existing fish passage barriers would be removed by Mine Year -1, two new barriers would be constructed in Mine Years 2 (Fiddle Creek DRSF diversion) and -2 (Meadow Creek TSF and Hangar Flats DRSF and Meadow Creek diversion) preventing upstream volitional passage.
- Water temperatures are predicted to increase under Alternative 2 and would result in a net decrease in habitat in the optimal temperature range for Chinook salmon spawning, incubation/ emergence, juvenile rearing, and common summer habitat use, however; there would be a net increase in habitat in the optimal temperature range for adult swimming performance.

The Forest Service has preliminarily determined that Alternative 2 will adversely affect Chinook salmon and their critical habitat. Informal Section 7 ESA consultation is ongoing with the NMFS.

4.12.2.4.5 Steelhead Trout Specific Impacts – Alternative 2

4.12.2.4.5.1 Intrinsic Potential Modeling – Alternative 2

The following section summarizes the IP modeling results for Alternative 2. See Section 3.12.4.2.5.1, Intrinsic Potential Modeling - Methods. for a description of the IP methodology and Section 3.12.4.3.5.1 Results – Steelhead Trout, for a description of baseline conditions. The full technical memorandum is provided as **Appendix J-4**.

The results are summarized from mine site construction through closure and reclamation (baseline, and Mine Years -2 through 20) for the IP analysis area.

Results are presented as the length of IP habitat per Mine Year and the percentage change from baseline conditions at EOY 20. For steelhead trout the habitat is rated as high, medium, and low. **Figure 4.12-9** illustrates the results for steelhead trout in Reach 5 (Upper EFSFSR above Sugar Creek) and **Table 4.12-33** presents the results for all reaches in the analysis area in tabular form.

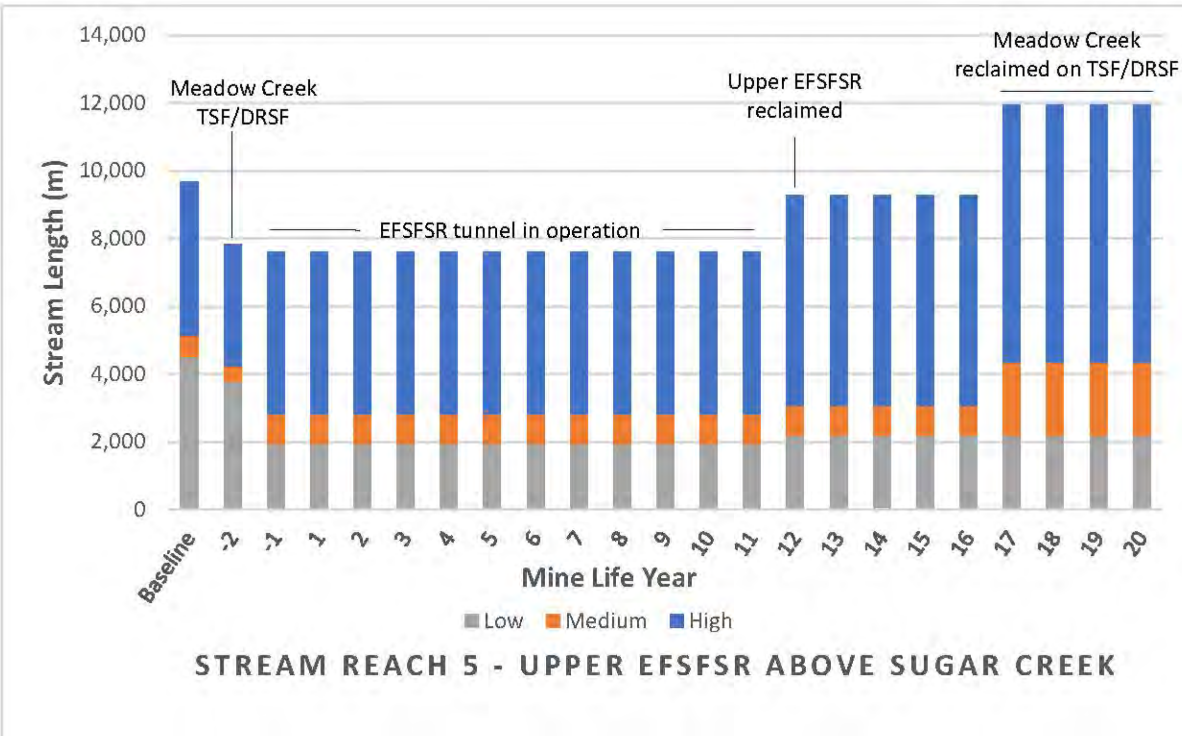


Figure Source: **Appendix J-4**, Intrinsic Potential Technical Memoranda.

Figure Notes:

HL1 and HL2 = Meadow Creek SFA reaches through the Hangar Flats pit lake. “None” IP rating not included in the figure.

Figure 4.12-9 Alternative 2 Study Area IP Habitat for Steelhead Trout from Baseline to Mine Year 20

Table 4.12-33 Alternative 2 Length of Steelhead Trout IP Habitat per IP Rating and Percent Change Between Baseline and Mine Year 20

	Length of Stream (km)[1]							Change (EOY 20 - Baseline)[2]	
Intrinsic Potential Habitat[3]	Baseline	EOY -2	EOY -1	EOY 6	EOY 12	EOY 17	EOY 20	Loss/Gain (km)[4]	Change (%)[4]
High	8.04	7.11	8.30	8.30	9.70	11.10	11.10	+3.06	+38.1
Medium	0.60	0.45	0.88	0.88	0.88	2.15	2.15	+1.55	+258
Low	9.25	8.50	6.67	6.67	6.92	6.92	6.92	-2.33	-25.2
Total Usable	17.90	16.06	15.84	15.84	17.50	20.17	20.17	+2.28	+12.7

Table Source: **Appendix J-4**, Intrinsic Potential Modeling Technical Memoranda

Table Notes:

1 Results are presented as the length (km) of IP habitat per Mine Year during life of mine and post-closure.

2 The permanent change in IP is presented as the loss or gain (in km) of IP rated streams and the percent change based on Mine Year 20 is based on the difference between that year and baseline conditions (% Change = [Mine Year 20 – baseline]/baseline).

3 For Steelhead trout the IP is rated as high, medium, and low. ”Total Usable” IP habitat is defined as all of these classes combined (usable = high + medium + low) and does not consider whether the IP habitat is naturally available (i.e., migratory fish can access). ”None” indicates that there is no intrinsic potential to provide habitat for the species and is not shown in this table.

4 Change in IP habitat for both “Loss/Gain” and “Percent Change” is shown as negative (-) for loss of IP and positive (+) as a gain in IP.

IP = intrinsic potential; EOY = End of Mine Year; km = kilometers (1 km = 0.62 mi).

Useable habitat would increase 12.7 percent over the SGP, a gain of approximately 2.8 km. The length of High and Medium-rated stream reaches would increase, while the length of Low-rated reaches would decrease over the SGP. The increase in steelhead trout IP habitat is expected to occur in Mine Year 12 (decommissioning of EFSFSR tunnel) and Mine Year 17 (Meadow Creek DRSF/TSF channel construction).

Barriers to Migratory Fish Access to IP Habitat

IP habitat for steelhead trout upstream of barriers, would be the same as under Alternative 1. The Yellow Pine pit cascade barrier, the EFSFSR box culvert, and steep section of Meadow Creek currently block volitional passage to IP habitat for steelhead trout (**Table 4.12-34**).

Table 4.12-34 Length of Alternative 2 Steelhead Trout IP Habitat Blocked by Fish Passage Barriers

Block ID	Steelhead Trout - Useable Habitat Blocked (km)					
	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20
EFSFSR Yellow Pine Pit (02)	8.53	6.94	NB	NB	NB	NB
EFSFSR Box Culvert (203)*	6.94	5.11	NB	NB	NB	NB
Meadow Creek (05)*	1.83	NB	NB	NB	NB	NB
Meadow Creek diversion and TSF/DRSF	NB	NB	1.91	1.91	1.91	1.91

Table Source: Appendix J-4, Intrinsic Potential Modeling Technical Memoranda

Table Notes:

km = kilometers (1 km = 0.62 mi).

EOY= End of Mine Year.

NB = No Barrier.

* partial barriers may not be barriers to steelhead trout passage.

As mentioned previously, steelhead trout habitat may not be currently blocked at the EFSFSR box culvert or the Meadow Creek barrier, as these barriers are partial and they may be able to pass under higher flow conditions. Under Alternative 2, by Mine Year -1 all existing habitat barriers would be removed; and, the Meadow Creek diversion would be added in Mine Year -2. In Mine Year 17, the TSF/DRSF in Meadow Creek would be completed and would become a permanent barrier to both upstream and downstream fish passage as Meadow Creek would be constructed on the top of the TSF/DRSF creating a high gradient down the outslope. 1.91 km of steelhead trout IP habitat would be blocked by the Meadow Creek diversion and then permanently by the high gradient at the TSF/DRSF.

4.12.2.4.5.2 Streamflow Changes – Alternative 2

There was an attempt to complete a similar modeling analysis for streamflow productivity as was done for Chinook salmon (Section 4.12.2.3.4.2). An effort was made to recreate the streamflow-productivity analysis performed by NOAA in the Big Creek Diversion Biological

Opinion (NMFS 2013). However, the results could not be replicated for steelhead trout and therefore the modeling has not been completed for this EIS.

4.12.2.4.5.3 Water Temperature Changes – Alternative 2

The effects of stream temperature changes on fish under the action alternatives were analyzed and reported in a technical memorandum titled Stream Temperature Impacts on Fish, provided as **Appendix J-2**. Analysis methods used in this memorandum are summarized in Section 4.12.2.3.4.3, Water Temperature Changes – Alternative 1 (Chinook Salmon). The following is a summary of the analysis and results for steelhead trout under Alternative 2.

It is anticipated that water temperature will increase under Alternative 2 and would cause a net increase in suitable habitat for steelhead trout. **Table 4.12-35** presents the length of streams within selected relevant baseline temperature threshold categories for steelhead trout life stages under Alternative 2, including at certain time intervals (Mine Years 6, 12, 18, and 112 [i.e., post-closure]). The dataset for steelhead trout under Alternative 2 presented in Table 11 of **Appendix J-2**.

Table 4.12-35 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 2 – Steelhead Trout

Steelhead Trout Temperature Threshold Categories	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Juvenile Rearing - Optimal	2.13 km	11.19 km (+9.06 km)	11.28 km (+9.15 km)	6.54 km (+4.41 km)	10.29 km (+8.16 km)
Common Summer Habitat Use - Optimal	2.13 km	7.71 km (+5.58 km)	11.28 km (+9.15 km)	6.54 km (+4.41 km)	9.11 km (+6.98 km)
Total Available Habitat	2.13 km	11.19 km (+9.06 km)	12.96 km (+10.83 km)	12.12 km (+9.99 km)	12.12 km (+9.99 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62).

Temperatures are in °C.

Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

Specifically, **Table 4.12-35** shows the following:

- A net increase in habitat within the optimal temperature range for juvenile rearing habitat during operations and at post-closure; from 2.13 km at baseline to 10.29 km at EOY 112;
- A net increase in habitat within the optimal temperature range for common summer habitat during operations and at post-closure; from 2.13 km at baseline to 9.11 km at EOY 112;
- Total habitat availability for this species increases to varying degrees at points along the timeline of the SGP and is anticipated to be higher than baseline at post-closure; From 2.13 km at baseline to 12.12 km at EOY 112.

4.12.2.4.5.4 Critical Habitat – Alternative 2

The effects on steelhead trout critical habitat would be the same as those described under Alternative 1 (Section 4.12.2.3.5.4, Critical Habitat – Steelhead Trout – Alternative 1).

4.12.2.4.5.5 Integration of Species/Habitat Effects for Steelhead Trout – Alternative 2

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs under Alternative 2 would affect steelhead trout in the analysis area. These effects may cause injury or mortality to individuals and temporary displacement from several mine site streams during certain periods when habitat conditions become unsuitable. This would cause a temporal loss of habitat.

Effects on steelhead trout outside the mine site would be the same as described under Alternative 1.

Following closure and reclamation, the net effect would be an increase in both the quantity and quality of habitat for steelhead trout.

- **Net gain for steelhead trout IP habitat:** Useable habitat would increase 12.7 percent over the SGP, a gain of approximately 2.8 km. The increase in steelhead trout IP habitat would occur in Mine Year 12 (decommissioning of EFSFSR tunnel) and Mine Year 17 (Meadow Creek DRSF/TSF channel construction).
- By Mine Year -1, steelhead trout would gain access to 8.53 km of natural habitat that is currently blocked by barriers. However, also occurring in Mine Year -2, access to 1.91 km of steelhead trout IP habitat in upper Meadow Creek would be blocked by a diversion and in-perpetuity by the TSF/DRSF.
- The predicted increase in stream temperatures would result in an increase of approximately 10 km in the amount of available habitat with stream temperatures suitable to support the life processes of steelhead trout.

The Forest Service has preliminarily determined that Alternative 2 will adversely affect steelhead trout and their critical habitat. Informal Section 7 ESA consultation is ongoing with the NMFS.

4.12.2.4.6 Bull Trout Specific Impacts - Alternative 2

4.12.2.4.6.1 Occupancy Modeling – Alternative 2

The following subsections summarize the results of the OM for bull trout under Alternative 2 for selected Mine Years. See Section 3.12.4.4.5, Occupancy Modeling, for a description of the OM methodology and baseline conditions. The full technical memorandum for the OM is provided as **Appendix J-7**.

Occupancy Probabilities

Table 4.12-36 presents the OM-derived distance-weighted average occupancy probabilities for bull trout by stream reach under Alternative 2 for five different time periods.

Table 4.12-36 Distance Weighted Average Bull Trout Occupancy Probabilities for Selected Modeled Mine Years Under Alternative 2

Stream Reach	Baseline	EOY 6	EOY 12	EOY 18	EOY 112
Stream Reach 1 (EFSFSR upstream of Sugar Creek to Meadow Creek)	9.51%	7.42%	6.59%	5.83%	6.56%
Stream Reach 2 (Meadow Creek Watershed)	6.27%	5.93%	5.66%	3.12%	4.37%
Stream Reach 3 (EFSFSR upstream of Meadow Creek)	9.34%	7.33%	7.31%	7.25%	7.40%
Stream Reach 5 (Headwaters of EFSFSR watershed)	8.31%	7.04%	6.76%	5.42%	6.11%

Table Source: **Appendix J-7**, Occupancy Modeling Technical Memoranda

Table Notes:

EOY = End of Mine Year.

Stream channel alternations described in Section 4.12.2.4.1, Physical Stream Channel Changes – Alternative 2, would impact occupancy probabilities for bull trout in the OM model area. The greatest reduction in bull trout occupancy probabilities is predicted to occur in Stream Reach 1 and Stream Reach 2 in EOY 18 because of the completion of the TSF/DRSF. However, the operational diversion of Meadow Creek around the Hangar Flats pit lake, which would be retained as the post-closure main channel, occurs at Mine Year -1. This change would block lake habitat for bull trout. Also, diversion of low streamflows in Meadow Creek via underground pipes around the TSF and Hangar Flats DRSF would prevent water temperature increases during operations and mitigate some of the potential reductions of downstream bull trout occupancy probabilities that would occur without this diversion.

Length of Available Habitat

Table 4.12-37 provides the length of available habitat for bull trout for each modeled mine year for Alternative 2.

Table 4.12-37 Length of Available Habitat for Bull Trout for Each Stream Reach within the Mine Site Study Area for Alternative 2

Stream Reach	Baseline (km)	EOY 6 (km)	EOY 12 (km)	EOY 18 (km)	EOY 112 (km)
Stream Reach 1 (EFSFSR upstream of Sugar Creek to Meadow Creek)	10.45	6.23	10.00	10.92	10.92
Stream Reach 2 (Meadow Creek Watershed)	15.10	6.44	6.44	14.72	14.72
Stream Reach 3 (EFSFSR upstream of Meadow Creek)	16.16	16.16	16.16	16.16	16.16
Stream Reach 5 (Headwaters of EFSFSR watershed)	41.70	28.83	32.60	41.80	41.80

Table Source: **Appendix J-7**, Occupancy Modeling Technical Memoranda

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).

The greatest decreases of available potential habitat for bull trout under Alternative 2 are projected to occur from baseline to Mine Year 6 in Stream Reach 1 and Stream Reach 2. During this period, the main activities that contribute to the loss of habitat in these areas are the diversion of Meadow Creek around the Hangar Flats pit lake, the construction of the French drain on Blowout Creek, the EFSFSR tunnel, and dewatering of the Yellow Pine pit lake. The length of available habitat in Stream Reach 2 would remain below baseline as the operational diversion of Meadow Creek around the Hangar Flats pit lake would be retained as the post-closure main channel, eliminating regular available access for bull trout into the pit lake.

Under Alternative 2, the amount of blocked suitable habitat for bull trout would be the same as under Alternative 1, except that Hennessey Creek would not be routed into the EFSFSR tunnel so no suitable habitat would be blocked by Mine Year 6. Major barriers associated with the Yellow Pine pit cascade and the box culvert would be removed in Mine Year -1. By Mine Year 18, following mine actions (e.g., EFSFSR tunnel decommissioning, stream enhancement, and reclamation), suitable habitat would only be blocked by fish passage barriers associated with the TSF and two DRSFs. Two areas, Fiddle Creek (approximately 4 km) and Upper Meadow Creek (approximately 10 km), would remain blocked in perpetuity due to the high-gradient stream segments flowing off the TSF/DRSF or Fiddle DRSF.

Based on the current known extent of bull trout occupancy, bull trout may be extirpated from the reaches upstream of the TSF/DRSFs when the reaches within the footprint would be dewatered and flow would be diverted into the diversions that route water around the facilities. With no evidence that bull trout occur in small headwater streams upstream of the proposed TSF, and the gradient barriers that would be created on the facility faces, there would be no mechanism by which bull trout would be able to volitionally (i.e., naturally) recolonize the reaches on top of the TSF/DRSF.

Access for bull trout to available habitat is further discussed in the associated technical memorandum provided in **Appendix J-3,** Barriers Technical Memorandum.

4.12.2.4.6.2 Streamflows – Alternative 2

As described previously in Section 4.12.2.3.6.2, Streamflows - PHABSIM Analysis for Bull Trout for Alternative 1, the assessment of impacts to bull trout habitat is based on the results of the Snake River Basin Adjudication PHABSIM study of the late 1980s and early 1990s (Fifth Judicial District, State of Idaho 2014). Key to the impact assessment is the change in discharge rates during the low-flow period in the different stream reaches of the mine site, including the functional relationship between discharge rate and bull trout habitat, expressed as WUA. A more detailed description of the process and the impact assessment approach for bull trout WUA is provided in the above-referenced section.

Given the general relationships between stream discharge and bull trout habitat previously provided in **Table 4.12-18,** potential impacts can be inferred from changes in discharge at the stream reaches of the mine site. **Table 4.12-38** shows that the changes in discharge during the low-flow period in the different mine site reaches under Alternative 2 varies as a function of location and Mine Year.

Table 4.12-38 Alternative 2 Percent Change in Streamflow for the Low-Flow Period (August – March) for Active Mine Years and Post-closure

Mine Year	EFSFSR Upstream of Sugar Creek (Index 2 Stream)[2]	Sugar Creek (Index 2 Stream)[2,3]	EFSFSR Upstream of Meadow Creek (Index 1 Stream)[2]	Meadow Creek (Index 1 Stream)[2]
-1	-5.2	+2.9	+2.2	-31.0
1	-15.3	+4.9	+3.5	-26.3
2	-16.7	+4.4	+3.3	-25.9
3	-24.7	+4.4	+3.0	-24.8
4	-23.0	+5.3	+3.5	-25.3
5	-21.3	+4.9	+4.1	-23.4
6	-21.7	+5.2	+4.4	-23.2
7	-13.3	+4.3	+6.3	-28.4
8	-9.7	+4.1	+7.4	-29.3
9	-19.7	+4.7	+6.1	-36.6
10	-19.0	+2.9	+5.2	-38.9
11	-15.9	+1.4	+4.9	-37.8
12	-6.8	+1.9	+5.4	-32.8

Mine Year	EFSFSR Upstream of Sugar Creek (Index 2 Stream)[2]	Sugar Creek (Index 2 Stream)[2,3]	EFSFSR Upstream of Meadow Creek (Index 1 Stream)[2]	Meadow Creek (Index 1 Stream)[2]
13	-13.8	-17.6	+2.4	-26.6
14	-5.2	-10.2	+2.1	-23.9
15	+0.5	-7.5	+1.7	-7.5
16	+2.1	-10.1	+2.0	+1.4
17	+2.8	-9.1	+1.9	+1.8
18	+2.6	-6.5	+1.4	+1.3
19	+3.7	-4.9	+1.6	+0.1
20	+3.5	-6.8	+2.2	+3.0
Post-Closure[1]	+3.7	+2.2	+2.1	+2.4

Table Source: **Appendix J-8**, PHABSIM Technical Memorandum

Table Notes:

1 The Low-Flow Period for Post-closure is defined as average of Mine Years 21 through 118.

2 Numbers represent percent change in streamflow; negative numbers (-) indicate a reduction in streamflow while positive numbers (+) indication an increase in streamflow.

3 Sugar Creek is summarized by itself because data were available for Sugar Creek.

There is a relationship between percent change in flow and the amount of available habitat per species and life stage.

The most common changes in stream flows are reductions in discharge, which are generally associated with the use of surface water for mining purposes, including the filling of the Hangar Flats pit in the Meadow Creek subwatershed (Mine Years 12 through 14). There also are years when stream reaches at the mine site would experience increases in discharge rate, largely due to groundwater pumping to provide water for the worker housing facility and other mining activities.

According to the data in **Table 4.12-38**, the greatest change in streamflow would be at Meadow Creek, a Stream Index 1 stream, where between Mine Year 1 and Mine Year 14 discharges are predicted to decrease at various levels ranging from 23.2 percent to 38.9 percent. The reach of the stream where these decreases would occur is the lower portion downstream of the Meadow Creek TSF/DRSF. During the first 13 years of mine activity, reductions of bull trout habitat for adult and juvenile fish are expected to reach as high as roughly 40 percent below baseline conditions. After Mine Year 15, and once mining activities are complete in Mine Year 20, Meadow Creek flows and associated adult/juvenile WUA are expected to rise by a small incremental percentage.

More moderate changes in streamflow are expected in Stream Reach 1, which encompasses the EFSFSR between its confluence with Meadow and Sugar creeks (represented by Index 2). For this reach, reductions in streamflow are predicted for all years up to Mine Year 14, ranging in value from 5.2 to 24.7 percent. For the five streams represented by Index 2 streams, the PHABSIM model predicts a roughly equivalent 10-15 percent reduction in adult and juvenile bull trout WUA. Slight increases in streamflow are predicted for the remaining Mine Years and the post-closure period, which are expected to result in equally small increases in bull trout WUA.

The two stream reaches in the mine site that are not expected to experience appreciable changes in flow or in bull trout habitat under Alternative 2 are Sugar Creek and the EFSFSR upstream of Meadow Creek. In the case of EFSFSR upstream of Meadow Creek, all years under consideration would experience a small percentage increase in the discharge rate with connected increases in bull trout WUA. Similar increases are expected for Sugar Creek, except during Mine Years 13 through 20, which would experience small decreases in discharge rate up to 17.6 percent in Mine Year 13. These WUA dynamics would not be expected to substantially alter long-term habitat values in Sugar Creek nor substantially affect populations of bull trout as streamflow and WUA values are expected to rise slightly in the post-closure years.

4.12.2.4.6.3 Water Temperature Changes – Alternative 2

The effects of stream temperature changes on fish under the action alternatives were analyzed and reported in a technical memorandum titled Stream Temperature Impacts on Fish, provided as **Appendix J-2**. Analysis methods used in this memorandum are summarized in Section 4.12.2.3.4.3, Water Temperature Changes – Alternative 1 (Chinook Salmon). The following is a summary of the analysis and results for bull trout under Alternative 2.

Table 4.12-39 presents the length of streams within selected relevant baseline temperature threshold categories for bull trout life stages under Alternative 2 as well as at certain intervals over the timeline of the SGP (Mine Years 6, 12, 18, and 112 [i.e., post-closure]). Full data for bull trout under Alternative 2 is presented in Table 13 of **Appendix J-2**.

Table 4.12-39 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 2 – Bull Trout

Bull Trout Temperature Threshold Categories	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Adult Spawning - Functioning Appropriately (FA)	1.61 km	0.00 km (-1.61 km)	0.00 km (-1.61 km)	0.00 km (-1.61 km)	0.00 km (-1.61 km)
Adult Spawning - Functioning at Risk (FR)	8.69 km	4.66 km (-4.03 km)	3.08 km (+5.61 km)	4.41 km (-4.28 km)	4.41 km (-4.28 km)
Adult Spawning - Functioning at Unacceptable Risk (FUR)	18.69 km	8.78 km (-9.91 km)	12.59 km (-6.10 km)	11.71 km (-6.98 km)	11.71 km (-6.98 km)
Incubation/Emergence - FUR	28.99 km	13.44 km (-15.55 km)	15.67 km (-13.32 km)	16.12 km (-12.87 km)	16.12 km (-12.87 km)
Juvenile Rearing - FA	13.66 km	6.66 km (-7.00 km)	6.41 km (-7.25 km)	6.41 km (-7.25 km)	6.41 km (-7.25 km)
Juvenile Rearing - FR	12.89 km	3.49 km (-9.40 km)	3.06 km (-9.83 km)	2.54 km (-10.35 km)	3.04 km (-9.85 km)

Bull Trout Temperature Threshold Categories	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Juvenile Rearing - FUR	2.44 km	3.29 km (+0.85 km)	6.2 km (+3.76 km)	7.17 km (+4.73 km)	6.67 km (+4.23 km)
Common Summer Habitat Use - Spawning Initiation	8.66 km	6.41 km (-2.25 km)	6.41 km (-2.25 km)	6.41 km (-2.25 km)	6.41 km (-2.25 km)
Total Available Habitat	28.99 km	13.44 km (-15.55 km)	18.42 km (-10.57 km)	16.12 km (-12.87 km)	16.12 km (-12.87 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

FA = functioning appropriately; FR = functioning at risk; FUR = functioning at unacceptable risk.

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).

Temperatures are in °C.

Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

It is anticipated that water temperature increases under Alternative 2 would result in a net decrease in suitable habitat for bull trout life stages.

Specifically, **Table 4.12-39** shows the following:

- A net decrease in habitat within the “functioning appropriately” category for juvenile rearing; from 13.66 km at baseline to 6.41 km at EOY 112;
- A net decrease in habitat within the “functioning at risk” category for juvenile rearing; from 12.89 km at baseline to 3.04 km at EOY 112;
- A net decrease in habitat within the “functioning at unacceptable risk” category for adult spawning (from 18.69 km at baseline to 11.71 at EOY 112) and incubation/emergence (from 28.99 km at baseline to 16.12 km at EOY 112);
- A net increase in habitat within the “functioning at unacceptable risk” category for juvenile rearing; from 2.44 km at baseline to 6.67 km at EOY 112;
- A net decrease in habitat within the optimal temperature range for spawning initiation; Ffrom 8.66 km at baseline to 6.41 km at EOY 112; and
- Total habitat availability for bull trout would decrease to varying degrees at points along the timeline of the SGP and is anticipated to be lower than baseline at post-closure; Ffrom 28.99 km at baseline to 16.12 km at EOY 112.

4.12.2.4.6.4 Loss of Lake Habitat – Alternative 2

Under Alternative 2, the Hangar Flats pit lake water depth would be approximately 140 feet due to the partial backfilling of the pit with development rock (Brown and Caldwell 2019d), which is approximately 40 feet shallower than under the other action alternatives. Meadow Creek would not be routed through the Hangar Flats pit lake post-closure, but instead the interim channel around the Hangar Flats pit would be retained as the main channel. Therefore, there would be no connection between Meadow Creek and the Hangar Flats pit lake except as occasional outflow from the lake through a channel that would reconnect with lower Meadow Creek downstream of the lake. In order to fill the pit lake faster, combined flows above 5 cfs between Meadow Creek and Blowout Creek, would be diverted to the Hangar Flats pit. Also, there would be a fish exclusion diversion installed to prevent fish from being entrained (i.e., trapped) during the diversion of water.

Under Alternative 2, the Hangar Flats pit lake would be connected to Meadow Creek only at the outlet, which would create changes in the outflow discharge and water temperature.

The mean August discharge from the Hangar Flats pit lake to Meadow Creek would be 1.09 cfs with an average daily water temperature of 19.6°C. The maximum weekly summer flow would be slightly higher at 1.16 cfs at a water temperature of 21.1°C. And the maximum weekly fall flow would be approximately 1.06 cfs at 14.2°C (Brown and Caldwell 2019d).

Because the pit lake would not be connected to Meadow Creek (except at the outlet), it is unclear if bull trout would move into and out of the lake. Based on the flows described for Alternative 1, it is unlikely that there would be sufficient flows to connect the pit lake to Meadow Creek and provide for passage of bull trout for most of the year.

4.12.2.4.6.5 Critical Habitat – Alternative 2

Alternative 2 would have the same type of impacts on bull trout critical habitat at the mine site that are described under Alternative 1; however, the magnitude of the changes in flow and water temperature described above would be reduced by the proposed water management measures at the mine site. The effects on bull trout critical habitat outside the mine site would be the same as those described under Alternative 1 because there would be no changes to access roads or off-site facilities that would impact fish or fish habitat differently.

The Meadow Creek diversion and then the construction and operation of the TSF/DRSF would block approximately 4.7 km of bull trout habitat starting in Mine Year -1 with the diversion and continuing with the TSF (**Table 4.12-40**). Volitional fish access upstream of this area would be permanently blocked.

Table 4.12-40 Alternative 2 Length of Bull Trout Critical Habitat Blocked Above Each Fish Passage Barrier

Block ID	Bull Trout - Critical Habitat Blocked (km)					
	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20
EFSFSR Yellow Pine pit (02)	17.11	11.71	NB	NB	NB	NB
EFSFSR Box Culvert (203)	13.78	9.12	NB	NB	NB	NB
Hennessy Creek (01)	0	0	NB	NB	NB	NB
Meadow Creek (05)	5.39	NB	NB	NB	NB	NB
Meadow Creek diversion and TSF/DRSF	NB	NB	4.67	4.67	4.67	4.67

Table Source: **Appendix J-3**, Barriers Technical Memorandum

Table Notes:

NB = No Barrier.

km = kilometer (1 km = 0.62 mi).

EOY = End of Mine Year.

4.12.2.4.6.6 Integration of Species/Habitat Effects – Alternative 2

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs under Alternative 2 would affect bull trout in the analysis area. These effects may cause injury or mortality to individuals and temporary displacement from several mine site streams during certain periods when habitat conditions become unsuitable. This would cause a temporal loss of habitat. Following reclamation, the net effect would be a loss of both quantity and quality of habitat for bull trout.

Post-closure, a net decrease in quality and quantity of bull trout habitat would occur despite removal of passage barriers and an increase of lake habitat for bull trout including:

- The greatest reduction in bull trout occupancy probabilities would occur in Stream Reach 1 and Stream Reach 2 in EOY 18 following the construction of the operational diversion of Meadow Creek around the Hangar Flats pit lake that would be retained as the post-closure main channel. This change would result in a loss of connection to lake habitat for bull trout. Diversion of low streamflows in Meadow Creek via underground pipes around the TSF and Hangar Flats DRSF would prevent water temperature increases during operations and mitigate some of the potential reductions of downstream bull trout occupancy probabilities that would occur without this diversion.
- The greatest change in streamflow would be at Meadow Creek where, between Mine Year 1 and Mine Year 14, discharges are predicted to decrease at various levels ranging from 23.2 percent to 38.9 percent. The reach of the stream where these decreases would occur is the lower portion downstream of the Meadow Creek TSF/DRSF. During the first 13 years of mine activity, reductions of bull trout adult and juvenile habitat are expected to reach as high as roughly 40 percent below baseline conditions. After Mine

Year 15, and once mining activities are complete in Mine Year 20, Meadow Creek flows and associated adult/juvenile WUA are expected to rise by a small incremental percentage.

- It is anticipated that water temperature increases under Alternative 2 would result in a net decrease in suitable habitat for bull trout life stages, from approximately 29 km at baseline to 16 km post-closure.
- In Mine Year -1 access to approximately 4.7 km of bull trout critical habitat in upper Meadow Creek would be permanently blocked by the diversion of Meadow Creek around the TSF/DRSF footprint and the completion of the TSF/DRSF, which would become a gradient barrier to upstream and downstream fish passage.

The Forest Service has preliminarily determined that Alternative 2 will adversely affect bull trout and their critical habitat. Informal Section 7 ESA consultation is ongoing with the USFWS.

4.12.2.4.7 Cutthroat Trout Specific Impacts – Alternative 2

4.12.2.4.7.1 Occupancy Modeling – Alternative 2

The following subsections summarize the results of the OM for cutthroat trout under Alternative 2 for selected mine years. See Section 3.12.4.4.5, Occupancy Modeling, for an extensive description of the OM methodology and baseline conditions. The full technical memorandum for the OM is provided as **Appendix J-7**.

Occupancy Probabilities

Table 4.12-41 presents the OM-derived distance-weighted average occupancy probabilities for cutthroat trout by stream reach under Alternative 2 for five different time periods.

Table 4.12-41 Distance Weighted Average Cutthroat Trout Occupancy Probabilities for Selected Modeled Mine Years in Each Stream Reach under Alternative 2

Stream Reach	Baseline	EOY 6	EOY 12	EOY 18	EOY 112
Stream Reach 1 (EFSFSR upstream of Sugar Creek to Meadow Creek)	64.73%	63.71%	64.32%	62.50%	63.66%
Stream Reach 2 (Meadow Creek Watershed)	64.06%	64.21%	64.11%	61.39%	63.90%
Stream Reach 3 (EFSFSR upstream of Meadow Creek)	63.59%	63.04%	63.04%	63.05%	63.04%
Stream Reach 5 (Headwaters of EFSFSR watershed)	63.79%	63.45%	63.64%	62.32%	63.51%

Table Source: **Appendix J-7**, Occupancy Modeling Technical Memoranda

Table Notes:

EOY = End of Mine Year.

Stream channel alterations described in Section 4.12.2.4.1, Physical Stream Channel Changes – Alternative 2 would impact occupancy probabilities for cutthroat trout in the OM model area. As described for bull trout, the greatest reduction in cutthroat trout occupancy probabilities would occur in Stream Reach 1 and Stream Reach 2 in EOY 18 following the construction of the operational diversion of Meadow Creek around the Hangar Flats pit lake that would be retained as the post-closure main channel. As described for bull trout, diversion of low streamflows in Meadow Creek via underground pipes around the TSF and Hangar Flats DRSF would prevent water temperature increases and mitigate some of the potential reductions of downstream cutthroat trout occupancy probabilities that would occur without this diversion.

Length of Available Habitat

Table 4.12-42 presents the length of available habitat for cutthroat trout from baseline to several modeled Mine Years by stream reach.

Table 4.12-42 Length of Available Habitat for Cutthroat Trout for Stream Reach within the Mine Site Analysis Area for Alternative 2

Stream Reach	Baseline (km)	EOY 6 (km)	EOY 12 (km)	EOY 18 (km)	EOY 112 (km)
Stream Reach 1 (EFSFSR upstream of Sugar Creek to Meadow Creek)	10.45	6.23	10.00	10.92	10.92
Stream Reach 2 (Meadow Creek Watershed)	15.10	6.44	6.44	14.72	14.72
Stream Reach 3 (EFSFSR upstream of Meadow Creek)	16.16	16.16	16.16	16.16	16.16
Stream Reach 5 (Headwaters of EFSFSR watershed)	41.70	28.83	32.60	41.80	41.80

Table Source: **Appendix J-7**, Occupancy Modeling Technical Memoranda

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).

The changes in habitat for cutthroat trout would be the same as those described for bull trout in Section 4.12.2.4.6.1, Occupancy Modeling – Alternative 2.

The amount of cutthroat trout habitat blocked by existing passage barriers at baseline conditions as a result of activities and infrastructure in Alternative 2 would be the same as for bull trout (Section 4.12.2.4.6.1, Occupancy Modeling – Alternative 2).

4.12.2.4.7.2 Streamflows – Alternative 2

As described previously in Section 4.12.2.3.6.2, Streamflows - PHABSIM Analysis for Bull Trout for Alternative 1, all assessments of impacts to cutthroat trout habitat are based on the results of the Snake River Basin Adjudication PHABSIM study of the late 1980s and early 1990s (Fifth Judicial District, State of Idaho 2014). Key to the impact assessment is the SGP-affected change in discharge rates during the low-flow period in the different stream reaches of the mine site, including the functional relationship between streamflow, or discharge rate, and cutthroat trout habitat, expressed as WUA by the PHABSIM model. A full description of how the PHABSIM model results are used to assess impacts to cutthroat trout WUA is provided in **Appendix J-8**.

Given the general direct relationship between stream discharge and cutthroat trout habitat provided in **Table 4.12-18,** project impacts can be inferred from changes in discharge at the stream reaches of the mine site. **Table 4.12-38** (in Alternative 2 bull trout section above) shows the changes in stream discharge at the different mine site stream locations under Alternative 2. As seen in **Table 4.12-38** changes in flow volume in streams are variable within the different Mine Years and stream reaches. The most common effects from the SGP are reductions in discharge associated with the use of surface water for mining purposes, including the filling of the Hangar Flats pit. There also are years when stream reaches would experience increases in discharge, primarily from treated water discharges from sanitary water, inflow from the RIBs, and other activities at the mine site.

The greatest change in streamflow would be at Meadow Creek, a Stream Index 1 stream, between Mine Year 1 and Mine Year 14, discharges are predicted to decrease from 23.2 to 38.9 percent. The reach of the creek where these decreases would be most noticeable is the lower portion downstream of the Meadow Creek TSF/DRSF The PHABSIM results predict that a 44 percent reduction in discharge would result in up to a 56 percent reduction in adult and juvenile in cutthroat trout WUA, while fry WUA is predicted to fall by approximately 8 percent. After Mine Year 15, and once mining activities are complete in Mine Year 20, Meadow Creek flows and associated cutthroat trout WUA are expected to rise by a small incremental percentage.

More moderate changes in streamflow are expected in Stream Reach 1, which encompasses the EFSFSR between its confluence with Meadow and Sugar creeks. For this reach, an Index 2 site, reductions in streamflow are predicted for all years up to Mine Year 14, ranging in value from 5.2 percent to 24.7 percent. For the five streams that represent Index 2 streams, the PHABSIM model predicts a 10 to 15 percent reduction in WUA for all life stages of cutthroat trout except fry, which are expected to experience very small reduction in WUA. Slight increases in streamflow are predicted for the remaining mine years and the post-closure period, which are expected to result in equally small increases in WUA for all four life stages. These small changes in WUA are not expected to materially affect populations of cutthroat trout in Stream Reach 1.

The two stream reaches at the mine site that are not expected to experience meaningful changes in flow or cutthroat trout habitat are Sugar Creek and the EFSFSR upstream of Meadow Creek. In the case of EFSFSR upstream of Meadow Creek, all years under consideration would experience a small increase in streamflow with connected increases in cutthroat trout WUA. Similar increases are expected for Sugar Creek, except for Mine Years 13 through 20, which would experience small decreases in streamflow up to 17.6 percent in Mine Year 13. These small changes are the result of limited SGP activities occurring within EFSFSR upstream of Meadow Creek confluence and Sugar Creek. These WUA dynamics would not be expected to substantially alter long-term habitat values in these two stream reaches and streamflow and WUA values are expected to rise slightly in the post-closure years.

4.12.2.4.7.3 Water Temperature Changes – Alternative 2

The effects of stream temperature changes on fish under the action alternatives were analyzed and reported in a technical memorandum titled Stream Temperature Impacts on Fish, provided as **Appendix J-2**. Analysis methods used are summarized in Section 4.12.2.3.4.3, Water Temperature Changes – Alternative 1 (Chinook Salmon). The following is a summary of the analysis and results for cutthroat trout under Alternative 2.

Table 4.12-43 presents the length of streams within selected relevant baseline temperature threshold categories for cutthroat trout life stages under Alternative 2 as well as at certain intervals over the timeline of the SGP (Mine Years 6, 12, 18, and 112 [i.e., post-closure]). Full data for cutthroat trout under Alternative 2 presented in Table 12 of **Appendix J-2**.

Table 4.12-43 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 2 – Cutthroat Trout

Cutthroat Trout Temperature Threshold Categories	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Adult Spawning - Field Observed Spawning Temperature	0.85 km	0.89 km (+0.04km)	0.52 km (-0.33 km)	0.52 km (-0.33 km)	0.52 km (-0.33 km)
Juvenile Rearing - Functioning Appropriately	5.01 km	2.54 km (-2.47 km)	2.29 km (-2.72 km)	2.37 km (-2.64 km)	2.37 km (-2.64 km)
Juvenile Rearing - Functioning at Risk	15.1 km	7.59 km (-7.51 km)	7.59 km (-7.51 km)	6.76 km (-8.34 km)	9.04 km (-6.06 km)
Juvenile Rearing - Functioning at Unacceptable Risk	8.87 km	5.93 km (-2.94 km)	10.27 km (+1.4 km)	18.51 km (+9.64 km)	16.23 km (+7.36 km)
Total Available Habitat	28.98 km	16.06 km (-12.92 km)	20.15 km (-8.83 km)	27.64 km (-1.34 km)	27.64 km (-1.34 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi.

Temperatures are in °C.

Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

It is anticipated that water temperature increases under Alternative 2 would result in a net loss of 1 km in overall stream lengths able to sustain optimal water temperatures for cutthroat trout life stages during mine operations and at post-closure.

Specifically, **Table 4.12-43** shows the following:

- A net decrease in habitat within the optimal field-observed temperatures range for spawning during operations and at post-closure;
- A net decrease in habitat within the “functioning appropriately” and “functioning at risk” temperature range during operations and at post-closure;
- A net increase in habitat within the “functioning at unacceptable risk” post-closure during operations and at post-closure; and
- Total habitat availability for this species decreases to varying degrees at points along the timeline of the SGP and is anticipated to be lower than baseline at post-closure.

4.12.2.4.7.4 Integration of Species/Habitat Effects for Cutthroat Trout – Alternative 2

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs under Alternative 2 would affect cutthroat trout in the analysis area. These effects may cause injury or mortality to individuals and temporary displacement from several mine site streams during certain periods when habitat conditions become unsuitable. This would cause a temporal loss of habitat. Following reclamation, the net effect would be a small loss of both quantity and quality of habitat for cutthroat trout.

Effects on cutthroat trout outside the mine site would be the same as described under Alternative 1.

Following reclamation, the net effect would be a minor loss of both quantity and quality of habitat for cutthroat trout including:

- Slight decrease (>0.5 percent) in projected occupancy potential and basically no change in the length of available stream length for habitat post-closure.
- The greatest change in streamflow would be at Meadow Creek where, between Mine Year 1 and Mine Year 14, discharges are predicted to decrease at various levels up to 38.9 percent. The reach of the stream where these decreases would occur is the lower portion downstream of the Meadow Creek TSF/DRSF. During the first 13 years of mine activity, reductions of cutthroat trout adult and juvenile habitat are expected to reach as high as roughly 40 percent below baseline conditions. After Mine Year 15, and once mining activities are complete in Mine Year 20, Meadow Creek flows and associated adult/juvenile WUA are expected to rise by a small incremental percentage.
- Water temperature increases predicted under Alternative 2 would result in a small net loss of 1 km in overall stream lengths (from approximately 29 km at baseline to 28 km at EOY 20) able to sustain optimal water temperatures for cutthroat trout life stages during mine operations and at post-closure.

Alternative 2 may indirectly impact Westslope cutthroat trout individuals but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

4.12.2.4.8 Impacts To Other Species – Alternative 2

Under Alternative 2, the same types of negative effects on all aquatic species described under Alternative 1 also would occur. The proposed changes in water management at the mine site would reduce the level of changes in water temperature and streamflow important to fish, which would reduce the magnitude of impacts to all aquatic species at the mine site. Despite these beneficial measures, it would not eliminate all potential impacts. Impacts to all aquatic species in waterways outside the mine site would be the same as described under Alternative 1.

4.12.2.4.9 Alternative 2 Water Quality Management Plan

Under Alternative 2, potential surface water quality impacts could be mitigated by implementing both active and passive water treatment systems during the SGP and post-closure. Water treatment technologies considered in the Water Quality Management Plan (Brown and Caldwell 2020b) include temporary membrane systems; evaporation to reduce the volume of water requiring treatment; iron coprecipitation to treat arsenic and antimony; sulfide precipitation as a contingency to treat dissolved mercury; and biochemical reactors to passively treat post-closure flows from the TSF and Fiddle DRSF. While it is predicted these measures would improve water quality in the mine site streams, the Water Quality Management Plan proposed activities also would affect stream flows and water temperature.

It should be noted that the changes in stream flows as they relate to the proposed activities in the Water Quality Management Plan (Brown and Caldwell 2020b) are not included in the fish habitat modeling summarized under Alternative 2 and detailed in the following technical memorandums in **Appendix J**: Stream Temperature Impacts on Fish, Barriers, Intrinsic Potential, Chinook Salmon Streamflow/Productivity, Occupancy Modeling, and PHABSIM. Because the water treatment activities have not been incorporated into the fish habitat modeling, the following provides a qualitative analysis of how these activities may affect fish.

Fish Passage

Water treatment would not affect fish passage under Alternative 2 because Meadow Creek would not be routed through the Hangar Flats pit lake; rather, the operational diversion of Meadow Creek around the Hangar Flats pit lake would be retained as the post-closure main channel. The Hangar Flats pit lake overflow water would be diverted to the active Water Treatment Plant located in the EFSFSR drainage.

Water Quality

In general, Alternative 2 would maintain existing surface water quality in the headwaters of the EFSFSR sub-watershed during the mine operations period (Section 4.9.2.2.2, Surface Water Quality – Alternative 2).

The following describes the main differences in mine site stream water quality for Alternative 2, and Section 4.9.2.2.2, Surface Water Quality – Alternative 2, provides more detailed information. In Meadow Creek, water treatment would be at meeting arsenic and mercury surface water standards, reducing concentrations by 50 and 60 percent, respectively, compared to Alternative 1 without water treatment. The treatment of the Fiddle DRSF toe seepage under Alternative 2 would substantially reduce arsenic loading to Fiddle Creek, such that predicted arsenic concentrations at YP-T-11 would remain below the surface water standard during the entire post-closure period. In the EFSFSR, water quality improvements would be less pronounced; however, water treatment would reduce arsenic and mercury at post-closure to below or near baseline levels. Copper concentrations were not predicted in the EFSFSR under Alternative 2, but conditions similar to arsenic and mercury may be expected for copper as well. Similarly, reductions in concentration levels of COCs would lead to reduced impacts to fish, fish habitat, or fish prey.

Stream Flows

Storing mine contact water in equalization ponds as proposed in the Water Quality Management Plan (Brown and Caldwell 2020b) during the construction and operation periods could result in small changes to stream flows that have not been quantified. The impounded contact water would likely represent a small percentage of the runoff contributing to predicted operational streams flows. The discharge of treated water also is projected to have minimal effect on monthly average flow in the EFSFSR downstream of Meadow Creek compared to the baseline flows (Brown and Caldwell 2020b).

The proposed active treatment of the Hangar Flats pit lake water could affect downstream flows in Meadow Creek by diverting the pit lake overflow to the active Water Treatment Plant located in the EFSFSR drainage. The rate of diversion from the pit lake during the maximum weekly summer condition (corresponding to late season baseflow) is estimated to be 1.23 cfs (Brown and Caldwell 2020b). Assuming this entire diversion volume would have otherwise flowed directly to Meadow Creek, the pit lake diversion for water treatment could reduce late season flows in Meadow Creek by up to one third, based on average predicted seasonal low flows of 3.8 cfs for the baseline scenario. Although the pit lake discharge requiring treatment would be removed from Meadow Creek, it would still be restored to the watershed at a downstream outfall on the EFSFSR where it may have a positive effect on fish passage by increasing flow during the low flow season. The reduction in flow in Meadow Creek would negatively affect fish, especially given that the portion of Meadow Creek is currently almost too shallow for Chinook salmon and steelhead trout passage. If the stream flows are reduced enough to create a new barrier to these species, it would cut off access to spawning habitat upstream.

Water Temperature

Three actions associated with water treatment in the centralized Water Treatment Plant could affect surface water temperatures:

- Warming of water by the addition of a heat load in the treatment process;
- Warming of contact runoff water residing in contact water storage ponds; and
- Addition of pit dewatering water to the contact water runoff in the Water Treatment Plant.

Equalization in contact water ponds would be managed to minimize water temperature increases during the summer. In the warm, low-flow periods (July, August, and September), it is predicted that there would be very little change in stream temperature for the average water yield scenario, which represents the typical condition (Brown and Caldwell 2020b). Water withdrawal from the ponds would be managed to minimize holding times during the summer, when the greatest degree of warming would occur, and maximize withdrawal prior to winter in order to create space for storage of spring runoff.

Results of the water temperature modeling analysis for the treated water indicate that increases in EFSFSR water temperatures would be limited to late fall through spring. From November through March, stream temperatures at the outfall would increase from 0 to 4ºC (Brown and Caldwell 2020b). Optimal incubation temperatures for salmonids vary but are generally warmer than 4°C. The optimal incubation temperature for most salmon species is 8°C. Optimal incubation temperatures for bull trout eggs and rearing larvae are generally reported to be in the range of 2 to 10°C (Brown and Caldwell 2020b). The increased water temperatures would be closer to optimum for incubation and emergence for Chinook salmon and bull trout than they are at baseline. This would have a positive effect on these species, potentially increasing survivorship. As described in Section 4.12.2.3.3.1, Changes to Watershed Condition Indicators Analyzed in Detail at the Mine Site, subsection on Streamflows – Alternative 1, decreased winter flows may negatively affect fish species that overwinter or have eggs in the mine site streams; under Alternative 2 these impacts may be mitigated by the warmer winter flows.

The length of the EFSFSR for which water temperatures would be raised during the winter-spring period would be limited because mixing of the discharge with colder ambient streamflow would result in water temperatures being lowered rapidly within a relatively short stream reach, especially given the cold air temperatures and limited solar input during this period (Brown and Caldwell 2020b).

4.12.2.5 Alternative 3

Under Alternative 3 the Meadow Creek TSF and Hangar Flats DRSF would be relocated to the Upper EFSFSR valley upstream of the confluence with Meadow Creek. This proposed change would require relocating several growth media stockpiles, the worker housing facility, sanitary wastewater treatment facility, and composting facility adjacent to the worker housing facility; modifying access roads, service roads, and trails; and rerouting approximately 4 km of new transmission line. During construction of the TSF and DRSF in EFSFSR, the 7.5 million tons of spent ore in Meadow Creek valley would not be removed and reused, and the Bradley Mine tailings would not be reprocessed.

Like Alternative 1, the Burntlog Route would be the mine access road; however, an approximately 5.1-km-long segment would be routed through the Blowout Creek valley.

4.12.2.5.1 PHYSICAL STREAM CHANNEL CHANGES - ALTERNATIVE 3

Under Alternative 3 stream channel changes at the mine would differ from Alternative 1 at the EFSFSR, West End Creek, Hennessey Creek, and Meadow Creek to accommodate the different TSF/DRSF location (**Figure 4.12-10**).

Table 4.12-44 lists the stream channel changes, which include changing existing stream reaches into constructed diversions and stream enhancements. Compared to Alternative 1, Alternative 3 would affect a much longer section of the EFSFSR and a much shorter section of Meadow Creek. Two additional streams, Rabbit Creek and Fern Creek, also would be affected.

Table 4.12-44 Alternative 3 Stream Channel Changes

Stream Reaches	Length of Existing Channel Removed (km)	Length (km) and Duration of Diversions	Length of Enhancement (km)
EFSFSR	9.5 (1.9 hectares of Yellow Pine pit lake)	1.3 km for the re- routing of the EFSFSR into the tunnel (14 years)	4.0
Fiddle Creek	1.8	8 years	
Meadow Creek	0.6	16 years	
East Fork of Meadow Creek	7.7	No diversion	0.61
Rabbit Creek	0.8	No diversion	
Fern Creek	0.6	No diversion	
TOTAL	21	19.8	4.61

Table Source: AECOM 2020

Table Notes:

km = kilometers (1 km = 0.62 mi).

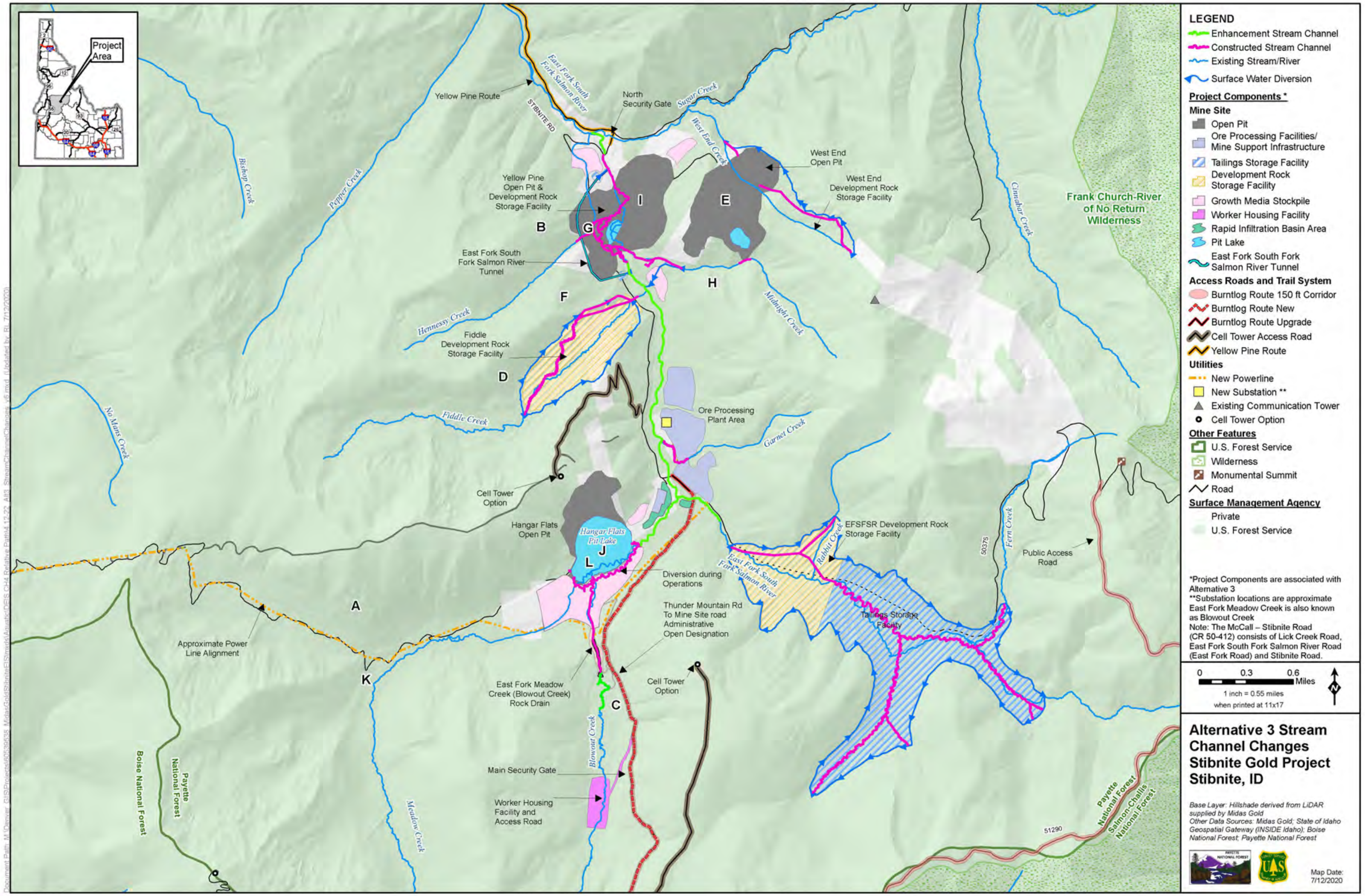


Figure Source: AECOM 2020

Figure 4.12-10 Alternative 3 Stream Channel Changes

This page intentionally left blank

4.12.2.5.2 Direct Effects To Individuals - Alternative 3

The risk of chemical spills under Alternative 3 would be the same as that described for Alternative 1 (refer to Section 4.12.2.3.2, Direct Effects to Individuals – Alternative 1).

Table 4.12-45a presents lengths of important fish habitat within 91 meters of the two access routes (Yellow Pine Route and Burntlog Route) under Alternative 3.

Table 4.12-45a Alternative 3 Important Fish Habitat within 91 meters of the Two Access Routes (Yellow Pine Route and Burntlog Route)

Fish Habitat within 91 meters	Yellow Pine Route	Burntlog Route
Bull Trout Critical Habitat	33.74 km	5.74 km
Steelhead Trout Critical Habitat	32.30 km	1.23 km
Chinook Salmon IP Habitat	35.99 km	4.83 km
TOTAL LENGTH	102.03	11.80

Table Source: AECOM 2020

Table Notes:

km = kilometers (1 km = 0.62 mi).

The risk of injury or mortality under Alternative 3 from access routes would be nearly the same as that described for Alternative 1, although there would be a decrease of 3.5 km for Burntlog Route in the length of important fish habitat within 91 meters of the access roads that would decrease the risk of injury or mortality of fish species in this area.

4.12.2.5.2.1 Mine Site – Dewatering, Fish Salvage, and Relocation

Compared to Alternative 1, Alternative 3 would affect a longer section of the EFSFSR and a shorter section of Meadow Creek because of the placement of the TSF/DRSF in EFSFSR drainage. In addition, Rabbit Creek and Fern Creek would be affected. The lengths of the channels to be removed are summarized in **Table 4.12-44**. There were no snorkeling sites in the headwaters of the EFSFSR upstream of the confluence with Meadow Creek, Rabbit Creek, or Fern Creek. The fish communities, if any, of Rabbit Creek and Fern Creek are unknown. Therefore, density estimates for the four special status fish are not available for this area of the subwatershed. **Table 4.12-45b** summarizes the range of density data and range of estimated fish salvage for the snorkeling sites in closest proximity to the stream channels to be removed.

Table 4.12-45b Estimated Fish Linear Densities and Salvage Numbers for Fish Sampling Sites Near or Within the Stream Channels to be Dewatered Under Alternative 3

Stream	Length of Existing Channel Removed (km)	Site Identification and Location	Mean Fish Linear Density – fish/m[1,2]			
			Chinook Salmon	Steelhead/Rainbow Trout	Bull Trout	Westslope Cutthroat Trout
Downstream of the Yellow Pine Pit and Upstream of Sugar Creek						
EFSFSR	9.5	MHWH-30 Upstream of Sugar Creek	0.561 (5330)	0.631 (5994)	0.093 (884)	0.125 (1188)
Upstream of the Yellow Pine Pit						
EFSFSR	9.5	MWH-22 Upstream of Midnight Creek	4.707 (44,716)	Not Present	Not Present	0.073 (694)
EFSFSR	9.5	MWH-011 Near Mining Camp	2.113 (20,074)	Not Present	Not Present	0.142 (1349)
EFSFSR	9.5	MWH-013 Near Mining Camp	0.061 (580)	Not Present	Not Present	0.263 (2498)
EFSFSR	9.5	MWH-025 Middle Reach	0.088 (836)	Not Present	Not Present	0.418 (3971)
EFSFSR	9.5	MWH-044 Stibnite Lodge	Not Present	Not Present	Not Present	0.608 (5776)
EFSFSR	9.5	MWH-026 Stibnite Lodge	Not Present	Not Present	Not Present	0.145 (1378)
Fiddle Creek	1.8	MWH-023 Lower Reach	Not Present	Not Present	Not Present	0.181 (326)
Fiddle Creek	1.8	MWH-024 Middle Reach	Not Present	Not Present	Not Present	0.430 (773)
Meadow Creek	0.6	MWH-031 Upstream of the East Fork Confluence	7.407 (4444)	Not Present	0.015 (9)	0.267 (160)

Stream	Length of Existing Channel Removed (km)	Site Identification and Location	Mean Fish Linear Density – fish/m[1,2]			
			Chinook Salmon	Steelhead/Rainbow Trout	Bull Trout	Westslope Cutthroat Trout
Meadow Creek	0.6	MWH-014 Stibnite Mine Site	4.020 (24,120)	Not Present	Not Present	0.090 (54)
EFMC	7.7	MWH-028 Lower Reach	6.175 (47,548)	Not Present	Not Present	0.097 (747)
EFMC	7.7	MWH-027 Upper Reach	Not Present	Not Present	Not Present	0.044 (339)

Table Sources: **Appendix J-10**

Table Notes:

1 (Total Fish Numbers/Length of Channel Removed).

2 Daytime surveys only – all fish size classes combined.

Fish/m = number of fish per meter of stream.

km = kilometer (1 km = 0.62 mi) m = meter (1 m = 3.28 ft).

DRSF = Development Rock Storage Facility.

EFMC = East Fork Meadow Creek.

Note that Fiddle Creek remains unchanged from Alternative 1. Large estimates of Chinook salmon salvage are the result of periodic translocations of spawning fish from South Fork Salmon River.

4.12.2.5.3 HABITAT ELEMENTS/WATERSHED CONDITION INDICATORS – ALTERNATIVE 3

4.12.2.5.3.1 Changes to WCIs at the Mine Site – Alternative 3

Water Temperature – Alternative 3

As described in Section 4.9.2.3.2.1, Surface Water Quality - Temperature, Alternative 3 would result in higher water temperatures than baseline conditions within Meadow Creek and the upper EFSFSR during both the mine operational and post-closure periods.

Table 4.12-46 provides a summary of predicted maximum weekly summer and fall water temperatures under Alternative 3 in the six stream reaches within the mine site for five different time periods.

Table 4.12-46 Maximum Weekly Summer and Fall Stream Temperatures Simulated for Alternative 3

Area	Simulated Daily Temperature Statistic	Existing Condition/No Action (°C)	EOY6 (°C)	EOY12 (°C)	EOY18 (°C)	EOY112 (°C)	Change from Baseline to EOY 112 (°C)
Upper EFSFSR immediately upstream of Meadow Creek	Summer	13.4	20.5	20.5	25.5	22.4	9.0
	Fall	11.1	16	16	19.2	15.5	4.4
Meadow Creek upstream of East Fork Meadow Creek	Summer	17.9	19.1	19.3	18.7	18.8	0.9
	Fall	15.1	16	16.2	16	16.1	1.0
Meadow Creek downstream of East Fork Meadow Creek	Summer	19.8	21.2	20.9	21.2	21.2	1.4
	Fall	16.2	17	16.9	16.5	17.3	1.1
Middle EFSFSR (between Meadow and Fiddle creeks)	Summer	17.4	21.8	21.4	23	22.3	4.9
	Fall	14	16.5	16.4	17.2	16.3	2.3
Lower EFSFSR (between Fiddle and Sugar creeks)	Summer	17.4	22	22.9	23.1	22.2	4.8
	Fall	14	16.5	17	17.6	16	2.0
EFSFSR downstream of Sugar Creek	Summer	14.9	18.8	19.9	19.8	19.4	4.5
	Fall	11.9	14.2	15	15.5	14.2	2.3

Table Source: Brown and Caldwell 2019b, Table B-47

Table Notes:

Temperatures in °C.

EOY = End of Mine Year.

Table 4.9-23 in Section 4.9.2.3.2.1, Surface Water and Groundwater Quality – Mine Site Temperature – Alternative 3, summarizes the temperatures for selected years for the predicted maximum weekly summer condition, average weekly summer condition, maximum weekly fall condition, and average weekly fall temperatures for several stream reaches throughout the mine site (Brown and Caldwell 2019b). Alternative 3 would result in water temperature increases for all simulated stream reaches during the mine operational and post-closure periods. As shown in **Table 3.12-22** and **Figure 3.12-12**, all six stream reaches within the mine site have baseline summer-season (June 1 through August 31) water temperatures that are in the “functioning at risk” WCI range for Chinook salmon, steelhead trout, and bull trout.

The following discussion provides an overview of the predicted water temperature changes that would affect fish and fish habitat to varying degrees depending on the timing, magnitude, duration, and frequency of exposure to the temperature tolerance thresholds for each species and life history function (e.g., spawning, juvenile rearing). The discussion is organized by the stream reaches shown in **Table 4.12-5**. The species-specific temperature analysis occurs in the Chinook salmon, steelhead trout, bull trout, and cutthroat trout subsections.

Water temperatures at the mine site would be increased primarily by the decrease in streamflow caused by the use of water for mining activities, and the change in stream habitat structure to longer and flatter meandering channels, which initially would have less shade due to riparian vegetation having been removed by general SGP disturbances including construction and operations activities.

The SPLNT models (Brown and Caldwell 2018, 2019a,b,c) used for the temperature predictions in **Table 4.12-46** do not account for changes to stream temperatures caused by changing climate conditions. Modeled future water temperatures (e.g., EOY 112) assumed, stream temperatures would be similar to the historic water temperature average without the SGP (Brown and Caldwell 2018). However, water temperature would likely be higher if climate change had been incorporated in the model. For additional information regarding potential climate change impacts to water temperatures see Section 3.12.4.7.3.3, East Fork South Fork Salmon River Watershed Baseline, Mine Site Watershed Condition Indicators Described in Detail – Water Temperature.

Upper EFSFSR Immediately Upstream of Meadow Creek

Temperatures in the Upper EFSFSR immediately upstream of Meadow Creek would increase from baseline conditions during operations and at post closure due to the construction of the TSF/DRSF in this location. Maximum water temperatures during the summer season in this area have the potential to exceed temperatures that are known to be stressful and even lethal to all the special status salmonids (**Appendix J-2**: Table 1) in perpetuity. Water temperatures that exceed 21°C for extended periods of time can be lethal to salmonids (**Appendix J-2**). **Table 4.12-46** indicated that such water temperature levels may be reached during the summer period based on SPLNT modeling (Brown and Caldwell 2019b). As such, the Upper EFSFSR immediately upstream of Meadow Creek would have a WCI rating for salmonids during the summer of functioning at risk at best through Mine Year 12, and potentially functionally unacceptable for much of the time thereafter (Rio ASE 2019).

Meadow Creek (both Upstream and Downstream of East Fork Meadow Creek)

In Meadow Creek, simulated stream temperatures upstream of its confluence with Blowout Creek would be warmer than baseline conditions due to reduced stream baseflows from dewatering Hangar Flats pit. In Meadow Creek downstream of the confluence with Blowout Creek, simulated maximum summer water temperatures are expected to be up to 1.4°C higher than baseline conditions during both mine operations and post-closure. Post-closure conditions in lower Meadow Creek are impacted by simulated discharges from the Hangar Flats pit lake.

During the life of the mine, maximum summer water temperatures in Meadow Creek have the potential to exceed temperatures that are known to be stressful and even lethal to all the special status salmonids (**Table 4.12-46**). Meadow Creek downstream of the East Fork Meadow Creek would have potentially lethal water temperatures during the summer in perpetuity. As such, Meadow Creek would have a WCI rating for salmonids during the summer of functioning at risk at best, and potentially functionally unacceptable for much of the time (Rio ASE 2019).

EFSFSR from Meadow Creek Downstream to Sugar Creek (Middle and Lower EFSFSR in **Table 4.12-46**)

Baseline water temperature conditions in this reach are less than optimum during the summer season with the potential for the maximum temperatures to reach sublethal and even lethal levels during the summer (**Table 4.12-46**). Water temperatures in this reach during the summer have the potential to adversely impact all four salmonid species and result in WCI ratings that are at best functioning at risk, and at worst functioning unacceptably (Rio ASE 2019).

EFSFSR Downstream of Sugar Creek

In the EFSFSR downstream of Sugar Creek, summer and fall stream temperatures would increase during the mine operational period and early post-closure period to reach a maximum at the EOY 18. After that time, average and maximum temperatures would likely remain stable or gradually decrease as riparian vegetation is established shading the stream. However, maximum summer and fall temperatures are still predicted to be greater than baseline during the post-closure period (**Table 4.12-46**). EFSFSR Downstream of Sugar Creek would have a WCI rating for salmonids during the summer of functioning at risk during operations and at post-closure based on the data for water temperature tolerances presented in **Appendix J-2**.

Sediment and Turbidity – Alternative 3

Under Alternative 3, sediment inputs to Meadow Creek upstream of Hangar Flats pit may decrease due to reduced surface disturbance from relocating the TSF and Hangar Flats DRSF to the EFSFSR drainage. However, the local reduction in erosion would likely be offset at the watershed scale by increased sedimentation in the Upper EFSFSR upstream of Meadow Creek.

Other than these localized changes resulting from the TSF relocation, impacts to surface water quality from erosion and sedimentation would be the same as Alternative 1. The baseline WCI rating for sediment in the mine site stream reaches (“functioning at unacceptable risk”) is likely to remain the same under Alternative 3 due to increased potential for erosion and sedimentation under this alternative compared to baseline.

Barriers – Alternative 3

Under Alternative 3, the EFSFSR tunnel would be operating by Mine Year -1, thereby bypassing the Yellow Pine pit gradient barrier which would no longer block access to upstream Chinook salmon and bull trout Critical Habitat (**Figure 4.12-2**). Under Alternative 3, there would be no activity in the Meadow Creek watershed and therefore the Meadow Creek barrier would permanently block Chinook salmon and bull trout habitat (**Figure 4.12-11**).

Under Alternative 3, the Upper EFSFSR TSF/DRSF would be a barrier to fish movement starting in Mine Year 18 where this barrier blocks access to 11.58 km of Chinook salmon critical habitat and 6.52 km of bull trout critical habitat (**Figure 4.12-11**). This barrier would be permanent.

Chemical Contaminants – Alternative 3

See Section 4.12.2.3.3.1, Changes to WCIs at the Mine Site – Alternative 1 - Chemical Contaminants, for the analysis of changes in analysis criteria and the potential impacts on fish under Alternative 1. Under Alternative 3, the only difference would be that the Hangar Flats TSF/DRSF would be located in the Upper EFSFSR and the spent ore and legacy tailings in Meadow Creek Valley would not be removed. Groundwater quality and surface water quality in the Meadow Creek Valley would remain impacted by spent ore disposal area and Bradley Mine tailings and would likely stay at similar baseline levels in Meadow Creek.

Streamflows – Alternative 3

Impacts to fish from changes to streamflow were assessed using simulated monthly discharge for the August to March low-flow period for Mine Years -1 through post-closure. The potential effects of these changes in stream flow on fish and fish habitat are discussed below.

Table 4.12-47 shows predicted monthly streamflows during the August-March low flow period at five gaging stations and one SFA reach in mine site streams for Mine Years -1 through 112 and predicted change from average baseline low flow period streamflows during the same time period. **Figure 4.12-12** shows the percent change in simulated streamflows graphically. See Section 4.8.2.2.1.1, Changes in Stream Flow Characteristics, for additional details regarding the potential for the SGP to result in changes to baseline water quantities in mine site waterbodies.

This page intentionally left blank

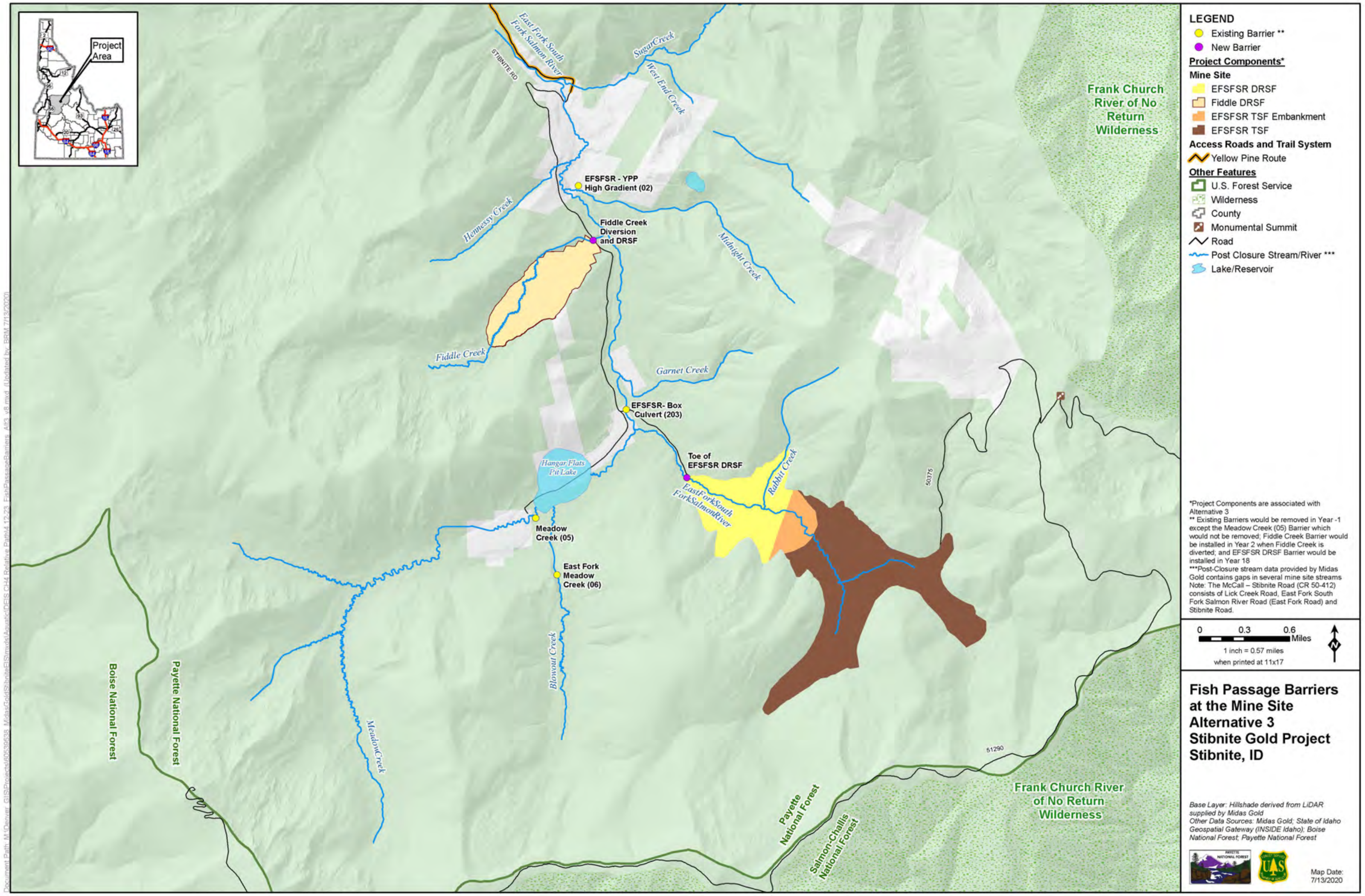


Figure Source: AECOM 2020

Figure 4.12-11 Fish Passage Barriers at the Mine Site Alternative 3

This page intentionally left blank

Table 4.12-47 Alternative 3 Predicted Monthly Discharge August-March Low Flow Period at USGS Gaging Stations and One SFA Reach (MC-6)

	EFSFSR above Meadow Creek (Gaging station 13310800)		EFSFSR at Stibnite (13311000)		EFSFSR above Sugar Creek (13311250)		Sugar Creek (13311450)		Meadow Creek (13311850)		Meadow Creek (MC-6)	
Mine Year	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline
-1	4.3 cfs	3.5 cfs (-19.2%)	9.1 cfs	7.9 cfs (-12.9%)	13.6 cfs	12.4 cfs (-8.6%)	10.2 cfs	10.2 cfs (+0.0%)	2.8 cfs	2.8 cfs (+2.4%)	4.6 cfs	4.2 cfs (-8.4%)
1	4.1 cfs	3.1 cfs (-22.9%)	8.5 cfs	8.5 cfs (-0.3%)	13.0 cfs	10.4 cfs (-20.1%)	9.6 cfs	9.6 cfs (+0.0%)	2.5 cfs	2.6 cfs (+2.2%)	4.2 cfs	4.3 cfs (+1.3%)
2	6.4 cfs	5.5 cfs (-14.4%)	13.6 cfs	13.7 cfs (+0.6%)	18.9 cfs	15.5 cfs (-18.4%)	14.2 cfs	14.2 cfs (+0.0%)	3.6 cfs	3.6 cfs (+1.6%)	6.8 cfs	6.8 cfs (+1.2%)
3	4.3 cfs	3.4 cfs (-22.1%)	8.9 cfs	8.9 cfs (-0.7%)	13.6 cfs	9.5 cfs (-30.4%)	10.1 cfs	10.1 cfs (+0.0%)	2.7 cfs	2.7 cfs (+2.4%)	4.4 cfs	4.5 cfs (+1.6%)
4	5.2 cfs	4.2 cfs (-19.9%)	10.9 cfs	10.9 cfs (-0.2%)	15.9 cfs	11.7 cfs (-26.3%)	11.8 cfs	11.8 cfs (+0.0%)	3.0 cfs	3.1 cfs (+1.5%)	5.4 cfs	5.5 cfs (+1.6%)
5	4.7 cfs	3.7 cfs (-21.7%)	9.8 cfs	10.3 cfs (+5.8%)	14.7 cfs	10.7 cfs (-27.4%)	11.0 cfs	11.0 cfs (+0.0%)	2.8 cfs	2.9 cfs (+2.6%)	4.8 cfs	4.9 cfs (+3.3%)
6	4.7 cfs	3.7 cfs (-21.5%)	9.6 cfs	10.4 cfs (+7.6%)	14.5 cfs	10.5 cfs (-27.6%)	10.8 cfs	10.8 cfs (+0.0%)	2.7 cfs	2.8 cfs (+2.0%)	4.7 cfs	4.9 cfs (+3.9%)
7	5.2 cfs	4.3 cfs (-17.9%)	10.9 cfs	12.1 cfs (+10.6%)	16.1 cfs	12.4 cfs (-22.7%)	12.0 cfs	12.0 cfs (+0.0%)	3.0 cfs	3.1 cfs (+2.2%)	5.4 cfs	3.6 cfs (-32.0%)
8	7.5 cfs	6.6 cfs (-12.4%)	16.0 cfs	17.2 cfs (+7.8%)	22.1 cfs	18.5 cfs (-16.3%)	16.2 cfs	16.2 cfs (+0.0%)	4.8 cfs	4.9 cfs (+1.4%)	8.1 cfs	5.2 cfs (-35.6%)

	EFSFSR above Meadow Creek (Gaging station 13310800)		EFSFSR at Stibnite (13311000)		EFSFSR above Sugar Creek (13311250)		Sugar Creek (13311450)		Meadow Creek (13311850)		Meadow Creek (MC-6)	
Mine Year	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline
9	4.7 cfs	3.9 cfs (-16.9%)	9.7 cfs	9.5 cfs (-2.8%)	14.7 cfs	10.5 cfs (-28.7%)	11.0 cfs	11.0 cfs (+0.0%)	2.8 cfs	2.9 cfs (+2.1%)	4.8 cfs	1.7 cfs (-65.8%)
10	5.1 cfs	4.3 cfs (-14.9%)	10.9 cfs	9.8 cfs (-10.2%)	15.6 cfs	11.5 cfs (-26.3%)	11.7 cfs	11.7 cfs (+0.0%)	3.0 cfs	3.1 cfs (+1.7%)	5.5 cfs	2.1 cfs (-62.0%)
11	6.1 cfs	5.1 cfs (-16.5%)	12.9 cfs	11.6 cfs (-10.1%)	18.0 cfs	13.9 cfs (-22.8%)	13.2 cfs	13.2 cfs (+0.0%)	3.7 cfs	3.7 cfs (+1.4%)	6.4 cfs	3.0 cfs (-52.7%)
12	8.6 cfs	7.3 cfs (-15.1%)	18.1 cfs	17.8 cfs (-1.7%)	24.4 cfs	21.1 cfs (-13.9%)	17.7 cfs	17.7 cfs (+0.0%)	5.0 cfs	5.1 cfs (+1.9%)	8.9 cfs	5.5 cfs (-38.8%)
13	5.4 cfs	5.4 cfs (-0.6%)	11.3 cfs	6.0 cfs (-46.6%)	16.6 cfs	10.4 cfs (-37.1%)	12.7 cfs	10.8 cfs (-14.7%)	3.3 cfs	3.2 cfs (-2.2%)	5.6 cfs	0.5 cfs (-91.5%)
14	4.5 cfs	4.6 cfs (1.4%)	9.6 cfs	4.7 cfs (-51.1%)	13.9 cfs	9.1 cfs (-34.5%)	10.7 cfs	9.7 cfs (-9.0%)	2.9 cfs	2.8 cfs (-1.6%)	4.9 cfs	0.1 cfs (-97.1%)
15	6.5 cfs	6.4 cfs ()-1.9%	13.8 cfs	9.1 cfs (-34.0%)	18.8 cfs	14.2 cfs (-24.8%)	14.2 cfs	13.6 cfs (-4.2%)	4.0 cfs	3.8 cfs (-4.8%)	7.0 cfs	2.6 cfs (-62.4%)
16	4.8 cfs	4.7 cfs (-0.4%)	9.8 cfs	6.5 cfs (-33.9%)	14.7 cfs	11.3 cfs (-22.9%)	11.3 cfs	10.2 cfs (-9.9%)	2.9 cfs	2.9 cfs (+0.1%)	4.8 cfs	1.6 cfs (-67.5%)
17	4.0 cfs	4.1 cfs (0.8%)	8.4 cfs	6.8 cfs (-19.1%)	12.8 cfs	11.2 cfs (-12.5%)	9.8 cfs	8.9 cfs (-9.6%)	2.5 cfs	2.5 cfs (+0.6%)	4.1 cfs	2.4 cfs (-40.9%)
18	4.5 cfs	4.5 cfs (-1.5%)	9.4 cfs	9.5 cfs (+0.9%)	14.0 cfs	14.0 cfs (+0.3%)	10.9 cfs	10.3 cfs (-5.5%)	2.6 cfs	2.6 cfs (-2.1%)	4.6 cfs	4.6 cfs (+0.1%)

	EFSFSR above Meadow Creek (Gaging station 13310800)		EFSFSR at Stibnite (13311000)		EFSFSR above Sugar Creek (13311250)		Sugar Creek (13311450)		Meadow Creek (13311850)		Meadow Creek (MC-6)	
Mine Year	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline	No Action (Baseline)	Alternative 3 and Change from Baseline
19	4.4 cfs	4.4 cfs (-1.0%)	9.6 cfs	9.8 cfs (+2.1%)	13.3 cfs	13.7 cfs (+3.0%)	10.0 cfs	9.8 cfs (-1.5%)	2.8 cfs	2.7 cfs (-3.7%)	4.9 cfs	5.0 cfs (+2.1%)
20	4.5 cfs	4.4 cfs (-0.9%)	9.3 cfs	9.6 cfs (+3.2%)	13.7 cfs	13.9 cfs (+1.6%)	10.4 cfs	9.7 cfs (-6.9%)	2.8 cfs	2.8 cfs (-0.3%)	4.6 cfs	4.8 cfs (+4.1%)
Post-closure	5.0 cfs	5.0 cfs (-0.8%)	10.6 cfs	10.9 cfs (+2.7%)	15.4 cfs	15.7 cfs (+2.0%)	11.7 cfs	11.5 cfs (-1.8%)	3.1 cfs	3.0 cfs (-2.5%)	5.3 cfs	5.5 cfs (+3.1%)

Table Source: data from Rio-ASE spreadsheet: Modflow_Alternatives_Summary_08192019.xls

Table Notes:

USGS = U.S. Geological Survey.

cfs = cubic feet per second.

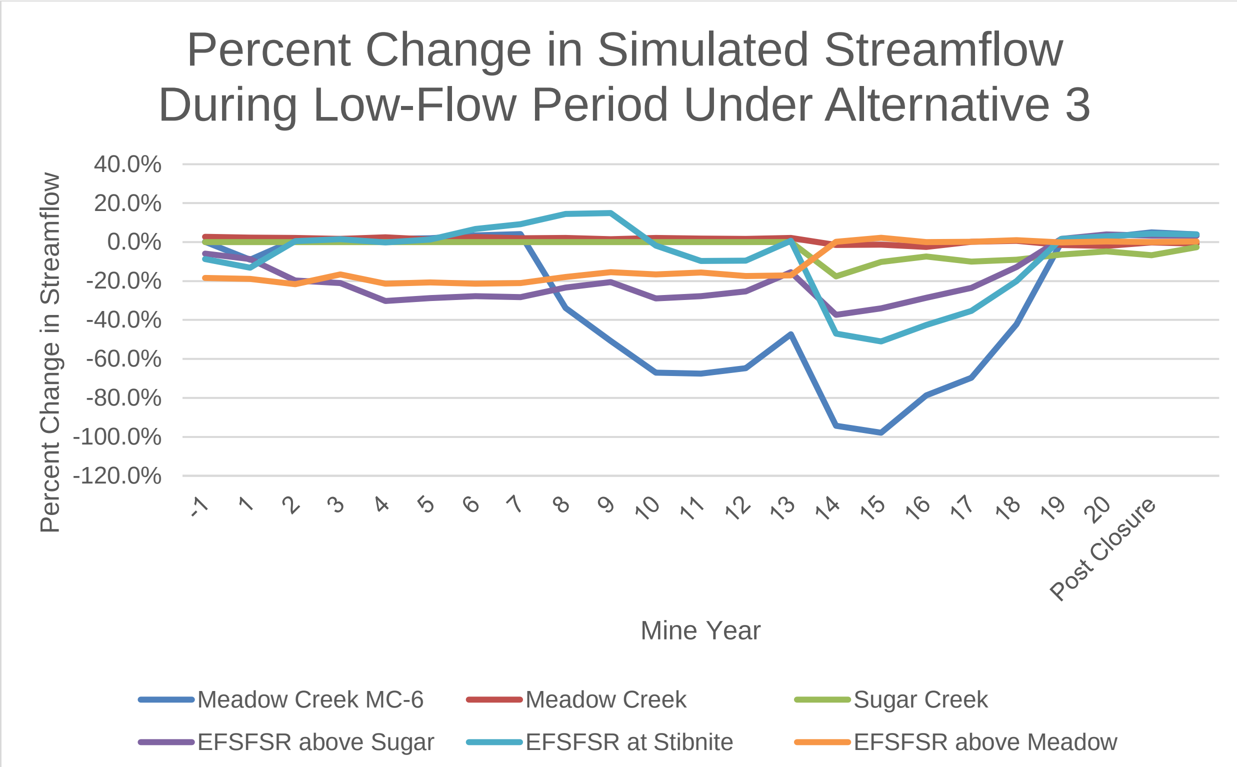


Figure Source: Appendix J-1, Supplemental Information

Figure 4.12-12 Alternative 3 Percent Change in Simulated Streamflow During Low-Flow Period (August to March)

The largest changes would be in the EFSFSR above Sugar Creek and in Meadow Creek SFA reach (MC-6). In the EFSFSR above Sugar Creek, flow reductions would occur from year -1 to year 17 but would be followed by an increase in flows that would persist in perpetuity. Post-closure the flows in Meadow Creek SFA reach (MC-6) would return to close to baseline, with a 3.1 percent increase remaining in perpetuity.

As described in Section 4.8.2.3.1.1, Changes in Stream Flow Characteristics, base flows at the USGS Gaging Station 13310800 (EFSFSR upstream of the confluence with Meadow Creek) are predicted to be lower under Alternative 3 than predicted for the baseline conditions (**Figure 4.8-36**). Predicted base flow reductions at this gage location would result from reductions in groundwater discharge to the EFSFSR beneath the TSF and DRSF. The model-simulated streamflows at USGS Gage 13311000 (EFSFSR at Stibnite), which is downstream of the confluence with Meadow Creek, are higher than the existing conditions simulation (**Figure 4.8-37**). For the EFSFSR upstream of the confluence with Sugar Creek (USGS 13311250), the simulated streamflows are lower for Alternative 3 relative to baseline conditions (**Figure 4.8-38**). The greatest impacts of Alternative 3 are predicted for Meadow Creek downstream of the Hangar Flats pit to the confluence with the EFSFSR where low flows in January through March show an average of 53 percent reduction in Mine Years 7 through 12 (Brown and Caldwell 2019e).

As described in Section 4.12.2.3.3.1 Changes to WCIs at the Mine Site – Alternative 1 - Streamflows, flow reductions may affect the suitability of over-wintering habitat in the mine site streams. Under Alternative 3, reductions in streamflows during the winter months would likely affect over-wintering fish or fish eggs, especially in Meadow Creek.

4.12.2.5.3.2 Changes to WCIs Outside the Mine Site – Alternative 3

Under Alternative 3, changes to WCIs outside the mine site would be the same as described under Alternative 1.

4.12.2.5.4 CHINOOK SALMON SPECIFIC IMPACTS – ALTERNATIVE 3

4.12.2.5.4.1 Intrinsic Potential Modeling – Alternative 3

The following section summarizes the IP modeling results for Alternative 3. See Section 3.12.4.2.5.1, Intrinsic Potential Modeling Methods, for a description of the IP methodology and baseline conditions. The full technical memorandum is provided in **Appendix J-4**.

The results are summarized from baseline through closure and reclamation (i.e., baseline and Mine Year 20) for the IP analysis area.

Table 4.12-48 presents the results for Chinook salmon. **Figure 4.12-13** shows the results for Chinook salmon.

Table 4.12-48 Alternative 3 - Results for Chinook Salmon IP Habitat Baseline to Mine Year 20

Intrinsic Potential	Baseline Length (km)	Mine Year 20 Length (km)[1]	Loss/Gain (km)[2,4]	Change (%)[2,4]
High	0.84	0.22	-0.61	-73.2
Medium	7.29	3.80	-3.49	-47.9
Low	8.74	8.67	-0.78	-0.9
Negligible	1.74	0.750	-0.99	-56.9
Usable Habitat[3]	18.61	13.44	-5.17	-27.8

Table Source: **Appendix J-4**, Intrinsic Potential Modeling Technical Memoranda

Table Notes:

1 Results are presented as the length (km) of IP habitat at Mine Year 20.

2 The permanent change in IP is presented as the loss or gain (in km) of IP rated streams and percent change per is based on the difference between that Mine Year 20 and baseline conditions (% Change = [Mine Year 20 – baseline]/baseline).

3 For Chinook salmon the IP is rated as high, medium, low, and negligible. ”Total Useable” IP habitat is defined as all of these classes combined (useable = high + medium + low + negligible) and does not consider whether the IP habitat is naturally available to migrating fish. ”None” indicates that there is no intrinsic potential to provide habitat for the species and is not shown in this table.

4 Change in IP habitat for both “Loss/Gain” and “Percent Change” is shown as negative (-) for loss of IP and positive (+) as a gain in IP.

IP = Intrinsic Potential; EOY = end of Mine Year; km = kilometer (1 km = 0.62 mi).

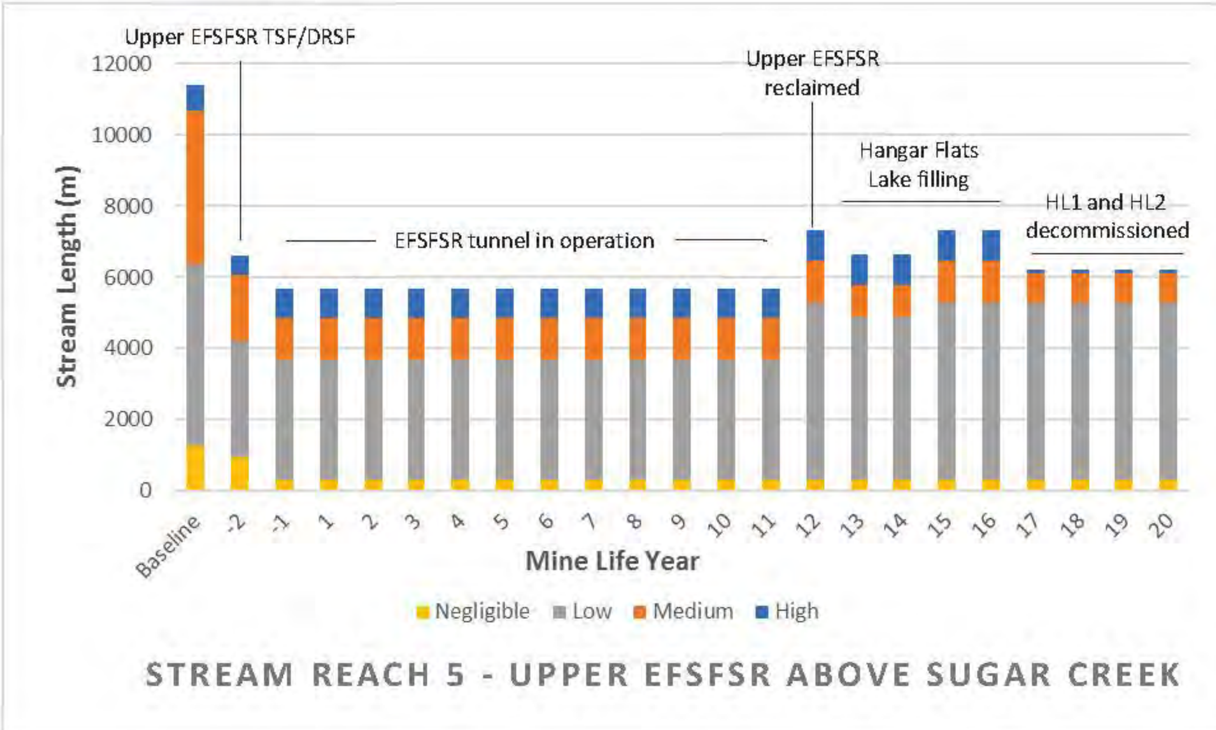


Figure Source: **Appendix J-4**, Intrinsic Potential Technical Memoranda

Figure Notes:

HL1 and HL2 = Meadow Creek SFA reaches through the Hangar Flats pit lake. “None” IP rating not included in the figure.

Figure 4.12-13 Alternative 3 Study Area IP Habitat for Chinook Salmon from Baseline to Mine Year 20

Useable habitat would decrease by 27.8 percent over the life of the mine, a loss of over 5.1 km (18.6 km at baseline to 13.4 at Mine Year 20). Reductions in Chinook salmon IP habitat would occur in Mine Years -2 (diversions in the Upper EFSFSR upstream of Meadow Creek), EFSFSR tunnel operation (Mine Years -1 through 12), during the filling of Hangar Flats pit lake (Mine Years 13 through 17), and the loss of SFA reaches HL1 and HL2 due to Hangar Flats pit lake (Mine Years 17 through 20) (**Figure 4.12-13**).

These results indicate that under Alternative 3, the habitat changes at the mine site would reduce the amount of IP habitat. Both the quantity and quality of Chinook salmon spawning and early rearing habitat would decrease from 18.61 km at baseline to 13.44 km at Mine Year 20.

Based on the IP results for Chinook salmon, there would be no available Chinook salmon IP habitat above the Meadow Creek barrier. Similar to Alternatives 1 and 2, by Mine Year -1 the major barriers along the EFSFSR (the Yellow Pine pit cascade and box culvert) would be removed and IP habitat upstream of these barriers is accessible by migratory Chinook salmon.

Overall, under Alternative 3, by Mine Year 17 all available habitat that was previously blocked by a fish passage barrier would be available, except for Meadow Creek upstream of the fish passage barrier Meadow Creek (05). This blockage does not impact Chinook salmon IP habitat because flow is insufficient to create the desired physical stream characteristics to support spawning and early rearing habitat for the species. The barrier would remain in perpetuity. (**Table 4.12-49**).

Table 4.12-49 Alternative 3 Chinook Salmon IP Habitat Blocked Above Fish Passage Barriers

ALT3 EFSFSR TSF	Chinook Salmon - Useable Habitat Blocked (km)					
Block ID	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20
EFSFSR Yellow Pine pit (02)	10.21	5.41	NB	NB	NB	NB
EFSFSR Box Culvert (203)*	7.63	2.83	NB	NB	NB	NB
Meadow Creek (05)*	2.22	0	0	0	0	0

Table Source: **Appendix J-3**, Barriers Technical Memorandum

Table Notes:

NB = No Barrier.

km = kilometers (1 km = 0.62 mi).

4.12.2.5.4.2 Streamflow Changes – Alternative 3

Surface water management under Alternative 3 would be similar to Alternative 1 except that channels would divert the EFSFSR and hillside runoff around the TSF and the diversion of Meadow Creek upstream of the Hangar Flats pit would not be needed.

Brown and Caldwell (2019c) revised the hydrologic model based on these changes and reported the following general impact:

- Alternative 3 would result in reduced base flows due to reductions in groundwater discharge to the EFSFSR beneath the TSF and DRSF and would have lower low-flows throughout Mine Years 7 through 12 compared to Alternatives 1 and 2 (Brown and Caldwell 2019c).

Effects of Streamflow Changes on Chinook Salmon Productivity

As described in Section 4.12.2.3.4.2, Streamflow/Productivity Analysis Chinook Salmon – Alternative 1, the effects of flow changes on Chinook salmon were analyzed using a flow-productivity model (see **Appendix J-5**).

Under Alternative 3, the upper watershed impacts at the mine site would shift from exclusively Meadow Creek to a mix of the Upper EFSFSR and Meadow Creek. The model results shown in **Table 4.12-50** predict about a 1 percent decrease in productivity post-closure.

Table 4.12-50 Alternative 3 Predicted Amount of Change (%) in Chinook Salmon Productivity from Baseline by Mine Year and Location

Alternative 3		Location					
Time Frame	Mine Year	EFSFSR above Meadow 13310800	EFSFSR at Stibnite 1331100	EFSFSR above Sugar 13311250	Sugar Creek 13311450	Meadow Creek 13311850	Meadow Creek MC-6
Mine Life Timeframe	-2	-16.9	-11.2	-7.9	0.0	2.8	-5.7
	-1	-16.9	-6.2	-10.3	0.0	2.5	-3.5
	1	-20.3	1.4	-19.9	4.3	2.0	2.1
	2	-15.4	0.9	-19.5	2.0	1.8	1.5
	3	-19.7	0.9	-26.1	4.8	2.0	2.0
	4	-19.1	3.5	-24.1	3.9	2.6	2.8
	5	-19.3	9.5	-24.1	4.1	2.8	4.3
	6	-18.4	17.1	-22.7	4.2	1.7	-5.0
	7	-16.3	20.7	-20.4	4.0	1.2	-30.8
	8	-15.3	8.9	-21.4	3.6	2.8	-37.8
	9	-15.8	-4.9	-24.6	3.9	1.8	-43.3
	10	-13.9	-7.7	-22.9	3.3	1.6	-43.7
	11	-17.4	-5.2	-20.7	4.9	1.9	-40.6
	12	-10.2	-11.5	-19.2	-4.9	2.0	-36.6
	13	0.8	-36.3	-29.7	-12.8	-1.6	-52.8
	14	1.7	-37.5	-28.3	-11.1	-1.2	-53.3
	15	0.9	-34.1	-24.2	-9.5	-2.3	-46.5
	16	-0.1	-18.4	-18.4	-10.5	-0.8	-41.0
	17	1.7	-5.9	-5.9	-10.1	-0.5	-21.3
	18	-0.3	2.3	2.3	-8.9	-1.7	2.7
	19	1.5	7.1	7.1	-6.1	-1.2	6.8
	20	0.1	2.9	2.9	-8.7	-0.8	4.2

Alternative 3		Location					
Time Frame	Mine Year	EFSFSR above Meadow 13310800	EFSFSR at Stibnite 1331100	EFSFSR above Sugar 13311250	Sugar Creek 13311450	Meadow Creek 13311850	Meadow Creek MC-6
Mine Life (-2 to 20) Summary	Max	1.7	20.7	7.1	4.9	2.8	6.8
	Mean	-10.4	-4.3	-16.3	-1.8	0.8	-18.7
	Min	-20.3	-37.5	-29.7	-12.8	-2.3	-53.3
Post Closure (21 to 118)	Mean	0.6	4.7	4.0	-2.5	-1.3	4.8

Table Source: **Appendix J-5**, Chinook Salmon Streamflow/Productivity Technical Memorandum

Table Notes:

The Numbers Represent Annual Percent Change in Productivity from Baseline.

The Post-closure Value Represents an Average Annual Percent Change in Productivity for Mine Years 21 through 118.

As with the other action alternatives, the model predicts that Stream Reach 1 from the confluence of Meadow Creek and the Upper EFSFSR to Sugar Creek would increase in productivity at the top of the stream reach but decrease in productivity towards the bottom of the stream reach for the first half of the mine life. The filling of the Yellow Pine pit and construction of a bypass tunnel followed by a new channel being created over the current Yellow Pine pit location further complicate this stream reach's productivity. It is projected the productivity decreases 10 to 20 percent from Mine Years -2 through 12, then increases to near baseline for the EFSFSR upstream of Meadow Creek. As with all productivity results, they must be interpreted along with the IP and barrier changes, as the reduction in available habitat in this reach would decrease due to the TSF/DRSF placement within the watershed. Sugar Creek follows the pattern of the EFSFSR near Stibnite with increases in productivity in the first half of the mine life and decreases in productivity in the second half (likely due to pit filling).

4.12.2.5.4.3 Water Temperature Changes – Alternative 3

The effects of stream temperature changes on fish under the action alternatives were analyzed and reported in a technical memorandum titled Stream Temperature Impacts on Fish, provided as **Appendix J-2**. Analysis methods used are summarized in Section 4.12.2.3.4.3, Water Temperature Changes – Alternative 1 (Chinook Salmon). The following is a summary of the analysis and results for Chinook salmon under Alternative 3.

Table 4.12-51 presents the length of streams within selected relevant baseline temperature threshold categories for Chinook salmon life stages under Alternative 3 as well as at certain intervals over the timeline of the SGP (Mine Years 6, 12, 18, and 112 [i.e., post-closure]). Full data for Chinook salmon under Alternative 3 presented in Table 14 of **Appendix J-2**.

Table 4.12-51 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 3 – Chinook Salmon

Chinook Salmon (Spring/Summer-Run) Temperature Threshold Category	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Adult Migration – Lethal (1-week exposure)	0.00 km	3.84 km (+3.84 km)	4.18 km (+4.18 km)	6.49 km (+6.49 km)	6.49 km (+6.49 km)
Adult Migration – High Disease Risk (lab studies)	0.00 km	0.00 km (+0.00 km)	2.15 km (+2.15 km)	6.63 km (+6.63 km)	5.70 km (+5.70 km)
Adult Migration – Optimal Adult Swimming Performance	2.44 km	7.79 km (+5.35 km)	9.15 km (+6.71 km)	2.17 km (-0.27 km)	6.17 km (+3.73 km)
Adult Spawning – Field Observed Spawning Temp	16.72 km	10.49 km (-6.23 km)	12.57 km (-4.15 km)	4.84 km (-11.88 km)	10.61 km (-6.11 km)
Incubation/Emergence – Optimal	4.99 km	0.00 km (-4.99 km)	0.00 km (-4.99 km)	0.00 km (-4.99 km)	0.00 km (-4.99 km)
Juvenile Rearing – Optimal	16.72 km	7.01 km (-9.71 km)	7.01 km (-9.71 km)	5.59 km (-11.13 km)	5.59 km (-11.13 km)
Common Summer Habitat Use – Optimal	16.72 km	7.01 km (-9.71 km)	3.10 km (-13.62 km)	5.59 km (-11.13 km)	5.59 km (-11.13 km)
Total Available Habitat	16.72 km	11.21 km (-5.51 km)	12.57 km (-4.15 km)	12.22 km (-4.50 km)	12.22 km (-4.50 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).

Temperatures are in °C.

Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

It is anticipated that water temperature increases under Alternative 3 would result in an overall decrease in habitat within optimal water temperature ranges for Chinook salmon life stages, though there would be a net increase in habitat within the optimal temperature range for adult swimming performance.

Specifically, **Table 4.12-51** shows the following:

- A net increase in habitat with lethal one-week exposure temperatures during operations and at post-closure; from 0 km at baseline to 6.49 km at EOY 112;

- A net increase in habitat with temperatures in the range of high disease risk (as found in lab studies) during operations and at post-closure; from 0 km at baseline to 5.7 km at EOY 112.
- A net increase in habitat within the optimal temperature range for adult swimming performance during operations and at post-closure; from 2.44 km at baseline to 6.17 km at EOY 112;
- A net decrease in habitat with temperatures in the range of field-observed spawning during operations and at post-closure; from 16.72 km at baseline to 10.61 km at EOY 112;
- A net decrease in habitat within the optimal temperature range for incubation/emergence, juvenile rearing, and common summer habitat use during operations and at post-closure (**Table 4.12-51**);
- Total habitat availability for this species decreases to varying degrees at points along the timeline of the SGP and is anticipated to be lower than baseline at post-closure; from 16.72 km at baseline to 12.22 km at EOY 112.

4.12.2.5.4.4 Critical Habitat – Alternative 3

Under Alternative 3, the TSF/DRSF would be located in the Upper EFSFSR drainage rather than the Meadow Creek drainage.

With no mining activity occurring in upper Meadow Creek that creates barriers to available habitat under Alternative 3, 6.8 km of Chinook salmon critical habitat would remain upstream of passage barriers for the life of the SGP (**Table 4.12-52**). Similar to Alternatives 1 and 2, by Mine Year -1 the major barriers along the EFSFSR (Yellow Pine pit cascade and box culvert) would be removed and critical habitat above these barriers would be accessible.

Table 4.12-52 Alternative 3 Length of Chinook Salmon Critical Habitat Blocked Above Each Fish Passage Barrier

ALT3 EFSFSR TSF	Chinook Salmon - Critical Habitat Blocked (km)					
Block ID	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20
EFSFSR Yellow Pine Pit (02)	26.49	12.99	NB	NB	NB	NB
EFSFSR Box Culvert (203)	22.96	10.05	NB	NB	NB	NB
Hennessy Creek (01)	0	0	NB	NB	NB	NB
Hennessy Creek (199)	0	0	NB	NB	NB	NB
Hennessy Creek (202)	0	0	NB	NB	NB	NB
Midnight Creek (03)	0	0	NB	NB	NB	NB
Fiddle Creek (04)	0	0	0	NB	NB	NB
Fiddle Creek (200)	0	0	0	NB	NB	NB
Garnet Creek (201)	0	0	0	0	NB	NB
Rabbit Creek (204)	0	0	0	0	0	0

ALT3 EFSFSR TSF	Chinook Salmon - Critical Habitat Blocked (km)					
Block ID	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20
Fern Creek (205)	0.17	0.17	0.17	0.17	0.17	0.17
Fern Creek Tributary (206)	0	0	0	0	0	0
Meadow Creek (05)	6.80	6.80	6.80	6.80	6.80	6.80
East Fork Meadow Creek (06)	0	0	NB	NB	NB	NB
Fiddle Creek diversion and DRSF	NB	NB	0	0	0	0
Upper EFSFSR TSF/DRSF	NB	NB	NB	NB	11.58	11.58

Table Source: **Appendix J-3**, Barriers Technical Memorandum

Table Notes:

km = kilometers (1 km = 0.62 mi).

EOY = End of Mine Year.

NB = No Barrier.

4.12.2.5.4.5 Integration of Species/Habitat Impacts for Chinook Salmon – Alternative 3

Under Alternative 3, the TSF/DRSF would be located in Upper EFSFSR drainage rather than the Meadow Creek drainage. This would result in decreased streamflows and an increased amount of stream channel changes to divert streams around the TSF/DRSF location.

A summary of the overall impacts to Chinook salmon habitat and specific points regarding the impacts are provided below.

- **Net loss of IP habitat for Chinook salmon.** Useable habitat would decrease by 27.8 percent over the life of the mine, a loss of over 5.1 km. Reductions in Chinook salmon IP habitat would occur in Mine Years -2 (diversions in the Upper EFSFSR upstream of Meadow Creek), EFSFSR tunnel operation (Mine Years -1 through 12), during the filling of Hangar Flats pit lake (Mine Years 13 through 17), and the loss of SFA reaches HL1 and HL2 due to Hangar Flats pit lake (Mine Years 17 through 20).
- **Loss in Chinook salmon productivity as a result of changes to baseline streamflows.** The filling of the Yellow Pine pit and construction of a bypass tunnel followed by a new channel being created over the current Yellow Pine pit location further complicate this stream reach's productivity. Productivity decreases 10 to 20 percent from Mine Years -2 through 12, then changes to near baseline for the EFSFSR upstream of Meadow Creek.
- It is anticipated that water temperature increases under Alternative 3 would result in an overall decrease in habitat within optimal water temperature ranges for Chinook salmon life stages, though there would be a net increase in habitat within the optimal temperature range for adult swimming performance. The total length of available habitat

for all life stages within optimum temperatures would decrease from 16.7 km at baseline to 12.2 km at post-closure.

- The Yellow Pine pit barrier would be removed in Mine Year -1 with the construction of the EFSFSR tunnel providing 19.7 km of naturally accessible Chinook critical habitat. The diversions of streams related to the TSF/DRSF in upper EFSFSR would block upstream and downstream movement to 11.6 km of habitat starting in Mine Year -1 and continuing in perpetuity.

Following closure and reclamation, the overall net effect from the SGP would be a loss of both quantity and quality of habitat for Chinook salmon.

The Forest Service has preliminarily determined that Alternative 3 will adversely affect Chinook salmon and their critical habitat. Informal Section 7 ESA consultation is ongoing with the NMFS.

4.12.2.5.5 Steelhead Trout Specific Impacts – Alternative 3

4.12.2.5.5.1 Intrinsic Potential – Alternative 3

The following section summarizes the IP modeling results for Alternative 3. See Section 3.12.4.2.5.1, Intrinsic Potential Modeling Methodology, for a description of the IP methodology and baseline conditions. The full technical memorandum is provided in **Appendix J-4**.

The results are summarized from mine site construction through closure and reclamation for specific Mine Years (i.e., baseline, EOY -2, EOY -1, EOY 12, EOY 17, and EOY 20) for IP analysis area.

Table 4.12-53 presents the results for steelhead trout for Alternative 3. **Figure 4.12-14** illustrates the results for steelhead trout under Alternative 3.

Table 4.12-53 Alternative 3 – Results for Steelhead Trout IP Habitat Baseline to Mine Year 20 Baseline/Baseline

Intrinsic Potential Habitat[3]	Change (EOY 20 – Baseline)[2]							
	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20	Loss/Gain (km)[2,4]	Change (%)[2,4]
High	8.04	6.36	7.55	8.95	10.15	10.15	+2.11	+26.3
Medium	0.60	0.60	1.03	1.03	0.26	0.26	-0.34	-56.9
Low	9.25	8.65	6.82	7.07	7.56	8.27	-0.99	-10.7
Usable	17.90	15.62	15.40	17.05	17.97	18.68	+0.78	+4.4

Table Source: **Appendix J-4**, Intrinsic Potential Modeling Technical Memoranda

Table Notes:

1 Results are presented as the length (km) of IP habitat per Mine Year during life of mine and post-closure.

2 The permanent change in IP is presented as the loss or gain (in km) of IP rated streams and the percent change based on EOY 20 is based on the difference between that year and baseline conditions (% Change = [Mine Year 20 – baseline]/baseline).

3 For Steelhead trout the IP is rated as high, medium, and low. "Total Usable" IP habitat is defined as all of these classes combined (usable = high + medium + low) and does not consider whether the IP habitat is naturally available (i.e., migratory fish can access). "None" indicates that there is no intrinsic potential to provide habitat for the species and is not shown in this table.

4 Change in IP habitat for both "Loss/Gain" and "Percent Change" is shown as negative (-) for loss of IP and positive (+) as a gain in IP.

IP = intrinsic potential; EOY = End of Mine Year; km = kilometers (1 km = 0.62 mi).

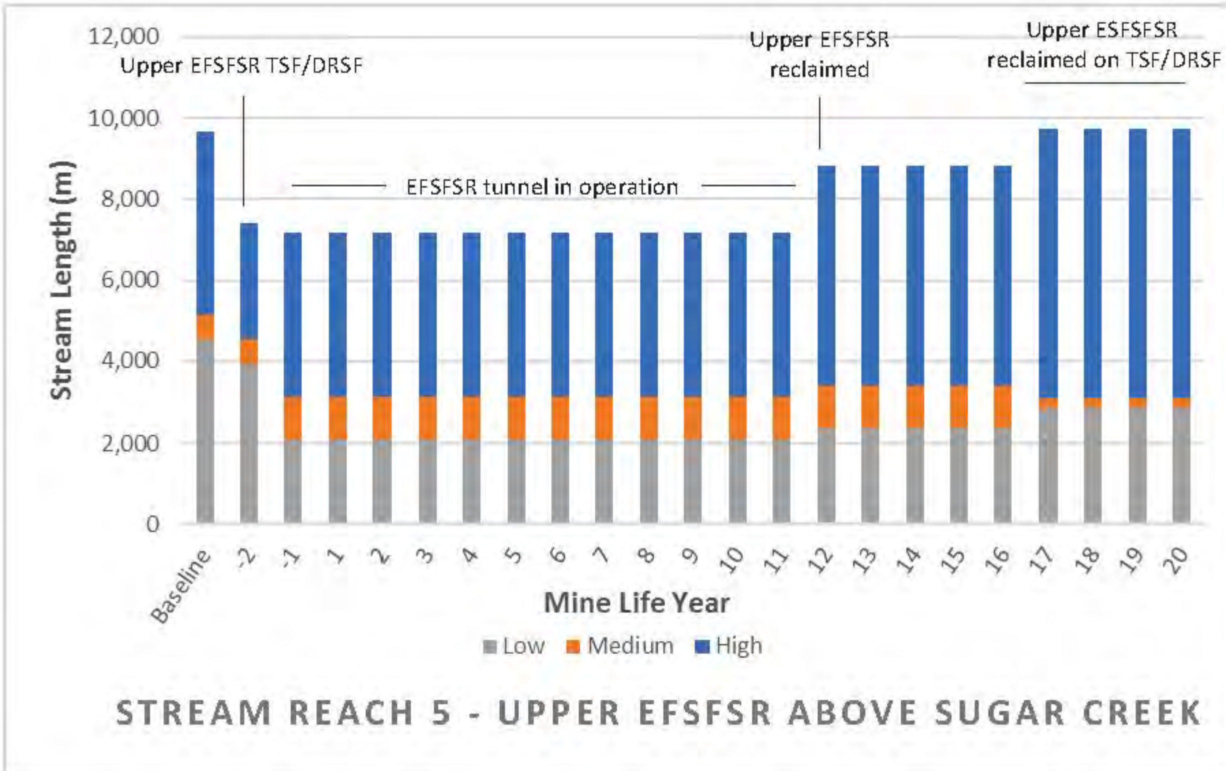


Figure Source: **Appendix J-4**, Intrinsic Potential Technical Memoranda.

Figure Notes:

"None" IP rating not included in the figure.

Figure 4.12-14 Alternative 3 Study Area IP habitat for Steelhead Trout from Baseline to Mine Year 20

Suitable habitat would increase 0.4 percent over the SGP, a gain of approximately 0.7 km, from 17.9 km at baseline to 18.6 km at EOY 20. The length of high rated stream reaches would increase 26 percent over the life of the mine, while the length of medium and low-rated stream reaches would decrease 57 percent and 11 percent, respectively. An increase in steelhead trout IP habitat would occur in Mine Year 12 with the decommissioning of EFSFSR tunnel and in Mine Year 17 with the Upper EFSFSR constructed on top of the TSF/DRSF (**Figure 4.12-14**).

Table 4.12-54 Alternative 3 Length of Steelhead Trout IP Habitat Blocked Above Each Fish Passage Barrier

ALT3 EFSFSR TSF	Steelhead Trout – Useable Habitat Blocked (km)					
Block ID	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20
EFSFSR Yellow Pine pit (02)	8.53	4.72	NB	NB	NB	NB
EFSFSR Box Culvert (203)	6.94	4.66	NB	NB	NB	NB
Meadow Creek (05)	1.83	1.83	1.83	1.83	1.83	1.83
Upper EFSFSR TSF/DRSF	NB	1.93	1.93	1.93	1.93	1.93
Total Available Habitat (km)	9.67	7.40	7.17	8.82	9.74	9.74

Table Source: **Appendix J-3**, Barriers Technical Memorandum

Table Notes:

km = kilometers (1 km = 0.62 mi)

EOY = End of Mine Year

Both the quantity and quality of steelhead trout habitat would improve; however, upstream and downstream IP habitat would be permanently blocked to natural migration by the activities required to build the TSF/DRSF and the high gradient barrier created at the face of the facility. With no major stream alterations occurring in upper Meadow Creek under Alternative 3, 1.83 km of steelhead trout IP habitat remain blocked in perpetuity (**Table 4.12-54**). However, this is a partial barrier and may not be a blockage to steelhead trout if flows are sufficient.

4.12.2.5.5.2 Streamflow Changes – Alternative 3

There was an attempt to complete a similar modeling analysis for streamflow productivity as was done for Chinook salmon (Section 4.12.2.3.4.2). An effort was made to recreate the streamflow-productivity analysis performed by NOAA in the Big Creek Diversion Biological Opinion (NMFS 2013). However, the results could not be replicated for steelhead trout and therefore the modeling has not been completed for this EIS.

4.12.2.5.5.3 Water Temperature Changes – Alternative 3

The effects of stream temperature changes on fish under the action alternatives were analyzed and reported in a technical memorandum titled Stream Temperature Impacts on Fish, provided as **Appendix J-2**. Analysis methods are summarized in Section 4.12.2.3.4.3, Water Temperature Changes – Alternative 1 (Chinook Salmon). The following is a summary of the analysis and results for steelhead trout under Alternative 3.

Table 4.12-55 presents the length of streams within selected relevant baseline temperature threshold categories for steelhead trout life stages under Alternative 3 as well as at certain intervals over the timeline of the SGP (Mine Years 6, 12, 18, and 112 [i.e., post-closure]). Full data for steelhead trout under Alternative 3 presented in Table 15 of **Appendix J-2**.

Table 4.12-55 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 3 – Steelhead Trout

Steelhead Trout Temperature Threshold Category	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Juvenile Rearing – Optimal	2.13 km	7.01 km (+4.88 km)	7.01 km (+4.88 km)	5.59 km (+3.46 km)	5.59 km (+3.46 km)
Juvenile Rearing – Lethal (1-week exposure)	0.00 km	0.00 km (+0.00 km)	0.00 km (+0.00 km)	7.52 km (+7.52 km)	7.52 km (+7.52 km)
Common Summer Habitat Use – Optimal	2.13 km	7.01 km (+4.88 km)	7.01 km (+4.88 km)	5.59 km (+3.46 km)	5.59 km (+3.46 km)
Total Available Habitat	2.13 km	11.21 km (+9.08 km)	12.57 km (+10.44 km)	12.22 km (+10.09 km)	12.22 km (+10.09 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

EOY = End of Mine Year.

Km = kilometers (1 km = 0.62 mi).

Temperatures are in °C.

Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

It is anticipated that water temperature increases under Alternative 3 would result in a net increase in suitable habitat for steelhead trout.

Specifically, **Table 4.12-55** shows the following:

- A net increase in habitat within the optimal temperature range for juvenile rearing habitat during operations and at post-closure; from 2.13 km at baseline to 5.59 km at EOY 112;
- A net increase of habitat with lethal (1-week exposure) temperatures for juvenile rearing during operations and at post-closure; from 0 km at baseline to 7.52 km at EOY 112;
- A net increase in habitat within the optimal temperature range for common summer habitat during operations and at post-closure; from 2.13 km at baseline to 5.59 km at EOY 112;
- Total habitat availability for this species increases to varying degrees at points along the timeline of the SGP and is anticipated to be higher than baseline at post-closure; from 2.13 km at baseline to 12.22 km at EOY 112.

4.12.2.5.5.4 Critical Habitat – Alternative 3

The effects on steelhead trout critical habitat would be the same as those described under Alternative 1 in Section 4.12.2.3.5.4, Critical Habitat – Steelhead Trout.

4.12.2.5.5.5 Integration of Species/Habitat Impacts for Steelhead Trout – Alternative 3

Under Alternative 3, the TSF would be located in Upper EFSFSR drainage rather than the Meadow Creek drainage. This would result in decreased streamflows compared to the other alternatives and increased amount of stream channel changes compared to Alternative 1.

The Forest Service has preliminarily determined that Alternative 3 will adversely affect steelhead trout and their critical habitat. Informal Section 7 ESA consultation is ongoing with the NMFS.

4.12.2.5.6 BULL TROUT SPECIFIC IMPACTS – ALTERNATIVE 3

4.12.2.5.6.1 Occupancy Modeling – Alternative 3

The following subsections summarize the results of the OM for bull trout under Alternative 3 for selected mine years. See Section 3.12.4.4.5, Occupancy Modeling, for an extensive description of the OM methodology and baseline conditions. The full technical memorandum for the OM is provided as **Appendix J-7**.

Occupancy Probabilities – Alternative 3

Table 4.12-56 presents the OM-derived distance-weighted average occupancy probabilities for bull trout by stream reach under Alternative 3 for five different time periods.

Table 4.12-56 Distance Weighted Average Bull Trout Occupancy Probabilities for Selected Modeled Mine Years in Each Stream Reach under Alternative 3

Stream Reach	Baseline	EOY 6	EOY 12	EOY 18	EOY 112
Stream Reach 1 (EFSFSR upstream of Sugar Creek to Meadow Creek)	9.51%	7.17%	9.04%	7.18%	7.16%
Stream Reach 2 (Meadow Creek Watershed)	6.27%	6.27%	6.09%	5.30%	5.22%
Stream Reach 3 (EFSFSR upstream of Meadow Creek)	9.34%	3.87%	3.97%	3.66%	3.77%
Stream Reach 5 (Headwaters of EFSFSR watershed)	8.27%	5.82%	6.52%	5.11%	5.13%

Table Source: **Appendix J-7**, Occupancy Modeling Technical Memoranda

Table Notes:

EOY = End of Mine Year.

Stream channel alterations described in Section 4.12.2.5.1, Physical Stream Channel Changes – Alternative 3, would impact occupancy probabilities for bull trout in the OM model area. The greatest reduction in bull trout occupancy probabilities would occur in Stream Reach 3 before Mine Year 6 due to the diversion of stream channels for the construction of the TSF/DRSF in this location.

Length of Available Habitat – Alternative 3

Table 4.12-57 provides the length of available habitat for bull trout for each modeled mine year for Alternative 3.

Table 4.12-57 Length of Available Habitat for Bull Trout and Cutthroat Trout for Each Stream Reach for Alternative 3

Stream Reach	Baseline (km)	EOY 6 (km)	EOY 12 (km)	EOY 18 (km)	EOY 112 (km)
Stream Reach 1 (EFSFSR upstream of Sugar Creek to Meadow Creek)	10.45	6.75	10.33	10.88	10.88
Stream Reach 2 (Meadow Creek Watershed)	15.10	13.77	13.77	13.79	13.86
Stream Reach 3 (EFSFSR upstream of Meadow Creek)	16.16	7.84	7.84	17.20	17.20
Stream Reach 5 (Headwaters of EFSFSR watershed)	41.70	28.37	31.95	41.87	41.94

Table Source: **Appendix J-7**, Occupancy Modeling Technical Memoranda

Table Notes:

EOY = End of Mine Year.

km = kilometer (1 km = 0.62 mi).

The length of OM habitat for bull trout changes throughout the mine life as channel configurations change and water is diverted into temporary conveyances. Stream Reach 3 loses over half of its available habitat from baseline through EOY 12 due to the re-routing of the EFSFSR into the tunnel. The length of available habitat increases to slightly above baseline conditions during EOY 18 and EOY 112 as sinuous streams are constructed. However, as noted previously, bull trout may not have a way to colonize the newly created sections on top of the TSF/DRSF.

With no mining activity occurring in Meadow Creek, over 9 km of suitable habitat would remain permanently blocked. By Mine Year 6 the major blockages along the EFSFSR would be removed (including the Yellow Pine pit lake cascade barrier and the EFSFSR box culvert). Overall, by Mine Year 18 all available habitat that was blocked by a fish passage barrier would be available, except for the Meadow Creek area upstream of the existing fish passage barrier Meadow Creek (05). Also, in Mine Year 18, there would be a complete blockage to upstream and downstream fish passage created in Upper EFSFSR upstream of Meadow Creek from the construction of the TSF/DRSF. This facility would block access to over 15 km of suitable bull trout habitat.

4.12.2.5.6.2 Streamflows – Alternative 3

As described previously in Section 4.12.2.3.6.2, Streamflows - PHABSIM Analysis for Bull Trout for Alternative 1, the assessment of impacts to bull trout habitat is based on the results of the

Snake River Basin Adjudication PHABSIM study of the late 1980s and early 1990s (Fifth Judicial District, State of Idaho 2014). Key to the impact assessment is the change in discharge rates during the low-flow period in the different stream reaches of the mine site, as well as the functional relationship between discharge rate and bull trout habitat, expressed as WUA by the PHABSIM model. A more detailed description of the process by which the PHABSIM model results are used to assess impacts to bull trout WUA is provided in the above-referenced section.

The percent change in modeled flows for the low-flow period (defined as August-March) for selected locations within the mine site under Alternative 3 are presented in **Table 4.12-58**.

Table 4.12-58 Alternative 3 – Percent Change in Flow for the Low-flow Period for Selected Mine Years and Post-closure

Mine Year	Period	EFSFSR Upstream of Sugar Creek Long-term Difference (%)	Sugar Creek Long-term Difference (%)	EFSFSR Upstream of Meadow Creek Long-term Difference (%)	Meadow Creek Upstream of the EFSFSR Long-term Difference (%)
-2	low flow	-5.9	0.0	-18.4	0.2
-1	low flow	-8.7	0.0	-18.9	-9.0
1	low flow	-19.7	0.0	-21.6	1.2
2	low flow	-21.1	0.0	-16.6	1.6
3	low flow	-30.2	0.0	-21.4	1.6
4	low flow	-28.8	0.0	-20.7	2.0
5	low flow	-27.8	0.0	-21.3	3.4
6	low flow	-28.2	0.0	-21.0	4.1
7	low flow	-23.4	0.0	-17.9	-33.9
8	low flow	-20.5	0.0	-15.4	-50.8
9	low flow	-28.9	0.0	-16.6	-67.1
10	low flow	-27.7	0.0	-15.5	-67.6
11	low flow	-25.3	0.0	-17.3	-64.8
12	low flow	-15.4	0.1	-17.1	-47.4
13	low flow	-37.3	-17.6	0.2	-94.3
14	low flow	-34.0	-10.2	2.2	-97.9
15	low flow	-28.6	-7.4	0.0	-78.7
16	low flow	-23.4	-10.0	0.2	-69.6
17	low flow	-12.7	-9.0	1.1	-42.3

Mine Year	Period	EFSFSR Upstream of Sugar Creek Long-term Difference (%)	Sugar Creek Long-term Difference (%)	EFSFSR Upstream of Meadow Creek Long-term Difference (%)	Meadow Creek Upstream of the EFSFSR Long-term Difference (%)
18	low flow	1.6	-6.4	-0.1	-0.1
19	low flow	4.0	-4.8	0.4	2.4
20	low flow	3.3	-6.7	0.1	5.0
Post-closure	low flow	3.6	1.7	0.0	4.0

Table Source: **Appendix J-8**, PHABSIM Technical Memorandum

Table Notes:

The Low-Flow Period is defined as the average of Mine Years 21 through 118. Numbers represent percent change in streamflow; negative numbers indicate a reduction in streamflow while positive numbers indication an increase in streamflow. Sugar Creek is summarized by itself because data were available for Sugar Creek. There is a relationship between percent change in flow and the amount of available habitat per species and life stage.

Given the general direct relationship between stream discharge and bull trout habitat previously provided in **Table 4.12-18,** impacts can be inferred from changes in discharge at the stream reaches of the mine site. **Table 4.12-58** shows that the changes in discharge during the low-flow period in the different mine site reaches under Alternative 3 varies as a function of location and Mine Year.

The most common changes are reductions in discharge, which are generally associated with the use of surface water for mining purposes, including the filling of the Hangar Flats pit in the Meadow Creek subwatershed (Mine Years 12 through 14). There also are years when stream reaches at the mine site would experience increases in discharge rate, largely due to groundwater pumping to provide water for the worker housing facility and other mining activities.

According to the data in **Table 4.12-58**, the greatest change in streamflow would be at Meadow Creek, where between Mine Year 7 and Mine Year 14 discharges are predicted to decrease at various levels ranging up to 98 percent. This is likely from the diversion of Meadow Creek into Hangar Flats pit to fill the pit lake and in the Upper EFSFSR above Meadow Creek substantial reductions in flow occur between Mine Years -2 and 12 when the EFSFSR is diverted around the footprint of the EFSFSR drainage TSF/DRSF.

4.12.2.5.6.3 Water Temperature Changes – Alternative 3

The effects of stream temperature changes on fish under the action alternatives were analyzed and reported in a technical memorandum titled Stream Temperature Impacts on Fish, provided as **Appendix J-2**. Analysis methods used in this memorandum are summarized in Section 4.12.2.3.4.3, Water Temperature Changes – Alternative 1 (Chinook Salmon). The following is a summary of the analysis and results for bull trout under Alternative 3.

Table 4.12-59 presents the length of streams within selected relevant baseline temperature threshold categories for bull trout life stages under Alternative 3 as well as at certain intervals over the timeline of the SGP (Mine Years 6, 12, 18, and 112 [i.e., post-closure]). Full data for bull trout under Alternative 3 presented in Table 17 of **Appendix J-2**.

Table 4.12-59 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 3 – Bull Trout

Bull Trout Temperature Threshold Category	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Adult Spawning - Functioning Appropriately (FA)	1.61	0.76 km (-0.85 km)	0.76 km (-0.85 km)	0.00 km (-1.61 km)	0.00 km (-1.61 km)
Adult Spawning - Functioning at Risk (FR)	8.69	0.83 km (-7.86 km)	0.83 km (-7.86 km)	1.59 km (-7.10 km)	1.59 km (-7.10 km)
Adult Spawning - Functioning at Unacceptable Risk (FUR)	18.69	16.70 km (-1.99 km)	18.52 km (-0.17 km)	18.82 km (+0.13 km)	18.82 km (+0.13 km)
Adult Spawning - Spawning Initiation	1.61	0.76 km (-0.85 km)	0.76 km (-0.85 km)	0.00 km (-1.61 km)	0.00 km (-1.61 km)
Incubation/Emergence - FUR	28.99	18.29 km (-10.70 km)	20.11 km (-8.88 km)	20.41 km (-8.58 km)	20.41 km (-8.58 km)
Juvenile Rearing - FA	13.66	4.95 km (-8.71 km)	4.95 km (-8.71 km)	4.95 km (-8.71 km)	4.95 km (-8.71 km)
Juvenile Rearing - FR	12.89	5.69 km (-7.20 km)	6.15 km (-6.74 km)	5.94 km (-6.95 km)	5.94 km (-6.95 km)
Juvenile Rearing - FAR	2.44	7.65 km (+5.21 km)	9.01 km (+6.57 km)	9.52 km (+7.08 km)	9.52 km (+7.08 km)
Common Summer Habitat Use - Spawning Initiation	8.66	4.95 km (-3.71 km)	4.95 km (-3.71 km)	4.95 km (-3.71 km)	4.95 km (-3.71 km)
Total Available Habitat	28.99	18.29 km (-10.7 km)	20.11 km (-8.88 km)	20.41 km (-8.58 km)	20.41 km (-8.58 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).

Temperatures are in °C.

Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

It is anticipated that an increase in stream temperatures under Alternative 3 would result in a net loss of suitable habitat for bull trout adults and juveniles by post-closure.

Specifically, **Table 4.12-59** shows the following:

- A net decrease in habitat in the “functioning appropriately”, “functioning at risk”, and spawning initiation categories for adult spawning during operations and at post-closure;
- A net increase in habitat in the “functioning at unacceptable risk” category for adult spawning during operations and at post-closure;
- A net decrease in habitat in the “functioning at unacceptable risk” category for incubation/emergence during operations and at post-closure;
- A net decrease in habitat in the “functioning appropriately” and “functioning at risk” categories for juvenile rearing during operations and at post-closure;
- A net increase in habitat in the “functioning at unacceptable risk” category for juvenile rearing during operations and at post-closure;
- A net decrease in habitat in the optimal temperature range for spawning initiation during operations and at post-closure;
- Total habitat availability for this species decreases to varying degrees at points along the timeline of the SGP and is anticipated to be lower than baseline at post-closure.

4.12.2.5.6.4 Loss of Lake Habitat – Alternative 3

Alternative 3 would have similar conditions for bull trout access to pit lakes as Alternative 1. Specifically, the relocation of the TSF/DRSF does not affect the Hangar Flats pit lake creation. According to the EFSFSR TSF/DRSF Modeling and Analysis Report (Brown and Caldwell 2019e), for the summer period, the warmest 7-day period in each of the 92 model years was identified, and the median temperature (19.3°C) was used for the discharge to lower Meadow Creek. For the fall period the median temperature of the first week of fall for each of the 92 model years (11.8°C) was applied. The analysis of the impact on bull trout use of the Hangar Flats pit lake therefore applies to Alternative 3. Based on the results of Occupancy Modeling, there would be 9.6 km of available fish habitat upstream of the Hangar Flats pit lake for prey species of bull trout to reside in.

4.12.2.5.6.5 Critical Habitat – Alternative 3

With no mining activity occurring in upper Meadow Creek under Alternative 3, 5.4 km of bull trout critical habitat upstream of barriers would remain blocked for the life of the SGP (**Table 4.12-60**). By Mine Year -1 the major barriers along the EFSFSR (the Yellow Pine pit cascade and box culvert) would be removed and critical habitat upstream of these barriers to the Meadow Creek (05) barrier would no longer be blocked.

Table 4.12-60 Alternative 3 Length of Bull Trout Critical Habitat Blocked Above Each Fish Passage Barrier

ALT3 EFSFSR TSF	Bull Trout – Critical Habitat Blocked (km)					
Block ID	Baseline	EOY -2	EOY -1	EOY 12	EOY 17	EOY 20
EFSFSR Yellow Pine Pit (02)	17.11	10.75	NB	NB	NB	NB
EFSFSR Box Culvert (203)	13.78	8.15	NB	NB	NB	NB
Hennessy Creek (01)	0	0	NB	NB	NB	NB
Hennessy Creek (199)	0	0	NB	NB	NB	NB
Hennessy Creek (202)	0	0	NB	NB	NB	NB
Midnight Creek (03)	0	0	NB	NB	NB	NB
Fiddle Creek (04)	0	0	NB	NB	NB	0
Fiddle Creek (200)	0	0	NB	NB	NB	0
Garnet Creek (201)	0	0	0	NB	NB	0
Rabbit Creek (204)	0	0	0	0	0	0
Fern Creek (205)	0	0	0	0	0	0
Fern Creek Tributary (206)	0	0	0	0	0	0
Meadow Creek (05)	5.40	5.40	5.40	5.40	5.40	5.40
East Fork Meadow Creek (06)	0	0	NB	NB	NB	NB
Fiddle Creek diversion and DRSF	NB	NB	0	0	0	0
Upper EFSFSR TSF/DRSF	NB	NB	NB	NB	6.52	6.52

Table Source: **Appendix J-3**, Barriers Technical Memorandum

Table Notes:

km = kilometers (1 km = 0.62 mi).

EOY = End of Mine Year.

4.12.2.5.6.6 Integration of Species/Habitat Effects for Bull Trout – Alternative 3

Under Alternative 3 the TSF/DRSF would be located in the Upper EFSFSR drainage rather than the Meadow Creek drainage.

Effects on bull trout outside the mine site would be the same as described under Alternative 1.

Post-closure, a net decrease in quality and quantity of bull trout habitat would occur despite removal of passage barriers and an increase of lake habitat for bull trout including:

- Stream Reach 3 loses over half of its available OM habitat from baseline through EOY 12 due to the re-routing of the EFSFSR into the tunnel. The length of available habitat increases to slightly above baseline conditions during EOY 18 and EOY 112 as sinuous streams are constructed. However, as noted previously, bull trout may not have a way to colonize the newly created sections on top of the TSF/DRSF.

- The largest change in streamflow would be at Meadow Creek, where between Mine Year 7 and Mine Year 14 discharges are predicted to decrease at various levels ranging up to 98 percent. This is likely from the diversion of Meadow Creek into Hangar Flats pit to fill the pit lake. And in the Upper EFSFSR above Meadow Creek substantial reductions in flow occur between Mine Years -2 and 12 when the EFSFSR is diverted around the footprint of the EFSFSR drainage TSF/DRSF.
- It is predicted that an increase in stream temperatures under Alternative 3 would result in a net loss of suitable habitat for bull trout adults and juveniles by post-closure, from approximately 29 km at baseline to 20.4 km at Mine Year 20.

The Forest Service has preliminarily determined that Alternative 3 will adversely affect bull trout and their critical habitat. Informal Section 7 ESA consultation is ongoing with the USFWS.

4.12.2.5.7 Cutthroat Trout Specific Impacts – Alternative 3

4.12.2.5.7.1 Occupancy Modeling – Alternative 3

The following section summarizes the OM results for Alternative 3. See Section 3.12.4.4.5.1, Methods, for a description of the OM methodology and baseline conditions (see **Table 3.12-14**). The full technical memorandum is provided as **Appendix J-7**.

Occupancy Probabilities – Alternative 3

Tables 4.12-61 presents the OM-derived distance-weighted average occupancy probabilities for cutthroat trout by stream reach under Alternative 3 for five different time periods.

Table 4.12-61 Distance-Weighted Average Occupancy Probabilities for Cutthroat Trout for Each Stream Reach for Alternative 3

Stream Reach	Baseline	EOY 6	EOY 12	EOY 18	EOY 112
Stream Reach 1 (EFSFSR upstream of Sugar Creek to Meadow Creek)	63.73%	61.27%	63.52%	63.34%	63.37%
Stream Reach 2 (Meadow Creek Watershed)	64.06%	64.22%	64.12%	64.64%	64.62%
Stream Reach 3 (EFSFSR upstream of Meadow Creek)	63.59%	59.61%	59.63%	62.78%	62.83%
Stream Reach 5 (Headwaters of EFSFSR watershed)	63.79%	62.24%	62.84%	63.54%	63.57%

Table Source: **Appendix J-7**, Occupancy Modeling Technical Memoranda

Table Notes:

EOY = End of Mine Year.

Stream channel alterations described in Section 4.12.2.5.1, Physical Stream Channel Changes – Alternative 3 would impact occupancy probabilities for cutthroat trout in the OM model area. The largest decreases in occupancy potentials for cutthroat trout would occur in Stream Reach 3 from baseline to EOY 6 and EOY 12. This is likely caused by the large decrease in available habitat from stream changes—there are few reaches that remain active (receive occupancy potentials) during EOY 6 and EOY 12 in Stream Reach 3 due to construction of the TSF/DRSF in the Upper EFSFSR upstream of Meadow Creek.

Length of Available Habitat – Alternative 3

The changes in length of OM habitat for cutthroat trout would be the same as those described for bull trout in Section 4.12.2.5.6.1, Occupancy Modeling – Alternative 3.

With no mining activity occurring in upper Meadow Creek, over 9 km of suitable cutthroat trout habitat would remain blocked in perpetuity. By Mine Year 6 the major blockages along the Upper EFSFSR would be removed. Overall, by Mine Year 18 all available habitat that was blocked by a fish passage barrier would be available, except for the Meadow Creek area upstream of the existing fish passage barrier Meadow Creek (05). Also, in Mine Year 18, there would be a complete barrier created in Upper EFSFSR upstream of Meadow Creek from the construction of the TSF/DRSF. This facility would block access to over 15 km of suitable cutthroat trout habitat.

4.12.2.5.7.2 Streamflow – Alternative 3

The percent change in modeled flows for the low-flow period (defined as August-March) for selected locations within the mine site under Alternative 3 are presented in **Table 4.12-62**.

Table 4.12-62 Alternative 3 - Percent Change in Flow for the Low-flow Period for Selected Mine Years and Post-closure

Mine Year	Period	EFSFSR Upstream of Sugar Creek	Sugar Creek	EFSFSR Upstream of Meadow Creek	Meadow Creek Upstream of EFSFSR
		Long-term Difference (%)	Long-term Difference (%)	Long-term Difference (%)	Long-term Difference (%)
-2	low flow	-5.9	0.0	-18.4	0.2
-1	low flow	-8.7	0.0	-18.9	-9.0
1	low flow	-19.7	0.0	-21.6	1.2
2	low flow	-21.1	0.0	-16.6	1.6
3	low flow	-30.2	0.0	-21.4	1.6
4	low flow	-28.8	0.0	-20.7	2.0
5	low flow	-27.8	0.0	-21.3	3.4
6	low flow	-28.2	0.0	-21.0	4.1
7	low flow	-23.4	0.0	-17.9	-33.9
8	low flow	-20.5	0.0	-15.4	-50.8
9	low flow	-28.9	0.0	-16.6	-67.1

Mine Year	Period	EFSFSR Upstream of Sugar Creek	Sugar Creek	EFSFSR Upstream of Meadow Creek	Meadow Creek Upstream of EFSFSR
		Long-term Difference (%)	Long-term Difference (%)	Long-term Difference (%)	Long-term Difference (%)
10	low flow	-27.7	0.0	-15.5	-67.6
11	low flow	-25.3	0.0	-17.3	-64.8
12	low flow	-15.4	0.1	-17.1	-47.4
13	low flow	-37.3	-17.6	0.2	-94.3
14	low flow	-34.0	-10.2	2.2	-97.9
15	low flow	-28.6	-7.4	0.0	-78.7
16	low flow	-23.4	-10.0	0.2	-69.6
17	low flow	-12.7	-9.0	1.1	-42.3
18	low flow	1.6	-6.4	-0.1	-0.1
19	low flow	4.0	-4.8	0.4	2.4
20	low flow	3.3	-6.7	0.1	5.0
Post-closure	low flow	3.6	1.7	0.0	4.0

Table Source: **Appendix J-8**, PHABSIM Technical Memorandum

Table Notes:

The Low-Flow Period for Active Mine Years and Post-closure is defined as average of Mine Years 21 through 118. Numbers represent percent change in streamflow; negative numbers indicate a reduction in streamflow while positive numbers indication an increase in streamflow. Sugar Creek is summarized by itself because data were available for Sugar Creek. There is a relationship between percent change in flow and the amount of available habitat per species and life stage.

The most common changes are reductions in discharge, which are generally associated with the use of surface water for mining purposes, including the filling of the Hangar Flats pit in the Meadow Creek subwatershed (Mine Years 12 through 14). There also are years when stream reaches at the mine site would experience increases in discharge rate, largely due to groundwater pumping to provide water for the worker housing facility and other mining activities.

According to the data in **Table 4.12-62**, the largest change in streamflow would be at Meadow Creek, where between Mine Year 7 and Mine Year 17 discharges are predicted to decrease at various levels ranging up to 98 percent. This is likely from the diversion of Meadow Creek into Hangar Flats pit to fill the pit lake. And in the Upper EFSFSR above Meadow Creek, substantial reductions in flow occur between Mine Years -2 and 12 when the EFSFSR is diverted around the footprint of the EFSFSR drainage TSF/DRSF.

4.12.2.5.7.3 Water Temperature Changes – Alternative 3

The effects of stream temperature changes on fish under the action alternatives were analyzed and reported in a technical memorandum titled Stream Temperature Impacts on Fish, provided as **Appendix J-2**. Analysis methods used in this memorandum are summarized in Section 4.12.2.3.4.3, Water Temperature Changes – Alternative 1 (Chinook Salmon). The following is a summary of the analysis and results for cutthroat trout under Alternative 3.

Table 4.12-63 presents the length of streams within selected relevant baseline temperature threshold categories for cutthroat trout life stages under Alternative 3 as well as at certain intervals over the timeline of the SGP (Mine Years 6, 12, 18, and 112 [i.e., post-closure]). Full data for cutthroat trout under Alternative 3 presented in Table 16 of **Appendix J-2**.

Table 4.12-63 Lengths of Stream Reaches within Temperature Threshold Categories under Alternative 3 – Cutthroat Trout

Cutthroat Trout Temperature Threshold Category	Baseline	EOY 6 (Change from Baseline)	EOY 12 (Change from Baseline)	EOY 18 (Change from Baseline)	EOY 112 (Change from Baseline)
Adult Spawning - Field Observed Spawning Temp	0.85 km	0.89 km (+0.04 km)	0.85 km (+0.00 km)	0.52 km (-0.33 km)	0.52 km (-0.33 km)
Juvenile Rearing - Functioning Appropriately	5.01 km	2.48 km (-2.53 km)	2.44 km (-2.57 km)	2.53 km (-2.48 km)	2.53 km (-2.48 km)
Juvenile Rearing - Functioning at Risk	15.1 km	8.2 km (-6.90 km)	8.2 km (-6.90 km)	6.94 km (-8.16 km)	6.94 km (-8.16km)
Juvenile Rearing - Functioning at Unacceptable Risk	8.87 km	14.63 km (+5.76 km)	18.31 km (+9.44 km)	24.56 km (+15.69 km)	24.56 km (+15.69 km)
Total Available Habitat	28.98 km	25.31 km (-3.67 km)	28.95 km (-0.03 km)	34.03 km (+5.05 km)	34.03 km (+5.05 km)

Table Source: **Appendix J-2**, Stream Temperature Impacts on Fish Technical Memorandum

Table Notes:

EOY = End of Mine Year.

km = kilometers (1 km = 0.62 mi).

Temperatures are in °C.

Negative numbers in parentheses represent decreases in stream length within water temperature thresholds from baseline; positive numbers in parentheses represent increases in stream length within water temperature thresholds from baseline.

It is anticipated that an increase in stream temperatures under Alternative 3 would result in a net loss of overall stream lengths able to sustain optimal water temperatures for cutthroat trout life stages during mine operations and post-closure, from approximately 29 km at baseline to 34 km at Mine Year 20.

This analysis predicts a net loss of overall stream lengths able to sustain optimal water temperatures for cutthroat trout life stages during mine operations and post-closure. Specifically, **Table 4.12-63** shows the following:

- A net decrease in habitat with temperatures in the range of field-observed spawning during operations and at post-closure;
- A net decrease in juvenile rearing habitat within the “functioning appropriately” and “functioning at risk” category during operations and at post-closure;
- A net increase in habitat within the juvenile rearing habitat “functioning at unacceptable risk” category post-closure during operations and at post-closure;
- Total habitat availability for this species decreases in EOY 6 and 12 but increases in EOY 18 and is anticipated to be higher than baseline at post-closure; from approximately 29 km at baseline to 34 km at Mine Year 20.

4.12.2.5.7.4 Integration of Species/Habitat Effects for Cutthroat Trout – Alternative 3

Under Alternative 3 the TSF would be located in Upper EFSFSR drainage rather than the Meadow Creek drainage. This would result in decreased streamflows compared to the other alternatives, and increased amount of stream channel changes compared to Alternative 1. See summary of impacts below.

Effects on cutthroat trout outside the mine site would be the same as described under Alternative 1.

Post-closure, a net decrease in quality and quantity of cutthroat trout habitat would occur including:

- The largest decreases in occupancy potentials for cutthroat trout would occur in Stream Reach 3 from baseline to EOY 6 and EOY 12. This is likely caused by the large decrease in available habitat from stream changes—there are few reaches that remain active (receive occupancy potentials) during EOY 6 and EOY 12 in Stream Reach 3 due to construction of the TSF/DRSF in the Upper EFSFSR upstream of Meadow Creek;
- The greatest change in streamflow would be at Meadow Creek, where between Mine Year 7 and Mine Year 17 discharges are predicted to decrease at various levels ranging up to 98 percent. This is likely from the diversion of Meadow Creek into Hangar Flats pit to fill the pit lake. And in the Upper EFSFSR above Meadow Creek substantial reductions in flow occur between Mine Years -2 and 12 when the EFSFSR is diverted around the footprint of the EFSFSR drainage TSF/DRSF;
- It is anticipated that an increase in stream temperatures under Alternative 3 would result in a net loss of overall stream lengths able to sustain optimal water temperatures for cutthroat trout life stages during mine operations and post-closure, from approximately 29 km at baseline to 34 km at Mine Year 20.

Alternative 3 may indirectly impact Westslope cutthroat trout individuals but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

4.12.2.5.8 Impacts To Other Species – Alternative 3

Under Alternative 3, the negative effects on all aquatic species described under Alternative 1 would still occur. The change in TSF location would further decrease streamflows and increase the amount of stream channel changes, which would increase the magnitude of impacts on all aquatic species. Impacts to all aquatic species in waterways outside the mine site would be the same as described under Alternative 1.

4.12.2.6 Alternative 4

The SGP components of Alternative 4 with the potential to affect fish, other aquatic species, and aquatic habitats are more similar to those described for Alternative 1 than Alternatives 2 and 3. The SGP components of Alternative 4 that differ from Alternative 1 that may result in different potential aquatic resource effects to fish, other aquatic species, and aquatic habitats are discussed below.

Under Alternative 4, the Yellow Pine Route would be upgraded and used for mine site access during mine construction, operations, closure and reclamation (i.e., the Burntlog Route would not be constructed). Waterbody modifications would be the same as those described for Alternative 1, except for the following changes:

- The Blowout Creek channel diversion would use step pools in place of a rock drain beginning in Mine Year -1 (**Table 4.12-1**);
- During mine operations, the 1.3-km-long EFSFSR diversion tunnel (EFSFSR Tunnel) would not include features facilitating upstream fish passage; and
- During mine operations, Meadow Creek would be routed around the Hangar Flats pit in a 716-meter-long pipeline (**Table 4.12-1**).

These differences between Alternatives 1 and 4 are expected to change the magnitude of several impacts to fish, other aquatic species, and aquatic habitats.

Under Alternative 4, the total amount of stream channel disturbance would be the same as Alternative 1, **Table 4.12-2**. There would be no change in the effects from Alternative 4 compared to Alternative 1 from streamflow reductions or increases in water temperatures that may cause fish to either suffer additional injury or additional mortality, or to avoid additional mine site streams for certain periods throughout the SGP.

Under Alternative 4, the EFSFSR would be routed through the EFSFSR Tunnel during Mine Year -1 (**Table 4.12-1**) that would bypass the Yellow Pine pit around its western perimeter. The tunnel would be designed to pass streamflows and sediment/debris; however, the tunnel would not be designed to provide for upstream fish passage. The tunnel design would block all fish movement upstream of the tunnel entrance during Yellow Pine pit mining operations (i.e., Mine Years -1 through 13). At the time that the EFSFSR Tunnel is being constructed, a fish exclusion barrier also would be installed on the EFSFSR to prevent fish from entering the Yellow Pine pit area. Because of this, Alternative 4 would avoid impacts to upstream migratory fish (i.e., Chinook salmon, steelhead trout, bull trout, and cutthroat trout) that may seasonally migrate upstream via the tunnel under Alternative 1. The tunnel would prevent these fish from accessing streams in the upper EFSFSR until Mine Year 14 when the EFSFSR Tunnel would be decommissioned and upstream passage reclaimed via the constructed channel of the EFSFSR through the Yellow Pine pit area (**Table 4.12-1**). The tunnel would not prevent fish from moving downstream.

4.12.2.6.1 PHYSICAL STREAM CHANNEL CHANGES – ALTERNATIVE 4

The effects of physical stream channel changes under Alternative 4 would be the same as those described for Alternative 1 with the following exceptions:

- There would be a habitat loss of approximately 1.3 km in the stream reach of the EFSFSR to be diverted to the EFSFSR Tunnel. This includes the linear length of the EFSFSR through the 1.9 hectares Yellow Pine pit lake, plus the length of the EFSFSR over the Yellow Pine pit high gradient cascade passage barrier;
- There would be a habitat loss of 0.72 km in the reach of Meadow Creek to be diverted to a pipeline around Hangar Flats pit for the duration of active mining operations; and
- The Blowout Creek surface diversion would incorporate step pool channel enhancements rather than a rock drain.

4.12.2.6.2 DIRECT IMPACTS TO INDIVIDUALS – ALTERNATIVE 4

Under Alternative 4 the direct impacts to individual fish at the mine site would be the same as those described for Alternative 1 (refer to Section 4.12.2.3.2, Direct Effects to Individuals – Alternative 1), including from blasting, waterbody dewatering and fish salvage, changes in fish access, and contaminant spills. Under Alternative 4, the risk of chemical spills would be generally the same as for Alternative 1, except that the risk of spills into waterways adjacent to the access roads during operations would be constrained to along the Yellow Pine Route as the Burntlog Route would not be constructed.

Table 4.12-64 shows the total length of important fish habitat within 91 meters of Yellow Pine Route.

Table 4.12-64 Alternative 4 Length of Important Fish Habitat within 91 meters of the Yellow Pine Route

Fish Habitat within 91 meters	Yellow Pine Route
Bull Trout Critical Habitat	33.74 km
Steelhead Trout Critical Habitat	32.30 km
Chinook Salmon IP Habitat	35.99 km
TOTAL LENGTH	102.03 km

Table Source: AECOM 2020

The Yellow Pine Route is adjacent to much larger streams (e.g., Johnson Creek and the EFSFSR) with documented large populations of fish species of management concern. A spill on that route could affect a greater number of fish and more habitat, including more Chinook salmon IP habitat, and more critical habitat for steelhead trout and bull trout, compared to a spill along the Burntlog Route.

4.12.2.6.2.1 Mine Site – Dewatering, Fish Salvage, and Relocation

Under Alternative 4, the amount of stream channel and Yellow Pine pit lake disturbance would be the same as under Alternative 1 (shown in **Table 4.12-2**). The estimated total salvage numbers for streams by salmonid species are summarized in **Table 4.12-2b.**

4.12.2.6.3 HABITAT ELEMENTS/WATERSHED CONDITION INDICATORS – ALTERNATIVE 4

The effects of physical stream channel changes under Alternative 4 would be the same as under Alternative 1, except for the Physical Barriers WCI. For details regarding the remaining effects to WCIs and habitat elements (i.e., contaminants, sediment, existing barriers, etc.) refer to Section 4.12.2.3.3.1, Changes to WCIs at the Mine Site, and Section 4.12.2.3.3.2, Changes to WCIs outside the Mine Site. Under Alternative 4, the EFSFSR Tunnel would not provide for upstream fish passage from Mine Year -1 through 13, a period of 14 years. In addition, upstream migrating fish in the EFSFSR would be blocked from moving into the Yellow Pine pit due to the dewatering of the pit for mining. By the time the tunnel is operational in Mine Year -1, the barrier at the EFSFSR Yellow Pine pit cascade, a complete and artificial barrier (**Table 4.12-8**), would have been modified to allow fish passage; however, there would be no fish passage upstream of this former barrier due to mining in the Yellow Pine pit. Mining and backfilling in at the Yellow Pine pit would continue until Mine Year 13, after which up- and downstream fish passage in the EFSFSR would be fully reclaimed. Under baseline conditions, the Physical Barriers WCI FI for Stream Reach 1 (EFSFSR from Sugar Creek upstream to Meadow Creek) rates as “functioning at unacceptable risk.” Once the tunnel is decommissioned in Mine Year 14, the Physical Barriers WCI would be rated as Functionally Acceptable for Stream Reach 1.

During mining operations under Alternative 4, Meadow Creek would be diverted around Hangar Flats pit in a pipeline beginning in Mine Year -1 and extending to Mine Year 19 when Meadow Creek would be connected directly to the filled Hangar Flats pit lake. This pipeline would create a new passage barrier to all resident fish species attempting to move upstream in Meadow Creek upstream of the Hangar Flats pit. Mining at the Hangar Flats pit also would create a future barrier for fish attempting to move upstream in Meadow Creek. The TSF/DRSF facilities would block fish passage upstream of the pit by creating a gradient barrier. Even though Meadow Creek would be constructed on top of the TSF/DRSF facilities by Mine Year 17 (**Table 4.12-1**), the gradient on the outslope of the facilities would prevent upstream fish passage in perpetuity. The baseline Physical Barrier WCI FI for Stream Reach 2 (Meadow Creek watershed) is currently at “functioning at unacceptable risk” and it would remain so in perpetuity under Alternative 4.

4.12.2.6.4 CHINOOK SALMON SPECIFIC IMPACTS – ALTERNATIVE 4

Under Alternative 4, the EFSFSR Tunnel would not be designed for fish passage and the Yellow Pine pit lake would be dewatered and mined as described for Alternative 1. This would prevent fish passage upstream of the Yellow Pine pit until Mine Year 13. Stocking of Chinook salmon upstream of the Yellow Pine pit would continue under Alternative 4.

4.12.2.6.4.1 Intrinsic Potential

Alternative 4 would have similar effects on Chinook salmon IP habitat as described for Alternative 1, except that during the first 13 years of the SGP all IP habitat upstream of the Yellow Pine pit cascade barrier would remain inaccessible to migratory Chinook salmon because the EFSFSR tunnel would not be designed for fish passage.

4.12.2.6.4.2 Streamflow Changes

Alternative 4 would have similar effects on streamflows as described for Alternative 1. The diversion locations and volumes of water diverted would remain the same except for Meadow Creek where only the method of diversion would be different.

4.12.2.6.4.3 Water Temperature Changes

It is assumed that under Alternative 4 effects on stream temperatures would be the same as described for Alternative 1 even with the addition of a 716-meter-long pipeline around Hangar Flats pit.

4.12.2.6.4.4 Critical Habitat

Alternative 4 would have similar effects at the mine site on Chinook salmon critical habitat as described for Alternative 1, except that Chinook salmon could not access any critical habitat upstream of the EFSFSR tunnel entrance and upstream of the Yellow Pine pit exclusion barrier until Mine Year 13 when the EFSFSR Tunnel would be decommissioned and the exclusion barrier removed, thereby allowing fish to return to using the EFSFSR to access habitat. In addition, under Alternative 4, by Mine Year 17 when Meadow Creek is constructed on top of the

Meadow Creek TSF/DRSF, those facilities would permanently block Chinook salmon access to 5.50 km of critical habitat due to the steep gradient at the downstream face of the TSF/DRSF.

The effects on Chinook salmon critical habitat outside the mine site would be the same as those described under Alternative 1 for the use of the Yellow Pine Route. This habitat is at risk of impacts associated with the road upgrades and use, contaminant spills, and sedimentation. Under Alternative 4 the Burntlog Route would not be constructed and critical habitat along the Yellow Pine Route would be exposed to these potential effects for the life of the SGP, as opposed to only during the construction phase as under all other action alternatives.

4.12.2.6.4.5 Integration of Species/Habitat Effects for Chinook Salmon

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs would negatively affect Chinook salmon in the analysis area. These effects may cause injury or mortality to individuals and temporary displacement of Chinook salmon from several mine site streams (e.g., Meadow Creek) where habitat conditions may become unsuitable due to streamflow volume or water temperature, or where fish passage is impaired. Such environmental conditions would cause a temporal to permanent loss of Chinook salmon habitat. Following reclamation, the net effect would be a loss of both quantity and quality of habitat for Chinook salmon.

The activities and infrastructure of Alternative 4 that have the potential to affect fish and fish habitat are very similar to those described in Alternative 1, with a few exceptions related to the Meadow Creek pipeline diversion, the EFSFSR Tunnel without fish passage, and Blowout Creek surface diversion enhanced with step pools.

Specifically, for Alternative 4, the potential effects to Chinook salmon include:

- Risk of direct effects to individuals in 102.03 km of important fish habitat within 91 meters of the Yellow Pine Route for all SGP phases;
- A new temporary passage barrier at the Meadow Creek pipeline diversion; and
- A permanent passage barrier at the Meadow Creek TSF/DRSF that prevents access to critical habitat.

The Forest Service has preliminarily determined that Alternative 4 will adversely affect Chinook salmon and their critical habitat. Informal Section 7 ESA consultation is ongoing with the NMFS.

4.12.2.6.5 STEELHEAD TROUT SPECIFIC IMPACTS – ALTERNATIVE 4

Under Alternative 4, the EFSFSR Tunnel would not be designed for fish passage and the Yellow Pine pit lake would be dewatered, mined, and reclaimed as described for Alternative 1. This would prevent steelhead trout access upstream of the Yellow Pine pit until Mine Year 13. Since this habitat is currently inaccessible to steelhead trout upstream of the Yellow Pine pit gradient barrier, steelhead trout access would not be changed from baseline access conditions until Mine

Year 13. Future steelhead trout passage limitations in the Meadow Creek watershed are similar to those described for Chinook salmon.

4.12.2.6.5.1 Intrinsic Potential

Alternative 4 would have similar effects on steelhead trout IP habitat as described for Alternative 1, except that during the first 13 years of mining all habitat upstream of the Yellow Pine pit cascade barrier would remain inaccessible to migratory steelhead trout. By Mine Year 17 the Meadow Creek TSF/DRSF would block steelhead trout access to 1.91 km of IP habitat.

4.12.2.6.5.2 Streamflow Changes

Alternative 4 would have similar effects on streamflows as described for Alternative 1. The diversion locations and volumes of water diverted would remain the same except for Meadow Creek where only the method of diversion would be different.

4.12.2.6.5.3 Water Temperature Changes

Alternative 4 would have the same effects on stream temperatures as described under Alternative 1.

4.12.2.6.5.4 Critical Habitat

There is no designated steelhead trout critical habitat in the vicinity of the mine site. Alternative 4 would have the same type of effects on steelhead trout critical habitat as described for Alternative 1 along the Yellow Pine Route only. These include, but are not limited to, potential impacts from hazardous materials spills, injury or mortality during culvert replacement, sediment in streams from road construction and use leading to potential temperature or water quality changes causing potential fish avoidance. Under Alternative 4 these risks would remain for all phases of the SGP.

4.12.2.6.5.5 Integration of Species/Habitat Effects for Steelhead Trout

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs would negatively affect steelhead trout in the analysis area. These effects may cause injury or mortality to individuals and temporary displacement of steelhead trout from several mine site streams (e.g., Meadow Creek) where habitat conditions may become unsuitable due to streamflow or water temperature or where fish passage is impaired. Such environmental conditions would cause a temporal to permanent loss of habitat. Even following reclamation, the net effect would be a loss of both quantity and quality of habitat for steelhead trout.

The activities and infrastructure under Alternative 4 that have the potential to affect fish and fish habitat are very similar to those described in Alternative 1, with a few exceptions related to the Meadow Creek pipeline diversion, the EFSFSR Tunnel without fish passage, and Blowout

Creek surface diversion enhanced with step pools. Specifically, for Alternative 4, the potential effects to steelhead trout include:

- Risk of direct effects to individuals in 102.03 km of important fish habitat within 91 meters of the Yellow Pine Route for all SGP phases;
- A new temporary passage barrier at the Meadow Creek pipeline diversion; and
- A new permanent passage barrier at the Meadow Creek TSF/DRSF that prevents access to suitable habitat.

The Forest Service has preliminarily determined that Alternative 4 will adversely affect steelhead trout and their critical habitat. Informal Section 7 ESA consultation is ongoing with the NMFS.

4.12.2.6.6 BULL TROUT SPECIFIC IMPACTS – ALTERNATIVE 4

Under Alternative 4, the EFSFSR Tunnel would not be designed for fish passage and the Yellow Pine pit lake would be dewatered and mined as described for Alternative 1. Therefore, an upstream exclusion barrier would be created for resident bull trout who move downstream in EFSFSR below the Yellow Pine pit lake, access would not be restored until Mine Year 13. Bull trout resident upstream of the Yellow Pine pit cascade would be impacted by various mining activities. Future bull trout passage limitations in the Meadow Creek watershed are similar to those described for Chinook salmon and steelhead trout. Specifically, fluvial bull trout would be prevented during mining operations from moving upstream in Meadow Creek by the Meadow Creek pipeline, a temporary barrier. Later during mining operations, the Meadow Creek TSF/DRSF would permanently block bull trout passage in Meadow Creek to headwater streams even after Meadow Creek is reconstructed by Mine Year 17 (**Table 4.12-1**).

4.12.2.6.6.1 Occupancy Modeling

Occupancy modeling was not performed for Alternative 4 because there would be no change from Alternative 1 except that the EFSFSR Tunnel and the Yellow Pine pit exclusion barrier. These barriers would prevent bull trout not already resident upstream of the Yellow Pine pit cascade barrier from moving upstream until Mine Year 13, the year fish passage is reclaimed upstream of the Yellow Pine pit lake. Currently, there is an estimated 41.7 km of bull trout OM habitat in the mine site area (**Table 4.12-17**). The amount of habitat would vary over the course of the SGP, ranging from 28.9 km in Mine Year 6 to 41.2 km at mine closure. Streams with reduced access to OM habitat at mine closure due to passage barriers include Fern Creek, Blowout Creek, Fiddle Creek, and Meadow Creek upstream of the TSF/DRSF (**Table 4.12-17**).

4.12.2.6.6.2 Streamflow Changes

Alternative 4 would have similar effects on streamflows as described for Alternative 1. The diversion locations and volumes of water diverted would remain the same except for Meadow Creek where only the method of diversion would be different.

4.12.2.6.6.3 Water Temperature Changes

SGP activities under Alternative 4 would have the same effects on water temperatures as described as under Alternative 1.

4.12.2.6.6.4 Loss of Lake Habitat

The changes associated with Alternative 4 would be similar to Alternative 1, except that the EFSFSR Tunnel would not be designed to provide upstream fish passage. After the EFSFSR is constructed over the Yellow Pine pit area, there would be bull trout access to the Hangar Flats pit lake. The lake would begin to be filled in Mine Year 11. All flow to the EFSFSR channel would be diverted in Mine Year 13, which would provide access at certain periods of the year for bull trout to Hangar Flats pit lake. The potential effects of the temporal loss of lake habitat, and the changes to the available lake habitat once Hangar Flats pit lake is completed are detailed in Alternative 1.

4.12.2.6.6.5 Critical Habitat

Alternative 4 would have the same type of effects on bull trout critical habitat at the mine site as are described for Alternative 1. The effects on bull trout critical habitat outside the mine site would be the same as those described under Alternative 1 for the use of the Yellow Pine Route. The habitat used by bull trout in the Yellow Pine pit lake is not designated as critical habitat for the species.

4.12.2.6.6.6 Integration of Species/Habitat Effects for Bull Trout

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs would negatively affect bull trout in the analysis area. These effects may cause injury or mortality to individuals and temporary displacement of bull trout from several mine site streams (e.g., Meadow Creek) where habitat conditions may become unsuitable due to streamflow or water temperature or where fish passage is impaired. Such environmental conditions would cause a temporal to permanent loss of habitat. Even following reclamation, the net effect would be a loss of both quantity and quality of habitat for bull trout.

The activities and infrastructure of Alternative 4 that have the potential to affect fish and fish habitat are very similar to those described in Alternative 1, with a few exceptions related to the Meadow Creek pipeline diversion, the EFSFSR Tunnel without fish passage, and Blowout Creek surface diversion enhanced with step pools. Specifically, for Alternative 4, the potential effects to bull trout include:

- Risk of direct effects to individuals in 33.7 km of critical habitat within 91 meters of the Yellow Pine Route for all SGP phases;
- A new temporary passage barrier at the Meadow Creek pipeline diversion; and
- A new permanent passage barrier at the Meadow Creek TSF/DRSF that prevents access to critical habitat.

The Forest Service has preliminarily determined that Alternative 4 will adversely affect bull trout and their critical habitat. Informal Section 7 ESA consultation is ongoing with the USFWS.

4.12.2.6.7 Cutthroat Trout Specific Impacts – Alternative 4

Under Alternative 4, the EFSFSR Tunnel would not be designed for fish passage and the Yellow Pine pit lake would be dewatered, mined, and reclaimed as described for Alternative 1. Therefore, there would be an exclusion barrier created for cutthroat trout resident in the EFSFSR downstream of the tunnel and they would not have access upstream of the Yellow Pine pit until Mine Year 13. Cutthroat trout resident upstream of the Yellow Pine pit cascade under baseline conditions would be impacted by various mining activities (e.g., stream diversions, and construction and operation of the TSF and DRSFs). Future cutthroat trout passage issues in the Meadow Creek watershed would be similar to those described for Chinook salmon, steelhead trout, and bull trout. Specifically, cutthroat trout would be prevented during mining operations from moving upstream in Meadow Creek by the Meadow Creek pipeline, a temporary barrier. Later during mining operations, the Meadow Creek TSF/DRSF would permanently block cutthroat trout passage in Meadow Creek to headwater streams even after Meadow Creek is reconstructed by Mine Year 17 (**Table 4.12-1**).

4.12.2.6.7.1 Occupancy Modeling

Occupancy modeling was not performed for Alternative 4 because there would be no change from Alternative 1, except that the EFSFSR Tunnel and the Yellow Pine pit exclusion barrier would prevent cutthroat trout not already resident upstream of the Yellow Pine pit cascade barrier from moving upstream until Mine Year 13, the year fish passage is reclaimed upstream of the Yellow Pine pit. Under baseline conditions, there is an estimated 41.7 km of cutthroat trout OM habitat in the mine site area (**Table 4.12-17**). Habitat loss would vary over the course of the mine's life, ranging from 28.9 km in Mine Year 6 to 41.2 km at mine closure. Streams with reduced access to OM habitat at mine closure due to passage barriers include Fern Creek, East Fork Middle Creek, Fiddle Creek, and Meadow Creek upstream of the TSF/DRSF (**Table 4.12-17**).

4.12.2.6.7.2 Streamflow Changes

Alternative 4 would have similar effects on streamflows as described for Alternative 1. The diversion locations and volumes of water diverted would remain the same except for Meadow Creek where the diversion method would be different.

4.12.2.6.7.3 Water Temperature Changes

Alternative 4 would have the same effects on temperatures as described as under Alternative 1 (Section 4.12.2.3.7.3, Water Temperature Changes – Cutthroat Trout – Alternative 1).

4.12.2.6.7.4 Integration of Species/Habitat Effects for Cutthroat Trout

The combination of physical stream channel changes, direct effects to individuals, and changes too many of the WCIs would negatively affect cutthroat trout in the analysis area.

These effects to habitat and the environmental conditions may cause injury or mortality to individuals and temporary displacement of cutthroat trout from several mine site streams (e.g., Meadow Creek) where habitat conditions may become unsuitable due to streamflow or water temperature or where fish passage is impaired. Such environmental conditions would cause a temporal to permanent loss of habitat. Even following reclamation, the net effect would be a loss of both quantity and quality of habitat for cutthroat trout.

The activities and infrastructure of Alternative 4 that have the potential to affect fish and fish habitat are very similar to those described in Alternative 1, with a few exceptions related to the Meadow Creek pipeline diversion, the EFSFSR Tunnel without fish passage, and Blowout Creek surface diversion enhanced with step pools. Under Alternative 4, the potential effects to cutthroat trout include the following:

- A new temporary passage barrier at the Meadow Creek pipeline diversion; and
- A new permanent passage barrier at the Meadow Creek TSF/DRSF that prevents access to upstream cutthroat trout habitat.

Alternative 4 may indirectly impact Westslope cutthroat trout individuals but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

4.12.2.6.8 Impacts To Other Species – Alternative 4

Under Alternative 4, impacts to all aquatic species would be similar to those described under Alternative 1. The use of the Yellow Pine Route as the only access route, would put all aquatic species in the adjacent streams, mainly Johnson Creek and the EFSFSR, at risk of potential impacts from spill risk, contamination, etc. to the Yellow Pine Route. There would be no potential impacts along streams associated with the Burntlog Route.

4.12.2.7 Alternative 5

Under Alternative 5 (i.e., the No Action Alternative), there would be no surface (open-pit) mining or ore processing to extract gold, silver, and antimony, and no underground exploration or sampling or related operations and facilities on National Forest System lands. Midas Gold could continue to conduct surface exploration that has been previously approved on National Forest System lands. Midas Gold would continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations (Midas Gold 2016). These commitments include reclamation of the drill pads and temporary roads and monitoring to ensure that BMPs are in place and effective so that soil erosion and other potential resource impacts are avoided or minimized. This also would include monitoring commitments required by the Forest Service relating to the Golden Meadows Exploration Environmental Assessment (Forest Service 2015).

In the absence of the SGP, current uses by Midas Gold on patented mine/mill site claims, and on PNF and Boise National Forest would continue. Uses of National Forest System lands include mineral exploration, dispersed and developed recreation, such as pleasure driving, hunting, off-highway-vehicle use, camping, hiking, snowmobiling, bird watching, target shooting, firewood cutting, and other forms of recreation. Private businesses, such as outfitter and guide services, also operate on the Forest through special use permits. Access to public land in the area would continue as governed by law, regulation, policy, and existing and future landownership constraints, the latter of which may include denial of access over private land.

Under the No Action Alternative there would be no SGP-caused impacts on physical stream channels, WCIs, individual fish (including federally-listed and forest service species sensitive species), or fish habitat.

4.12.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.12.4 Cumulative Effects

The cumulative effects analysis area for fish and aquatic habitat that could be directly or indirectly affected by the SGP is the same analysis area used to evaluate direct effects on fish and aquatic habitat, which consists of all of the watercourses and waterbodies in the Hydrologic Unit Code 6th field (10-digit code watersheds that overlap potential SGP disturbance areas. This area is shown on **Figure 3.12-1**. Section 4.1.5, Cumulative Impacts, describes the timeframe and general analysis area and methods for cumulative effects. Also, see **Table 4.1-2** for a list of reasonably foreseeable future actions, including brief descriptions of the projects, in the vicinity of the SGP area.

Cumulative effects consider the range of existing and foreseeable activities and their potential effects with respect to fish and aquatic habitat when combined with the potential direct and indirect impacts of the SGP. Past and present actions that have, or are currently, affecting fish and aquatic habitat include past and current mining activities (including exploration), infrastructure projects, ongoing Forest Service management projects, recreation, fishing, transportation projects, water diversions, hydropower projects, and wildland fires.

4.12.4.1 Alternative 1

Reasonably foreseeable future actions that could cumulatively contribute to the impacts of Alternative 1 on fish and aquatic habitat in the analysis area include:

- South Fork Restoration and Access Management Plan
- East Fork Salmon River Restoration and Access Management Plan
- PNF's Wildlife Conservation Strategy

These actions would occur in the same watershed and are expected to have similar types of impacts to fish and aquatic habitat as described for Alternative 1, such as increases in sediment and stream temperatures, streamflow reductions, and stream channel changes. However, because these projects appear to be at a smaller scale than the SGP (**Table 4.1-2** and **Figure 4.1-1**), their impacts also would be at a smaller scale. These projects also could have beneficial effects on fish and aquatic habitat in the long-term and are summarized below.

The South Fork Restoration and Access Management Plan and the East Fork Salmon River Restoration and Access Management Plan include numerous actions related to watershed reclamation within the SFSR watershed, and is therefore expected to have a long-term beneficial effect on habitat conditions for fish.

The PNF's Wildlife Conservation Strategy would affect fish because one of its objectives to actively reclaim or maintain conditions for sensitive fish and 303(d) listed waterbodies.

Cumulative effects from large-scale management of Forest vegetation could include short-term disturbance of fish habitats and increases in sediment; but would be beneficial in the long-term. **Table 4.12-65** provides a general description of effects on fish and aquatic resources from the other types of projects that are expected to occur in the analysis area.

Table 4.12-65 Cumulative Effects on Fish and Aquatic Habitat from Other Future Projects or Activities

Cumulative Project Type	Effects on Fish and Aquatic Habitat
Mineral exploration and mining activities	Currently planned or future mine development would affect fish and habitat during development through direct disturbance of habitat, increase sediment, changes in stream flow and temperature.
Closure and reclamation projects	Projects within fish habitat that are currently, or in the future, undergoing reclamation would likely improve fish habitat because these projects involve the removal of some infrastructure and reclamation of native habitats.
Transportation projects	Road maintenance, bridge or culvert replacement, and improvement projects are likely in the analysis area. Installation or improvement of culverts or bridges may impact fish habitat due to construction-related effects such as erosion and sediment in streams. Maintenance of existing roadways and culverts/bridges would create short-term impacts, while new roadways and culverts/bridges could have impacts for a longer period.

Cumulative Project Type	Effects on Fish and Aquatic Habitat
Recreation and tourism effects	Recreational activities such as fishing would continue to affect fish in the future. Fishing activities could decrease localized fish populations. These are regulated by the Idaho Fish and Game Department and would not lead to cumulative impacts when combined with impacts from this project.
Private Development Projects	Private residential developments are likely to have minor temporary impacts on fish and fish habitat, such as culvert installations or replacements, and increases in sediment related to construction and vehicle use in the future.

The impacts from the specific reasonably foreseeable future projects and other future projects or activities would likely be short duration and are planned at a smaller scale. However, when combined with the potential impacts and duration of SGP Alternative 1, the duration and scale of cumulative impacts on fish and aquatic habitat would be larger because all these projects would occur during the same time period. The resulting cumulative effect on fish and aquatic habitat in the analysis area would be temporal losses or degradation of habitat and behavioral disturbances, along with some long-term beneficial effects from habitat improvements.

4.12.4.2 Alternative 2

The effects discussed under Alternative 1 for the SGP and other reasonably foreseeable future actions (RFFAs), such as increases in stream temperatures, sediment, streamflow reductions, and stream channel changes also would occur under Alternative 2. However, temperature and streamflow effects from the SGP would be lower magnitude compared to Alternative 1. Therefore, the cumulative effects on fish from Alternative 2 combined with RFFAs would be lower than under Alternative 1.

4.12.4.3 Alternative 3

The effects discussed under Alternative 1 for the SGP and other RFFAs, such as increases in stream temperatures, sediment, streamflow reductions, and stream channel alterations also would occur under Alternative 3. However, the change in location of the TSF/DRSF could increase the water temperature and decrease the streamflow greater, which may reduce fish species and aquatic habitat. Therefore, the cumulative impacts of Alternative 3 combined with RFFAs could be greater than those described under Alternative 1

4.12.4.4 Alternative 4

The effects discussed under Alternative 1 for the SGP and other RFFAs, such as increases in stream temperatures, sediment, streamflow reductions, and stream channel changes also would occur under Alternative 4. The use of the Yellow Pine Route rather than the construction and use of the Burntlog Route would increase the risk of spills and increase the amount of sediment into Johnson Creek. Therefore, the cumulative impacts on fish from Alternative 4 combined with RFFAs would be greater than under Alternative 1, 2, or 3.

4.12.4.5 Alternative 5

The existing baseline conditions of fish and aquatic habitat in and adjacent to the mine site would remain unchanged under Alternative 5 as the SGP would not be approved. Although the SGP would not occur under Alternative 5, the RFFAs described under Alternative 1 would still have cumulative impacts in the analysis area, although likely small in scale and short in duration.

4.12.5 Irreversible and Irretrievable Commitments of Public Resources

4.12.5.1 Alternative 1

Irreversible Commitments – A commitment of resources is irreversible when the impacts of the proposed action or alternatives would limit the future options for use of the resource. This applies primarily to non-renewable resources or to processes or resources that are renewable over long periods of time.

Certain biological resources that would be affected by the SGP are renewable only over long-time spans including mature vegetation, seedbanks, and topsoil. Loss of these resources would be considered irreversible. Soils would be stockpiled and reused to the greatest degree possible, but there would still be some irreversible commitment of soil to this SGP.

The direct mortality of fish would be an irreversible impact that could occur under Alternative 1. Although fish exclusion barriers and trap and transfer activities would be incorporated to minimize fish mortality, incidental injury or mortality is expected to occur. These “takes” of fish in the mine site would be considered irreversible. Species subject to potential irreversible losses include the threatened Snake River spring/summer Chinook salmon, steelhead trout, bull trout, and cutthroat trout.

Irretrievable Commitments – A commitment of resources is irretrievable when the impacts of the action alternatives would result in a loss of production, harvest, or use of renewable resources. An irretrievable commitment of resources occurs when a resource that is renewable over a relatively short period of time is consumed during the life of the SGP and is therefore unavailable for other uses until the use ceases and it is renewed and once again available. It is the temporal loss of resources that is considered irretrievable.

This includes resources that are renewable over a short time, such as riparian vegetation and streams. While the loss of the resource itself is reversible (through mitigation), the temporal loss of the use of the resource or habitat is irretrievable. The SGP would cause a temporal loss of fish habitat for fish species inhabiting certain stream reaches, as described in the following subsections.

Portions of Meadow Creek upstream of the southern extent of the TSF would be irretrievable and unavailable to downstream fish within Meadow Creek during construction and operations.

During construction and operations, the presence of the TSF and Hangar Flats DRSF would essentially isolate any populations of bull trout and cutthroat trout which are known to inhabit the upper reaches of Meadow Creek. After closure and reclamation, this habitat would be re-connected through construction of Meadow Creek over the TSF/DRSF and is expected to allow fish passage throughout Meadow Creek.

The loss of existing fish habitat in the Yellow Pine pit lake may constitute as an irretrievable commitment of resources.

A portion of Fiddle Creek would be irretrievable and unavailable to fish during construction and operations due to the presence of the Fiddle DRSF. The known cutthroat trout inhabiting Fiddle Creek would be displaced during this process. Stream channel changes to Meadow Creek around the proposed Hangar Flats open pit also would constitute as an irretrievable commitment of resources. Changes in fish habitat due to altered streamflows and temperatures that would persist post-closure also would be an irretrievable commitment of resources.

4.12.5.2 Alternative 2

The irreversible and irretrievable commitment of fish and aquatic habitat resources under Alternative 2 would be the same as under Alternative 1.

4.12.5.3 Alternative 3

The irreversible and irretrievable commitment of fish and aquatic habitat resources under Alternative 3 would be similar to that described under Alternative 1, except the location of the TSF in the EFSFSR rather than Meadow Creek would change the location of the fish habitat that would be lost.

4.12.5.4 Alternative 4

The irreversible and irretrievable commitment of fish and aquatic habitat resources under Alternative 4 would be the same as under Alternative 1.

4.12.5.5 Alternative 5

Under the Alternative 5 there would be no irreversible or irretrievable commitment of fish and aquatic habitat resources.

4.12.6 Short-term Uses versus Long-term Productivity

4.12.6.1 Alternative 1

Construction and operation of the proposed mine would result in short-term impacts to fish and associated habitat. During construction and operations, some sections of fish habitat would be removed from the footprint of the proposed mine site, as described above in Section 4.12.2, Direct and Indirect Effects. The following paragraphs briefly summarize these short-term changes and describes how these changes would affect the long-term productivity of fish and fish habitat.

Short-term changes to fish habitat include diverting the EFSFSR around Yellow Pine pit and subsequently backfilling and constructing a stream channel atop the pit at closure. Restoring fish passage upstream of the Yellow Pine pit would result in an increase in available habitat for anadromous and resident fish in the analysis area.

Short-term changes to fish habitat in Meadow Creek include diverting a portion of the creek just south of the proposed Hangar Flats open pit, and the loss of habitat where the TSF and Hangar Flats DRSF would be located. The short-term loss of habitat would negatively affect fish populations in Meadow Creek over the life of the mine. The long-term change in habitat would favor steelhead trout over Chinook salmon.

4.12.6.2 Alternatives 2 through 4

Under Alternatives 2 through 4 the effects of short-term use and long-term productivity would be the same as that described for Alternative 1. This is because all the action alternatives include the same type and intensity of impacts to fish and aquatic habitat at the mine site.

4.12.6.3 Alternative 5

Alternative 5 would not affect the short-term use or long-term productivity of fish or aquatic habitat.

4.12.7 Summary

For fish and aquatic habitat, the important differences among the alternatives lie in the location of the TSF/DRSF (which affects different species), the modifications in surface water management at the mine site, access through the EFSFSR tunnel, and the location of access roads.

Alternative 2 would have the smallest amount of habitat loss and the lowest magnitude of impacts on streamflow and temperature; however, the modifications that cause these changes also could be implemented as mitigations under Alternatives 3 or 4 (**Table 4.12-66**).

Alternative 3 would have the greatest reductions in useable habitat for Chinook salmon and steelhead trout and cause the greatest reduction in bull trout occupancy and impact the largest amount of Critical Habitat. It also would cause the greatest changes in streamflow and temperature of any of the action alternatives. While it would have the greatest effect on the EFSFSR, it would have the least effect on Meadow Creek (**Table 4.12-66**).

Alternative 4 would be the same as Alternative 1 at the mine site but shifts the risk of spills along the access route during operations from the Burntlog Route to the Yellow Pine Route, which would substantially increase the total length of travel within 91 meters of Important fish habitat for the duration of SGP. Alternative 4 also would not allow fish passage through the EFSFSR tunnel, which reduces the amount of available habitat but avoids fish mortality/injury in the mine site streams during mining.

Table 4.12-66 provides a summary comparison of fish and aquatic resource impacts by issues.

This page intentionally left blank

Table 4.12-66 Comparison of Fish and Aquatic Resource Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may cause changes in fish habitat in the analysis area that may affect aquatic species, including federally listed fish species and aquatic habitat (e.g., critical habitat) and MIS within and downstream of the SGP area.	Length (km) of stream and lake habitat directly impacted by removal.	Not applicable.	EFSFSR: 1.6 km Fiddle Creek: 1.8 km Meadow Creek: 5.6 km EFMC: 1.8 km Yellow Pine Pit Lake: 1.9 hectares	Same as Alternative 1.	EFSFSR: 9.5 km Fiddle Creek: 1.8 km Meadow Creek: 0.6 km EFMC: 7.7 km Rabbit Creek: 0.8 km Fern Creek: 0.6 km Yellow Pine Pit Lake: 1.9 hectares	EFSFSR: 2.9 km Fiddle Creek: 1.8 km Meadow Creek: 6.3 km EFMC: 1.8 km (surface diversion would incorporate step pool channel enhancements rather than a rock drain) Yellow Pine Pit Lake: 1.9 hectares	No stream channel changes.
	Change in amount of total useable Chinook salmon IP habitat in km.	18.61 km	Loss of 1.78 km (9.6 percent).	Loss of 0.93 km (5 percent).	Loss of 5.17 km (27 percent).	Same as Alternative 1	No changes from baseline.
	Direct loss of Chinook salmon critical habitat.	26.49 km	Loss of 5.5 km (20.8 percent) – permanent barrier from Meadow Creek TSF/DRSF	Loss of 5.5 km (20.8 percent) – permanent barrier from Meadow Creek TSF/DRSF	Loss of 6.9.km (26.0 percent) – permanent barrier from EFSFSR TSF/DRSF	Same as Alternative 1.	No changes from baseline.
	Change in total useable steelhead trout IP habitat.	17.90 km	Gain of 1.41 km (8 percent).	Gain of 2.3 km (13 percent).	Gain of 0.8 km (4.4 percent).	Same as Alternative 1.	No changes from baseline.
	Length of bull trout habitat (km).	Baseline Stream Reach 1: 10.45 km Stream Reach 2: 15.10 km Stream Reach 3: 16.15 km Stream Reach 5: 41.70 km	Post-closure (EOY 112) Stream Reach 1: 10.43 km Stream Reach 2: 14.61 km Stream Reach 3: 16.15 km Stream Reach 5: 41.19 km	Post-closure (EOY 112) Stream Reach 1: 10.92 km Stream Reach 2: 14.72 km Stream Reach 3: 16.16 km Stream Reach 5: 41.80 km	Post-closure (EOY 112) Stream Reach 1: 10.88 km Stream Reach 2: 13.86 km Stream Reach 3: 17.20 km Stream Reach 5: 41.94 km	Same as Alternative 1.	No changes from baseline.
	Bull trout occupancy probability (percent).	Baseline Stream Reach 1: 9.51% Stream Reach 2: 6.27% Stream Reach 3: 9.34% Stream Reach 5: 8.31%	Post-closure (EOY 112) Stream Reach 1: 8.40% Stream Reach 2: 4.76% Stream Reach 3: 8.81% Stream Reach 5: 7.27%	Post-closure (EOY 112) Stream Reach 1: 6.56% Stream Reach 2: 4.37% Stream Reach 3: 7.40% Stream Reach 5: 6.11%	Post-closure (EOY 112) Stream Reach 1: 7.16% Stream Reach 2: 5.22% Stream Reach 3: 3.77% Stream Reach 5: 5.13%	Same as Alternative 1.	No changes from baseline.
	Direct loss of bull trout critical habitat	17.11 km	Loss of 4.7 km (27.5 percent)	Loss of 4.7 km (27.5 percent)	Loss of 11.9 km (69.5 percent)	Same as Alternative 1.	No changes from baseline.
	Change in access to bull trout lake habitat	Bull trout can currently use the Yellow Pine pit lake.	The existing bull trout habitat in the Yellow Pine pit Lake would be permanently lost. Access to the Hangar Flats pit lake would begin in year 20; however, potentially warmer water temperatures and less foraging habitat in comparison to the Yellow Pine pit lake may make the lake habitat less suitable for bull trout.	Under Alternative 2, Meadow Creek would not be routed through the Hangar Flats pit lake so there would be no connection between Meadow Creek and the Hangar Flats pit lake except as occasional outflow from the lake through a channel that would reconnect with lower Meadow Creek downstream of the lake, which may be insufficient to provide for passage of bull trout for most of the year.	Alternative 3 would have similar conditions for bull trout access to lakes as Alternative 1.	The EFSFSR Tunnel would not be designed as fish passable, so bull trout would have no access to Hangar Flats pit lake habitat until after the EFSFSR stream is fully constructed in Mine Year 13.	Bull trout would continue to use Yellow Pine pit lake.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Length of cutthroat trout habitat (km).	Baseline Stream Reach 1: 10.45 km Stream Reach 2: 15.10 km Stream Reach 3: 16.15 km Stream Reach 5: 41.70 km	Post-closure (EOY 112) Stream Reach 1: 10.43 km Stream Reach 2: 14.61 km Stream Reach 3: 16.15 km Stream Reach 5: 41.19 km	Post-closure (EOY 112) Stream Reach 1: 10.92 km Stream Reach 2: 14.72 km Stream Reach 3: 16.16 km Stream Reach 5: 41.80 km	Post-closure (EOY 112) Stream Reach 1: 10.88 km Stream Reach 2: 13.86 km Stream Reach 3: 17.20 km Stream Reach 5: 41.94 km	Same as Alternative 1.	No changes from baseline.
	Cutthroat trout occupancy probability (percent).	Baseline Stream Reach 1: 63.73% Stream Reach 2: 64.06% Stream Reach 3: 63.59% Stream Reach 5: 63.79%	Post-closure (EOY 112) Stream Reach 1: 64.40% Stream Reach 2: 62.90% Stream Reach 3: 63.65% Stream Reach 5: 63.57%	Post-closure (EOY 112) Stream Reach 1: 63.66% Stream Reach 2: 63.90% Stream Reach 3: 63.04% Stream Reach 5: 63.51%	Post-closure (EOY 112) Stream Reach 1: 63.37% Stream Reach 2: 64.62% Stream Reach 3: 62.83% Stream Reach 5: 63.57%	Same as Alternative 1.	No changes from baseline.
	Changes in monthly discharge during the August-March low flow period (percent change in cfs).	Mean monthly discharge at baseline at 6 locations: EFSFSR above Meadow: 5.0 cfs EFSFSR at Stibnite: 10.6 cfs EFSFSR above Sugar Creek: 15.4 cfs Sugar Creek: 11.7 cfs Meadow Creek: 3.1 cfs Meadow Creek MC-6: 5.3 cfs	Change in mean monthly discharge from baseline to post-closure at 6 locations: EFSFSR above Meadow: -0.2% EFSFSR at Stibnite: +1.3% EFSFSR above Sugar Creek: -4.5% Sugar Creek: -3.5% Meadow Creek: -83.1% Meadow Creek MC-6: +1.5%	Change in mean monthly discharge from baseline to post-closure at 6 locations: EFSFSR above Meadow: +1.9% EFSFSR at Stibnite: +2.5% EFSFSR above Sugar Creek: +1.7% Sugar Creek: -0.9% Meadow Creek: -78.6% Meadow Creek MC-6: +0.1%	Change in mean monthly discharge from baseline to post-closure at 6 locations: EFSFSR above Meadow: -0.8% EFSFSR at Stibnite: +2.7% EFSFSR above Sugar Creek: +2.0% Sugar Creek: -1.8% Meadow Creek: -2.5% Meadow Creek MC-6: +3.1%	Same as Alternative 1.	Trends in baseline stream flows would continue.
	Changes in water temperature (degrees Celsius [ºC]).	Summer Maximum Temperatures (ºC): Upper EFSFSR (above MC): 13.4 Meadow Creek (above EFMC): 17.9 Meadow Creek (below EFMC): 19.8 Middle EFSFSR (between Meadow and Fiddle Creeks): 17.4 Lower EFSFSR (between Fiddle and Sugar Creek): 17.4 EFSFSR downstream of Sugar Creek: 14.9	Change in Summer Maximum from Baseline to post-closure (ºC): Upper EFSFSR (above MC): +0.5 Meadow Creek (above EFMC): +2.0 Meadow Creek (below EFMC): +1.4 Middle EFSFSR (between Meadow and Fiddle Creeks): +2.6 Lower EFSFSR (between Fiddle and Sugar Creek): +4.2 EFSFSR downstream of Sugar Creek: +4.4	Change in Summer Maximum from Baseline to post-closure (ºC): Upper EFSFSR (above MC): +0.5 Meadow Creek (above EFMC): +4.8 Meadow Creek (below EFMC): +2.6 Middle EFSFSR (between Meadow and Fiddle Creeks): +2.4 Lower EFSFSR (between Fiddle and Sugar Creek): +3.3 EFSFSR downstream of Sugar Creek: +4.1	Change in Summer Maximum from Baseline to post-closure (ºC): Upper EFSFSR (above MC): +9.0 Meadow Creek (above EFMC): +0.9 Meadow Creek (below EFMC): +1.4 Middle EFSFSR (between Meadow and Fiddle Creeks): +4.9 Lower EFSFSR (between Fiddle and Sugar Creek): +4.8 EFSFSR downstream of Sugar Creek: +4.5	Same as Alternative 1.	Not applicable.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Chinook Salmon - Changes in Lengths (km) of Stream Reaches within Temperature Threshold Categories at EOY 112 Note: + = added length within threshold from baseline; - = less length within threshold from baseline	Adult Migration - Lethal (1-week exposure) – (0.00 km) Adult Spawning - Field Observed Spawning Temperature – (16.72 km) Incubation/Emergence – Optimal – (4.99 km) Juvenile Rearing – Optimal – (16.72 km) Common Summer Habitat Use – Optimal – (16.72 km) Total Available Habitat – (16.72 km)	Adult Migration - Lethal (1-week exposure) – (+2.65 km) Adult Spawning - Field Observed Spawning Temperature – (-5.63 km) Incubation/Emergence – Optimal – (+2.58 km) Juvenile Rearing – Optimal – (-9.05 km) Common Summer Habitat Use – Optimal – (-9.05 km) Total Available Habitat – (-4.02 km)	Adult Migration - Lethal (1-week exposure) – (0.00 km) Adult Spawning - Field Observed Spawning Temperature – (-4.6 km) Incubation/Emergence – Optimal – (-0.58 km) Juvenile Rearing – Optimal – (-6.43 km) Common Summer Habitat Use – Optimal – (-6.43 km) Total Available Habitat – (-4.6 km)	Adult Migration - Lethal (1-week exposure) – (+6.49 km) Adult Spawning - Field Observed Spawning Temperature – (-6.11 km) Incubation/Emergence – Optimal – (-4.99 km) Juvenile Rearing – Optimal – (-11.13 km) Common Summer Habitat Use – Optimal – (-11.13 km) Total Available Habitat – (-4.5 km)	Same as Alternative 1	Not applicable
	Steelhead Trout – Changes in Lengths (km) of Stream Reaches within Temperature Threshold Categories at EOY 112 Note: + = added length within threshold from baseline; - = less length within threshold from baseline	Juvenile Rearing – Optimal – (2.13 km) Common Summer Habitat Use – Optimal – (2.13 km) Total Available Habitat – (2.13 km)	Juvenile Rearing – Optimal – (+5.54 km) Common Summer Habitat Use – Optimal – (+5.54 km) Total Available Habitat – (+10.57 km)	Juvenile Rearing – Optimal – (+8.16 km) Common Summer Habitat Use – Optimal – (+6.98 km) Total Available Habitat – (+9.99 km)	Juvenile Rearing – Optimal – (+3.46 km) Common Summer Habitat Use – Optimal – (+3.46 km) Total Available Habitat – (+10.09 km)	Same as Alternative 1	Not applicable
	Bull Trout - Changes in Lengths of Stream Reaches within Temperature Threshold Categories at EOY 112 Note: + = added length within threshold from baseline; - = less length within threshold from baseline	Adult Spawning – Functioning Appropriately – (1.61 km) Adult Spawning – Functioning at Risk – (8.69 km) Adult Spawning – Functioning at Unacceptable Risk – (18.69 km) Incubation/Emergence – Functioning at Unacceptable Risk – (28.99 km) Juvenile Rearing – Functioning Appropriately – (13.66 km) Juvenile Rearing – Functioning at Risk – (12.89 km) Juvenile Rearing – Functioning at Unacceptable Risk – (2.44 km) Common Summer Habitat – Use – Spawning Initiation – (8.66 km) Total Available Habitat – (28.99 km)	Adult Spawning – Functioning Appropriately – (-1.61 km) Adult Spawning – Functioning at Risk – (-4.28 km) Adult Spawning – Functioning at Unacceptable Risk – (-7.01 km) Incubation/Emergence – Functioning at Unacceptable Risk – (-12.9 km) Juvenile Rearing – Functioning Appropriately – (-7.80 km) Juvenile Rearing – Functioning at Risk – (-10.31 km) Juvenile Rearing – Functioning at Unacceptable Risk – (+5.21 km) Common Summer Habitat – Use – Spawning Initiation – (-2.80 km) Total Available Habitat – (-12.9 km)	Adult Spawning – Functioning Appropriately – (-1.61 km) Adult Spawning – Functioning at Risk – (-4.28 km) Adult Spawning – Functioning at Unacceptable Risk – (-6.98 km) Incubation/Emergence – Functioning at Unacceptable Risk – (-12.87 km) Juvenile Rearing – Functioning Appropriately – (-7.25 km) Juvenile Rearing – Functioning at Risk – (-9.85 km) Juvenile Rearing – Functioning at Unacceptable Risk – (+4.23 km) Common Summer Habitat – Use – Spawning Initiation – (-2.25 km) Total Available Habitat – (-12.87 km)	Adult Spawning – Functioning Appropriately – (-1.61 km) Adult Spawning – Functioning at Risk – (-7.10 km) Adult Spawning – Functioning at Unacceptable Risk – (+0.13 km) Incubation/Emergence – Functioning at Unacceptable Risk – (-8.58 km) Juvenile Rearing – Functioning Appropriately – (-8.71 km) Juvenile Rearing – Functioning at Risk – (-6.95 km) Juvenile Rearing – Functioning at Unacceptable Risk – (+7.08 km) Common Summer Habitat – Use – Spawning Initiation – (-3.71 km) Total Available Habitat – (-8.58 km)	Same as Alternative 1	Not applicable
	Changes in water chemistry (above analysis criteria). at the mine site	Refer to **Table 3.12-24** for baseline measurements.	Predicted post-closure exceedance by constituent of concern: Aluminum: No exceedance Copper: EFSFSR – 0.00265 mg/L and Meadow Creek – 0.005 mg/L Antimony: Exceedance at YP-T-27 (0.225) and YP-SR-4 (0.051) Arsenic: Exceeds at all but 2 nodes, highest concentration at	During post-closure YP-SR-4 seasonally exceeds the analysis criteria for antimony, arsenic, and mercury. YP-SR-2, YP-T-11, and YP-T-6 exceed the analysis criteria for mercury.	Similar to Alternative 1, except the spent ore and legacy tailings in Meadow Creek Valley would not be removed. Chemical constituent levels in Meadow Creek would likely be similar to baseline conditions.	Same as Alternative 1.	No changes from baseline.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
			YP-T-11:Fiddle Creek (0.79 mg/L) Mercury: Exceeds at all but 1 node, highest concentration at YP-T-6:West End Creek (9.0E-06)				
The SGP may affect fish species by degrading water quality in waterways adjacent to access roads.	Amount of increased traffic (average daily traffic).	Refer to **Table 3.16-2**.	Increases in AADT over baseline: Construction Phase = 65 vehicles Operations Phase = 68 vehicles Closure and Reclamation Phase = 25 vehicles Post-Closure Phase = 6 vehicles	Increases in AADT over baseline: Construction Phase = 65 vehicles Operations Phase = 50 vehicles Closure and Reclamation Phase = 25 vehicles Post-Closure Phase = 6 vehicles Water Chemical Delivery = 40 trucks per year (Operations and Closure and Reclamation phases)	Same as Alternative 1.	Same as Alternative 1 except the traffic level on Burnt Log Road would remain at baseline since it would not be used for mine site access. The access road traffic during operations would shift from the Burntlog Route to the Yellow Pine Route.	No change from baseline.
The SGP may affect fish populations through establishment of fish access upstream of the Yellow Pine pit.	Changes in migratory patterns of fish.	Several barriers exist on the EFSFSR and Meadow Creek, including the gradient barrier at the Yellow Pine pit lake, which currently blocks 10.4 km of Chinook salmon habitat, 8.8 km of steelhead trout habitat, and 39.7 km of bull trout and cutthroat trout habitat.	Fish passage at Yellow Pine pit lake would initially be provided in a the EFSFSR tunnel, then ultimately by backfilling the Yellow Pine pit and building a new stream channel over the top of the backfill, thereby providing permanent fish passage through the area. The Meadow Creek diversions and then construction and operation of TSF/DRSF and the construction/operation of the DRSF in Fiddle Creek would create new barriers to natural fish movement that would be permanent.	Same as Alternative 1, except Meadow Creek would be permanently routed around the Hangar Flats pit lake likely creating a barrier to bull trout lake habitat.	Same as Alternative 1, except the existing partial barrier in Meadow Creek would remain in perpetuity, blocking 9.5 km of fish habitat, and the TSF/DRSF would be located in the upper EFSFSR drainage where it would create a barrier that would permanently block 15.7 km of fish habitat to natural migration.	Same as Alternative 1, except the EFSFSR tunnel would not be designed as fish passable. Natural migration up or downstream through the Yellow Pine pit area would not be available until after full reclamation of the EFSFSR through the Yellow Pine pit area is complete in Mine Year 13. The Yellow Pine pit barrier would continue to block access to 10.4 km of Chinook salmon habitat, 8.8 km of steelhead habitat, and 39.7 km of bull trout and cutthroat trout habitat.	No change from baseline.
	Length of suitable habitat upstream of the Yellow Pine pit lake (km).	Chinook salmon IP modeled habitat:11.4 km Steelhead trout IP modeled habitat: 8.8 km Bull trout and cutthroat trout OM habitat: 39.7 km.	Chinook salmon IP modeled habitat: 6.9 km Steelhead trout IP modeled habitat: 8.9 km Bull trout and cutthroat trout OM habitat: 39.8 km.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1, except that access to all fish habitat upstream of the Yellow Pine pit lake would remain blocked until Mine Year 13.	Same as Baseline.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may affect fish health through hazardous material spills at the mine site or along the access roads.	Length of Chinook salmon IP habitat within 91 meters of access routes.	Not applicable.	Yellow Pine Route: 36 km Burntlog Route: 7.3 km Warm Lake Road: 9.2 km	Yellow Pine Route and Warm Lake Road, same as Alternative 1. Burntlog Route: 5.91 km	Yellow Pine Route and Warm Lake Road, same as Alternative 1. Burntlog Route: 4.83 km	Yellow Pine Route and Warm Lake Road, same as Alternative 1. Potential impacts would be for all phases of SGP. The Burntlog Route would not be constructed under Alternative 4.	Not applicable.
	Length of critical habitat for steelhead and bull trout within 91 meters of access routes.	Not applicable.	Yellow Pine Route: Steelhead Trout-32.3 km, and Bull Trout - 33.7 km Burntlog Route: Steelhead Trout – 1.62 km, and Bull Trout – 8.87 km Warm Lake Road: Steelhead Trout – 4.06 km, and Bull Trout – 9.05 km	Yellow Pine Route and Warm Lake Road, same as Alternative 1. Burntlog Route: Steelhead Trout – 1.23 km, and Bull Trout – 7.67 km	Yellow Pine Route and Warm Lake Road, same as Alternative 1. Burntlog Route: Steelhead Trout – 1.23 km, and Bull Trout – 5.74 km	Yellow Pine Route and Warm Lake Road, same as Alternative 1. Potential impacts would be for all phases of SGP. The Burntlog Route would not be constructed under Alternative 4.	Not applicable.

Table Source: AECOM Geographic Information System data and **Appendices J-2** through **J-9**.

Table Notes:

AADT = annual average daily traffic

This page intentionally left blank

4.13 Wildlife and Wildlife Habitat (Including Threatened, Endangered, Proposed, and Sensitive Species)

4.13.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects on wildlife and wildlife habitat includes the following issues and indicators:

Issue: The Stibnite Gold Project (SGP) may cause changes in wildlife habitat in the analysis area that may affect wildlife species including special-status species (threatened, endangered, Management Indicator Species, and sensitive species).

Indicators:

- Acres of general wildlife habitat disturbed.
- Acres of special-status wildlife habitat disturbed.
- Acres of disturbance to other high-value habitats such as crucial and or high-value big game ranges, wetlands, and seep and spring areas.
- Change in noise levels (in decibels) in, or in proximity to, wildlife habitat.
- Miles of new roads proposed for the SGP.
- Acres of disturbance for new and upgraded transmission lines.

Issue: The SGP may affect wildlife by introducing barriers to movement, including the mine site, infrastructure, new/existing maintained roads, new transmission line.

Indicators:

- Length of potential movement barriers.

Issue: The SGP may affect wildlife by potentially increasing the risk of direct injury or mortality.

Indicators:

- Amount of increased traffic along the access routes, or acres of ground disturbance for less-mobile species.
- Miles of new roads and transmission lines.
- Miles of existing roads that are not currently plowed that would be plowed.

4.13.2 Direct and Indirect Effects

The following analysis of effects associated with wildlife and wildlife habitat is considered in the overall context of the affected environment presented in Section 3.13, Wildlife and Wildlife Habitat. The discussion for each of the alternatives is organized in terms of effects on species and/or habitats, by alternative and SGP phasing (e.g., construction, operations, closure and reclamation) wherever possible, to more clearly define the potential impacts to a given species from the SGP. Effects to wildlife and wildlife habitat were analyzed using species-specific models developed for the Payette National Forest (PNF) and Boise National Forest (BNF) and U.S. Forest Service (Forest Service) Region 4, geographic information system spatial analyses, scientific literature reviews, and information and analysis documented in reports prepared for the SGP. Survey reports and geographic information system data were obtained for vegetation groups and habitat types, forest stand information, listed species occurrences, and other wildlife species. Geographic information system analysis was used to quantify direct and indirect effects on species, where possible, by overlaying the action alternatives with the species-specific modeled habitat and other selected analysis areas.

Additional factors considered in this analysis:

- While there is significant historical mining activity in the Stibnite area, much of the analysis area is on remote National Forest System lands and in close proximity to the Frank Church-River of No Return Wilderness (FCRNRW), with little prior anthropogenic (i.e., human) influence.
- Human activity during the winter near the mine site and on many of the SGP area roadways is currently low. All phases of the SGP and all alternatives would increase miles of road plowed during the winter, including new routes in previously undisturbed areas.
- Noise levels are measured in decibels on the A-weighted scale (dBA), which is meant for human perception. Wildlife species are likely more sensitive to these noise levels. Continuous (ongoing) noises would attenuate to ambient levels in 1 to 2 miles of construction/operation activities, while temporary disturbances (e.g., blasting, winter maintenance) would be short-term, but potentially carry a farther distance from the source and be louder in nature.
- Based on known responses to varying levels of anthropogenic disturbance (i.e., displacement from primary and secondary habitat from noise, light and human presence) and based on professional judgement and existing literature, buffers were developed to more accurately address potential indirect and cumulative effects from the SGP components.

Effects on wildlife or habitat associated with Alternative 1 would likely be largest near the mine site and the access roads (specifically, the Burntlog Route during operations under Alternatives 1, 2, and 3 and the Yellow Pine Route during construction for Alternatives 1, 2, and 3, and construction and operations under Alternative 4). During construction, mine traffic under all action alternatives (Alternatives 1, 2, 3, and 4) would generate an estimated annual average daily traffic (AADT) level of 65 vehicles (45 heavy vehicles and 20 light vehicles). During operations under Alternatives 1, 3, and 4, there would be an AADT level of 68 vehicles per day (vpd) (49 heavy vehicles and 19 light vehicles) resulting in approximately five mine-related vehicles traveling outside the mine site per hour between 5:00 am and 7:00 pm. Under all action alternatives, closure and reclamation would generate a total estimated AADT of 25 vehicles (13 heavy vehicles and 12 light vehicles).

Noise levels would vary among SGP phases and depending on distances to activities, but impacts would generally be higher during the construction phase and closer to activities, particularly because wildlife are more sensitive to noises than the measurements used for human perception. For example, during construction, noise levels 1 mile from the mine site and 0.5 mile from the access roads would be 50 dBA higher than ambient levels. However, noise levels 2 miles from the mine site and 2 miles from the access roads would drop to 34 dBA during construction.

The approximately 36-mile Yellow Pine Route consisting of Johnson Creek Road (County Road [CR] 10-413) and the Stibnite Road portion of McCall-Stibnite Road (CR 50-412) would be used for construction purposes while the primary mine access, the Burntlog Route is constructed. The Burntlog Route would include the 20-mile existing Burnt Log Road (National Forest System Road [FR] 447), two new road segments totaling approximately 15 miles and crossing a 1-mile portion of Meadow Creek Lookout Road (FR 51290). A 4.5-mile, 15-foot-wide off-highway vehicle (OHV) connector trail would be constructed between Horse Heaven/Powerline route and Meadow Creek Lookout Road (FR 51290) and would include 3 miles of new road. Additionally, the existing 11-mile groomed over-snow vehicle (OSV) trail from Warm Lake to Landmark would be closed under Alternative 1, and a new 10.4-mile groomed trail would be constructed using the existing Cabin Creek Road (FR 467). There would also be a 2-acre parking area west of FR 467 and a new 1.5-mile groomed access trail from the Forest Service Warm Lake Project Camp on Paradise Valley Road (FR 488). An approximately 7-mile temporary groomed OSV trail, on National Forest System lands adjacent to the west side of Johnson Creek Road (CR 10-413) from Landmark to Trout Creek, would also be maintained during construction of the Burntlog Route to replace the current OSV route that runs within the Johnson Creek Road travelway, but after Johnson Creek Road is no longer in use for construction traffic, the OSV route would return to the travelway.

Alternative 2 includes the following changes to the SGP that would affect wildlife differently than Alternative 1. Under Alternative 2, a 5.3-mile-long segment of the Burntlog Route would be located to the southern side of the Riordan Creek drainage, and cross Riordan Creek north of Black Lake. The Burntlog Route would be shortened by approximately 1.5 miles with inclusion of the Riordan Creek segment; however, the rerouted segment would be in closer proximity to the FCRNRW. This may affect listed or sensitive species that inhabit the FCRNRW, such as wolverine and Rocky Mountain big horn sheep. Under this alternative, there would be slightly less truck traffic (50 vehicles/day; 33 heavy vehicles and 17 light vehicles) due to the on-site lime generation plant, resulting in approximately four mine-related vehicles traveling outside the mine site per hour. This would likely reduce some traffic-related impacts to wildlife. Two sections of upgraded transmission line as described under Alternative 1 would be relocated under

Alternative 2, which would affect similar habitats and species. Noise levels would vary among SGP phases and depending on distances to activities but would be the same as Alternative 1.

Alternative 3 includes the following changes to the SGP that would affect wildlife differently than Alternative 1. Under Alternative 3, the Meadow Creek tailings storage facility (TSF) and Hangar Flats development rock storage facility (DRSF) would be relocated, which would require relocation of several on-site roads and trails, including the primary mine access which would be through a road construction along Blowout Creek. Additionally, approximately 2.5 miles of new transmission line would be rerouted through an existing corridor from the Johnson Creek substation to the mine site. The OHV connector from Horse Heaven/Powerline route to Meadow Creek Lookout Road (FR 51290) would not be constructed. Noise levels would vary among SGP phases and depending on distances to activities but would be similar to Alternative 1.

Alternative 4 includes the following changes to the SGP that would affect wildlife differently from noise impacts than Alternative 1. Under Alternative 4, the mine site and utilities would operate similarly to Alternative 1. However, very high frequency radio repeater and cell tower sites would be constructed and maintained using helicopters (instead of constructing access roads) in Inventoried Roadless Areas. This would reduce direct habitat impacts but would increase the disturbance of wildlife due to noise. For example, during construction, noise levels 1 mile from the mine site and 0.5 mile from the utilities constructed with a helicopter would be 58 dBA higher than ambient levels. Under this same scenario, noise levels would drop below ambient levels within 2 miles of the mine site and 2 miles of the utility construction activities, estimated to be 39 dBA. In addition, the Burntlog Route would not be constructed under Alternative 4, and the existing Yellow Pine Route would be used for access during mine construction, operations, and closure and reclamation. Traffic noise levels would be similar to those predicted for the other action alternatives; however, all the noise would be along Yellow Pine Route. The OHV connector from Horse Heaven/Powerline route to Meadow Creek Lookout Road (FR 51290), as well as the Cabin Creek OSV trail, would not be constructed under this alternative. Additionally, the temporary OSV trail along the west side of Johnson Creek Road would be maintained through operations under Alternative 4.

Impacts from SGP activities related to wildlife species, discussed in detail below, could include:

- Direct removal or disturbance of general or special-status species habitat;
- Disturbance and avoidance of habitat due to noise and light or increased human activity;
- Blockage or fragmentation of wildlife movement corridors;
- Mortality or injury from construction of new structures or vehicle traffic; or
- Loss of forage (e.g., vegetation) or prey species (e.g., insects, small mammals, etc.).

4.13.2.1 Threatened, Endangered, Proposed, and Candidate Species

The analysis of direct effects includes the potential take of Endangered Species Act (ESA) listed species. Pursuant to the ESA, take is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” (16 United States Code 35.1531 et seq.). Take of an individual or population could occur for various reasons such as traffic collisions, change in an individual or population’s habitat use due to noise, other disturbance, or contamination of food or water sources. Direct effects also would include loss of habitat or the encroachments into wildlife migration or travel areas, although no defined corridors have been identified. For all species, habitat loss could be temporary (0 to 3 years); short-term (3 to 15 years); long-term (>15 years); or permanent for land use changes (i.e., pit lakes, TSF, DRSFs, transmission line upgrades, or new transmission line remaining in perpetuity under Alternative 2).The analysis of potential indirect effects on threatened, endangered, proposed, and candidate species includes fragmentation of habitat; increased competition for resources or habitat due to displacement of individuals from the affected area into the territory of other animals; or other effects, such as increased human presence in the species-specific analysis areas (e.g., hunters, trappers, and recreationists) that can cause mortality or reduced breeding and recruitment in the future population.

All figures discussed below for threatened, endangered, candidate, and proposed species are included in **Appendix K-4**, Figures.

4.13.2.1.1 CANADA LYNX

4.13.2.1.1.1 Direct and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-1 displays the SGP components of Alternative 1 and 2 compared to modeled habitat within each Lynx Analysis Unit (LAU). **Figure 4.13-2** displays the project components of Alternative 3 compared to modeled habitat within each LAU. **Figure 4.13-3** shows the components of Alternative 4 within the Canada lynx analysis area compared to modeled habitat. Direct and indirect effects to Canada lynx are analyzed within a 5-mile buffer of all alternative components within the LAUs, to assess all potential impacts, including noise disturbance. However, most indirect impacts would occur within 1 to 2 miles from project components.

Mine Site

Although there is potentially suitable habitat for Canada lynx in the Canada lynx analysis area, there is no designated critical habitat on the PNF or BNF. The mine site and associated infrastructure may displace transient Canada lynx around the perimeter of these disturbances. This would be a large area, because the mine site area would measure approximately 6 miles long by 1 mile wide. Ruediger et al. (2000) found that Canada lynx often avoid large developments (e.g., ski resorts, facilities, etc.); therefore, it is likely that the mine site area would be a barrier to lynx movement, which would be a direct effect.

Direct mortality on lynx (e.g., vehicle collisions, destruction of dens, etc.) is not likely because lynx have not been documented in the Canada lynx analysis area; the analysis area does not contain prime denning habitat; and their movements are often nocturnal (Forest Service 2008) when limited vehicle traffic would occur. Although some denning habitat may exist, the PNF and BNF are considered secondary lynx habitat (Interagency Lynx Biology Team 2013). The lack of denning habitats and on-going activity in the vicinity of the mine site make it unlikely that there are resident individuals that would be displaced by Alternative 1.

Indirect disturbance impacts to Canada lynx due to an increase in noise and light (e.g., blasting, vehicle traffic, operations, etc.) would be long-term (i.e., through the life the SGP; approximately 20 years). Construction, operation, and closure and reclamation activities at the mine site are likely to disturb any transient Canada lynx in the vicinity. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc., see **Appendix D**, Mitigation Measures and Environmental Commitments, **Table D-2**, Mitigation Measures Proposed by Midas Gold Idaho, Inc. [Midas Gold] as SGP Design Features) would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Additionally, light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. The noise and light reduction strategies employed in the SGP area are expected to reduce impacts on transient Canada lynx by minimizing the intensity and duration; however, they would not prevent all indirect impacts.

The effects to Canada lynx at the mine site under Alternatives 2 or 4 would be the same as Alternative 1.

Although there would be some changes under Alternative 3 (e.g., moving the Meadow Creek TSF and Hangar Flats DRSF to the East Fork South Fork Salmon River (EFSFSR) drainage, and associated facilities and roads), lynx would likely still avoid the mine site area and the impacts would be similar to Alternative 1.

Access Roads

Direct mortality on lynx (e.g., vehicle collisions) is not likely because lynx have not been documented in the Canada lynx analysis area and their movements are often nocturnal (Forest Service 2008) when limited vehicle traffic would occur. However, Alternative 1 would include construction of 15 miles of new road between the existing Burnt Log Road (FR 447) to the Thunder Mountain Road (FR 50375) at the mine site, and several smaller segments of realignment and upgrades. Construction and the year-round operation (and plowing in winter), of the Burntlog Route could be a potential source of mortality for transient Canada lynx. During operations (when traffic levels would be highest), the AADT level would be 68 vpd. The slow speed limits on the Burntlog Route would likely limit potential mortality or injury for individual Canada lynx by giving drivers more time to react to wildlife occurrences.

Roadways under Alternative 1 may displace or alter the movement of transient Canada lynx. Linkage areas for Canada lynx have been estimated to occur north to south across Warm Lake Road (CR 10-579) and east to west across the South Fork of the Salmon River (Claar et al. 2004). Construction and use of the new 15-mile-long portion of the Burntlog Route would fragment habitat and could act as a barrier to movement (Interagency Lynx Biology Team 2013). Increased traffic on Warm Lake Road (CR 10-579), Johnson Creek Road (CR 10-413), and Stibnite Road portion of the McCall-Stibnite Road (CR 50-412) also would discourage lynx from crossing these roads. Ruediger et al. (2000) found that Canada lynx often avoid roadways more as they scale from gravel roads to highways; therefore, it is possible that the access roads could act as a barrier to transient lynx movement, which would be a direct effect.

Additionally, the existing 11-mile groomed OSV trail from Warm Lake to Landmark would be closed under Alternative 1, and an approximately 10.4-mile groomed trail would utilize the existing Cabin Creek Road (FR 467). There would also be a 2-acre parking area west of FR 467, and a new 1.5-mile groomed access trail from the Forest Service Warm Lake Project Camp on Paradise Valley Road (FR 488). This trail would cross modeled habitat for Canada lynx, which would cause additional indirect impacts during the winter due to noise from OSVs. During construction, the current OSV trail associated with Johnson Creek Road would be moved to the side of the road (see **Figure 2.3-1**), but there would be no expected changes as it is an existing route.

Disturbance impacts to Canada lynx along roadways due to noise and light would be long-term (i.e., through the life of the SGP; approximately 20 years). The noise and light reduction strategies employed along access roads during the SGP may be sufficient to reduce impacts on transient Canada lynx (see Mine Site section above for these measures). **Appendix D**, Mitigation Measures and Environmental Commitments contains mitigation measures required by the Forest Service and proposed by Midas Gold to reduce impacts on wildlife. For example, construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible; pumps, generators, and engines would be turned off when not in use; and light shields would be placed over outside lights, confining light to the immediate area in order to further limit visual impacts.

Indirect impacts could occur in the form of increased competition for resources, including the competition created by plowing the approximately 38-mile Burntlog Route which is currently not plowed for winter use. Currently, access in this area during the winter is limited to predators suited for over-snow travel (i.e., lynx and wolverine). Construction and operation of the Burntlog Route would open new corridors for predators and recreational activities. This could increase the predation on snowshoe hares by other predators (e.g., coyotes) or become a source of mortality for prey species (e.g., snowshoe hare, squirrels, etc.), which could affect food availability for transient Canada lynx. The increased human access and potential increase in hunting and trapping pressure for lynx and prey species in previously undisturbed areas also would be indirect effects.

Upon closure, the new segments of the Burntlog Route would be decommissioned, recontoured, and reclaimed, which would remove impacts associated with traffic or human access in the long-term.

Under Alternative 2, the Burntlog Route would be shortened by approximately 1.5 miles due to the Riordan Creek segment reroute, but the road would be closer to the FCRNRW. Direct mortality on lynx (e.g., vehicle collisions) is not likely because they have not been documented in the Canada lynx analysis area, but transient individuals that use the FCRNRW could be affected by noise, light, and traffic dangers. The rerouted segment would still be in a potential linkage area as well. Under Alternative 2, on-site lime production would reduce the AADT to 50 vpd during operations, which would reduce the risk of wildlife-vehicle collisions.

Alternative 3 would include construction of 19.6 miles of new road for the Burntlog Route, which is similar to Alternative 1. Transient Canada lynx would likely be affected similarly to Alternative 1. Alternative 3 would include an additional 5 miles of new roadway down the Blowout Creek valley to access mine facilities. This new route would pass the main gate and worker housing facility and would not overlap any suitable habitat; thus, impacts would be similar to those described for mine impacts under Alternative 1.

Under Alternative 4, the Yellow Pine Route would be used instead of the Burntlog Route, which would eliminate the disturbance of 15 miles of habitat adjacent to the FCRNRW. This would avoid the impacts of noise, light, and traffic on Canada lynx in the FCRNRW area where suitable current habitat is mapped. In addition, the 3 miles of new road for the OHV connector route would not be constructed under Alternative 4. However, it is expected that transient Canada lynx would still cross SGP area roadways, including the Yellow Pine Route. Traffic levels on Stibnite Road and Johnson Creek Road (both part of the Yellow Pine Route) would increase by about 174 percent and 119 percent, respectively, during operations. Therefore, there would still be a chance of wildlife mortality for Alternative 4.

Utilities

Direct impacts on Canada lynx due to construction and operation of the utility corridors, substations, and communication towers are not likely because lynx have not been documented in the Canada lynx analysis area and the construction activities would be temporary (e.g., 3 years). However, transient Canada lynx may occur sporadically. There would be an addition of 25 miles of new utility access roads, as well as a disturbance of approximately 115 acres due to new transmission lines and 158 acres due to upgraded transmission lines. Habitats along utility corridors would be maintained in low structure (e.g., low vegetation) condition, which would widen the right-of-way (ROW) effect for Canada lynx (Interagency Lynx Biology Team 2013). The new transmission line between the mine site and Johnson Creek substation would not intersect any modeled habitat. Upon closure, this new segment would be decommissioned and reclaimed, under all alternatives, except Alternative 2. Decommissioning of the transmission line under Alternatives 1, 3, and 4 would remove any potential effects in the long term.

Potential disturbance impacts due to noise and light near the substations would be long-term (approximately 20 years) and likely of low impact. However, the impacts from constructing the utility corridors, substations, and communication towers would be temporary (i.e., up to 3 years) but of higher intensity. The noise and light reduction strategies employed along utility corridors and near communication towers would reduce impacts on transient Canada lynx during construction (see Mine Site section above and **Appendix D,** Mitigation Measures and Environmental Commitments).

Under Alternative 2, there would be approximately 26 miles of new utility access roads, as well as a disturbance of approximately 141 acres due to new transmission lines, and 156 acres due to upgraded transmission lines. However, the new transmission line along Warm Lake Road would not intersect any modeled habitat. The new transmission line between the mine site and Johnson Creek substation would not be decommissioned in closure, which would continue the operational impacts (potential avoidance behavior) in the long-term.

Under Alternative 3, there would be approximately 22 miles of new utility access roads, as well as a disturbance of 121 acres due to new transmission lines and 158 acres due to upgraded transmission lines.

There would be no differences to the utilities under Alternative 4, so effects would be the same as Alternative 1.

Off-site Facilities

Direct impacts on Canada lynx from construction of the off-site facilities are unlikely because lynx have not been documented in the Canada lynx analysis area. However, the off-site facilities would impact approximately 4 acres of habitat in the Canada lynx analysis area. Transient Canada lynx individuals would likely avoid the off-site facility locations, but traffic associated with the off-site facilities may increase the potential for vehicle-wildlife collisions. The slow speed limits imposed would likely limit potential mortality or injury for individual Canada lynx.

Disturbance impacts to Canada lynx at the off-site facility locations due to noise and light would mostly occur during construction, but some effects would persist long-term (i.e., through the life of Alternative 1; approximately 20 years). The noise and light reduction strategies employed at the off-site facilities would likely be sufficient to reduce impacts on transient Canada lynx.

The Burntlog maintenance facility under Alternative 2 is in close proximity to roadways and would not likely disturb transient Canada lynx.

There would be no change to the off-site facilities under Alternative 3, so effects would be the same as Alternative 1.

Under Alternative 4, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus Alternative 1. However, effects to transient Canada lynx are expected to be the same.

Habitat Impacts

As discussed in Section 3.13.3.2.1.2, Baseline, not meeting Forest Service threatened, endangered, proposed, and candidate Standard 15 (TEST15) indicates the percentage of unsuitable habitat in the LAUs is higher than the 30 percent threshold.

In several LAUs that are currently not meeting the Forest Plan Standard TEST15 for suitable habitat (Stibnite, Yellowpine, Burntlog, Warm Lake, and Landmark; see **Table 3.13-3**), there would be an additional loss of suitable habitat, and these LAUs would continue to not meet the Standard. For the LAUs currently meeting the Standard (East Mountain and West Mountain), the direct impacts from the SGP would not cause the Standard to be exceeded.

Table 4.13-1 shows the acres of suitable habitat that would be directly impacted by each alternative in each LAU. Direct impacts to Canada lynx habitat across all LAUs would vary between 214 and 283 acres. Using a 5-mile buffer on the project components within each LAU, the area of indirect impacts on Canada lynx habitat could total approximately 58,852 to 59,357 acres.

Table 4.13-1 Direct and Indirect Impacts on Canada Lynx Habitat

LAU	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Stibnite	170	14,207
Yellowpine	36	8,168
Burntlog	65	15,443
Warm Lake	1	1,131
Landmark	2	5,712
East Mountain	9	14,531
West Mountain	0	0
Total	**283**	**59,192**
Alternative 2		
Stibnite	101	14,342
Yellowpine	36	8,168
Burntlog	65	15,443
Warm Lake	1	1,131
Landmark	2	5,712
East Mountain	9	14,561
West Mountain	0	0
Total	**214**	**59,357**

LAU	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 3		
Stibnite	168	14,209
Yellowpine	36	8,168
Burntlog	65	15,443
Warm Lake	1	1,131
Landmark	2	5,712
East Mountain	9	14,561
West Mountain	0	0
Total	**281**	**59,224**
Alternative 4		
Stibnite	172	14,275
Yellowpine	0	7,809
Burntlog	67	15,426
Warm Lake	1	1,131
Landmark	6	5,650
East Mountain	9	14,561
West Mountain	0	0
Total	**255**	**58,852**

Table Source: Forest Service 2020

4.13.2.1.1.2 Alternative 5

Mine Site

Transient Canada lynx would likely continue to use the mine site area much as they currently do, although there are no recent observations of lynx use in the area.

Access Roads

Because some of the existing roadways in the Canada lynx analysis area bisect potential linkage areas, they also would likely continue to affect transient Canada lynx through habitat fragmentation and vehicle-wildlife collisions.

Utilities

Transient Canada lynx would likely continue to use the Canada lynx analysis area much as they currently do.

Off-site Facilities

Depending on the future use of existing off-site facilities, Canada lynx would likely continue to avoid them as they currently do.

4.13.2.1.1.3 Determination

The Forest Service has preliminarily determined that the mine site, access roads, and utilities would affect, but not adversely affect, Canada lynx utilizing the area or their habitat. Direct impacts would be highest (and similar) for Alternatives 1 and 3, while Alternative 2 would have the lowest? direct impacts. The off-site facilities would likely not affect transient Canada lynx under any action alternative. Under all action alternatives, the Stibnite LAU and Burntlog LAU would have the highest direct impacts to lynx habitat. Informal Section 7 ESA consultation is ongoing with the U.S. Fish and Wildlife Service (USFWS).

4.13.2.1.2 NORTHERN IDAHO GROUND SQUIRREL

4.13.2.1.2.1 Direct and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-4 shows the components of Alternative 1 and 2 within the Northern Idaho ground squirrel (NIDGS) analysis area compared to modeled habitat. **Figure 4.13-5** shows the components of Alternative 3 within the NIDGS analysis area compared to modeled habitat. **Figure 4.13-6** shows the components of Alternative 4 within the NIDGS analysis area compared to modeled habitat. Direct and indirect effects to NIDGS are analyzed within a 1-mile buffer of alternative components. This buffer distance was developed using best professional judgment, in coordination with the USFWS, to encompass the area of potential indirect impacts from anthropogenic influences (e.g., noise, light, human presence) at the mine site and along access roads.

Mine Site

There are no known observations of NIDGS or modeled habitat in the mine site area. Therefore, mine site activities under all alternatives would not affect NIDGS.

Access Roads

Road maintenance and vehicle traffic could directly impact individual NIDGS, if sites become occupied in the future, where Alternative 1 components cross modeled habitat. The Burntlog Route would not cross modeled suitable habitat, and construction would therefore not impact squirrel habitat. However, Warm Lake Road (CR 10-579) does cross modeled habitat, and the increased traffic could pose a direct risk of mortality due to collisions. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) and the new 7-mile temporary groomed OSV trail along Johnson Creek Road would occur in close proximity to modeled habitat for NIDGS but would be unlikely to affect NIDGS due to their season of use.

The existing (23 miles of National Forest System roads and 75 miles of county roads) and new roads (43 miles of Burntlog Route, OHV Connector, and utility access roads) may act as a barrier to squirrel movement and dispersal, which would be an indirect effect. Increased habitat fragmentation between colonies could indirectly impact dispersal between populations, which could lead to genetic and demographic consequences. Yensen and Tarifa (2018) observed no evidence of NIDGS or their sign at the proposed logistics facility location or near Trout Creek. Additional suitable sites, associated with project components, have been identified and will be assessed in the future. Site buffers and monitoring would be used to avoid or mitigate direct impacts on squirrel populations. If sites are determined to be occupied in the future, additional mitigation measures, such as seasonal restrictions, site buffers, and monitoring would be used to avoid or mitigate direct impacts on squirrel populations.

Alternatives 2 and 3 would have similar effects on NIDGS and modeled habitat as Alternative 1.

Under Alternative 4, the Yellow Pine Route does not cross modeled suitable habitat, although it is in closer proximity to modeled suitable habitat than the Burntlog Route. Construction and operations would not likely impact NIDGS habitat.

Utilities

Construction of the utility corridors, substations, and communication towers, as well as maintenance activities in the ROWs, would likely impact individual NIDGS where Alternative 1 components overlap modeled habitat known to support populations. Yensen and Tarifa (2018) observed no evidence of NIDGS or their sign at the logistics facility; however, the correct modeled habitat areas were not surveyed, and the timing of the survey may have been too late in the season to observe aboveground NIDGS. Reclamation during closure would reclaim the new transmission line segment, but this area does not overlap modeled habitat and would not likely provide additional modeled habitat.

Under Alternative 2, the new transmission line segment from Warm Lake Road to the Cascade switching station crosses several modeled habitat areas. This corridor would not be reclaimed upon closure, so direct impacts would be permanent. Ongoing operation of this transmission line corridor would likely continue to indirectly impact any NIDGS individuals within 0.5 mile.

Alternatives 3 and 4 would have similar effects on NIDGS and modeled habitat as Alternative 1.

Off-site Facilities

Construction of new off-site facilities (i.e., Stibnite Gold Logistics Facility) is unlikely to impact individual NIDGS, because Alternative 1 components do not overlap modeled habitat known to support populations. Yensen and Tarifa (2018) observed no evidence of NIDGS or their sign at the logistics facility; however, there is a possibility that NIDGS may occur in the future at suitable sites. Site checks and formal surveys will be conducted, as needed, prior to ground-disturbing activities in suitable habitat.

Vehicle traffic associated with the proposed off-site facilities could impact individual NIDGS where Alternative 1 components cross modeled habitat known to support populations. Surveys of modeled habitat would be required before construction activities occur. All staff and contractors would be trained to reduce wildlife collisions.

Under Alternative 2, construction of off-site facilities (i.e., Burntlog Maintenance Facility, Stibnite Gold Logistics Facility, etc.) is unlikely to impact individual NIDGS, because these components would not occur in modeled habitat known to support populations.

There would be no changes to the off-site facilities under Alternative 3 or 4, so effects would be the same as Alternative 1.

Habitat Impacts

Direct impacts to NIDGS modeled habitat across the wildlife analysis area would be approximately 55 acres for Alternatives 1, 3, or 4, and would be approximately 63 acres for Alternative 2. Using a 1-mile buffer on project components, the indirect area of impacts on modeled NIDGS suitable habitat is approximately 5,417 acres (**Table 4.13-2**).

Table 4.13-2 Direct and Indirect Impacts on NIDGS Habitat

Alternative	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1 or 3	55	5,347
Alternative 2	63	5,347
Alternative 4	55	5,348

Table Source: Forest Service 2020

4.13.2.1.2.2 Alternative 5

Mine Site

No NIDGS are known or estimated to occur in the mine site area.

Access Roads

Existing roads would likely continue to be used in a similar manner with similar traffic levels. Habitat fragmentation and vehicle-wildlife collisions would still be present for NIDGS, if they occur in suitable habitats in the future, due to existing roadways under Alternative 5.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or habitat fragmentation. There is a possibility that NIDGS may occur in the future at suitable sites.

Off-site Facilities

Because the existing off-site facilities occupy a small area and there would be no new facilities built, there would be no effects on NIDGS under Alternative 5.

4.13.2.1.2.3 Determination

The Forest Service has preliminarily determined that the access roads and utilities would affect, a small amount of NIDGS suitable habitat under all action alternatives. Direct impacts to habitat would be highest under Alternative 2 due to the new transmission line segment along Warm Lake Road, while direct and indirect impacts would be the same for the other action alternatives. The mine site and off-site facilities would not affect NIDGS habitat under any action alternative. Overall impacts from SGP would affect, but not adversely affect, NIDGS. Informal Section 7 ESA consultation is ongoing with the USFWS.

4.13.2.1.3 WOLVERINE

4.13.2.1.3.1 Direct and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-7 shows the components of Alternatives 1 and 2 within the wolverine analysis area compared to modeled habitat. **Figure 4.13-8** shows the components of Alternative 3 within the wolverine analysis area compared to modeled habitat. **Figure 4.13-9** shows the components of Alternative 4 within the wolverine analysis area compared to modeled habitat. Direct and indirect effects to wolverine are analyzed within a 5-mile buffer of alternative components, to assess all potential impacts, including noise disturbance. This buffer distance was developed using best professional judgment, in coordination with the USFWS, to address potential indirect impacts from anthropogenic influences (e.g., noise, light, human presence) and to account for potential impacts to wolverines moving through the general SGP area. However, impacts beyond 2 miles from alternative components would likely be negligible for wolverines, and the 5-mile buffer distance is large enough to include more than 2 home ranges.

Mine Site

Direct impacts on wolverines are likely in the mine site area due to habitat loss and associated habitat fragmentation; year-round vehicle traffic causing disturbance and potential avoidance behavior; and risk of vehicle collisions causing injury or mortality. However, the mine site also contains open water areas and disturbed ground, which would not provide habitat for wolverines. The mine site would measure approximately 6 miles long by 1 mile wide during operations. The mine site and associated infrastructure would reduce habitat quality or displace resident and transient wolverines around the perimeter of the mine site, because wolverines typically avoid crossing large openings, such as clear-cuts, roadways, and developed areas (Banci 1994; Luensmann 2008; Scrafford et al. 2018). The 3-mile-long and 15-foot-wide new road for the OHV connector trail would cross (and directly impact) this lower quality wolverine habitat and introduce additional indirect impacts to habitat due to vehicle noise. However, it would not likely be a barrier to wolverine movement. Because wolverines have been observed in the wolverine analysis area, and several individual wolverines have been captured, collared, and tracked via global positioning systems in the PNF and BNF adjacent to the wolverine analysis area (Forest Service 2012, 2015; Heinemeyer et al. 2017), it is likely that wolverines would be directly affected through loss of quality habitat or displacement around the mine site.

Noise and light also could directly disturb potential wolverine foraging or denning behavior throughout the life of the SGP (i.e., 20 years). Sustained levels of human disturbances, especially noise due to operations and helicopter flights to assist with exploratory drilling, is expected to contribute to increased levels of displacement of individual wolverines in the wildlife analysis area. Noise levels would be above ambient levels within 1 to 2 miles of the mine site but would attenuate below ambient levels beyond 2 miles. The noise and light reduction strategies employed in the SGP area would reduce impacts on wolverines by minimizing the intensity and duration but would not completely eliminate them (see **Appendix D**, Mitigation Measures and Environmental Commitments).

Increased human presence in the wolverine analysis area also could lead to additional recreational (e.g., snowmobiling, skiing, etc.) and other human activity in the area, which could indirectly affect wolverine populations by displacing them. Heinemeyer et al. (2017) observed that both motorized and non-motorized recreation has a larger negative effect on wolverines the further away they occurred from roadways and trails. Heinemeyer et al. (2019) also noted that female wolverines showed a stronger avoidance of off-road motorized recreation than males, indicating that indirect impacts would be higher for denning females.

There would not be a measurable difference in habitat use at the mine site under Alternative 2, and wolverines would likely still avoid it due to noise and light impacts and additional human presence.

Although there would be some facility and road changes under Alternative 3, wolverines would likely still avoid the mine site due to noise and light impacts and additional human presence. Overall, Alternative 3 would directly and indirectly impact the most habitat based on changes at the mine site (e.g., TSF, DRSF, Burntlog Route).

Although there would be some differences under Alternative 4 and this alternative would directly and indirectly impact the least amount of habitat (persistent spring snow cover), effects would largely be the same as Alternative 1. In addition, the OHV connector trail from Horse Heaven/Powerline route to Meadow Creek Lookout Road (FR 51290) would not be constructed, which would reduce direct and indirect impacts to wolverine modeled habitat (persistent spring snow cover).

Access Roads

Several surveys have observed wolverine presence surrounding the mine site, along Old Thunder Mountain Road, Cabin Creek Road (FR 467), and near Warm Lake (see Section 3.13.3.2.3.2, Baseline).

Direct impacts on wolverines are likely along the access roads due to habitat loss by access road construction, year-round vehicle traffic causing disturbance and potential avoidance behavior, over-snow recreation in the winter and new construction and plowing of the Burntlog Route through potential suitable habitat. Wolverines typically use remote areas that are not fragmented by roadways or other linear disturbances (Scrafford et al. 2018), and they have shown an aversion to crossing roadways with ROWs over 328 feet (100 meters) in width (Luensmann 2008). The Burnt Log (FR 447) and Thunder Mountain (FR 50375) roads would be widened to 26 feet wide, including shoulders, which is significantly narrower than 328 feet. Austin (1998) found that wolverines avoided areas within 100 meters of the Trans-Canada Highway, and showed low use of areas within 1,000 meters (i.e., approximately 0.6 mile) of it. Scrafford and Boyce (2014) found that wolverines in northern Alberta tended to avoid areas within 300 meters (i.e., approximately 1,000 feet) of roadways, but regularly crossed paved roads with more than 100 vpd. Traffic levels on the Burntlog Route would be highest during operations at about 68 vpd. Midas Gold would limit their vehicle traffic outside the mine site to between 5:00 am and 7:00 pm resulting in approximately five mine-related vehicles traveling on Burntlog Route per hour during operations. Additionally, Squires et al. (2006) observed that wolverines in southwestern Montana crossed major roadways in areas with the narrowest distance between forest cover on each side. Construction of 15 miles of new road for the Burntlog Route would fragment habitat but may not act as a barrier to movement due to its width and adjacent tree cover. Upon closure, the new segment of Burntlog Route would be recontoured and reclaimed, which would reduce direct and indirect impacts in the long-term.

An increase in big or small game collision mortality along roadways would be likely as the Burntlog Route segment would be new to the area and would be plowed throughout the winter. Because wolverines are largely scavengers in the winter (particularly on ungulate carrion), this could attract wolverines to roadways. Vehicle-wildlife collisions and habitat fragmentation would likely be the largest impact on the wolverine related to Alternative 1. Appropriate speed limits (i.e., generally 30 miles per hour or less) would be established for the Burntlog Route, mine site haul roads, and light vehicle access roads for Alternative 1 to reduce the possibility of vehicle-wildlife collisions. All staff and contractors would be trained to reduce wildlife collisions. However, wildlife-vehicle collisions would still be possible. Removing wildlife collision mortality from roadways also could reduce some impacts.

Additionally, Heinemeyer et al. (2017) observed that wolverines responded negatively to increasing intensity of winter recreation in Idaho, Montana, and Wyoming; and that off-road or dispersed recreation triggered a stronger response than recreation concentrated on access roads. Female wolverines showed a stronger avoidance effect to motorized off-road recreation than males, and therefore experienced higher habitat loss (Heinemeyer et al. 2019). Kortello et al. (2019) also documented the negative association of forestry roads and winter recreation on wolverine distribution in the southern Columbia Mountains of Canada. During construction, the current OSV trail associated with Johnson Creek Road would be moved to the side of the road (see **Figure 2.3-1**), but there would be no increase in snowmobile use as it is an existing route for OSVs. The new 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat for wolverines, and associated increased recreational activity (e.g., snowmobiling, skiing, etc.) would likely cause indirect impacts to wolverines due to noise from

OSVs as this would be a new winter route. Wolverines affected physically (i.e., habitat disturbance due to construction of the Burntlog Route) or behaviorally (i.e., displacement) would likely avoid the areas by moving away from the activities, which could have an impact on denning females. Public use of some roadways would likely also encourage additional backcountry recreational activities and hunting, which could cause direct mortality or avoidance behavior.

Noise and increased lighting also could disturb potential wolverine foraging or denning habitat throughout the life of the SGP (i.e., 20 years), but the area disturbed would be small relative to equivalent habitat in the contiguous forest area, and relative to the extremely large home range of wolverines (from 49 to 833 square miles; Heinemeyer et al. 2017). However, construction of the access roads would likely produce noise effects at further distances. For example, noise levels 1 mile from the access road construction are estimated to be 34 dBA, which is at or below ambient noise levels. Estimated average hourly traffic noise levels would be approximately 49 dBA at 50 feet from the roadway and would attenuate to below ambient noise levels of 40 dBA within 500 feet from the roadway (Section 4.6, Noise). Therefore, traffic noise could affect wolverines in the FCRNRW within 500 feet of the roadway during operations. The noise and light reduction strategies (e.g., noise mufflers, light shields and type) employed along access roads would likely reduce impacts on wolverines by minimizing the intensity and duration but may not eliminate them entirely (see **Appendix D**, Mitigation Measures and Environmental Commitments).

The year-round maintenance and winter plowing of the Burntlog Route could potentially open new and more remote areas for other predators, such as wolves or coyotes, which could indirectly increase the competition for food resources with wolverines.

Under Alternative 2, construction of 13.5 miles of new road for the Burntlog Route may fragment wolverine habitat. Although the Burntlog Route would be shortened by 1.5 miles due to the Riordan Creek segment reroute, the road would be closer to the FCRNRW, and would cross through more areas of persistent spring snow cover (i.e., areas more likely used by wolverines). Traffic levels would be highest during construction at about 65 vpd and would drop to 50 vpd during operations. Direct mortality is possible due to collisions with vehicles, and wolverines would likely be affected by noise, light, and traffic disturbances.

Although the Burntlog Route would include 19.6 miles of new roadway under Alternative 3, effects of the access roads on wolverine habitat use would be the same as Alternative 1.

Under Alternative 4, the Yellow Pine Route would be used instead of the Burntlog Route, which would eliminate the disturbance of 15 miles of wolverine habitat adjacent to the FCRNRW. This would avoid the impacts of noise, light, and traffic impacts on wolverines in the FCRNRW area. Additionally, the Yellow Pine Route would mostly avoid areas mapped as persistent spring snow cover, which are areas expected to be used most by wolverines. However, it is expected that wolverines would still cross SGP area roadways, including the Yellow Pine Route. Traffic levels on Stibnite Road and Johnson Creek Road (both part of the Yellow Pine Route) would increase by about 174 percent and 119 percent, respectively, during operations. Therefore, there would still be a chance of wildlife mortality for Alternative 4.

Utilities

Direct impacts on wolverines due to the utility corridors, substations, and communication towers are possible, and construction activities may cause wolverines to avoid these areas in the short-term. Some habitat would be removed for these areas along roadways, but they are not considered good habitat for wolverines due to their roadside location. The addition of 25 miles of new utility access roads, as well as a disturbance of approximately 115 acres due to new transmission lines and 158 acres due to upgraded transmission lines would likely be a threat to individual wolverines. Upon closure, the new transmission line between the mine site and Johnson Creek substation would be decommissioned, removed, and reclaimed, which would reduce long-term impacts under Alternative 1.

Noise and light due to construction of utility corridors, substations, and communication towers could temporarily (up to 3 years) disturb potential wolverine foraging habitat, but the area disturbed would be small relative to equivalent habitat in the contiguous forest area, and relative to the extremely large home range of wolverines (from 49 to 833 square miles; Heinemeyer et al. 2017). For example, noise levels 2 miles from the mine site and 1 mile from the utility construction are estimated to be 36 dBA, which is below the ambient noise levels. The noise and light reduction strategies employed along utility corridors and near communication towers would reduce impacts on wolverines but may not entirely eliminate them.

Under Alternative 2, direct impacts on wolverines due to construction and operation of the utility corridors, substations, and communication towers would be similar to Alternative 1, although some upgraded transmission line sections would be rerouted. There would be an addition of 26 miles of new utility access roads, as well as a disturbance of approximately 141 acres due to new transmission lines and 156 acres due to upgraded transmission lines under Alternative 2.

Under Alternative 3, direct impacts on wolverines would be the same as Alternative 1, although a segment of new transmission line would be rerouted through an existing corridor. The addition of 22 miles of new utility access roads, as well as a disturbance of approximately 121 acres due to new transmission lines and 158 acres due to upgraded transmission lines, could impact individual wolverines.

Under Alternative 4, utilities would be constructed and installed using helicopters in Inventoried Roadless Areas rather than by constructing access roads. This would introduce more noise impacts to wolverines in their vicinity during construction. For example, noise levels 2 miles from the mine site and 2 miles from the utility construction are estimated to be 39 dBA, which is below the ambient noise levels. During operations, the utilities would produce the same noise levels as Alternative 1.

Off-site Facilities

Direct impacts on wolverines due to off-site facilities are possible, as there are known breeding territories in the wolverine analysis area, and they would likely travel throughout the area. Because wolverines typically use remote areas that are not fragmented by roadways or buildings, it is likely that resident or transient wolverine individuals would naturally avoid the off-site facility areas. There could be some displacement and avoidance of more remote facilities (e.g., Landmark Maintenance Facility).

Noise and increased lighting near the off-site facilities may disturb potential wolverine foraging or denning habitat although the area disturbed would be small relative to equivalent habitat in the contiguous forest area, and relative to the extremely large home range of wolverines. It is likely that resident or transient wolverine individuals would avoid the off-site facilities.

Traffic associated with the facilities may increase the potential for vehicle-wildlife collisions. All employees and contractors would be trained to reduce wildlife collisions. Any adverse wildlife encounters would be reported to appropriate state and federal wildlife managers, and in accordance with state and federal laws.

Under Alternative 2, the Burntlog Maintenance Facility would affect a small amount of habitat in the wolverine analysis area. It is likely that resident or transient wolverine individuals would naturally avoid the off-site facility areas. However, because there are known breeding territories in the wolverine analysis area and they would likely travel throughout the area, it is possible that they would be affected.

Alternatives 3 and 4 would have similar effects on wolverines and modeled habitat as Alternative 1.

Habitat Impacts

Persistent snow cover is used to assess impacts to wolverine habitat (see Section 3.13.3.2.3.2, Baseline), particularly denning habitat. **Table 4.13-3** summarizes the areas (in acres) with persistent snow cover in numbers of years (from 1 through 7) impacted by action Alternatives 1, 2, 3, and 4. This model depicts the number of years, out of seven, in which snow cover was present in the spring in selected pixels (April 24 – May 15). This time frame generally corresponds to the period of wolverine den abandonment. Most dens were located in areas that were snow covered for 6 to 7 years out of the total seven years studied, indicating that wolverines select den sites in areas with the highest consistent snow coverage. Thus, the direct impacts on these areas would be a direct effect to wolverines and denning activities.

To be conservative, areas with persistent snow cover for years 5 through 7 indicate higher quality habitat (particularly denning habitat) than years 1 through 4. Indirect impacts were calculated by including all modeled habitat (years 1 through 7) within 5 miles of action alternative components. Alternative 4 would directly and indirectly impact the least amount of higher quality habitat and persistent spring snow cover overall, while Alternative 3 would impact the most habitat overall based on direct and indirect impacts. This is largely due to changes at the mine site (e.g., TSF, DRSF, Burntlog Route) impacting different areas of wolverine habitat.

Table 4.13-3 Direct and Indirect Impacts on Wolverine Habitat

Persistent Spring Snow Cover Years	Directly Impacted Habitat (acres)	Indirectly Impacted Habitat (acres)
Alternative 1		
1-4	2,370	192,495
5-7	203	80,996
Alternative 2		
1-4	2,257	192,697
5-7	202	80,908
Alternative 3		
1-4	2,497	199,104
5-7	172	83,963
Alternative 4		
1-4	2,115	173,698
5-7	99	52,822

Table Source: Forest Service 2020

4.13.2.1.3.2 Alternative 5

Mine Site

Wolverines would likely continue to use the mine site area much as they currently do.

Access Roads

Existing roads also would continue to affect wolverines through habitat fragmentation and vehicle-wildlife collisions.

Utilities

There would be no new loss of habitat or source of noise and light for wolverines due to utility construction.

Off-site Facilities

Depending on the future use of current off-site facilities, wolverines would likely continue to avoid them as they currently do.

4.13.2.1.3.3 Determination

Wolverines have been well documented in the analysis area and several individual wolverines have been captured in and adjacent to the wolverine analysis area (Forest Service 2012, 2015; Heinemeyer et al. 2017). The Forest Service has preliminarily determined that the mine site, access roads, utilities, and off-site facilities would result in adverse effects to wolverine but would not jeopardize the continued existence of this species. Alternative 4, which would not include the Burntlog route, would directly and indirectly impact the least amount of higher quality habitat (persistent snow cover years 5 through 7) overall, while Alternative 3 would impact the most habitat overall based on direct and indirect impacts. Alternatives 1 and 2 would be similar in direct and indirect impacts.

4.13.2.2 Focal Species, including Region 4 Sensitive Species and Management Indicator Species

Habitat impact figures discussed below for focal species, Region 4 sensitive species, and Management Indicator Species are included in **Appendix K-4**, Figures.

4.13.2.2.1 HABITAT FAMILY 1 – LOW ELEVATION, OLD FOREST

4.13.2.2.1.1 White-Headed Woodpecker

Direct (Habitat) and Indirect Effects Alternatives 1, 2, 3, and 4

Figure 4.13-10 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-11** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-12** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

<u>Mine Site</u>

The white-headed woodpecker is expected to be uncommon in the wildlife analysis area. Modeled habitat for white-headed woodpecker does not occur in the mine site area and direct impacts are unlikely.

Alternative 1 would cause an increase in noise and light in the vicinity of the mine site, which could cause indirect effects to white-headed woodpecker within 1 mile of the mine site. Wildlife behaviors that may change as a result of increased noise include nesting or foraging changes. Noise-reduction strategies would be used to lower potential indirect effects on woodpeckers. For example, buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2, 3, and 4 would have similar effects on white-headed woodpecker as Alternative 1.

<u>Access Roads</u>

There is very limited modeled habitat for white-headed woodpecker near the proposed Burntlog Route, so there would be only low direct impacts for the access roads (8 acres; see **Table 4.13-4**). Alternative 1 would cause an increase in noise and light in the wildlife analysis area due to road construction, vehicle traffic, and maintenance. However, most modeled habitat is adjacent to existing roadways (e.g., Warm Lake Road). Wildlife behaviors that may change as a result of increased noise and light due to increased traffic include nesting or foraging changes. Noise-reduction strategies would be used to lower indirect effects on woodpeckers (see **Appendix D**, Mitigation Measures and Environmental Commitments).

Alternatives 2 and 3 would have similar effects on white-headed woodpecker as Alternative 1.

Under Alternative 4, the Burntlog Route would not be constructed. There is modeled habitat for white-headed woodpecker along the Yellow Pine Route. Because the Stibnite Road and Johnson Creek Road are existing roadways that would be upgraded, there would be approximately 9 acres of direct impacts on white-headed woodpecker habitat, and there would be more indirect impacts due to noise and light disturbance from increased traffic levels.

Utilities

There is very limited modeled habitat for white-headed woodpecker along the utilities, so there would be very little direct impacts (approximately 10 acres; see **Table 4.13-4**). Direct take of adult birds, nests, eggs, or young due to construction or operational activities is unlikely, because white-headed woodpeckers are expected to be uncommon.

Alternative 1 would cause an increase in noise and light in the wildlife analysis area, due to construction, operation, and maintenance of the utilities, particularly along the new transmission line between the mine site and Johnson Creek substation (where some modeled habitat occurs). Wildlife behaviors that may change as a result of increased noise include nesting or foraging changes. Noise-reduction strategies would be used to lower indirect effects on woodpeckers. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2, 3, and 4 would have similar effects on white-headed woodpecker as Alternative 1.

Off-site Facilities

Alternative 1 is unlikely to disturb individual white-headed woodpeckers due to clearing and construction activities for off-site facilities, because none are expected to impact modeled habitat. However, indirect effects on woodpeckers could include reduced use of foraging or nesting habitat.

Alternatives 2, 3, and 4 would have similar effects on white-headed woodpecker as Alternative 1.

Habitat Impacts

Table 4.13-4 White-headed Woodpecker Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	0	N/A
Access Roads	8	N/A
Utilities	10	N/A
Off-site Facilities	0	N/A
Total	**18**	**1,498**
Alternative 2		
Mine Site	0	N/A
Access Roads	8	N/A
Utilities	12	N/A
Off-site Facilities	0	N/A
Total	**20**	**1,498**
Alternative 3		
Mine Site	0	N/A
Access Roads	8	N/A
Utilities	10	N/A
Off-site Facilities	0	N/A
Total	**18**	**1,498**
Alternative 4		
Mine Site	0	N/A
Access Roads	9	N/A
Utilities	10	N/A
Off-site Facilities	0	N/A
Total	**19**	**1,505**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (0.5 mile for woodpeckers) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

Mine Site

There is no modeled habitat near the mine site for white-headed woodpeckers, and they are not expected to occur.

Access Roads

Existing roads (e.g., Stibnite Road, Johnson Creek Road, Warm Lake Road) in close proximity to modeled habitat would continue to affect white-headed woodpeckers through habitat fragmentation.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light, or increased risk of collision for woodpeckers.

Off-site Facilities

There would be no loss of habitat or new sources of noise and light due to off-site facilities.

Determination

The action alternatives would have no impact to white-headed woodpecker individuals and habitat and would not contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

4.13.2.2.1.2 Lewis's Woodpecker

Direct and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-13 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-14** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-15** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

Effects to the Lewis's woodpecker at the mine site under all action alternatives would be similar to the white-headed woodpecker analysis (Section 4.13.2.2.1.1). No modeled habitat would be impacted in the mine site area under all action alternatives (see **Table 4.13-5**).

Access Roads

Effects to the Lewis's woodpecker along the access roads under all action alternatives would be similar to the white-headed woodpecker analysis (Section 4.13.2.2.1.1). Approximately 11 acres of modeled habitat would be impacted along the access roads for each of the action alternatives.

Utilities

Effects to the Lewis's woodpecker associated with the utilities under all action alternatives would be similar to the white-headed woodpecker analysis (Section 4.13.2.2.1.1). Approximately 6 acres of modeled habitat would be impacted along the access roads for each of the action alternatives.

Off-site Facilities

There would be no effects to the Lewis's woodpecker due the off-site facilities under all action alternatives.

Habitat Impacts

Table 4.13-5 Lewis's Woodpecker Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	0	N/A
Access Roads	11	N/A
Utilities	6	N/A
Off-site Facilities	0	N/A
Total	**17**	**1,360**
Alternative 2		
Mine Site	0	N/A
Access Roads	11	N/A
Utilities	6	N/A
Off-site Facilities	0	N/A
Total	**17**	**1,360**
Alternative 3		
Mine Site	0	N/A
Access Roads	11	N/A
Utilities	6	N/A
Off-site Facilities	0	N/A
Total	**17**	**1,360**

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 4		
Mine Site	0	N/A
Access Roads	11	N/A
Utilities	6	N/A
Off-site Facilities	0	N/A
Total	**17**	**1,366**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (0.5 mile for woodpeckers) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

See the white-headed woodpecker analysis (Section 4.13.2.2.1.1) for effects under Alternative 5 that also would apply to the Lewis's woodpecker.

Determination

The action alternatives would have no impact to Lewis's woodpecker individuals and habitat and would not contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

4.13.2.2.2 Habitat Family 2 – Broad Elevation, Old Forest

4.13.2.2.2.1 American Three-Toed Woodpecker

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-16 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-17** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-18** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

While there is modeled habitat for American three-toed woodpeckers in the mine site area, there are no documented occurrences and they are expected to be rare. However, there would be a direct impact of 39 acres of modeled habitat in the mine site area for American three-toed woodpeckers under Alternative 1 (see **Table 4.13-6**). Removal of snag trees would cause a loss of suitable habitat for this species, which would likely displace resident birds. Adjacent areas contain similar habitat types, but individual birds may face more competition for these areas, which would be an indirect effect. Direct take of adult birds due to construction or operational activities is possible, but unlikely, because most individuals are expected to avoid areas of activity and they are rare in the mine site area. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. To the extent practicable, trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although these mitigation measures would reduce impacts, there would still be a decrease in modeled habitat.

Alternative 1 would cause an increase in noise and light in the woodpecker analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting or foraging changes. Noise-reduction strategies would be used to reduce indirect effects on woodpeckers (see **Appendix D**, Mitigation Measures and Environmental Commitments). For example, buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2 and 4 would have similar effects on American three-toed woodpecker as Alternative 1.

Alternative 3 would impact 47 acres of modeled habitat at the mine site, primarily due to the TSF and DRSF.

Access Roads

There would be a direct impact of 10 acres to modeled habitat along the Burntlog Route for American three-toed woodpeckers under Alternative 1 (see **Table 4.13-6**). Removal of snag trees along this roadway would cause a loss of suitable habitat for this species. Direct take of adult birds due to construction or operational activities is unlikely because they are expected to be uncommon. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. To the extent practicable, trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although these mitigation measures would reduce impacts, there would still be a decrease in habitat.

Alternative 1 would cause an increase in noise and light in the woodpecker analysis area, due to road construction, vehicle traffic, and maintenance. Wildlife behaviors that may change as a result of increased noise include nesting or foraging changes. Noise-reduction strategies would be used to lower indirect effects on woodpeckers. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt American three-toed woodpeckers due to OSV noise.

Alternatives 2 and 3 would have similar effects on American three-toed woodpecker as Alternative 1.

Under Alternative 4, the Burntlog Route would not be constructed. However, there would be a direct impact of 2 acres of modeled habitat associated with upgrades to the Yellow Pine Route. Additionally, the increased traffic along Stibnite Road, Johnson Creek Road, and Warm Lake Road would cause indirect impacts to woodpeckers using the modeled habitat within 1 mile of the roadways due to noise and light.

Utilities

There would be a direct impact of 16 acres of modeled habitat along the utilities for American three-toed woodpeckers under Alternative 1 (see **Table 4.13-6**). Removal of snag trees near utility corridors, substations, and communication towers would cause a loss of suitable habitat for this species, which would likely displace any resident birds. Adjacent areas contain similar habitat types, but individual birds may face more competition for these areas, which would be an indirect effect. Direct take of adult birds due to construction or operational activities is unlikely because they are expected to be uncommon. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. This could occur along the new transmission line segment between the mine site and Johnson Creek substation or along the upgraded transmission line segments along Johnson Creek Road and Warm Lake Road. To the extent practicable, trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although these mitigation measures would reduce impacts, there would still be a decrease in habitat.

Alternative 1 would cause an increase in noise and light in the woodpecker analysis area, due to construction, operation, and maintenance of the utilities. Wildlife behaviors that may change as a result of increased noise include nesting or foraging changes. Noise-reduction strategies would be used to reduce indirect effects on woodpeckers. Buildings and equipment would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2, 3, and 4 would have similar effects on American three-toed woodpecker as Alternative 1.

Off-site Facilities

Alternative 1 is unlikely to disturb individual American three-toed woodpeckers due to clearing and construction activities for off-site facilities, because none of the facilities are expected to overlap modeled habitat. However, indirect effects on woodpeckers could include reduced use of foraging or nesting habitat within 1 mile of the off-site facilities due to noise and light.

Alternatives 2 and 3 would have similar effects on American three-toed woodpecker as Alternative 1.

Under Alternative 4, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus Alternative 1 and cause a direct impact of about 1 acre. It is not expected that this change would cause effects different from Alternative 1.

Habitat Impacts

Table 4.13-6 American Three-toed Woodpecker Direct and Indirect impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	39	N/A
Access Roads	10	N/A
Utilities	16	N/A
Off-site Facilities	0	N/A
Total	**65**	**2,930**
Alternative 2		
Mine Site	36	N/A
Access Roads	10	N/A
Utilities	16	N/A
Off-site Facilities	0	N/A
Total	**62**	**2,930**
Alternative 3		
Mine Site	47	N/A
Access Roads	6	N/A
Utilities	17	N/A
Off-site Facilities	0	N/A
Total	**70**	**2,882**

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 4		
Mine Site	39	N/A
Access Roads	2	N/A
Utilities	16	N/A
Off-site Facilities	1	N/A
Total	**58**	**2,347**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (0.5 mile for woodpeckers) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

See the white-headed woodpecker analysis (Section 4.13.2.2.1.1) for effects under Alternative 5 that also would apply to the American three-toed woodpecker.

Determination

The action alternatives may directly and indirectly impact American three-toed woodpecker individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. The action alternatives would all have similar direct and indirect impacts, but Alternative 3 would marginally have the most direct impacts to mature forest stands or stands impacted by wildfires or beetle infestations, and Alternative 4 would directly impact the least habitat.

4.13.2.2.2.2 Black-Backed Woodpecker

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-19 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-20** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-21** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

Effects to the black-backed woodpecker at the mine site would be similar to the American three-toed woodpecker analysis (Section 4.13.2.2.2.1). However, there would be a direct impact of 98 acres of modeled habitat under Alternative 1 and 92 acres under Alternative 2 (see **Table 4.13-7**).

Alternatives 3 and 4 would have similar effects on black-backed woodpecker, with direct impacts of 109 and 104 acres, respectively. Alternative 3 would impact more habitat due to the TSF and DRSF.

Access Roads

Effects to the black-backed woodpecker along the access roads would be similar to the American three-toed woodpecker analysis (Section 4.13.2.2.2.1). Alternatives 1, 2, and 3 would have similar direct impacts of 22, 19, and 17 acres, respectively (see **Table 4.13-7**). This would primarily occur due to construction of the Burntlog Route through modeled habitat. Indirect impacts (due to noise and light from construction and increased traffic) would occur within 1 mile of the Burntlog Route as well.

Alternative 4 would directly impact 3 acres of modeled habitat, due to shifting the primary access route to the Yellow Pine Route. There would also be indirect impacts along this route due to an abundance of modeled habitat along Stibnite Road, Johnson Creek Road, and Warm Lake Road.

Utilities

Effects to the black-backed woodpecker associated with the utilities would be similar to the American three-toed woodpecker analysis (Section 4.13.2.2.2.1). Direct impacts on modeled habitat for black-backed woodpecker would be similar across all action alternatives.

Off-site Facilities

Effects to the black-backed woodpecker at the off-site facilities under all action alternatives would be similar to the American three-toed woodpecker analysis (Section 4.13.2.2.2.1).

Habitat Impacts

Table 4.13-7 Black-backed Woodpecker Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	98	N/A
Access Roads	22	N/A
Utilities	19	N/A
Off-site Facilities	0	N/A
Total	**139**	**7,994**

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 2		
Mine Site	92	N/A
Access Roads	19	N/A
Utilities	19	N/A
Off-site Facilities	0	N/A
Total	**130**	**7,994**
Alternative 3		
Mine Site	109	N/A
Access Roads	17	N/A
Utilities	21	N/A
Off-site Facilities	0	N/A
Total	**147**	**7,962**
Alternative 4		
Mine Site	104	N/A
Access Roads	3	N/A
Utilities	19	N/A
Off-site Facilities	1	N/A
Total	**127**	**6,535**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (0.5 mile for woodpeckers) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

See the white-headed woodpecker analysis (Section 4.13.2.2.1.1) for effects under Alternative 5 that also would apply to the black-backed woodpecker.

Determination

The action alternatives may directly and indirectly impact black-backed woodpecker individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. The action alternatives would all have similar direct and indirect impacts, but Alternative 3 would marginally have the most direct impacts to mature forest stands or stands impacted by wildfires or beetle infestations, and Alternative 4 would directly impact the least habitat.

4.13.2.2.2.3 Dusky Grouse (Summer)

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-22 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-23** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-24** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

<u>Mine Site</u>

Modeled summer habitat for dusky grouse is limited and occurs only in the northern portion of the mine site area. However, no modeled habitat would be directly impacted by any of the action alternatives in the mine site.

Alternative 1 would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Dusky grouse behaviors that may change as a result of increased noise and light include changes in nesting and foraging patterns that could lead to fragmentation of habitat. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Additionally, light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on dusky grouse would differ depending on the specific conditions at each individual Alternative 1 component location based on the density of vegetation and proximity to adjoining hillsides and valleys.

Direct and i indirect effects for dusky grouse would likely be exposure to emissions and a reduction in insects due to emissions, which could affect dusky grouse during the brood-rearing season (summer).

Insects and insectivorous birds may be exposed to metals (e.g., mercury) and other elements from atmospheric emissions and tailings piles associated with gold and silver mining activities (Custer et al. 2009; Eagles-Smith et al. 2018; Jones and Miller 2005). Emissions of metals from mining operations and ore processing, in the form of particulate matter and dust, may be deposited directly on local soils and waterways. In addition, rainwater and snow melt may provide a pathway for these elements to leach from tailings piles or be physically transported as solid particles into adjacent waterbodies. These elements may enter the food web through plants and insects and then be consumed by insectivorous wildlife, potentially causing injury if exposure is sufficient. The Forest Service would require an adaptive management plan to address dust and emissions (see **Appendix D**, Mitigation Measures and Environmental Commitments). Although this mitigation measure would reduce impacts, there would still likely be direct and indirect impacts to insectivorous birds like the dusky grouse.

Alternatives 2, 3, and 4 would have similar effects on dusky grouse as Alternative 1.

Access Roads

Alternative 1 could directly disturb dusky grouse in the wildlife analysis area through habitat removal and disturbance. The new segment of the Burntlog Route would be decommissioned and reclaimed during mine closure, but the effects would still be considered permanent due to the long time period. The Burntlog Route does not cross much modeled suitable habitat, but there would still be approximately 36 acres of direct impacts (see **Table 4.13-8**). The operational traffic (AADT of 68 vpd) associated with the workforce, supplies, haulage, and other miscellaneous traffic, including road maintenance on the access roads, could expose individual dusky grouse to vehicle-wildlife collisions.

Also, noise and light disturbance from road construction, road maintenance, and routine vehicle traffic may disturb or displace individual grouse where they occur. Dusky grouse behaviors that may change as a result of increased noise and light include changes in nesting and foraging patterns that could lead to fragmentation of habitat.

Another indirect impact to dusky grouse along access roads could include fugitive dust. Dust associated with construction of facilities and roads, road maintenance, and vehicle travel may have indirect impacts on wildlife forage (e.g., plants and insects) (see Section 4.10.2.1.1.2 Indirect Impacts, in Section 4.10, Vegetation: General Vegetation Communities, Botanical Resources, and Non-Native Plants). Increased dust deposition could result in negative impacts on wildlife foods ranging from plant metabolic process inhibition, plant mortality, inhibition of pollination, or injury to pollinating insects. For SGP, the potential for dust deposition is likely to be higher in the immediate area of roads and other surface-disturbing actions but would diminish with distance from these actions. Dust impacts on wildlife forage plants and insects would start during construction and continue through closure and reclamation. Some dust deposition also may occur in the post-closure period where monitoring-related travel on dirt roads would occur; however, this would be negligible. Effects of dust on plants and insects would occur immediately at the time of dust propagating activities and is likely to continue throughout the lifetime of SGP.

Alternatives 2 and 3 would have similar effects on dusky grouse as Alternative 1.

Under Alternative 4, the Burntlog Route would not be built. Most of the modeled dusky grouse habitat is located in proximity to the Yellow Pine Route. As such, dusky grouse could be impacted by Alternative 4 along the access roads due to direct impacts of 43 acres. There would also be more indirect impacts along the Yellow Pine Route due to more modeled habitat occurring along Stibnite Road, Johnson Creek Road, and Warm Lake Road.

Utilities

Alternative 1 would directly disturb dusky grouse in the wildlife analysis area through habitat loss due to clearing and construction activities for utility corridors, substations, and communication towers. Direct impacts would include 139 acres of modeled habitat along the utility features (see **Table 4.13-8**). During operations, the utility ROWs would be maintained in a low vegetation growth stage, which could provide summer nesting or brood-rearing habitat for dusky grouse.

Noise and light disturbance from construction of the utility corridors, substations, and communication towers may temporarily disturb or displace individuals. These indirect effects would be considered temporary during construction (up to 3 years). Once the construction is complete, it is expected that dusky grouse would resume use of the area.

Existing substations, structures, and upgraded transmission lines would exist in perpetuity. The new transmission line segment between the mine site and Johnson Creek substation (as well as the substation itself) would be removed and the area recontoured and reclaimed upon closure, which would reduce impacts after the life of the mine.

Alternative 2 would directly impact 149 acres of modeled summer habitat, primarily from the Cascade switching station to Warm Lake Road. The effects would be similar to those described for Alternative 1.

Alternatives 3 and 4 would have similar effects on dusky grouse as Alternative 1.

Off-site Facilities

There would be no direct impacts to modeled habitat due to the off-site facilities under all action alternatives. Construction and operation of the off-site facilities is also unlikely to have indirect effects on dusky grouse, as modeled habitat is limited within 1 mile of the off-site facilities.

Habitat Impacts

Table 4.13-8 Dusky Grouse (Summer) Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	0	N/A
Access Roads	36	N/A
Utilities	139	N/A
Off-site Facilities	0	N/A
Total	**175**	**6,346**
Alternative 2		
Mine Site	0	N/A
Access Roads	36	N/A
Utilities	149	N/A
Off-site Facilities	0	N/A
Total	**185**	**6,346**

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 3		
Mine Site	0	N/A
Access Roads	36	N/A
Utilities	139	N/A
Off-site Facilities	0	N/A
Total	**175**	**6,346**
Alternative 4		
Mine Site	0	N/A
Access Roads	43	N/A
Utilities	139	N/A
Off-site Facilities	0	N/A
Total	**182**	**6,358**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (0.5 mile for dusky grouse) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

Mine Site

Modeled habitat is limited for dusky grouse in the mine site area, and they are assumed to occur sporadically. Individuals would likely continue to use the mine site as they currently do.

Access Roads

Existing roads (e.g., Stibnite Road, Johnson Creek Road, and Warm Lake Road) would continue to affect dusky grouse through habitat fragmentation, direct mortality through vehicle strikes, and noise or light impacts from traffic.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no loss of habitat, sources of noise and light impacts, or increased risk of collision for grouse.

Off-site Facilities

There would be no loss of habitat or sources of noise and light impacts due to off-site facilities.

Summary of Impacts

The action alternatives may directly and indirectly impact dusky grouse individuals and habitat. All action alternatives would all have similar impacts, but Alternative 2 would marginally have the most direct impacts and Alternatives 1 and 3 would directly impact the least (and same amount of) habitat (e.g., herblands, grasslands, and shrublands adjacent to ponderosa pine, lodgepole pine, aspen, and fir forests).

4.13.2.2.2.4 Boreal Owl

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-25 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-26** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-27** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

Boreal owls are known to occur and breed in the mine site area, and modeled habitat occurs as well. Alternative 1 could directly disturb boreal owls in the wildlife analysis area through habitat loss, disturbance from increased human activity, and helicopter use associated with some exploratory drilling support.

Approximately 60 acres of modeled habitat would be directly impacted or removed at the mine site under Alternative 1 (see **Table 4.13-9**). Direct take of adult birds due to construction or operational activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. To the extent practicable, trees found to contain nests or cavities (often used by boreal owls) would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Timing restrictions would restrict some activities within a certain radius of active nest trees for raptor species, which would help reduce habitat impacts. For example, the Forest Service would require restricting activities between March 1 and July 15 which occur up to 1,500 feet from active boreal owl nest sites, and a 350-foot ground disturbance buffer would be maintained around active nests, with some exceptions (see **Appendix D**, Mitigation Measures and Environment Commitments). Although these mitigation measures would reduce impacts, there would still be a decrease in modeled habitat.

The boreal owl also could be impacted by direct collision risks with structures at the mine site. Electric transmission line structures to serve Alternative 1 facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted).

Alternative 1 would cause an increase in noise, light, and emissions in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting or foraging changes. Bright lighting can disrupt feeding activities for many owl species. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Additionally, light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on wildlife would differ depending on the specific conditions at each individual Alternative 1 component location based on the density of vegetation and proximity to adjoining hillsides and valleys.

A possible indirect effect is that there could be a reduction in insects as prey species near the mine site activities. Any actions resulting in a decrease to insects could impact the boreal owl, including direct removal of foraging habitat (e.g., understory vegetation) or effects from fugitive dust and emissions.

Insects and insectivorous birds may be exposed to metals (e.g., mercury) and other elements from atmospheric emissions and tailings piles associated with gold and silver mining activities (Custer et al. 2009; Eagles-Smith et al. 2018; Jones and Miller 2005). Emissions of metals from mining operations and ore processing, in the form of particulate matter and dust, may be deposited directly on local soils and waterways. In addition, rainwater and snow melt may provide a pathway for these elements to leach from tailings piles or be physically transported as solid particles into adjacent waterbodies. These elements may enter the food web through plants and insects and then be consumed by insectivorous wildlife, potentially causing injury if exposure is sufficient. The Forest Service would require an adaptive management plan to address dust and emissions (see **Appendix D**, Mitigation Measures and Environmental Commitments). Although this mitigation measure would reduce impacts, there would still likely be indirect impacts to insectivorous birds like the boreal owl.

Alternatives 2, 3, and 4 would have similar effects on boreal owl as Alternative 1.

Access Roads

Alternative 1 could disturb individual boreal owls in the wildlife analysis area through direct habitat loss (12 acres) due to tree clearing, road construction, and increased human activity along the access roads (see **Table 4.13-9**). Direct take of adult birds due to these activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. Timing restrictions described for the mine site would be used to reduce impacts.

Additionally, increased vehicle traffic is likely to disturb or displace individuals from roadside habitats. Plowing of the Burntlog Route over the winter would introduce additional noise and disturbance, which could affect wintertime use by boreal owls. Noise-reduction strategies would be used to reduce indirect effects on owls. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt boreal owls due to OSV noise.

Alternatives 2 and 3 would have similar effects on boreal owl as Alternative 1.

Under Alternative 4, the Burntlog Route would not be constructed or used. While 2 acres of modeled habitat would be directly impacted under this alternative, there is modeled suitable habitat located along the Yellow Pine Route that could be indirectly affected by noise and light from increased traffic levels.

Utilities

Alternative 1 could disturb individual boreal owls in the wildlife analysis area through direct habitat loss (8 acres) due to clearing and construction activities for utility corridors, substations, and communication towers. Direct take of adult birds due to these activities is unlikely because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. Timing restrictions described for the mine site would be used to reduce impacts.

The communication towers and new or upgraded 138-kilovolt (kV) transmission line would be a potential source of mortality for boreal owls (Avian Power Line Interaction Committee [APLIC] 2012). In the long term, the transmission line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Transmission line structures to serve Alternative 1 facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted). However, the long-term presence of structures and communication towers would pose a risk of collision and direct mortality. Upon closure, the new segment of transmission line between the mine site and Johnson Creek substation would be reclaimed.

Noise and light from construction of the utility corridors, substations, and communication towers is likely to disturb or displace individuals. However, construction of these areas would be temporary (approximately 3 years), and it is not expected to become a barrier to long-term movement or to fragment habitat. Once the construction is complete, it is expected that owls would resume use of the area.

Alternatives 2, 3, and 4 would have similar effects on boreal owl as Alternative 1, except that under Alternative 2 the transmission line between the mine site and Johnson Creek substation would not be reclaimed.

Off-site Facilities

Alternative 1 would not have any direct impacts on modeled habitat due to clearing and construction activities for off-site facilities. Modeled habitat within 1 mile of the off-site facilities is limited, but Alternative 1 could disturb individual boreal owls in the wildlife analysis area through noise increases due to construction or operation of the off-site facilities. Noise-reduction strategies would be used to lower indirect effects on the boreal owl. Lighting best management practices (e.g., downturned/shielded lights, reduced number used, directional lighting, etc.) would be used to reduce indirect effects on sensitive wildlife species (see **Appendix D**, Mitigation Measures and Environmental Commitments). Buildings would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2 and 3 would have similar effects on boreal owl as Alternative 1.

Under Alternative 4, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus Alternative 1. While the facility would be closer to modeled habitat, it is not expected that this change would cause effects different from Alternative 1.

Habitat Impacts

Table 4.13-9 Boreal Owl Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	60	N/A
Access Roads	12	N/A
Utilities	8	N/A
Off-site Facilities	0	N/A
Total	**80**	**9,590**
Alternative 2		
Mine Site	56	N/A
Access Roads	9	N/A
Utilities	8	N/A
Off-site Facilities	0	N/A
Total	**73**	**9,590**

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 3		
Mine Site	62	N/A
Access Roads	12	N/A
Utilities	9	N/A
Off-site Facilities	0	N/A
Total	**84**	**9,538**
Alternative 4		
Mine Site	65	N/A
Access Roads	2	N/A
Utilities	8	N/A
Off-site Facilities	0	N/A
Total	**75**	**8,004**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (1.0 mile for owls) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

Mine Site

Overall, boreal owls would likely continue to use the mine site as they currently do.

Access Roads

Existing roads also would continue to affect wildlife through habitat fragmentation and the risk of vehicle-wildlife collisions.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no loss of habitat, sources of noise and light, or increased risk of collision for boreal owls.

Off-site Facilities

There would be no loss of habitat or sources of noise and light impacts due to off-site facilities.

Determination

The action alternatives may directly and indirectly impact boreal owl individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. The action alternatives would all have similar direct and indirect impacts, but Alternative 3 would marginally have the most direct impacts to high elevation, mature conifer forests with standing snags (particularly near the mine site), and Alternative 2 would directly impact the least habitat.

4.13.2.2.2.5 Fisher

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-28 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-29** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-30** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

Approximately 39 acres of direct impacts to modeled habitat would occur in the mine site under Alternative 1 (see **Table 4.13-10**). Olson et al. (2014) observed that although fishers are capable of long-distance dispersal movements (e.g., 6.2 miles), large expanses of non-favorable habitat may prevent them from doing so and become a barrier to movement. As the mine site would be approximately 6 miles long by 1 mile wide, it could fragment habitat.

These same effects also could reduce prey availability or redistribute their populations in the wildlife analysis area, causing them to travel further for foraging opportunities, which would indirectly affect the fisher. Noise and light at the mine site could also indirectly impact fishers.

Alternatives 2 and 4 would have similar effects on fisher as Alternative 1.

Alternative 3 would directly impact 47 acres of modeled habitat, primarily due to the TSF and DRSF. However, effects would be similar to those described for Alternative 1.

Access Roads

Approximately 10 acres of direct impacts to modeled habitat would occur along the access roads under Alternative 1 (see **Table 4.13-10**). The new 15-mile-long section of Burntlog Route would be used and plowed year-round; and along with all other access roads and other roads used for the SGP, would likely represent an increased potential for vehicle collisions. All employees and contractors would be trained to reduce wildlife collisions. The AADT for Alternative 1 would be approximately 68 vpd during operations. There also is the potential for an increase in trapping, resulting from increased access in remote areas. Restricting public access on the Burntlog Route and removing roadkill from roadways would likely reduce the chance of mortality (see **Appendix D**, Mitigation Measures and Environmental Commitments). These same effects also could reduce prey availability in the SGP area, which would indirectly affect the fisher. Upon reclamation, the new section of the Burntlog Route would be decommissioned, re-contoured, and seeded to resemble pre-mining conditions, although the vegetation would likely continue to be dominated by grasses and forbs for many years. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt fishers due to OSV noise.

Under Alternative 2, there would also be 10 acres of direct impacts on modeled habitat. However, the on-site lime production would reduce traffic to the mine site by 2,032 trips per year. As such, the AADT for Alternative 2 would be approximately 50 vpd. Other effects would be similar to Alternative 1.

Alternative 3 would have similar effects on fisher as Alternative 1.

Under Alternative 4, the Burntlog Route would not be constructed and there would be approximately 2 acres of direct impacts on modeled habitat associated with the Yellow Pine Route. Indirect effects would also be likely within 1 mile of the Yellow Pine Route, as modeled habitat occurs along Stibnite Road, Johnson Creek Road, and Warm Lake Road.

Utilities

Approximately 13 acres of direct impacts to modeled habitat would occur along the utilities under Alternative 1 (see **Table 4.13-10**). Direct impacts on the fisher would include disturbance or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes. Direct impacts would occur along new transmission lines (between the mine site and Johnson Creek substation) and along upgraded transmission lines (between Johnson Creek Road and the Thunderbolt Tap substation, and along Warm Lake Road). Construction impacts would likely displace fisher individuals further distances but would be temporary (up to 3 years). Vegetation would be cleared only in those areas necessary for Alternative 1 activities to preserve natural habitat to the greatest extent practicable. During operations, vegetation would be maintained in a low vegetation growth stage, and fishers would likely use the area again.

After mine closure is complete, the 8.5-mile new transmission line between the mine site and Johnson Creek substation would be removed, and fishers could continue to use modeled habitat in the area.

Alternatives 2, 3, and 4 would have similar effects on fisher as Alternative 1, except that under Alternative 2 the transmission line between Johnson Creek substation and the mine site would remain as a permanent feature.

Off-site Facilities

Construction and operation of the off-site facilities for Alternative 1 are unlikely to disturb the fisher, because construction activities are not planned to occur in modeled habitat. However, noise and light reduction strategies would be used to reduce indirect effects on them, as modeled habitat does occur adjacent to the Landmark Maintenance Facility. Buildings would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2 and 3 would have similar effects on fisher as Alternative 1.

Under Alternative 4, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus Alternative 1. This would cause approximately 1 acre of direct impacts to fisher; however, it is not expected that this change would cause effects different from Alternative 1.

Habitat Impacts

Table 4.13-10 Fisher Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	39	N/A
Access Roads	10	N/A
Utilities	13	N/A
Off-site Facilities	0	N/A
Total	**62**	**6,068**
Alternative 2		
Mine Site	36	N/A
Access Roads	10	N/A
Utilities	13	N/A
Off-site Facilities	0	N/A
Total	**59**	**6,068**
Alternative 3		
Mine Site	47	N/A
Access Roads	6	N/A
Utilities	14	N/A
Off-site Facilities	0	N/A
Total	**67**	**6,052**

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 4		
Mine Site	39	N/A
Access Roads	2	N/A
Utilities	13	N/A
Off-site Facilities	1	N/A
Total	**55**	**4,956**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (0.5 mile for fisher) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

Mine Site

Fishers may use the mine site area as they have in limited areas in the past.

Access Roads

Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts.

Off-site Facilities

There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Determination

The action alternatives may directly and indirectly impact fisher individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. The action alternatives would all have similar effects, but Alternative 3 would marginally have the most direct impacts on suitable habitat (particularly near the mine site), and Alternative 4 would directly and indirectly impact the least habitat.

4.13.2.2.2.6 Flammulated Owl

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-31 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-32** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-33** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

Alternative 1 could directly disturb 1 acre of modeled habitat in the mine site area (see **Table 4.13-11**), as modeled habitat is limited in this area. However, flammulated owls are known to occur in the wildlife analysis area. Direct take of adult birds due to construction or operational activities is unlikely because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. To the extent practicable, trees found to contain nests or cavities (often used by flammulated owls) would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although these mitigation measures would reduce impacts, there would still be a decrease in habitat.

Alternative 1 would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting or foraging changes. Bright lighting can disrupt feeding activities for many owl species. Because flammulated owls are primarily nocturnal, they also could be impacted by direct collision risks with structures at the mine site due to lighting. Transmission line structures to serve facilities under Alternative 1 would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted).

A likely indirect effect is that there could be a reduction in prey species near the mine site activities. Any actions resulting in a decrease to insects could impact the flammulated owl, including direct removal of foraging habitat (e.g., understory vegetation) or effects from fugitive dust and emissions. Flammulated owls are highly migratory and would primarily be impacted during the breeding season (mid-May to mid-August).

Insects and insectivorous birds, such as the flammulated owl, may be exposed to metals (e.g., mercury) and other elements from atmospheric emissions and tailings piles associated with gold and silver mining activities (Custer et al. 2009; Eagles-Smith et al. 2018; Jones and Miller 2005). Emissions of metals from mining operations and ore processing, in the form of particulate matter and dust, may be deposited directly on local soils and waterways. In addition, rainwater and snow melt may provide a pathway for these elements to leach from tailings piles or be physically transported as solid particles into adjacent waterbodies. These elements may enter the food web through plants and insects and then be consumed by insectivorous wildlife, potentially causing injury if exposure is sufficient. The Forest Service would require an adaptive management plan to address dust and emissions (see **Appendix D**, Mitigation Measures and Environmental Commitments). Although this mitigation measure would reduce impacts, there would still likely be indirect impacts to insectivorous birds like the flammulated owl.

Alternatives 2, 3, and 4 would have similar effects on flammulated owl as Alternative 1.

Access Roads

Alternative 1 could disturb individual flammulated owls in the wildlife analysis area through direct habitat loss (4 acres; see **Table 4.13-11**) due to tree clearing, road construction, and increased human activity in the access roads. Direct take of adult birds due to these activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is likely that nests, eggs, and young would be directly disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. Additionally, increased vehicle traffic is likely to directly disturb or displace individuals from roadside habitats.

Noise-reduction strategies would be used to reduce indirect effects on owls. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Cutting of trees for Alternative 1 activities would avoid avian tree nests, where feasible; and a Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although these mitigation measures would reduce direct impacts, there would still be a decrease in habitat due to construction of the Burntlog Route.

Another indirect impact to flammulated owls along access roads could include fugitive dust. Dust associated with construction of facilities and roads, road maintenance, and vehicle travel may have indirect impacts on owl prey (e.g., insects, small mammals due to plant forage changes, etc.) (see Section 4.10.3.1.1.2, Indirect Impacts, in Section 4.10, Vegetation: General Vegetation Communities, Botanical Resources, and Non-Native Plants). Increased dust deposition could result in negative impacts on wildlife foods ranging from plant metabolic process inhibition, plant mortality, inhibition of pollination, or injury to pollinating insects. For SGP, the potential for dust deposition is likely to be higher in the immediate area of roads and other surface-disturbing actions but would diminish with distance from these actions. Dust impacts on wildlife forage plants and insects would start during construction and continue through closure and reclamation. Some dust deposition also may occur in the post-closure period where monitoring-related travel on dirt roads would occur; however, this would be negligible. Effects of dust on plants and insects would occur immediately at the time of dust propagating activities and is likely to continue throughout the lifetime of SGP.

Alternatives 2 and 3 would have similar effects on flammulated owl as Alternative 1.

Under Alternative 4, the Burntlog Route would not be built. Most of the modeled suitable boreal owl habitat is located in proximity to the Yellow Pine Route. As such, there would be 5 acres of direct impacts to modeled habitat associated with the Yellow Pine Route. Indirect effects (e.g., noise, light, emissions) would also be likely due to modeled habitat occurring along the Stibnite Road, Johnson Creek Road, and Warm Lake Road.

Utilities

Alternative 1 could disturb individual flammulated owls in the wildlife analysis area through direct impacts of 39 acres to modeled habitat due to clearing and construction activities for utility corridors, substations, and communication towers. Direct take of adult birds due to these activities is unlikely because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young would be disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. To the extent practicable, trees found to contain nesting cavities would not be disturbed or cut. No trees with active nests would be cut.

The communication towers and new 138-kV transmission line would be a potential source of mortality for flammulated owls (APLIC 2012). The utility line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Electric transmission line structures to serve facilities under Alternative 1 would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted). However, the long-term (i.e., 20 years) presence of structures and communication towers would pose a risk of collision and direct mortality. Upon closure and reclamation, the new transmission line between the mine site and Johnson Creek substation would be removed, which would eliminate these impacts.

Noise and light from construction of the utility corridors, substations, and communication towers is likely to disturb or displace individuals. However, construction of these areas would be temporary (up to 3 years) and is not expected to become a barrier to long-term movement or to fragment habitat. Once the construction is complete, it is expected that owls would resume use of the area. The noise-reduction strategies described for the mine site and access roads would be employed along utility corridors and near communication towers, which would reduce noise impacts on flammulated owls.

Alternatives 2, 3, and 4 would have similar effects on flammulated owl as Alternative 1 except that under Alternative 2 the transmission line between the Johnson Creek substation and the mine site would remain.

Off-site Facilities

All action alternatives are unlikely to impact flammulated owls as there would be no direct impacts to modeled habitat. Additionally, indirect impacts would be unlikely as modeled habitat is very limited within 1 mile of the off-site facilities.

Habitat Impacts

Table 4.13-11 Flammulated Owl Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	1	N/A
Access Roads	4	N/A
Utilities	39	N/A
Off-site Facilities	0	N/A
Total	**44**	**6,590**
Alternative 2		
Mine Site	1	N/A
Access Roads	4	N/A
Utilities	42	N/A
Off-site Facilities	0	N/A
Total	**47**	**6,590**
Alternative 3		
Mine Site	1	N/A
Access Roads	4	N/A
Utilities	39	N/A
Off-site Facilities	0	N/A
Total	**44**	**6,590**
Alternative 4		
Mine Site	1	N/A
Access Roads	5	N/A
Utilities	39	N/A
Off-site Facilities	0	N/A
Total	**45**	**6,591**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (1.0 mile for owls) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

See the boreal owl analysis (Section 4.13.2.2.2.4) for effects under Alternative 5 that also would apply to the flammulated owl.

Determination

The action alternatives may directly and indirectly impact flammulated owl individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. The action alternatives would all have very similar direct and indirect impacts on modeled habitat (e.g., medium to large ponderosa pine, Douglas-fir, and aspen stands).

4.13.2.2.2.7 Great Gray Owl

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-34 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-35** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-36** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

Great gray owls are documented in the area and modeled habitat occurs throughout the wildlife analysis area. Alternative 1 would result in 277 acres of direct impacts to modeled habitat for great gray owl in the mine site area (see **Table 4.13-12**). Direct take of adult birds due to construction or operational activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. This resident species occasionally nests early in the season (in the snow). To the extent practicable, trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Timing restrictions would restrict some activities within a certain radius of active nest trees for raptor species, which would help reduce habitat impacts. For example, the Forest Service would require restricting activities between March 1 and August 1 which occur up to 1,500 feet from active great gray owl nest sites, and a 150-foot ground disturbance buffer would be maintained around active nests, with some exceptions (see **Appendix D**, Mitigation Measures and Environmental Commitments). Although these mitigation measures would reduce impacts, there would still be a decrease in modeled habitat.

The great gray owl also could be impacted by direct collision risks with structures at the mine site. Electric transmission line structures to serve Alternative 1 facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted). Additionally, the OHV connector trail would directly impact modeled habitat and cause further indirect impacts due to vehicle noise.

Alternative 1 would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting or foraging changes. Bright lighting can disrupt feeding activities for many owl species. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Additionally, light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on wildlife would differ depending on the specific conditions at each individual Alternative 1 component location based on the density of vegetation and proximity to adjoining hillsides and valleys.

Alternative 2 would directly impact 239 acres and Alternative 4 would impact 281 acres of modeled habitat, but effects would be similar to those described for Alternative 1.

Under Alternative 3, approximately 365 acres of direct impacts would occur to modeled habitat. Under Alternative 4, the 3 miles of new road for the OHV connector trail from Horse Heaven/Powerline route to Meadow Creek Lookout Road (FR 51290) would not be constructed, which would reduce indirect impacts to great gray owl modeled habitat.

Access Roads

Alternative 1 would result in 64 acres of direct impacts to modeled habitat for great gray owl associated with the Burntlog Route (see **Table 4.13-12**). Direct take of adult birds due to these activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. Timing restrictions described for the mine site would be used to reduce impacts.

Additionally, increased vehicle traffic is likely to disturb or displace individuals from roadside habitats. Noise-reduction strategies would be used to reduce indirect effects on owls. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Also, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt great gray owls due to OSV noise.

Alternatives 2 and 3 would have similar direct impacts (57 acres and 54 acres, respectively), and the effects on great gray owl would be similar to those described for Alternative 1.

Under Alternative 4, the Burntlog Route would not be constructed or used. Direct impacts on modeled habitat would total approximately 13 acres and would be associated with upgrades along the Yellow Pine Route. Additionally, there is modeled suitable habitat located along the Yellow Pine Route that could be indirectly affected by noise and light from increased traffic levels.

Utilities

There would be 48 acres of direct impacts to modeled habitat due to construction of the new substations and new transmission line between the mine site and Johnson Creek substation, in addition to the upgrades to transmission lines and substations between Johnson Creek Road and the Warm Lake substation, and along Warm Lake Road and Johnson Creek Road.

Direct take of adult birds due to these activities is unlikely because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. Timing restrictions described for the mine site would be used to reduce impacts.

The communication towers and new or upgraded transmission lines would be a potential source of mortality for great gray owls (APLIC 2012). In the long-term, the transmission line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Transmission line structures to serve Alternative 1 facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted). However, the long-term (e.g., 20 years) presence of structures and communication towers would pose a risk of collision and direct mortality. Upon closure and reclamation, the new transmission line between the mine site and Johnson Creek substation would be removed, which would eliminate some of these impacts.

Noise and light from construction of the utility corridors, substations, and communication towers is likely to disturb or displace individuals within 1 mile of the project components. However, construction of these areas would be temporary (approximately 3 years), and it is not expected to become a barrier to long-term movement or to fragment habitat. Once the construction is complete, it is expected that owls would resume use of the area.

Alternatives 2, 3, and 4 would have similar effects on great gray owl as Alternative 1, except that under Alternative 2 the transmission line between the Johnson Creek substation and the mine site would remain.

Off-site Facilities

Alternative 1 would not have any direct impacts on modeled habitat due to clearing and construction activities for off-site facilities. However, Alternative 1 could disturb individual great gray owls in the wildlife analysis area through noise pollution due to construction or operation of the off-site facilities. Noise-reduction strategies would be used to reduce indirect effects on the owls. Lighting best management practices (e.g., downturned/shielded lights, reduced number used, directional lighting, etc.) would be used to reduce indirect effects on sensitive wildlife species (see **Appendix D**, Mitigation Measures and Environmental Commitments). Buildings would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2 and 3 would also have no direct impacts on great gray owl.

Under Alternative 4, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus Alternative 1. While this would result in 2 acres of direct impacts to modeled habitat, it is not expected that this change would cause effects different from Alternative 1.

Habitat Impacts

Table 4.13-12 Great Gray Owl Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	277	N/A
Access Roads	64	N/A
Utilities	48	N/A
Off-site Facilities	0	N/A
Total	**389**	**22,652**
Alternative 2		
Mine Site	239	N/A
Access Roads	57	N/A
Utilities	48	N/A
Off-site Facilities	0	N/A
Total	**344**	**22,652**
Alternative 3		
Mine Site	365	N/A
Access Roads	54	N/A
Utilities	49	N/A
Off-site Facilities	0	N/A
Total	**468**	**22,379**
Alternative 4		
Mine Site	281	N/A
Access Roads	13	N/A
Utilities	48	N/A
Off-site Facilities	2	N/A
Total	**344**	**17,101**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (1.0 mile for owls) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

See the boreal owl analysis (Section 4.13.2.2.2.4) for effects under Alternative 5 that also would apply to the great gray owl.

Determination

The action alternatives may directly and indirectly impact great gray owl individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Alternative 3 would have the most direct impacts to great gray owl habitat (e.g., Engelmann spruce, spruce-subalpine fir, and riparian woodlands) due to the mine site. Alternatives 2 and 4 would directly impact the least (and same amount of) habitat, and Alternative 4 would indirectly impact the least amount of habitat due to the elimination of the Burntlog Route (where much modeled habitat occurs).

4.13.2.2.2.8 Northern Goshawk

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-37 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-38** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-39** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

Northern goshawks have been documented but are expected to be uncommon and there are no known nests in the wildlife analysis area. There would be 98 acres of direct impacts to modeled habitat in the mine site area under Alternative 1. Direct take of adult birds or nests, eggs, or young due to construction or operational activities is unlikely, as they are thought to be uncommon. However, to the extent practicable, trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Timing restrictions would restrict some activities within a certain radius of active nest trees for raptor species, which would help reduce habitat impacts. For example, the Forest Service would restrict activities within a 30-acre (650-foot radius) area surrounding active nests, with some exceptions (see **Appendix D**, Mitigation Measures and Environmental Commitments). Additionally, drilling operations, roadwork, and helicopter flights would be restricted within a 1,500-foot buffer of active goshawk nests from April 1 to August 15. Although these mitigation measures would reduce impacts, there would still be a decrease in modeled habitat.

The northern goshawk could also be impacted by direct collision risks with structures at the mine site. Electric transmission line structures to serve Alternative 1 facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted).

Alternative 1 would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include foraging changes.

Alternatives 2, 3, and 4 would have similar effects on northern goshawk as Alternative 1.

Access Roads

Alternative 1 would result in 22 acres of direct impacts to modeled habitat for northern goshawk associated with the Burntlog Route (see **Table 4.13-12**). Direct take of adult birds or nests, eggs, or young due to these activities is unlikely, because most individuals are expected to avoid areas of activity and there are no known nests in the area. However, timing restrictions described for the mine site would be used to reduce potential impacts.

Additionally, increased vehicle traffic is likely to disturb or displace individuals from roadside habitats and would cause indirect impacts on northern goshawk. Noise-reduction strategies would be used to reduce indirect effects on raptor species. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. The 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt northern goshawks due to OSV noise.

Alternatives 2 and 3 would have similar direct impacts (19 acres and 18 acres, respectively), and the effects on northern goshawk would be similar to those described for Alternative 1.

Under Alternative 4, the Burntlog Route would not be constructed or used. Direct impacts on modeled habitat would total approximately 4 acres and would be associated with upgrades along the Yellow Pine Route. Additionally, there is modeled habitat located along the Yellow Pine Route that could be indirectly affected by noise and light from increased traffic levels.

Utilities

There would be 19 acres of direct impacts to modeled habitat due to construction of the new substations and new transmission line between the mine site and Johnson Creek substation, in addition to the upgrades to transmission lines and substations between Johnson Creek Road and the Warm Lake substation, and along Warm Lake Road and Johnson Creek Road. Direct take of adult birds or nests, eggs, or young due to these activities is unlikely because most individuals are expected to avoid areas of activity and they are not known to nest in the area.

The communication towers and new or upgraded transmission lines would be a potential source of mortality for northern goshawk. However, the transmission line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Upon closure and reclamation, the new transmission line between the mine site and Johnson Creek substation would be removed, which would eliminate some of these collision impacts.

Noise and light from construction of the utility corridors, substations, and communication towers could disturb or displace individuals within 1 mile of the project components. However, construction of these areas would be temporary (approximately 3 years), and it is not expected to become a barrier to long-term movement or to fragment habitat. Once the construction is complete, it is expected that northern goshawks would resume use of the area.

Alternatives 2, 3, and 4 would have similar effects on northern goshawk as Alternative 1, except that under Alternative 2 the transmission line between the Johnson Creek substation and the mine site would remain.

Off-site Facilities

Alternative 1 would not have any direct impacts on modeled habitat due to clearing and construction activities for off-site facilities. Indirect impacts would also be unlikely as modeled habitat is limited within 1 mile of the off-site facilities.

Alternatives 2 and 3 also would have no direct impacts on northern goshawk.

Under Alternative 4, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus Alternative 1. While this would result in 1 acre of direct impacts to modeled habitat, it is not expected that this change would cause effects different from Alternative 1.

Habitat Impacts

Table 4.13-13 shows the direct and indirect impacts modeled habitat acres.

Table 4.13-13 Northern Goshawk Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	98	N/A
Access Roads	22	N/A
Utilities	19	N/A
Off-site Facilities	0	N/A
Total	**139**	**15,724**
Alternative 2		
Mine Site	92	N/A
Access Roads	19	N/A
Utilities	19	N/A
Off-site Facilities	0	N/A
Total	**130**	**15,724**

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 3		
Mine Site	109	N/A
Access Roads	18	N/A
Utilities	21	N/A
Off-site Facilities	0	N/A
Total	**148**	**15,657**
Alternative 4		
Mine Site	104	N/A
Access Roads	4	N/A
Utilities	19	N/A
Off-site Facilities	1	N/A
Total	**128**	**13,133**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (1.0 mile for raptors) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

Mine Site

Overall, northern goshawks would likely continue to use the mine site as they currently do.

Access Roads

Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light impacts, or increased risk of collision for northern goshawks.

Off-site Facilities

There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Determination

The action alternatives may directly and indirectly impact northern goshawk individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Alternative 3 would have the most direct impacts to northern goshawk habitat (e.g., medium and large tree size classes in most forested habitat types), while Alternative 4 would directly and indirectly impact the least amount of habitat.

4.13.2.2.2.9 Pileated Woodpecker

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-40 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-41** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-42** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

Effects to the pileated woodpecker at the mine site under all action alternatives would be similar to the white-headed woodpecker analysis (Section 4.13.2.2.1.1), as pileated woodpeckers and modeled habitat are uncommon in the mine site area. There are some documented occurrences in the Big Creek and Chamberlain areas, and it is possible they may utilize the wildlife analysis area.

There would be no direct impacts to pileated woodpecker modeled habitat on the mine site under any of the action alternatives. Indirect impacts could include displacement due to noise or light, and mitigation measures described for the white-headed woodpecker would likely reduce those impacts.

Access Roads

Effects to the pileated woodpecker along the access roads under all action alternatives would be similar to the white-headed woodpecker analysis (Section 4.13.2.2.1.1), as pileated woodpeckers and modeled habitat are rare along the access roads.

There would be 1 acre of direct impacts to modeled habitat along the access roads for each of the action alternatives. Indirect impacts could include displacement due to noise or light, and mitigation measures described for the white-headed woodpecker would likely reduce those impacts.

Utilities

Effects to the pileated woodpecker associated with the utilities under all action alternatives would be similar to the white-headed woodpecker analysis (Section 4.13.2.2.1.1), as pileated woodpeckers and modeled habitat are rare in the utility areas.

There would be no direct impacts to pileated woodpecker modeled habitat along the utilities under any of the action alternatives. Indirect impacts could include displacement due to noise or light, and mitigation measures described for the white-headed woodpecker would likely reduce those impacts.

Off-site Facilities

Effects to the pileated woodpecker at the off-site facilities under all action alternatives would be similar to the white-headed woodpecker analysis (Section 4.13.2.2.1.1), as pileated woodpeckers and habitat are rare near the off-site facilities.

There would be no direct impacts to pileated woodpecker modeled habitat for the off-site facilities under any of the action alternatives. Indirect impacts could include displacement due to noise or light, and mitigation measures described for the white-headed woodpecker would likely reduce those impacts.

Habitat Impacts

Table 4.13-14 shows the direct and indirect impacts modeled habitat acres.

Table 4.13-14 Pileated Woodpecker Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	0	N/A
Access Roads	1	N/A
Utilities	0	N/A
Off-site Facilities	0	N/A
Total	**1**	**391**
Alternative 2		
Mine Site	0	N/A
Access Roads	1	N/A
Utilities	0	N/A
Off-site Facilities	0	N/A
Total	**1**	**391**
Alternative 3		
Mine Site	0	N/A
Access Roads	1	N/A
Utilities	0	N/A
Off-site Facilities	0	N/A
Total	**1**	**391**

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 4		
Mine Site	0	N/A
Access Roads	1	N/A
Utilities	0	N/A
Off-site Facilities	0	N/A
Total	**1**	**392**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (0.5 mile for woodpeckers) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

Mine Site

Pileated woodpeckers would likely continue to use the mine site as they currently do, which is believed to be rarely.

Access Roads

Existing roads would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light impacts, or increased risk of collision for woodpeckers.

Off-site Facilities

There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Summary of Impacts

Although modeled habitat is limited in the wildlife analysis area, individuals are present during the breeding season. The action alternatives would likely have no direct impacts on pileated woodpecker modeled habitat (e.g., large and very large tree size classes in several different forest stands) but may affect individuals. There would be similar indirect impacts across all the action alternatives.

4.13.2.2.2.10 Silver-Haired Bat

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-43 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-44** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-45** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

Silver-haired bats are documented in the wildlife analysis area and FCRNRW. There would be approximately 48 acres of direct impacts to modeled habitat at the mine site under Alternative 1 (see **Table 4.13-15**). Removal of large trees could reduce roosting habitat, while removal of open riparian habitats or small natural openings could reduce foraging habitat.

Alternative 1 would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Silver-haired bat behaviors that may change as a result of increased noise and light include changes in roosting and foraging patterns that could lead to fragmentation of habitat. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Additionally, light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on silver-haired bats would differ depending on the specific conditions at each individual Alternative 1 component location based on the density of vegetation and proximity to adjoining hillsides and valleys.

Direct and indirect impacts for bat species would likely be emission exposure and a reduction in insects due to emissions.

Insects and insectivorous wildlife including bats may be exposed to metals (e.g., mercury) and other elements from atmospheric emissions and tailings piles associated with gold and silver mining activities (Custer et al. 2009; Eagles-Smith et al. 2018; Jones and Miller 2005). Emissions of metals from mining operations and ore processing, in the form of particulate matter and dust, may be deposited directly on local soils and waterways. In addition, rainwater and snow melt may provide a pathway for these elements to leach from tailings piles or be physically transported as solid particles into adjacent waterbodies. These elements may enter the food web through plants and insects and then be consumed by insectivorous wildlife, potentially causing injury if exposure is sufficient. The Forest Service would require an adaptive management plan to address dust and emissions (see **Appendix D**, Mitigation Measures and Environmental Commitments). Although this mitigation measure would reduce impacts, there would still likely be indirect impacts to the silver-haired bat.

Alternatives 2 and 4 would have effects similar to Alternative 1.

Alternative 3 would have approximately 74 acres of direct impacts to modeled habitat at the mine site, primarily due to the TSF and DRSF. Indirect impacts would be likely within 1 mile of the mine site components due to noise, light, and emissions, similar to those described for Alternative 1.

Access Roads

There would be approximately 46 acres of direct impacts to modeled habitat along the access roads under Alternative 1, due to construction of the Burntlog Route (see **Table 4.13-15**). Removal of large trees in this area could reduce roosting habitat. The new segment of the Burntlog Route would be decommissioned and reclaimed during mine closure, which would reduce impacts to silver-haired bats and potentially create foraging habitat in the long-term (e.g., 20 years).

The operational traffic associated with the workforce, supplies, haulage, and other miscellaneous traffic, including road maintenance on the access roads, could expose individual bats to indirect impacts due to noise and light. Bat behaviors that may change as a result of increased noise and light include changes in roosting and foraging patterns that could lead to fragmentation of habitat.

Alternatives 2 and 3 would have effects similar to Alternative 1.

Under Alternative 4, the Burntlog Route would not be built. While more of the modeled silver-haired bat habitat is located in proximity to the Yellow Pine Route, direct impacts for Alternative 4 would total approximately 33 acres. Due to the modeled habitat along the Yellow Pine Route, there would be indirect impacts due to increased traffic levels (e.g., noise and light) and emissions.

Utilities

There would be approximately 137 acres of direct impacts to modeled habitat along the utilities under Alternative 1, due to clearing and construction activities for utility corridors, substations, and communication towers (see **Table 4.13-15**). Removal of large trees during construction could reduce roosting habitat. The Forest Service would require that known roost sites and hibernacula be avoided during the roosting period whenever possible (see **Appendix D**, Mitigation Measures and Environmental Commitments). During operations, the utility ROWs would be maintained in a low vegetation growth stage, which could provide summer foraging habitat for silver-haired bats. Upon closure and reclamation, the new transmission line between the mine site and Johnson Creek substation would be removed and reclaimed, which would reduce habitat impacts.

Noise and light disturbance from construction of the utility corridors, substations, and communication towers may temporarily (up to 3 years) disturb or displace individual bats. Once the construction is complete, it is expected that silver-haired bats would resume use of the area.

Alternative 2 would directly impact 146 acres of modeled habitat, primarily from the new transmission line between the Cascade switching station and Warm Lake Road. The effects would be similar to those described for Alternative 1.

Alternatives 3 and 4 would have similar effects on silver-haired bats as Alternative 1, except that under Alternative 2 the transmission line between the Johnson Creek substation and the mine site would remain.

Off-site Facilities

There would be no direct impacts to modeled habitat for silver-haired bat at any of the off-site facilities under all action alternatives. Indirect impacts would be unlikely as well, due to modeled habitat being limited around these facilities.

Habitat Impacts

Table 4.13-15 shows the direct and indirect impacts modeled habitat acres.

Table 4.13-15 Silver-haired Bat Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	48	N/A
Access Roads	46	N/A
Utilities	137	N/A
Off-site Facilities	0	N/A
Total	**231**	**12,348**
Alternative 2		
Mine Site	44	N/A
Access Roads	41	N/A
Utilities	146	N/A
Off-site Facilities	0	N/A
Total	**231**	**12,348**
Alternative 3		
Mine Site	74	N/A
Access Roads	45	N/A
Utilities	137	N/A
Off-site Facilities	0	N/A
Total	**256**	**12,306**

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 4		
Mine Site	49	N/A
Access Roads	33	N/A
Utilities	136	N/A
Off-site Facilities	0	N/A
Total	**218**	**11,619**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (1.0 mile from mine site and 0.5 mile from other components for bats) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

Mine Site

Because there is suitable habitat nearby for silver-haired bat and they are assumed to occur in the mine site area (especially the northern portion), individuals would likely continue to use the mine site as they currently do.

Access Roads

Existing roads (e.g., Johnson Creek Road, Stibnite Road, and Warm Lake Road) would continue to affect silver-haired bats through habitat fragmentation and disturbance from noise or light impacts due to traffic.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light impacts, or increased risk of collision for bats. Individual bats would likely continue to use existing utility corridors for foraging.

Off-site Facilities

There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Summary of Impacts

The action alternatives may directly and indirectly impact silver-haired bat individuals and habitat. Alternative 3 would have the most direct impacts on habitat (e.g., forest stands adjacent to streams and riparian areas, and forested wetlands) and Alternative 4 would have the fewest direct and indirect impacts.

4.13.2.2.3 HABITAT FAMILY 3 – FOREST MOSAIC

4.13.2.2.3.1 Mountain Quail

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-46 shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-47** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figure 4.13-48** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

Mountain quail are believed to be rare in the wildlife analysis area, although modeled habitat is abundant and would be impacted. Alternative 1 could directly disturb 104 acres of modeled habitat in the mine site area. Mountain quail are ground nesters in shrub-dominated riparian areas and could be at risk of direct nest damage associated with the vegetation clearing and ground disturbance. However, the likelihood of mountain quail nesting in the wildlife analysis area is low, because suitable shrub-dominated riparian habitat is sparse in the Alternative 1 disturbance footprint, and the nearest observation of the species is approximately 8 miles west of the mine site (Strobilus Environmental 2017).

Implementation of Alternative 1 would require removal of vegetation from several habitat types during the life of the mine, some of which would be reclaimed during closure and reclamation. Alternative 1 would permanently impact approximately 116 acres of wetlands in the mine site, which could directly reduce habitat for mountain quail depending on specific riparian areas. Although riparian habitats would be directly disturbed in the short term, portions of the area would be reclaimed in the long term, including 51,350 linear feet of reclaimed stream channel and riparian habitat (Midas Gold 2016). The OHV connector trail would directly impact modeled habitat and cause further indirect impacts due to vehicle noise.

Alternative 1 would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Mountain quail behaviors that may change as a result of increased noise and light include modifications in nesting and foraging patterns that could lead to fragmentation of habitat. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Indirect impacts during the brood-rearing season due to loss of insects from emissions and fugitive dust is discussed in Section 4.13.2.2.2.3 (Dusky Grouse).

Alternative 2 would have similar effects on mountain quail as Alternative 1.

Alternative 3 would directly impact 177 acres of modeled habitat at the mine site, primarily due to the TSF and DRSF changes, but the effects would be similar to those described for Alternative 1. Under Alternative 4, the 3 miles of new road for the OHV connector trail from Horse Heaven/Powerline route to Meadow Creek Lookout Road (FR 51290) would not be constructed, which would reduce direct and indirect impacts to mountain quail modeled habitat.

Access Roads

Alternative 1 could directly disturb 99 acres of modeled habitat along the access roads. Alternative 1 would impact up to 18 acres of wetlands along access roads, which could directly reduce habitat for mountain quail depending on riparian areas. The operational traffic associated with the workforce, supplies, haulage, and other miscellaneous traffic, including road maintenance on the access roads, could expose individual mountain quail to vehicle-wildlife collisions. The new segment of the Burntlog Route would be decommissioned and reclaimed during mine closure, but the effects would be considered long-term (e.g., 20 years).

Noise and light disturbance from road construction, road maintenance, and routine vehicle traffic could potentially disturb or displace individual quail. Mountain quail behaviors that may change as a result of increased noise and light include modifications in nesting and foraging patterns that could lead to fragmentation of habitat. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt mountain quail due to OSV noise. See Section 4.13.2.2.2.3 (Dusky Grouse) for indirect impacts related to fugitive dust along access roads that could also impact mountain quail.

Under Alternative 2, the on-site lime production would reduce traffic to the mine site, and the AADT level would be 50 vpd, which could reduce the risk of wildlife-vehicle collisions. Other effects would be the same as Alternative 1.

Although the Burntlog Route would include an additional 5 miles of new road that would impact more mountain quail habitat, Alternative 3 would have similar effects on mountain quail as Alternative 1.

Under Alternative 4, the Burntlog Route would not be built. There would be 81 acres of direct impacts to modeled habitat, which would be associated with upgrades to the existing Yellow Pine Route roadways. Indirect effects due to traffic noise and light would be expected within 1 mile of the Yellow Pine Route.

Utilities

Alternative 1 could directly disturb 228 acres of modeled habitat due to clearing and construction activities for utility corridors, substations, and communication towers. Utilities under Alternative 1 would impact up to 46 acres of wetlands. Direct impacts to forested wetlands would likely be permanent as ROW management practices generally do not allow the establishment of woody vegetation. Utility corridors would be maintained in a low vegetation stage during operations, which could disturb modeled habitat as well.

Noise and light disturbance from construction of the utility corridors, substations, and communication towers may temporarily disturb or displace individuals. These indirect impacts would be considered temporary during construction (up to 3 years). Once the construction is complete, it is expected that mountain quail would resume use of the area.

Alternatives 2, 3, and 4 would have similar effects on mountain quail as Alternative 1.

Off-site Facilities

Alternative 1 would not directly disturb any modeled habitat for the off-site facilities, but up to 1 acre of wetlands would be impacted. However, it is expected that most individuals would avoid these areas, and any habitat effects would be minor.

Indirect impacts would be unlikely as modeled habitat is limited near these facilities. However, noise-reduction strategies would be used to reduce any potential indirect impacts on mountain quail. Buildings would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternative 2 would directly impact up to 1 acre of modeled habitat at the Burntlog Maintenance Facility, but indirect impacts would be limited. Alternatives 3 and 4 would have no direct impacts on mountain quail.

Habitat Impacts

Table 4.13-16 shows the direct and indirect impacts modeled habitat acres.

Table 4.13-16 Mountain Quail Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	104	N/A
Access Roads	99	N/A
Utilities	228	N/A
Off-site Facilities	0	N/A
Total	**431**	**14,065**
Alternative 2		
Mine Site	96	N/A
Access Roads	93	N/A
Utilities	237	N/A
Off-site Facilities	1	N/A
Total	**427**	**14,065**

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 3		
Mine Site	177	N/A
Access Roads	103	N/A
Utilities	226	N/A
Off-site Facilities	0	N/A
Total	**506**	**14,015**
Alternative 4		
Mine Site	106	N/A
Access Roads	81	N/A
Utilities	225	N/A
Off-site Facilities	0	N/A
Total	**412**	**12,588**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (0.5 mile for mountain quail) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

Mine Site

Because there is potentially suitable habitat for mountain quail, any individuals would likely continue to use the mine site as they currently do in limited areas.

Access Roads

Existing roads would continue to affect wildlife through habitat fragmentation, vehicle-wildlife collisions, and noise impacts.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts.

Off-site Facilities

There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Determination

The action alternatives may directly and indirectly impact mountain quail individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Alternative 3 would have the most direct impacts to mountain quail habitat (e.g., Douglas-fir, ponderosa pine, Western larch, and riparian habitats), particularly due to the mine site, while Alternative 4 would directly and indirectly impact the least amount of habitat.

4.13.2.2.4 HABITAT FAMILY 5 – FOREST AND RANGE MOSAIC

4.13.2.2.4.1 Gray Wolf

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Mine Site

Direct impacts on gray wolves would include habitat loss in the wildlife analysis area. Additional indirect impacts on gray wolves would include displacement due to noise and light or increased human activity. These same effects also could reduce prey availability or redistribute their populations in the wildlife analysis area, causing wolves to travel further for foraging opportunities. This could expose them to increased competition with other wolf packs as they seek new territory and would be a potential indirect effect.

Alternatives 2, 3, and 4 would have similar effects on gray wolves as Alternative 1.

Access Roads

Several wolf packs occur in the FCRNRW area, which is near the Burntlog Route. Direct impacts on gray wolves would include habitat loss and an increased potential of vehicle-wildlife collisions along the Burntlog Route. Vehicle traffic associated with the access roads could increase the risk of wildlife-vehicle collisions. All employees and contractors would be trained to reduce wildlife collisions. Midas Gold would develop a wildlife mortality-reporting procedure and form to be used for reporting accidental Alternative 1-related wildlife mortality. Any adverse wildlife encounters would be reported to appropriate state and federal wildlife managers, and in accordance with state and federal laws. Restricting public access on the Burntlog Route would likely reduce impacts due to mortality.

Indirect impacts would include displacement due to noise and light or increased human activity. The new road systems and groomed OSV trails could serve as hunting corridors for wolves, changing their movement patterns and indirectly increasing predation of big game species, including elk (Forest Service 2017). Although additional roadways could expose gray wolves to hunting pressure from humans in the wildlife analysis area, hunting or discharge of firearms during construction and operations in the SGP area would be prohibited. Signs would be posted throughout the mine site and off-site facilities and training would be provided to notify employees that hunting is prohibited, and employees would be prohibited from carrying firearms on any SGP site. Although these mitigation measures would reduce impacts, there would still be a direct decrease in habitat, and increase in risk of disturbance and injury or mortality. These same effects also could reduce prey availability in the SGP area, causing wolves to range further. This indirect effect also could expose them to increased competition with other wolf packs as they seek new territory.

Under Alternative 2, the on-site lime production would reduce traffic to the mine site, and the AADT level would be 50 vpd, which could reduce the risk of wildlife-vehicle collisions. Other effects would be the same as Alternative 1.

Alternative 3 would include 19.6 miles of new road that would disturb additional habitat, but it would have similar effects on gray wolves as Alternative 1.

Under Alternative 4, the Burntlog Route would not be built, and the Yellow Pine Route would be used instead. This would shift disturbance away from the FCRNRW area, where gray wolf packs are known to occur.

Utilities

Direct impacts on gray wolves would include loss or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes. Construction impacts would likely displace wolves further distances, but would be temporary (e.g., up to 3 years). Vegetation would be cleared only in those areas necessary for Alternative 1 activities to preserve natural habitat to the greatest extent practicable.

Alternatives 2, 3, and 4 would have similar effects on gray wolves as Alternative 1.

Off-site Facilities

Direct impacts on gray wolves would include habitat loss in the wildlife analysis area and could include displacement due to noise and light or increased human activity. These same effects also could reduce prey availability in the SGP area, which would indirectly affect the gray wolf.

Alternatives 2, 3, and 4 would have similar effects on gray wolves as Alternative 1.

Habitat Impacts

The focal species selected for the Wildlife Conservation Strategy (WCS) for the BNF and PNF represent the appropriate habitat types and are surrogates for many other species, including gray wolf. Thus, there are no specific habitat models available for this species.

Alternative 5

Mine Site

Gray wolves would likely continue to use the mine site area as they currently do.

Access Roads

Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts.

Off-site Facilities

There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Determination

The action alternatives may directly and indirectly impact gray wolf individuals and habitat (i.e., general habitat types), but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

4.13.2.2.4.2 Peregrine Falcon

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Mine Site

Direct impacts on peregrine falcon would include potential habitat loss in the wildlife analysis area. Indirect impacts would include displacement due to noise and light and increased human activity. These same effects also could reduce avian prey availability or redistribute their populations in the wildlife analysis area, which could indirectly impact falcons.

Alternatives 2, 3, and 4 would have similar effects on peregrine falcons as Alternative 1.

Access Roads

Direct impacts on peregrine falcon would include habitat loss within and adjacent to breeding territories that are known to occur in the FCRNRW area. Indirect impacts would include displacement due to noise and light from increased human activity and traffic.

Alternatives 2 and 3 would have similar effects on peregrine falcons as Alternative 1.

Under Alternative 4, the Burntlog Route would not be built. There are known breeding territories within the FCRNRW area that would not be impacted under Alternative 4. However, traffic would be higher along the Yellow Pine Route (Johnson Creek and the EFSFSR), where nesting also has been documented, and this would be an indirect impact.

Utilities

Direct impacts on peregrine falcons would include loss or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes. Construction impacts would likely displace falcons further distances, but would be temporary (e.g., 3 years). Vegetation would be cleared only in those areas necessary for Alternative 1 activities to preserve natural habitat to the greatest extent practicable.

Alternatives 2, 3, and 4 would have similar effects on peregrine falcons as Alternative 1.

Off-site Facilities

Direct impacts on peregrine falcons would include habitat loss in the wildlife analysis area and could include displacement due to noise and light or increased human activity.

Alternatives 2, 3, and 4 would have similar effects on peregrine falcons as Alternative 1.

Habitat Impacts

The focal species selected for the WCS for the BNF and PNF represent the appropriate habitat types and are surrogates for many other species, including peregrine falcon. Thus, there are no specific habitat models available for this species.

Alternative 5

Mine Site

Peregrine falcons would likely continue to use the mine site area as they currently do.

Access Roads

Existing roads, especially Johnson Creek Road, would continue to affect falcons through habitat fragmentation and disturbance due to noise and light impacts.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts.

Off-site Facilities

There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Determination

The action alternatives may directly and indirectly impact peregrine falcon individuals and habitat (e.g., forest and non-forest vegetation types within 10 miles of suitable nesting cliffs) but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

4.13.2.2.4.3 Rocky Mountain Bighorn Sheep

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figures 4.13-49 and **52** shows the components of Alternatives 1 and 2 within the wildlife analysis area compared to modeled habitat. **Figures 4.13-50** and **53** shows the components of Alternative 3 within the wildlife analysis area compared to modeled habitat. **Figures 4.13-51** and **54** shows the components of Alternative 4 within the wildlife analysis area compared to modeled habitat.

Mine Site

There is more Rocky Mountain bighorn sheep summer habitat in the vicinity of the mine site than winter habitat. As such, there would be approximately 560 acres of direct impacts to summer modeled habitat and 128 acres of winter modeled habitat under Alternative 1 at the mine site. This direct loss of habitat would displace any individuals that occur in the wildlife analysis area, which appears to be limited. The mine site and associated infrastructure may displace sheep around the perimeter of the disturbances. Rocky Mountain bighorn sheep are very mobile and able to avoid localized direct threat of injury or mortality. Although additional roadways near the mine site could expose individuals to direct vehicle collisions and mortality. Personnel and contractors traveling in vehicles would be required to observe posted speed limits or state secondary road speed limits, and to drive at speeds appropriate to reduce the possibility of vehicle-wildlife accidents.

Light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on sheep would differ depending on the specific conditions at each Alternative 1 component location, based on the density of vegetation and proximity to adjoining hillsides and valleys. As part of SGP standard operating procedures (SOPs), buildings, equipment, and drill rigs would have limited external lighting and use noise-reduction strategies when feasible (see **Appendix D**, Mitigation Measures and Environmental Commitments). The result would generally be a reduction in the area of habitat disturbed at most sites.

There would be no hunting or discharge of firearms during construction and operations in the mine site area. Signs would be posted at the SGP area and training would be provided to notify employees that hunting is prohibited, and employees would be prohibited from carrying firearms on the SGP site. However, illegal harvest of big game species is a potential risk and would be an indirect impact.

Alternatives 2, 3, and 4 would generally have the same effects on summer and winter modeled habitat as Alternative 1.

Access Roads

Because bighorn sheep are known to occur in the FCRNRW area, they could potentially be affected by loss of potential habitat along the access roads, and direct impacts would include approximately 74 acres of modeled summer habitat and 21 acres of modeled winter habitat. The new 15-mile-long section of Burntlog Route would be constructed and plowed year-round and have an AADT level of 68 vehicles during operations, which would likely directly disrupt or alter Rocky Mountain bighorn sheep movements. The intensity of this impact could range from minor injury to mortality. The duration ranges from temporary road construction (e.g., 3 years) to short-term (during 12 to 15 years of mining and ore processing operations). It is not expected that the increased risk of injury or mortality would become permanent, because the new segment of the Burntlog Route would be reclaimed upon closure, and traffic levels on the existing roads would return to current levels. The geographic extent of these impacts would be limited to the vicinity of the access road. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross bighorn sheep winter habitat, which may disrupt them due to OSV noise.

Although additional roadways could expose Rocky Mountain bighorn sheep to increased hunting pressure from humans in the wildlife analysis area, hunting or discharge of firearms during construction and operations in the SGP area would be prohibited. Signs would be posted throughout the SGP area and training would be provided to notify employees that hunting is prohibited, and employees would be prohibited from carrying firearms on the SGP site. Roadways also are used as corridors by predators such as wolves or mountain lions, which could indirectly increase predation of sheep.

The reroute of the Burntlog Route under Alternative 2 could disrupt or alter Rocky Mountain bighorn sheep movements as it would be in closer proximity to modeled habitat and the FCRNRW area, but effects would be generally the same as Alternative 1. Additionally, the on-site lime production would reduce traffic to the mine site, and have an AADT level of 50 vpd, which would slightly reduce the risk of wildlife-vehicle collisions.

Although Alternative 3 would include 19.6 miles of new roadway due to the Burntlog Route adjacent to bighorn sheep habitat, Alternative 3 would have similar effects on Rocky Mountain bighorn sheep as Alternative 1.

Under Alternative 4, the Burntlog Route would not be built. However, there is a comparable amount of modeled suitable habitat adjacent to the Yellow Pine Route as well. There would be 48 acres of direct impacts to modeled summer habitat and 23 acres of direct impacts to modeled winter habitat under Alternative 4.

Utilities

Direct impacts on Rocky Mountain bighorn sheep could include loss or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes. There would be 68 acres of direct impacts to modeled summer habitat and 22 acres of direct impacts to modeled winter habitat under Alternative 1 for the utility corridors.

Construction impacts would likely displace wildlife further distances, but this would be temporary (e.g., 3 years). Vegetation would be cleared only in those areas necessary for Alternative 1 activities to preserve natural habitat to the greatest extent practicable.

Noise-reduction strategies would be used to reduce indirect effects on sheep. Equipment would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2, 3, and 4 would have similar effects on Rocky Mountain bighorn sheep and modeled habitat as Alternative 1.

Off-site Facilities

There would be no direct impacts to modeled summer or winter habitat due to construction and operation of the off-site facilities under any of the action alternatives. Indirect impacts would also be unlikely, as modeled habitat is limited within 1 mile of these facilities.

Habitat Impacts

Table 4.13-17 shows the direct and indirect impacts modeled habitat acres.

Table 4.13-17 Rocky Mountain Bighorn Sheep Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres) - Summer	Indirectly Impacted Modeled Habitat (acres) - Summer	Directly Impacted Modeled Habitat (acres) - Winter	Indirectly Impacted Modeled Habitat (acres) - Winter
Alternative 1				
Mine Site	560	N/A	128	N/A
Access Roads	74	N/A	21	N/A
Utilities	68	N/A	22	N/A
Off-site Facilities	0	N/A	0	N/A
Total	**702**	**6,565**	**171**	**1,869**
Alternative 2				
Mine Site	511	N/A	128	N/A
Access Roads	79	N/A	21	N/A
Utilities	68	N/A	22	N/A
Off-site Facilities	0	N/A	0	N/A
Total	**658**	**6,565**	**171**	**1,869**
Alternative 3				
Mine Site	540	N/A	108	N/A
Access Roads	72	N/A	20	N/A
Utilities	62	N/A	24	N/A
Off-site Facilities	0	N/A	0	N/A
Total	**674**	**6,394**	**152**	**1,867**

Project Component	Directly Impacted Modeled Habitat (acres) - Summer	Indirectly Impacted Modeled Habitat (acres) - Summer	Directly Impacted Modeled Habitat (acres) - Winter	Indirectly Impacted Modeled Habitat (acres) - Winter
Alternative 4				
Mine Site	563	N/A	128	N/A
Access Roads	48	N/A	23	N/A
Utilities	67	N/A	22	N/A
Off-site Facilities	0	N/A	0	N/A
Total	**678**	**5,647**	**173**	**1,819**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (0.5 mile for bighorn sheep) from the action alternatives and occur outside of the project components.

0 acres indicates that project components would not cross or overlap modeled habitat.

Alternative 5

Mine Site

Rocky Mountain bighorn sheep may use the mine site area as they have in limited areas in the past.

Access Roads

Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts.

Off-site Facilities

There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Determination

The action alternatives may directly and indirectly impact Rocky Mountain bighorn sheep individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Across all action alternatives, more summer habitat (e.g., most forest types and tree size classes within 2 miles of a steep rock, cliff, or talus slope) would be directly and indirectly impacted than winter habitat (e.g., sagebrush-dominated cover types within 2 miles of a steep rock, cliff, or talus slope). For summer habitat types, Alternative 1 would directly impact the most habitat, Alternative 2 would directly impact the least habitat, and Alternative 4 would indirectly impact the least habitat (due to the Burntlog Route not being constructed). For winter habitat, Alternative 3 would have the fewest direct impacts, while the other action alternatives would have very similar direct and indirect impacts.

4.13.2.2.5 HABITAT FAMILY 7 – FORESTS, WOODLANDS, AND SAGEBRUSH

4.13.2.2.5.1 Townsend’s Big-Eared Bat

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Mine Site

Direct disturbance to the Townsend’s big-eared bat would be possible through habitat loss at the mine site. Although some historic mine workings that may serve as winter hibernacula habitat are present in the wildlife analysis area, there are no known occurrences of the Townsend’s big-eared bat. After closure and reclamation, the pit walls of the Hangar Flats and

West End pits would be exposed for a long time period, which could potentially create roost sites for them. The Forest Service would require that any potential drill pad sites adjacent to any open mine workings or natural caves should be observed for the presence of bats. If necessary, to maintain key features of habitat or to avoid disruption, activities would be modified in coordination with the Forest Service (see **Appendix D**, Mitigation Measures and Environmental Commitments).

Alternative 1 also would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Bat behaviors that may change as a result of increased noise or light include changes in roosting or foraging patterns that could lead to fragmentation of habitat. The potential effects on wildlife habitat are dependent on geographical conditions, because sound propagation is reduced by distance, vegetation, and intervening topography. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Refer to Section 4.13.2.2.2.10 (Silver-haired bat), which discusses additional indirect impacts that could likely also impact the Townsend’s big-eared bat, including emissions exposure and loss of insects due to air emissions and fugitive dust.

Alternatives 2, 3, and 4 would have similar effects on Townsend’s big-eared bat as Alternative 1.

Access Roads

Disturbance to the Townsend’s big-eared bat would be possible due to habitat loss along the access roads, but unlikely because of their limited occurrence in the area. Because they can occupy forested habitats within 15 miles of cave/rock crevices, they could potentially be displaced by the removal of summer roosting habitat.

Disturbance to the Townsend’s big-eared bat due to road construction and vehicle traffic along the Burntlog Route also would be possible. Potential effects could include direct disturbance and displacement, although signal masking due to traffic noise is unlikely, because traffic noise does not overlap much with bat echolocation calls (Caltrans 2016). The noise-reduction strategies mentioned above employed along access roads would likely be sufficient to reduce noise impacts on the Townsend’s big-eared bat. Refer to Section 4.13.2.2.2.10 (Silver-haired bat), which contains additional indirect impacts that would likely also impact the Townsend’s big-eared bat.

Alternatives 2 and 3 would have similar effects on Townsend’s big-eared bat as Alternative 1.

Under Alternative 4, the Burntlog Route would not be built and habitat along that corridor would not be impacted. However, bats along the Yellow Pine Route may be impacted in a similar manner.

Utilities

Direct impacts on the Townsend's big-eared bat could include loss or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes. Construction impacts would likely displace wildlife further distances, but would be temporary (e.g., 3 years). Vegetation would be cleared only in those areas necessary for Alternative 1 activities to preserve natural habitat to the greatest extent practicable.

Noise and light reduction strategies would be used to reduce indirect effects on the Townsend's big-eared bat. Equipment would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Lighting impacts could alter the Townsend's big-eared bat's natural activities, but construction of these areas would be temporary (e.g., 3 years). Refer to Section 4.13.2.2.2.10 (Silver-haired bat), which contains additional indirect impacts that would likely also impact the Townsend's big-eared bat.

Alternatives 2, 3, and 4 would have similar effects on Townsend's big-eared bat as Alternative 1.

Off-site Facilities

Direct impacts on the Townsend's big-eared bat are unlikely near the off-site facilities, because no construction or infrastructure would impact the habitats used by the Townsend's big-eared bat in the wildlife analysis area. Noise and light reduction strategies would be used to reduce indirect effects on the Townsend's big-eared bat within 1 mile of these facilities. Equipment would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Lighting impacts could alter the Townsend's big-eared bat's natural activities, but construction of these areas would be temporary (e.g., 3 years). Refer to Section 4.13.2.2.2.10 (Silver-haired bat), which contains additional indirect impacts that would likely also impact the Townsend's big-eared bat.

Alternatives 2, 3, and 4 would have similar effects on Townsend's big-eared bat as Alternative 1.

Habitat Impacts

The focal species selected for the WCS for the BNF and PNF represent the appropriate habitat types and are surrogates for many other species, including Townsend's big-eared bat. Thus, there are no specific habitat models available for this species.

Alternative 5

Mine Site

Townsend's big-eared bats have not been observed, but are assumed to occur in the mine site, and individuals would likely use the mine site much as they currently do.

Access Roads

Existing roads also would continue to affect wildlife through habitat fragmentation and noise and light impacts.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light impacts, or increased risk of collision for the Townsend's big-eared bat.

Off-site Facilities

There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Determination

The action alternatives may directly and indirectly impact Townsend's big-eared bat individuals and habitat (e.g., ponderosa pine, Douglas fir, and grand fir stands), but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

4.13.2.2.6 HABITAT FAMILY 13 – RIVERINE RIPARIAN AND WETLAND

4.13.2.2.6.1 Bald Eagle

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Mine Site

Alternative 1 could directly disturb bald eagles in the analysis area through habitat loss, disturbance from increased human activity, and helicopter flights. Direct take of adult birds due to construction or operational activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. Trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although these mitigation measures would reduce impacts, there would still be a decrease in habitat.

Alternative 1 would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting or foraging changes. A likely indirect effect is that there would be a reduction in prey species (i.e., fish) within the mine site.

The bald eagle also could be impacted by direct collision risks with structures at the mine site. Transmission line structures to serve Alternative 1 facilities and the new 138-kV transmission line in the mine site would be a potential source of mortality for raptors (APLIC 2012). However, the utility line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species.

Alternatives 2, 3, and 4 would have similar effects on bald eagle as Alternative 1.

Access Roads

Alternative 1 could directly disturb bald eagles in the wildlife analysis area through habitat loss due to tree clearing, road construction, and increased human activity along access roads. Direct take of adult birds due to these activities is unlikely, because most individuals are expected to avoid areas of activity. However, there are known eagle nests along Johnson Creek Road and Warm Lake, and it is possible that eagles would be displaced from these territories due to the increased traffic.

Bald eagles are opportunistic scavengers of carrion. Roadkill from Alternative 1 traffic could attract them to roadsides where they also would be exposed to vehicle-wildlife collisions. The operational traffic associated with the workforce, supplies, haulage, and other miscellaneous traffic, including road maintenance on the access roads, is expected to produce an annual average daily traffic level of 68 vehicles. Midas Gold would establish appropriate speed limits (i.e., generally 30 miles per hour or less) for the Burntlog Route, site haul roads, and light vehicle access roads on Alternative 1 site to reduce the possibility of vehicle-wildlife collisions. All staff and contractors would be trained to observe posted speed limits and reduce wildlife collisions. However, wildlife-vehicle collisions are still a possibility. Any adverse wildlife encounters would be reported to appropriate state and federal wildlife managers. Restricting public access on the Burntlog Route and removing roadkill from roadways would likely reduce impacts due to mortality.

Noise-reduction strategies would be used to reduce indirect effects on bald eagles. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Although timing restrictions would restrict some activities within a certain radius of active nest trees for raptor species, which would help reduce habitat impacts, some displacement and nest failure could occur. Cutting of trees for Alternative 1 activities would avoid avian tree nests, where feasible, and a Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although these mitigation measures would reduce direct impacts, there would still be a decrease in habitat.

Alternatives 2 and 3 would have similar effects on bald eagle as Alternative 1.

Under Alternative 4, the Burntlog Route would not be constructed and thus the area associated with the Burntlog Route would not be impacted. However, since there are known nest sites along the Yellow Pine Route, the increased traffic under Alternative 4 may displace eagles from these territories.

Utilities

Alternative 1 could directly disturb bald eagles in the analysis area through habitat loss due to clearing and construction activities for utility corridors, substations, and communication towers. Direct take of adult birds due to these activities is unlikely because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young would be disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. To the extent practicable, trees found to contain nests would not be disturbed or cut. No trees with active nests would be cut.

The communication towers and new 138-kV transmission line would be a potential source of mortality for bald eagles (APLIC 2012). The utility line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Electric transmission line structures to serve Alternative 1 facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted). However, the long-term presence of structures and communication towers would pose a risk of collision and direct mortality.

Noise and light from construction of the utility corridors, substations, and communication towers is likely to disturb or displace individuals. However, construction of these areas would be temporary (e.g., 3 years), and is not expected to fragment habitat. Once the construction is complete, it is expected that bald eagles would resume use of the area. The noise-reduction strategies employed along utility corridors and near communication towers would reduce noise impacts on individual bald eagles.

Alternatives 2, 3, and 4 would have similar effects on bald eagle as Alternative 1.

Off-site Facilities

Alternative 1 is unlikely to directly disturb bald eagles in the analysis area through habitat loss due to clearing and construction activities for off-site facilities.

Alternative 1 could disturb individual bald eagles in the wildlife analysis area through noise and light due to construction of the off-site facilities. Noise-reduction strategies would be used to reduce indirect effects on bald eagles. Lighting best management practices (e.g., downturned/shielded lights, reduced number used, directional lighting, etc.) would be used to reduce indirect effects on sensitive wildlife species. Buildings would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2, 3, and 4 would have similar effects on bald eagle as Alternative 1.

Habitat Impacts

The focal species selected for the WCS for the BNF and PNF represent the appropriate habitat types and are surrogates for many other species, including bald eagle. Thus, there are no specific habitat models available for this species.

Alternative 5

Mine Site

Because there is potentially suitable habitat for bald eagles and they are assumed to occur in the mine site, individuals would likely continue to use the mine site as they currently do in limited areas.

Access Roads

Existing roads also would continue to affect wildlife through habitat fragmentation, particularly along Johnson Creek Road and near Warm Lake where there are known nest sites.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light impacts, or increased risk of collision for bald eagles.

Off-site Facilities

There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Determination

The action alternatives may directly and indirectly impact bald eagle individuals and habitat (e.g., mature forest types within 1.25 miles of major waterbodies) but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

4.13.2.2.6.2 Columbia Spotted Frog

Direct (Habitat) and Indirect Effects from Alternatives 1, 2, 3, and 4

Figure 4.13-55 shows the components of Alternatives 1 and 2 within the analysis area compared to the riparian analysis area. **Figure 4.13-56** shows the components of Alternative 3 within the wildlife analysis area compared to the riparian analysis area. **Figure 4.13-57** shows the components of Alternative 4 within the wildlife analysis area compared to the riparian analysis area.

Mine Site

Amphibians are considered reliable indicators of environmental quality (Boyer and Grue 1995). Water quality criteria for frogs and other amphibians do not currently exist. Rather, the following discussion summarizes impacts on fish resources from chemical contaminants associated with SGP (see Section 4.12.2.3.3.1, Changes to WCIs at the Mine Site), as fish have historically been used as surrogates for amphibians in evaluating chemical impacts in aquatic environments (Glaberman et al. 2019).

Despite analysis area improvements to water quality as a result of the removal and reclamation of legacy mine wastes, exceedances of the most stringent water quality standards (including both human health and aquatic life) for water column antimony, arsenic, copper, and mercury are anticipated to extend indefinitely throughout SGP post-closure. In considering only the aquatic life criteria, which are more relevant for the protection of fish species, impacts due to antimony and arsenic are not anticipated. For copper and mercury, impacts may be minimal but substantial uncertainties exist. For copper, the Biotic Ligand Model-based criteria are preliminary and do not encompass the range of monitoring nodes and the range of variability required for Biotic Ligand Model implementation (Brown and Caldwell 2020a). For mercury, while the predicted concentrations do not exceed the aquatic life criterion based on water column, it is uncertain whether incremental change in water column concentrations beyond baseline would cause fish tissue concentrations to exceed the tissue-based criterion.

A Water Quality Management Plan was developed and presented in 2020 (Brown and Caldwell 2020b). Section 4.9.2.2.2, Surface Water Quality provides more details regarding changes to water quality; Section 4.12.2.4.9 Alternative 2 Water Quality Management Plan provides a summary of effects on fish. Section 4.12.2.3.3.1, Changes to WCIs Analyzed in Detail at the Mine Site, Chemical Contaminants, provides an analysis of changes and the impacts on fish resources under Alternative 1.

Alternative 1 could directly disturb Columbia spotted frog in the riparian analysis area through permanent impacts to wetlands in the mine site area. Up to 726 acres of direct impacts to this habitat would occur in the mine site (see **Table 4.13-18**). Columbia spotted frogs have been observed in the riparian analysis area near the operational areas and open pits along the EFSFSR, and their presence is also likely based on habitat (i.e., streams and wetlands). Disturbance of water sources would occur in areas occupied by spotted frogs, placing them at risk of direct mortality or displacement. The presence of traffic in the mine site could expose them to direct mortality from vehicles as well. The OHV connector trail would impact forested wetlands and riparian areas, which would be a direct impact to habitat for Columbia spotted frog, while noise from vehicles using this trail would be an indirect impact for frogs.

The Forest Service would require that potential water sources be surveyed for Columbia spotted frog egg masses and other amphibians after ice melt, and Alternative 1 would avoid disturbing any water sources with identified egg masses or other species, with some exceptions (see **Appendix D**, Mitigation Measures and Environmental Commitments). Construction of a natural stream channel for the EFSFSR and 51,350 linear feet of reclaimed stream channel and riparian habitat (Midas Gold 2016) on closure could reclaim some riparian habitat for Columbia spotted frogs in the future, although this would not represent suitable breeding habitat (i.e., wetlands and ponds).

Alternative 1 would cause an increase in noise and light in the riparian analysis area, mostly in the vicinity of the mine site. Columbia spotted frogs could be impacted by an interference in communication during breeding activities. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Additionally, light and noise impacts could be reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on wildlife would differ depending on the specific conditions at each individual Alternative 1 component location based on the density of vegetation and proximity to adjoining hillsides and valleys.

Another indirect effect for Columbia spotted frog could occur in wetlands affected by fugitive dust and emissions.

Amphibians and insects may be exposed to metals (e.g., mercury) and other elements from atmospheric emissions and tailings piles associated with gold and silver mining activities (Custer et al. 2009; Eagles-Smith et al. 2018; Jones and Miller 2005). Emissions of metals from mining operations and ore processing, in the form of particulate matter and dust, may be deposited directly on local soils and waterways. In addition, rainwater and snow melt may provide a pathway for these elements to leach from tailings piles or be physically transported as solid particles into adjacent waterbodies. These elements may enter the food web through plants and insects and then be consumed by insectivorous wildlife, potentially causing injury if exposure is sufficient. The Forest Service would require an adaptive management plan to address dust and emissions (see **Appendix D**, Mitigation Measures and Environmental Commitments). Although this mitigation measure would reduce impacts, there would still likely be indirect impacts to amphibians like the Columbia spotted frog.

Under Alternatives 2, 3, and 4, effects would generally be the same as Alternative 1. However, up to 877 acres of riparian and forested wetland habitat would be impacted under Alternative 3, which would be the highest direct impact among the action alternatives. Under Alternative 4, the 3 miles of new road for the OHV connector trail from Horse Heaven/Powerline route to Meadow Creek Lookout Road (FR 51290) would not be constructed, which would reduce direct and indirect impacts to forested wetlands and riparian areas, used as habitat for this species.

Access Roads

Alternative 1 could directly disturb Columbia spotted frog in the riparian analysis area through impacts to wetlands along the access roads, and up to 175 acres of modeled habitat could be impacted along the Burntlog Route. Road construction, culvert installation, disturbance of roadside ditches that contain enough water for egg laying, and increased traffic levels may cause direct mortality. Restricting public access on the Burntlog Route would likely reduce impacts due to mortality. Anurans (including Columbia spotted frogs) are very susceptible to mortality from roadways (Jochimsen et al. 2004) when they cross them or emerge from their eggs in the spring. The new segment of the Burntlog Route would be decommissioned and reclaimed during mine closure, but the effects would mostly still be considered permanent due to the long time-period. As described for the mine site, potential water sources would be surveyed for Columbia spotted frog egg masses and other amphibians after ice melt, and Alternative 1 would avoid disturbing any water sources with identified egg masses or other species.

Alternative 1 would cause an increase in noise and light in the riparian analysis area, which could directly affect frogs along the access roads. These indirect impacts are described in the mine site section. Another indirect impact to amphibians along access roads could include fugitive dust. Dust associated with construction of facilities and roads, road maintenance, and vehicle travel may have indirect impacts on insects. Increased dust deposition could result in negative impacts to pollinating insects. For SGP, the potential for dust deposition is likely to be higher in the immediate area of roads and other surface-disturbing actions but would diminish with distance from these actions. Dust impacts on insects would start during construction and continue through closure and reclamation. Some dust deposition also may occur in the post-closure period where monitoring-related travel on dirt roads would occur; however, this would be negligible. Effects of dust on insects would occur immediately at the time of dust propagating activities and is likely to continue throughout the lifetime of SGP.

Under Alternative 2, the on-site lime production would reduce traffic to the mine site, and the AADT would be 50 vpd during operations, which would slightly reduce the risk of wildlife-vehicle collisions. Other effects would be the same as Alternative 1.

Alternative 3 would have similar effects on Columbia spotted frog as Alternative 1.

Under Alternative 4, the Burntlog Route would not be constructed and there would be no impacts along the proposed Burntlog Route corridor. There would be 142 acres of direct impacts to modeled habitat under Alternative 4. Increased traffic along the existing Yellow Pine Route would likely increase direct mortality and indirect impacts (due to noise and light) along these roadways.

Utilities

Alternative 1 could directly disturb Columbia spotted frogs in the riparian analysis area through impacts to wetlands due to clearing and construction activities for utility corridors, substations, and communication towers. Direct impacts to modeled habitat are estimated to be 291 acres under Alternative 1. The effects on wetlands would be considered temporary during construction (up to 3 years). However, impacts to forested wetlands would likely be permanent as ROW management practices generally do not allow the establishment of woody vegetation. Construction activities associated with the utilities may cause direct mortality for some frogs.

As described for the mine site, potential water sources would be surveyed for Columbia spotted frog egg masses and other amphibians after ice melt, and Alternative 1 would avoid disturbing any water sources with identified egg masses or other species.

Alternative 1 would cause an increase in noise and light in the riparian analysis area, which could directly affect frogs in the utilities. These indirect impacts are described in the mine site section.

Alternatives 2, 3, and 4 would have similar effects on Columbia spotted frog as Alternative 1. However, up to 314 acres of riparian and forested wetland habitat would be impacted under Alternative 3, which would be the highest direct impact among the action alternatives.

Off-site Facilities

Alternative 1 would impact 6 acres of wetlands for construction of the off-site facilities (see **Table 4.13-18**). It is possible that individual frogs could be directly or indirectly impacted from these activities. The operating procedures and mitigation measures described above would be used to reduce impacts where possible.

Alternatives 2 and 3 would have similar effects on Columbia spotted frog as Alternative 1.

Under Alternative 4, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus Alternative 1 and create 8 acres of direct impacts. However, it is not expected that this change would cause effects different from Alternative 1.

Habitat Impacts

The focal species selected for the WCS for the BNF and PNF represent the appropriate habitat types and are surrogates for many other species, including Columbia spotted frog. Thus, there are no specific habitat models available for this species. However, the riparian analysis area has been used for estimating impacts to this amphibian. Indirect impacts are assessed by including any forested wetlands or riparian areas within 0.5 mile of project components. For each alternative, indirect impacts would be higher for riparian areas than for forested wetlands. For example, Alternative 1 would include 18,645 acres of riparian indirect impacts and 209 acres of forested wetland indirect impacts.

Table 4.13-18 Columbia Spotted Frog Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
Alternative 1		
Mine Site	726	N/A
Access Roads	175	N/A
Utilities	291	N/A
Off-site Facilities	6	N/A
Total	**1,198**	**18,853**
Alternative 2		
Mine Site	681	N/A
Access Roads	169	N/A
Utilities	288	N/A
Off-site Facilities	6	N/A
Total	**1,144**	**18,853**
Alternative 3		
Mine Site	877	N/A
Access Roads	165	N/A
Utilities	314	N/A
Off-site Facilities	6	N/A
Total	**1,362**	**18,886**
Alternative 4		
Mine Site	734	N/A
Access Roads	142	N/A
Utilities	289	N/A
Off-site Facilities	8	N/A
Total	**1,173**	**15,202**

Table Source: Forest Service 2020

Table Notes:

N/A = indirect impacts are calculated by buffer distances (0.5 mile for Columbia spotted frog) from the action alternatives and occur outside of the project components.

Alternative 5

Mine Site

Columbia spotted frogs would likely continue to use the mine site as they currently do.

Access Roads

Existing roads also would continue to affect frogs through habitat fragmentation, direct mortality risks due to vehicle-wildlife collisions, and noise and light impacts from vehicles.

Utilities

No new transmission lines or communication towers would be constructed, so there would be no new loss of riparian habitat.

Off-site Facilities

There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Determination

The action alternatives may directly and indirectly impact Columbia spotted frog individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Alternative 3 would directly impact the most habitat (e.g., forested wetlands and riparian areas) due to the mine site and utilities, Alternative 2 would have the fewest direct impacts, and Alternative 4 would have the fewest indirect impacts.

4.13.2.3 Species of Greatest Conservation Need

Direct impacts on Species of Greatest Conservation Need (SGCN) could include direct mortality (i.e., wildlife-vehicle collisions, removal of nest or roost trees, etc.) or loss of habitat due to land clearing activities and land use changes. Indirect impacts could include reduced use of foraging or breeding habitat or reduced prey resources in the analysis areas.

4.13.2.3.1 GENERAL HABITAT SPECIES

Mine Site

Direct effects on general habitat SGCN would primarily be due to loss and fragmentation of habitat, and disturbance from light, noise, and increased human activity. There would be a direct loss of habitat in the wildlife analysis area at the mine site under Alternative 1. Displaced individuals would likely only be lost to the population if the adjacent environment were at maximum carrying capacity, to the extent that there were not enough available habitats to support them. In such a case, individuals would have to travel further, exposing them to predation risks and energetic loss.

Light and noise impacts associated with mine site activities are likely to disturb or displace these SGCN. Bird and bat behaviors that may change as a result of increased noise or light including changes in roosting or foraging patterns that could lead to fragmentation of habitat. The estimated total average hourly noise levels from the mine site during the operations phase would be 102 dBA with blasting. Under the blasting scenario, SGP-related noise levels from the mine site during operations would attenuate to well below average ambient sound levels, because the impacts are reduced by vegetation, topography, and distance from the impact sources. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used and could reduce indirect effects on wildlife. Equipment would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. The result would generally be a reduction in the area of habitat disturbed at most sites, but there would be indirect effects regardless. Timing restrictions would restrict some activities (e.g., blasting, drilling, etc.) within 1 mile of active winter hibernacula and summary maternity sites, which would help reduce habitat impacts.

Alternatives 2, 3, and 4 would have similar effects on general habitat SGCN as Alternative 1.

Access Roads

Direct effects on general habitat SGCN would primarily be due to loss and fragmentation of habitat, and disturbance from light, noise, and increased human activity under Alternative 1. Construction of 15 miles of new road for the Burntlog Route would likely fragment habitat for SGCN and may act as a barrier to movement for some species. The new 15-mile-long section of Burntlog Route would be constructed and plowed year-round, and have an AADT level of 68 vpd, which could disturb the bird and bat SGCN. The intensity of this impact could range from minor displacement to mortality. The duration ranges from temporary road construction to short-term (during 12 to 15 years of mining and ore processing operations). It is not expected that the increased risk of injury or mortality would become permanent, because the new segment of the Burntlog Route would be reclaimed upon closure, and traffic levels on the existing roads would return to current levels. The geographic extent of these impacts would be limited to the vicinity of the access road. Restricting public access on the Burntlog Route would likely reduce impacts due to mortality.

Light and noise impacts associated with road construction, maintenance, and vehicle traffic are likely to disturb or displace these birds and bats. Mitigation measures and SGP SOPs would help reduce these impacts, but not eliminate them. The estimated noise levels from SGP-related traffic on the Burntlog Route during the operations phase would be 49 dBA. The estimated SGP-related noise level from road maintenance activity on the mine access road would range from 88 dBA during the summer months to 90 dBA during the winter months, when snow removal is required.

Under Alternative 2, the on-site lime production would reduce traffic to the mine site, and the AADT level would be 50 vpd, which would slightly reduce the risk of wildlife-vehicle collisions. Other effects would be the same as Alternative 1.

Alternative 3 would have similar effects on general habitat SGCN as Alternative 1.

Under Alternative 4, the Burntlog Route would not be constructed. All traffic would access the SGP area via the Yellow Pine Route. General habitat SGCN with occurrence along these existing roadways may be impacted from increased traffic levels.

Utilities

Direct impacts on general habitat SGCN could include loss or fragmentation of habitat along utility corridors, or at substations and communication towers due to land clearing activities and land use changes under Alternative 1. The addition of 25 miles of new utility access roads, as well as a disturbance of approximately 115 acres due to new transmission lines and 158 acres due to upgraded transmission lines, could impact individual SGCN. Construction impacts would likely displace wildlife, but effects would be temporary (up to 3 years). Vegetation would be cleared only in those areas necessary for Alternative 1 activities to preserve natural habitat to the greatest extent practicable. During operations, it's likely that wildlife would use the utility corridors again.

Noise and light reduction strategies would be used to reduce indirect effects on bird and bat SGCN. Equipment would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2, 3, and 4 would have similar effects on general habitat SGCN as Alternative 1.

Off-site Facilities

Direct impacts on general habitat SGCN due to the off-site facilities would include loss or fragmentation of habitat. Construction and operation of the off-site facilities of Alternative 1 are unlikely to disturb most species, because construction activities are not planned to occur in suitable habitat used by them. Noise and lighting reduction strategies would be used to reduce indirect effects on them. Buildings would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2, 3, and 4 would have similar effects on general habitat SGCN as Alternative 1.

4.13.2.3.2 RIPARIAN SPECIES

Mine Site

Direct effects on riparian SGCN would primarily be due to permanent impacts to wetlands in the mine site area under Alternative 1, and approximately 726 acres of direct impacts would occur (see **Table 4.13-18**). Construction of a natural stream channel for the EFSFSR and 51,350 linear feet of stream channel and riparian habitat (Midas Gold 2016) on closure could restore some habitat for these species in the future, but the effects would be long-term (e.g., 20 years) in these cases.

Implementation of Alternative 1 would cause an increase in noise and light in the riparian wildlife analysis area, mostly in the vicinity of the mine site. Bird behaviors that may change as a result of increased noise and light include changes in nesting and foraging patterns that could lead to fragmentation of habitat. The noise and light increase may affect western toad breeding activities in the mine site. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. Additionally, light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on wildlife would differ depending on the specific conditions at each individual Alternative 1 component location, based on the density of vegetation and proximity to adjoining hillsides and valleys.

Under Alternative 2, effects would generally be the same as Alternative 1 (681 acres of direct impacts), with the exception of the Midnight pit being backfilled in closure.

Alternatives 3 and 4 would have similar effects on riparian SGCN as Alternative 1. Alternative 3 would directly impact 877 acres and Alternative 4 would directly impact 734 acres.

Access Roads

Alternative 1 could directly disturb these riparian SGCN in the riparian analysis area through impacts to wetlands (175 acres of direct impacts). Road construction, culvert installation, disturbance of roadside ditches that contain enough water for egg laying, and increased traffic levels may cause direct mortality to the western toad. Anurans (including western toads) are very susceptible to mortality from roadways (Jochimsen et al. 2004) when they cross them or emerge from their eggs in the spring. The Forest Service would require that potential water sources be surveyed for amphibian egg masses after ice melt, and Alternative 1 would avoid disturbing any water sources with identified egg masses or other species (see **Appendix D**, Mitigation Measures and Environmental Commitments). The grebes and sandhill crane would likely be impacted from loss of riparian habitat throughout the life of the mine.

Noise and light disturbance from road construction, road maintenance, and routine vehicle traffic are likely to disturb or displace individual birds or toads that do occur in the access road vicinity. Western toads could be impacted by an interference in communication during breeding activities. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2 and 3 would have similar effects on riparian SGCN as Alternative 1.

Under Alternative 4, there would be no impacts associated with the Burntlog Route as it would not be constructed. However, riparian SGCN along the Yellow Pine Route may be impacted from the increased traffic.

Utilities

Alternative 1 could directly disturb riparian SGCN in the riparian analysis area through direct impacts to wetlands (291 acres) due to clearing and construction activities for utility corridors, substations, and communication towers. Some effects would be considered temporary during construction (up to 3 years). However, impacts to forested wetlands would likely be permanent as ROW management practices generally do not allow the establishment of woody vegetation. Construction activities associated with the utilities may cause direct mortality for some western toads, but likely not for the bird species. Potential water sources would be surveyed for amphibian egg masses, as described for the access roads. During operations, it’s likely that wildlife would use the utility corridors again.

Noise and light disturbance from construction of the utility corridors, substations, and communication towers may temporarily disturb or displace grebes or cranes that use the area. Western toads could be impacted by an interference in communication during breeding activities. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2, 3, and 4 would have similar effects on riparian SGCN as Alternative 1. Alternative 3 would impact the most riparian habitat, with direct impacts to 314 acres (see **Table 4.13-18**).

Off-site Facilities

Alternative 1 would impact 6 acres of wetlands for the off-site facilities. It is unlikely to directly disturb riparian SGCN in the riparian analysis area, with the possible exception of western toads that may use the affected wetland area.

Alternatives 2, 3, and 4 would have similar effects on riparian SGCN as Alternative 1.

4.13.2.3.3 ALPINE SPECIES

Mine Site

Direct impacts on the hoary marmot are possible in the mine site due to habitat loss and associated habitat fragmentation, year-round vehicle traffic causing disturbance and potential avoidance behavior, and a potential risk of vehicle collisions causing injury or mortality under Alternative 1. Impacts to persistent snow cover (i.e., wolverine analysis) are used as a surrogate for marmot habitat. Direct take of these species due to construction or operational activities is possible, but unlikely, because hoary marmots prefer higher elevation meadows or rocky talus slopes where construction activities are unlikely to occur.

Alternative 1 would cause an increase in noise and light in the wolverine analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include foraging or denning changes. Noise-reduction strategies would be used to reduce indirect effects on this species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2, 3, and 4 would have similar effects on hoary marmot as Alternative 1.

Access Roads

There would be a direct habitat loss along the access roads for the hoary marmot under Alternative 1. Direct mortality due to construction or operational activities is possible, but unlikely, because hoary marmots are expected to avoid areas of activity.

Alternative 1 would cause an increase in noise and light in the wolverine analysis area, due to road construction, vehicle traffic, and maintenance. Noise and light mitigation measures described for the mine site would likely reduce impacts.

Alternatives 2 and 3 would have similar effects on hoary marmot as Alternative 1.

Under Alternative 4, there would be a reduction of impacts due to the Burntlog Route not being built. However, any habitats adjacent to the Yellow Pine Route would be impacted from upgrades and increased traffic levels.

Utilities

There would be a direct habitat loss within the utilities for the hoary marmot under Alternative 1. Direct mortality due to construction or operational activities is possible, but unlikely, because the hoary marmot is expected to avoid areas of activity.

Alternative 1 would cause an increase in noise and light in the wolverine analysis area, due to construction, operation, and maintenance of the utilities. Noise and light mitigation measures described for the mine site would likely reduce impacts.

Alternatives 2, 3, and 4 would have similar effects on hoary marmot as Alternative 1.

Off-site Facilities

Alternative 1 is unlikely to disturb hoary marmots due to clearing and construction activities for off-site facilities, because a small amount of persistent snow cover years 1 through 7 are expected to be impacted for these facilities. However, indirect effects on them could include reduced use of nearby foraging or denning habitat.

Alternatives 2, 3, and 4 would have similar effects on hoary marmot as Alternative 1.

4.13.2.3.4 Summary of Impacts

The action alternatives may directly and indirectly impact SGCN (including general habitat, riparian, and alpine species) individuals and habitat.

4.13.2.4 General Wildlife Species

Direct impacts on general wildlife species could include direct mortality (i.e., wildlife-vehicle collisions, removal of nest or roost trees, etc.) or loss of habitat due to land clearing activities and land use changes. Indirect impacts could include reduced use of foraging or breeding habitat or reduced prey resources in the analysis area.

Mine Site

Direct effects on general wildlife species would primarily be due to loss and fragmentation of habitat; direct mortality through vehicle-wildlife collisions; and disturbance from light, noise, and increased human activity under Alternative 1. Displaced individuals would likely only be lost to the population if the adjacent environment were at maximum carrying capacity, to the extent that there were not enough available habitats to support them. In such a case, individuals would have to travel further, exposing them to predation, vehicle-wildlife collisions, and energetic loss.

General wildlife would likely be displaced around the perimeter of the mine site. Additional roadways in the mine site would expose individuals to direct vehicle collisions or increased hunting pressure from humans in the wildlife analysis area. There would be no hunting or discharge of firearms during construction and operations in the mine site area. Signs would be posted at the SGP area and training would be provided to notify employees that hunting is prohibited, and employees would be prohibited from carrying firearms on the SGP site. However, illegal harvest of some species is a potential risk. Employees and contractors traveling in vehicles would be encouraged to observe posted speed limits or state secondary road speed limits, and to drive at speeds appropriate to reduce the possibility of vehicle-wildlife accidents.

Light and noise impacts associated with mine site activities are likely to disturb or displace common wildlife species. The estimated total average hourly noise levels from the mine site during the operations phase would be 102 dBA with blasting. Under the blasting scenario, SGP-related noise levels from the mine site during operations would attenuate to well below average ambient sound levels, because the impacts are reduced by vegetation, topography, and distance from the impact sources. Noise-reduction strategies (e.g., enclosure of ore processing facility, use of electricity instead of diesel generators, muffling equipment, etc.) would be used to reduce indirect effects on wildlife. Several terrestrial wildlife species have shown responses to anthropogenic noise levels beginning at 40 dBA (Shannon et al. 2016). However, because the existing (ambient) sound levels vary between 20 and 40 dBA, it is likely that SGP area wildlife would have a higher tolerance for noise. Equipment would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use. As part of SGP SOPs, buildings, equipment, and drill rigs would have limited external lighting when feasible. The result would generally be a reduction in the area of habitat disturbed at most sites.

Hazardous materials and chemicals would be transported to the mine site in U.S. Department of Transportation-certified containers by trained personnel and would be stored in designated areas employing secondary containment measures. A Hazardous Materials Handling and Emergency Response Plan would address procedures for responding to accidental spills or releases of hazardous materials to minimize environmental effects. Used products would be stored on site in approved containers that would be separate from other trash and garbage products. Therefore, there is little chance of wildlife being exposed to hazardous materials.

Alternatives 2, 3, and 4 would have similar effects on general wildlife species as Alternative 1.

Access Roads

Direct effects on general wildlife species would primarily be due to loss and fragmentation of habitat; direct mortality through vehicle-wildlife collisions; and disturbance from light, noise, and increased human activity under Alternative 1. Construction of 15 miles of new road for the Burntlog Route would likely fragment habitat for general wildlife species and may act as a barrier to movement for some species. The new 15-mile-long section of Burntlog Route would be constructed and plowed year-round and have an annual average daily traffic level of 68 vehicles, which would likely directly disrupt wildlife movements. The intensity of this impact could range from minor displacement to mortality. The duration ranges from temporary road construction (up to 3 years) to short-term (during 12 to 15 years of mining and ore processing operations). It is not expected that the increased risk of injury or mortality would become permanent, because the new segment of the Burntlog Route would be reclaimed, and traffic levels on the existing roads would return to current levels. The geographic extent of these impacts would be limited to the vicinity of the access road.

Although additional roadways could expose general wildlife species to increased hunting pressure from humans in the wildlife analysis area, hunting or discharge of firearms during construction and operations within the SGP area would be prohibited. Signs would be posted throughout the SGP area and training would be provided to notify employees that hunting is prohibited, and employees would be prohibited from carrying firearms on the SGP site. All staff and contractors would be trained to reduce wildlife collisions. Midas Gold would develop a wildlife mortality-reporting procedure and form to be used for reporting accidental Alternative 1-related wildlife mortality. Any adverse wildlife encounters would be reported to appropriate state and federal wildlife managers, and in accordance with state and federal laws. Roadways also are used as corridors by predators such as wolves, which could indirectly increase predation of some general mammal species.

Light and noise impacts associated with road construction, maintenance, and vehicle traffic are likely to disturb or displace common wildlife species. Mitigation measures and SGP SOPs would help reduce these impacts, but not eliminate them. The estimated noise levels from SGP-related traffic on the Burntlog Route during the operations phase would be 49 dBA. The estimated SGP-related noise level from road maintenance activity on the mine access road would range from 88 dBA during the summer months to 90 dBA during the winter months, when snow removal is required.

Under Alternative 2, the on-site lime production would reduce traffic to the mine site, and the AADT would be 50 vpd, which would slightly reduce the risk of wildlife-vehicle collisions. Other effects would be the same as Alternative 1.

Although there would be 19.6 miles of new roadway due to the Burntlog Route, Alternative 3 would have similar effects on general wildlife species as Alternative 1.

Under Alternative 4, the Burntlog Route would not be built. This would avoid effects of noise disturbance, habitat loss, and habitat fragment on wildlife in the vicinity of Burnt Log Road (FR 447). However, general wildlife species that currently utilize habitats along the Yellow Pine Route would likely be more impacted due to increased traffic and noise disturbance.

Utilities

Direct impacts on general wildlife species could include loss or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes under Alternative 1. The addition of 25 miles of new utility access roads, as well as a disturbance of 115 acres due to new transmission lines and 158 acres due to upgraded transmission lines, could impact individual general wildlife species. Construction impacts would likely displace wildlife but would be temporary (up to 3 years). Vegetation would be cleared only in those areas necessary for Alternative 1 activities to preserve natural habitat to the greatest extent practicable. However, impacts to forested wetlands would likely be permanent as ROW management practices generally do not allow the establishment of woody vegetation.

Noise-reduction strategies would be used to reduce indirect effects. Equipment would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Alternatives 2, 3, and 4 would have similar effects on general wildlife species as Alternative 1.

Off-site Facilities

Construction and operation of the off-site facilities under Alternative 1 are unlikely to disturb most general wildlife species, because construction activities are not planned to occur in suitable habitat used by them. Noise and lighting reduction strategies would be used to reduce indirect effects on species in the vicinity. Buildings would have limited external lighting and would employ noise-minimizing practices. Construction equipment engines would be equipped with adequate mufflers, intake silencers, and engine enclosures when feasible. When practicable, pumps, generators, and engines would be turned off when not in use.

Although construction and operation of the off-site facilities themselves would likely not cause direct mortality to general wildlife species, vehicle traffic associated with the facilities could result in vehicle-wildlife collisions. All staff and contractors would be trained to reduce wildlife collisions.

Alternatives 2, 3, and 4 would have similar effects on general wildlife species as Alternative 1.

Summary of Impacts

The action alternatives may directly and indirectly impact general wildlife species individuals and habitat.

4.13.2.5 Big Game Species

Potential effects on big game species would be similar to those discussed for general wildlife species. The discussion below focuses on issues specific to big game species while Section 4.13.2.4 contains additional impacts to general wildlife.

Mine Site

Big game wildlife species are very mobile and generally able to avoid localized direct threat of injury or mortality due to construction. However, big game species would likely be displaced around the perimeter of the mine site disturbances. Additional roadways in the mine site would expose individuals to direct vehicle collisions or increased hunting pressure from humans in the wildlife analysis area.

Although there are no identified wildlife migration corridors between winter and spring ranges, elk are predicted to use the area for calving in the summer, and big game animals likely use the wildlife analysis area to migrate. Elk and deer may be displaced around the perimeter of the mine site and associated infrastructure, which would directly affect high-value seasonal habitat for elk and mule deer. Blum et al. (2015) observed that mule deer tended to avoid disturbed mining areas in Nevada, and rerouting around disturbances would increase their energy expenditures during migration, potentially decreasing survival or productivity. However, given the relatively small size of the mine site in context of the region and available habitat, any direct effect on survival or productivity would likely be small.

Alternatives 2, 3, and 4 would have similar effects on big game species as Alternative 1.

Access Roads

Roadways also are used as corridors by predators such as wolves, which could indirectly increase predation of elk and mule deer. Plowing the Burntlog Route would increase the access into a previously less accessible area for wolves and coyotes. Likewise, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) may increase access for predators during the winter.

Although there are no officially designated wildlife migration corridors between winter and spring ranges, big game animals likely use the wildlife analysis area to migrate. Roadways under Alternative 1 may displace elk and mule deer or increase the possibility of vehicle-wildlife collisions. Under Alternative 1, the AADT level during operations would be 68 vpd. The following are linear components of Alternative 1 that may present a barrier to the movement of wildlife. Warm Lake Road (CR 10-579) is not specifically a part of either access route; however, it is used by both access routes. The existing and proposed road segments are as follows:

- Yellow Pine Route (Johnson Creek Road [CR 10-413], and Stibnite Road [CR 50-412])
- Burntlog Route (Existing Burnt Log Road [FR 447] to be upgraded and extended 15 miles to Thunder Mountain Road [FR 50375], which also would be upgraded)

If fawning/calving activity is encountered during Alternative 1 activities, the activity would cease and/or be modified in coordination with the Forest Service. Although this and other mitigation measures would reduce impacts, there would still be a direct decrease in habitat, and increase in risk of disturbance and injury or mortality.

Under Alternative 2, the on-site lime production would reduce traffic to the mine site, and the AADT level would be 50 vpd, which would slightly reduce the risk of wildlife-vehicle collisions. Other effects would be the same as Alternative 1.

Although there would be 19.6 miles of new roadway due to the Burntlog Route, Alternative 3 would have similar effects on big game species as Alternative 1.

Under Alternative 4, the Burntlog Route would not be constructed. Impacts to big game species in the vicinity of Burnt Log Road (FR 447) would likely be avoided. However, big game species that currently utilize habitats along the Yellow Pine Route would be impacted due to increased traffic and noise disturbance associated with only using Yellow Pine Route for the SGP.

Utilities

There are no officially designated wildlife migration corridors between winter and spring ranges, or any elk winter range in the wildlife analysis area. The following are linear Alternative 1 components that may present a barrier to the movement of wildlife, although big game species would likely still use these corridors. The existing and proposed transmission line segments are as follows:

- Existing transmission line segment to be upgraded from East Fork to the Johnson Creek substation – 42 miles
- New transmission line segment from the Johnson Creek substation to the mine site – 8.5 miles

Alternatives 2, 3, and 4 would have similar effects on big game species as Alternative 1.

Off-site Facilities

Although there are no officially designated wildlife migration corridors between winter and spring ranges, big game animals likely use the wildlife analysis area to migrate. The off-site facilities would be unlikely to disrupt or alter big game herd movements, except for displacing them a short distance, which would have a negligible impact.

Alternatives 2, 3, and 4 would have similar effects on big game species as Alternative 1.

Summary of Impacts

The action alternatives may directly and indirectly impact big game species individuals and habitat.

4.13.2.6 Migratory Bird Species and Bald or Golden Eagles

Direct impacts on migratory bird species and bald and golden eagles could include direct mortality (i.e., collisions with vehicles, structures, removal of nest trees, etc.) or loss of habitat due to land clearing activities and land use changes. Indirect impacts on these species could include reduced use of foraging or nesting habitat; reduced prey resources (insects and pollinators) in the analysis areas; or disturbance from noise, light, and emissions. Bald eagles are assessed above in Section 4.13.2.2.6.1, Habitat Family 13 – Riverine Riparian and Wetland – Bald Eagle, and golden eagles would likely face similar impacts. Effects on migratory birds under the action alternatives are similar in nature to the effects discussed in Section 4.13.2.4, General Wildlife Species. Therefore, this section focuses only on the differences for migratory bird species.

Mine Site

Under Alternative 1, direct take of adult birds due to construction or operational activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. Impacts to the priority habitats mentioned in **Table 3.13-21** also may directly affect the migratory bird species found in the analysis areas. The Partners in Flight Idaho Bird Conservation Plan (Ritter 2000) contains several goals for the various habitats to reduce impacts on migratory bird species. Implementation of the SGP would require removal of vegetation from several habitat types during the life of the mine but would reclaim several habitats during closure. Although both habitats listed in **Table 3.13-21** (i.e., dry ponderosa pine and riparian habitats) would be directly disturbed in the short term, portions of the area would be reclaimed in the long term, including

51,350 linear feet of stream channel and riparian habitat (Midas Gold 2016). These activities would accomplish some of the Partners in Flight Idaho Bird Conservation Plan goals. Cutting of trees for Alternative 1 activities and removal of snags would avoid avian tree nests, where feasible; and a Forest Service wildlife biologist would be notified of any occupied sensitive species nests or dens encountered. Although these mitigation measures would reduce impacts, there would still be a decrease in habitat.

Migratory bird species also could be impacted by direct collision risks with structures at the mine site. Electric transmission line structures to serve Alternative 1 facilities and the new 138-kV transmission line in the mine site area would be a potential source of mortality for migratory bird species and raptors (APLIC 2012). However, the utility line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to these species.

Alternative 1 would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting or foraging changes. Chronic noise can interfere with an animal's ability to detect important sounds, while intermittent noise is often perceived as a threat, which can lead to a reduction in fitness (Francis and Barber 2013). Increased noise levels can mask some lower-frequency bird calls, interrupting mating processes. Additionally, Kleist et al. (2018) observed that anthropogenic noise could disrupt stress hormone signaling and lead to lower survival rates across several bird species (i.e., ash-throated flycatcher, western bluebird, mountain bluebird), which may be similar to migratory bird species in the SGP area. Over time, noise can change the composition of avian communities in favor of more noise-tolerant species, which reduces the number of species. Birds migrating through may avoid the area during noisy periods instead of stopping over during migration. Permanent physical damage to a bird's ability to hear can occur from short-duration, loud sounds (exceeding 140 dBA for single blasts or 125 dBA for multiple blasts), or from continuous (greater than 72 hours) noise at levels above 110 dBA (Dooling and Popper 2007). The average hourly noise level during construction at the mine site would be 94 dBA (at 50 feet) and 102 dBA (at 50 feet) with blasting during operations. As such, the SGP would not be expected to result in permanent hearing loss for birds. Additionally, light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on wildlife would differ depending on the specific conditions at each Alternative 1 component location, based on the density of vegetation and proximity to adjoining hillsides and valleys. Bright lighting can confuse birds into becoming active earlier in the day and staying alert throughout the night. It also can attract night-flying or migrating birds, causing them to alter their natural activities or expose them to accidental collisions with structures.

Possible direct and indirect effects are that there could be emission exposure and a reduction in prey species near the mine site activities, due to insects being affected by emissions or fugitive dust.

Insects and insectivorous birds may be exposed to metals (e.g., mercury) and other elements from atmospheric emissions and tailings piles associated with gold and silver mining activities (Custer et al. 2009; Eagles-Smith et al. 2018; Jones and Miller 2005). Emissions of metals from mining operations and ore processing, in the form of particulate matter and dust, may be deposited directly on local soils and waterways. In addition, rainwater and snow melt may provide a pathway for these elements to leach from tailings piles or be physically transported as solid particles into adjacent waterbodies. These elements may enter the food web through plants and insects and then be consumed by insectivorous wildlife, potentially causing injury if exposure is sufficient. The mitigation measure FS-146 would require an adaptive management plan to address dust and emissions (see **Appendix D**, Mitigation Measures and Environmental Commitments). Although this mitigation measure would reduce impacts, there would still likely be indirect impacts to insectivorous migratory birds.

As part of SGP SOPs, buildings, equipment, and drill rigs would employ noise-minimizing practices and would have limited external lighting when feasible. The result would generally be a reduction in the area of habitat disturbed at most sites. The noise and light reduction strategies employed in the SGP area would reduce noise impacts on migratory birds, but not eliminate them. Timing restrictions would restrict some activities within a certain radius of active nest trees for avian species, which would help reduce habitat impacts.

Alternatives 2, 3, and 4 would have similar effects on migratory bird species as Alternative 1.

Access Roads

Migratory bird species, including focal species that are migratory, could be directly impacted and disturbed in the wildlife analysis area through vehicle mortality, habitat loss due to tree clearing, road construction, traffic noise and dust, and increased human activity along access roads. Direct take of adult birds due to these activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is likely that nests, eggs, and young would be directly disturbed by vegetation removal, including cutting of trees, if it occurs during the nesting season. Ground disturbance associated with road construction and upgrades could cause injury or mortality of ground-nesting birds if conducted during the breeding season. Cutting of trees for Alternative 1 activities would avoid avian tree nests, where feasible, and a Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although these mitigation measures would reduce direct impacts, there would still be a decrease in habitat. The Burntlog Route may present a barrier to movement for sensitive migratory bird species.

Additionally, noise and light from road construction, road maintenance, and routine vehicle traffic is likely to disturb or displace individual migratory bird species or bald and golden eagles from roadside habitats. Increased ambient noise levels can mask some lower-frequency bird calls, interrupting mating processes. Additionally, Kleist et al. (2018) observed that anthropogenic noise could disrupt stress hormone signaling and lead to lower survival rates across several bird species (i.e., ash-throated flycatcher, western bluebird, mountain bluebird), which may be similar to migratory bird species in the SGP area. McClure et al. (2013) observed that simulated traffic noise led to a decline in bird abundance at sites in southern Idaho by about one quarter, and that many migratory bird species may avoid sites with such noise levels. The average hourly noise level during construction for the access roads would be 91 dBA (at 50 feet) and 86 (winter) to 88 (summer) dBA (at 50 feet) during operations. As such, the SGP would not be expected to result in permanent hearing loss for birds. Bright lighting can attract night-flying or migrating birds, causing them to alter their natural activities or expose them to accidental collisions with structures.

Noise- and light-reduction strategies described for the mine site and for other general wildlife species would be used to reduce indirect effects on migratory bird species.

Alternatives 2 and 3 would have similar effects on migratory bird species as Alternative 1.

Under Alternative 4, the Burntlog Route would not be constructed. However, the existing roadways included in the Yellow Pine Route would be upgraded and would likely cause direct and indirect impacts to migratory birds. Due to the increased traffic and noise, the Yellow Pine Route may present a barrier to movement of sensitive migratory bird species.

Utilities

Alternative 1 could directly disturb migratory bird species in the wildlife analysis area through habitat loss due to clearing and construction activities for utility corridors, substations, and communication towers. Direct take of adult birds due to these activities is unlikely because most individuals are expected to avoid areas of activity. However, it is likely that nests, eggs, and young would be disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. To the extent practicable, trees found to contain nests would not be disturbed or cut. No trees with active nests would be cut.

The communication towers and new or upgraded 138-kV transmission line would be a potential source of mortality for migratory bird species and raptors through accidental collisions with structures, cell towers, or transmission lines (APLIC 2012). In the long-term, the utility line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Electric transmission line structures to serve Alternative 1 facilities would be designed and constructed to avoid raptor perching (for predation purposes and to minimize the risk of being electrocuted). However, the long-term presence of structures and communication towers would pose a risk of collision and direct mortality.

The average hourly noise level during construction for the utilities would be 84 dBA (at 50 feet) without helicopter use and 100 dBA (at 50 feet) with helicopter use and attenuate to 55 dBA approximately 53 feet from the substation during operations. As such, the SGP would not be expected to result in permanent hearing loss for birds. Noise- and light-reduction strategies described for the mine site and for other general wildlife species would be used to reduce indirect effects on migratory bird species.

Construction effects (i.e., displacement) to these areas would be temporary (up to 3 years), but long-term (e.g., 20 years) effects could include habitat fragmentation due to the utility corridors. The following are linear Alternative 1 components that may present a barrier to the movement of sensitive migratory bird species (i.e., smaller birds or those that use mature interior forest). The existing and proposed transmission line segments are as follows:

- Existing transmission line segment to be upgraded from East Fork to the new Johnson Creek substation – 42 miles
- New transmission line segment from Johnson Creek substation to the mine site – 8.5 miles

Alternatives 2, 3, and 4 would have similar effects on migratory bird species as Alternative 1.

Off-site Facilities

Alternative 1 is unlikely to directly disturb migratory bird species in the wildlife analysis area, because only approximately 4 acres of habitat would be affected due to clearing and construction activities for off-site facilities. Direct take of adult birds due to these activities is unlikely, because most individuals are expected to avoid areas of activity. It also is unlikely that nests, eggs, and young would be disturbed by vegetation removal because nest sites are most likely not adjacent to roadways where the facilities would be built.

The average hourly noise level during construction for the off-site facilities would be 92 dBA (at 50 feet) and 84 dBA (at 50 feet) due to the borrow area activity during operations. As such, the SGP would not be expected to result in permanent hearing loss for birds. Noise- and light-reduction strategies described for the mine site and for other general wildlife species would be used to reduce indirect effects on migratory bird species.

Alternatives 2, 3, and 4 would have similar effects on migratory bird species as Alternative 1.

Summary of Impacts

The action alternatives may directly and indirectly impact migratory bird species individuals and habitat.

4.13.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final Environmental Impact Statement.

4.13.4 Cumulative Effects

The cumulative effects analysis area for wildlife and wildlife habitats that could be directly or indirectly affected by the SGP consists of the analysis areas described in Section 3.13.

Cumulative effects associated with the SGP consider the range of existing and foreseeable activities and their potential effects with respect to wildlife and wildlife habitats. Past and present actions that have, or are currently, affecting wildlife and wildlife habitats, as well as reasonably foreseeable future actions (RFFAs) that could cumulatively contribute to wildlife and wildlife habitat impacts in the analysis area include mineral exploration and mining activities, closure and reclamation projects, transportation projects, recreation and tourism effects, wildfire and noxious weed control projects, and development projects (see **Table 4.13-19**).

Table 4.13-19 Cumulative Effects on Wildlife Species in the Analysis Areas

Cumulative Project Type	Potential Effects on Wildlife
Mineral exploration and mining activities	Several historic mines in the analysis areas have changed the habitat over time through removal of vegetation and displacement of wildlife species. Currently planned or future mine development will modify additional habitat types during development; these habitats will likely also be reclaimed in part on closure of the mine projects. During exploratory drilling, development, and operations, the increased noise and light impacts and road networks will be a source of disturbance and mortality for wildlife and will likely also displace several species.
Closure and reclamation projects	Projects that are currently undergoing reclamation, or will in the future, will likely improve habitat for wildlife. These projects will likely be closed, which involves the removal of some of the infrastructure involved and reclamation of native habitats. Additional habitat would generally become available to wildlife use within different time frames, depending on the type of reclamation. Early seral and grassland habitats would be available for wildlife within a short time, while mature forest types would not be available for decades.
Transportation projects	Road maintenance, improvement projects, and bridge replacements are likely in the analysis areas. As roadways represent a threat to wildlife due to vehicle-wildlife collisions, habitat fragmentation, and noxious weed introduction, these types of projects are likely to also cause an impact on wildlife. Maintenance of existing roadways will likely only be short-term, while new roadways would have a larger effect.
Recreation and tourism	Recreational activities (i.e., camping, hiking, hunting, trapping, trail riding, firewood harvest, etc.) are likely to continue to affect wildlife in the future. Increased road and trail networks open new areas to additional human disturbance, which will likely displace wildlife. Hunting activities also could decrease localized wildlife populations, although these are regulated closely by Idaho Department of Fish and Game.
Wildfire and noxious weed control projects	Wildfires and noxious weeds have affected wildlife throughout the analysis areas. Additional wildfires are likely to affect wildlife in the future by reducing mature forest structure and transitioning to early seral communities. Small-scale harvesting of timber on private lands in the area also is likely to reduce the amount of forested habitat available. Control of invasive and noxious plant species also is likely to affect wildlife positively, because spraying or hand-pulling will reduce the invasive species present.
Development projects	Private residential developments are likely to impact wildlife in the future. Native habitats would be disturbed for wildlife, and additional human presence would likely displace individuals.

Table Source: Section 4.1, Introduction

These RFFAs would result in loss of habitat, but all projects (private or federal actions) would have to meet the requirements of Section 7 of the ESA, which include consultation with federal agencies (e.g., USFWS, National Oceanic and Atmospheric Administration, etc.) on listed species, completion of appropriate analysis documents, and compliance with agency-mandated reasonable and prudent measures to protect listed species. In addition, actions on PNF and BNF must meet the standards of the Forest Plans, which specifically addresses threatened, endangered, proposed, or candidate species, as well as sensitive species and species of special interest, such as elk, and related habitat.

4.13.4.1 Alternative 1

Alternative 1 would impact approximately 3,533 acres from the combined mine site, access roads, utilities, and off-site facilities, which would be a large increase of disturbed habitat compared to other past, present, and RFFAs in the area. Various components of this larger area would be considered habitat for different species, depending on the potential vegetation groups, tree size classes, and canopy cover classes present. However, these impacts would be mitigated through restoration of vegetation communities native to the area during the closure and reclamation process. The result is that long-term, net impacts (e.g., functional habitat losses and disturbed habitat in the analysis areas) would be minimized, although it would be decades before habitats would be reclaimed to similar functionalities. The effects of road upgrades and traffic-related incidents with wildlife are likely under Alternative 1, which would contribute to the other past, present, and RFFAs.

Following closure and reclamation of the mine site, existing and ongoing mineral exploration for the SGP would cease in the wildlife analysis areas. Activities that would continue in the future, and may contribute to cumulative effects on wildlife and habitats in the analysis areas would include mineral exploration activities outside the mine site; other closure and reclamation projects; continued road use, transportation infrastructure improvements and maintenance; recreational and tourism activities; wildfire and vegetation management actions (e.g., mechanical vegetation treatment, salvage harvest, and prescribed fire); and private development projects. Potential cumulative effects from these types of actions would include further ground disturbance and habitat alteration. These reasonably foreseeable future actions would have the potential to disturb wildlife habitats because of vegetation removal and ground disturbance. RFFAs would be governed by applicable laws and regulations and would be required to conform to applicable forest plan standards on PNF and BNF.

Cumulative impacts from past and present projects have resulted in temporary and permanent losses of habitats and ecological functions in the region, and future projects also would likely impact terrestrial wildlife species. However, the region is still somewhat remote and relatively wild, and the types of projects listed above are unlikely to significantly change this wilderness character in the near term, with the exception of additional wildfires reducing mature forest structure.

Alternative 1 includes a variety of reclamation projects over the course of mine construction, operation, and closure and reclamation. However, Alternative 1 would likely result in impacts that would be considered to permanently contribute to an adverse cumulative impact on these resources when combined with past, present, or RFFAs.

4.13.4.2 Alternative 2

Alternative 2 would impact approximately 3,423 acres from the combined mine site, access roads, utilities, and off-site facilities footprints. Although 110 acres less than Alternative 1, this would still be a large increase in the amount of disturbed habitat compared to other past, present, and RFFAs in the area. Because the size of disturbance footprint is very similar to that of Alternative 1, Alternative 2 would have the same cumulative impacts as Alternative 1.

4.13.4.3 Alternative 3

Alternative 3 would impact approximately 3,610 acres from the combined mine site, access roads, utilities, and off-site facilities footprints, which would be a large increase in the amount of disturbed habitat compared to other past, present, and RFFAs in the area. Although the disturbance footprint is larger than Alternative 1, Alternative 3 would have the same cumulative impacts as Alternative 1.

4.13.4.4 Alternative 4

Alternative 4 would impact approximately 3,219 acres from the combined mine site, access roads, utilities, and off-site facilities footprints, and would be a large increase in the amount of disturbed habitat compared to other past, present, and RFFAs in the area. Because the size of the disturbance footprint is smaller than that of Alternative 1 due to the absence of the Burntlog Route, the cumulative impacts of Alternative 4 would be less than under Alternative 1.

4.13.4.5 Alternative 5

Under Alternative 5, the analysis area would still be impacted by the types of projects discussed in Alternative 1. However, Alternative 5 itself would not contribute additional impacts to wildlife.

4.13.5 Irreversible and Irretrievable Commitments of Public Resources

The Council on Environmental Quality guidelines require an evaluation of “any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented” (40 Code of Federal Regulations 1502.16). Resources that would be irreversibly or irretrievably used during implementation of the alternatives would include a range of natural, physical, human, and financial resources.

Irreversible – A commitment of resources is irreversible when the impacts of the alternatives would limit the future options for use of the resource. This applies primarily to non-renewable resources or to processes or resources that are renewable over long periods of time.

Certain biological resources that would be affected by the alternatives are renewable only over long-time spans, including mature vegetation, seedbanks, and topsoil. Loss of these resources would be considered irreversible. Reclamation of high-value habitats for wildlife species such as wolverine, lynx, and tree-nesting bird species may require long periods of time (decades).

Irretrievable – A commitment of resources is irretrievable when the impacts of an action would result in a loss of production, harvest, or use of renewable resources; it describes the temporal loss of renewable resources. These opportunities are foregone for the period of the alternatives, during which the resource cannot be used.

An irretrievable commitment of resources occurs when a resource that is renewable over a relatively short period of time is consumed during the life of a project and is therefore unavailable for other uses until the use ceases, and it is renewed and once again available. It is the temporal loss of resources that is considered irretrievable.

The SGP would remove the land from other uses while it is ongoing, but the use would eventually be reversed through reclamation. The temporal loss of the land for other uses would be irretrievable. This includes biological resources that are renewable over a short time, such as vegetation, wetlands, and streams. Although the loss of the resource is reversible, the temporal loss of the use of the resource is irretrievable. The temporal loss of biological resources that are renewable only over long-time spans would be considered irretrievable.

Any incidental or induced mortality of wildlife resulting from the SGP would result in an irretrievable commitment of these resources. Although most animals displaced from the affected areas are expected to survive relocation, some displaced animals may not survive the stresses of relocation; their loss would be irretrievable.

Any reduction in habitat functions also would be irretrievable. Once the habitat is reclaimed to its full function, the irretrievable loss would be limited to the temporal loss of habitat during the period before it was reclaimed.

4.13.5.1 Alternative 1

Irreversible – Although most wildlife species are considered renewable, certain biological resources that would be affected by Alternative 1 are renewable only over long-time spans, including mature vegetation, including snags, seedbanks, and topsoil. Loss of these resources would be considered irreversible. Reclamation of high-value habitats for wildlife species such as Canada lynx, wolverines and migratory bird species may require long periods of time (decades). Impacts to populations of threatened or endangered species, or species with low populations, such as Canada lynx or wolverine, would be considered irreversible, because recovery may take a long period of time or not occur at all. The direct mortality of wildlife also would be an irreversible impact.

Irretrievable – Irretrievable commitments include biological resources that are renewable over a short time, such as vegetation, wetlands, and streams. Although the loss of the resource itself is reversible, the temporal loss of the use of the resource is irretrievable. Alternative 1 activities would cause a temporal loss of habitat for a number of species; both from direct removal of vegetation, and indirectly through avoidance due to human presence. Some species sensitive to human presence, such as Canada lynx and wolverine, may not return to the area for years after the mine is closed.

Injury or mortality of individuals, such as burrow-dwelling species and slow-moving species that are unable to relocate when ground-disturbance activities begin, or through vehicle or transmission line collisions, would result in an irretrievable commitment of these resources. Although most animals displaced from the affected areas are expected to survive relocation, some displaced animals may not survive due to the associated dangers of migration and competition for resources; their loss also would be irretrievable.

Any reduction in habitat functions also would be irretrievable. Once the habitat is reclaimed to its full function, the irretrievable loss would only be the temporal loss of habitat during the period before it was reclaimed. Some vegetation and soil habitats would be lost for future use by wildlife until reclamation could be successfully implemented. Wildlife displaced from the affected habitat may relocate throughout the region, changing the availability of game for hunters and predators. The change could increase or decrease hunting success, but any reduction in game availability would represent an irretrievable loss of opportunity.

4.13.5.2 Alternative 2

Irreversible – There would be irreversible effects similar to Alternative 1.

Irretrievable – There would be irretrievable effects similar to Alternative 1. However, the Riordan Creek segment of the Burntlog Route would affect different habitats than Alternative 1 and will likely take many years to reclaim. Similarly, there would be some transmission line reroutes and substation changes in Alternative 2 that could affect different habitats.

4.13.5.3 Alternative 3

Irreversible – There would be irreversible effects similar to Alternative 1.

Irretrievable – There would be irretrievable effects similar to Alternative 1. However, the TSF would be relocated to the EFSFSR drainage, which also would include relocation of the worker housing facility and changes to the Burntlog Route, haul routes, service roads, and trails; this could affect different habitats. There would be some transmission line reroutes in Alternative 3 that could affect different habitats as well.

4.13.5.4 Alternative 4

Irreversible – There would be irreversible effects similar to Alternative 1.

Irretrievable – Under Alternative 4, there would not be improvements or construction of new segments for Burntlog Route, which would be a significant reduction of irretrievable commitments compared to Alternative 1. Relocation of the maintenance facility could affect different habitats.

4.13.5.5 Alternative 5

There would be no irreversible and/or irretrievable commitment of resources under Alternative 5.

4.13.6 Short-term Uses versus Long-term Productivity

National Environmental Policy Act recognizes that short-term uses and long-term productivity of the environment are linked. The uses of environmental resources—or impacts on those resources—have corollary opportunity costs. These costs relate to lost opportunities and productivity that could continue into the future. This section discusses whether the short-term uses of environmental resources by the SGP would affect (either positively or negatively) the long-term productivity of the environment.

This section provides a brief overview of the short-term effects of the alternatives versus the maintenance and enhancement of potential long-term productivity of the environmental resources in the SGP area. Short-term refers to the timeframe for the proposed SGP (the 20-year life of the mine). Long-term refers to an indefinite period after the SGP ends.

4.13.6.1 Alternative 1

Wildlife resources contribute to biological productivity, and the long-term productivity of these resources provides economic, ecological, and recreational benefits. Construction and operation of the mine and associated off-site facilities would result in some temporary, short-, mid-, and long-term impacts on wildlife. During construction, wildlife habitat would be removed from the footprint of the proposed mine site and from land associated with off-site facilities, access roads, and utilities. Habitat loss would be short-term in some areas, and long-term in others, depending on the type of vegetative cover. Timbered areas to be cleared would take decades to re-generate, during which a loss of primary and secondary habitat for many species would occur. Natural recovery and reclamation of habitat would take place outside the footprint of the proposed mine site after construction activities cease. Additional habitat would be lost for the duration of the SGP, because the increase in human activity would cause avoidance of the area by certain sensitive wildlife species. The risk of wildlife injury or mortality also would be increased as a result of the increase in human activity.

These short-term impacts would persist long enough to potentially affect the long-term productivity for some sensitive wildlife species or those with limited habitat. It is possible that some species would not return to the area after being displaced, which would be a long-term impact.

4.13.6.2 Alternative 2

Although there would be construction or operational differences, Alternative 2 would have similar short-term effects as Alternative 1. As a result, the long-term productivity effects also would be similar.

4.13.6.3 Alternative 3

Although there would be construction or operational differences, Alternative 3 would pose short-term effects similar to Alternative 1. As a result, the long-term productivity effects also would be similar.

4.13.6.4 Alternative 4

Although there would be construction or operational differences, Alternative 4 would have short-term effects similar to Alternative 1. The exception is that upgrading the Yellow Pine Route would have fewer long-term impacts to many sensitive species and habitats than developing the Burntlog Route under the other action alternatives.

4.13.6.5 Alternative 5

Alternative 5 is not expected to affect the long-term productivity of the environment.

4.13.7 Summary

For wildlife and wildlife habitat, the important differences among the alternatives lie in the acres of habitat loss, the amount and location of the disturbance from noise and human activity, and the location of the facilities. Alternative 3 would have the most habitat loss (3,610 acres). Alternative 4 would have the smallest amount of habitat loss (3,219 acres), with 391 fewer acres than Alternative 3 due to the elimination of the Burntlog Route, which also would substantially reduce the magnitude and extent of impacts on most wildlife, especially wolverine, big game and migratory birds.

Table 4.13-20 provides a summary comparison of SGP impacts by issues and indicators for each alternative.

This page intentionally left blank

Table 4.13-20 Comparison of SGP Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may cause changes in wildlife habitat in the analysis area that may affect wildlife species including special-status species (endangered, threatened, Management Indicator Species, and sensitive species)	Acres of general wildlife habitat disturbed.	Hydrologic Unit Code 12 Wildlife Analysis Area: 400,417 acres	Direct Habitat Impacts: 3,476 acres	Direct Habitat Impacts: 3,368 acres	Direct Habitat Impacts: 3,573 acres	Direct Habitat Impacts: 3,153 acres	No additional general wildlife habitats would be disturbed.
	Acres of special-status wildlife habitat disturbed.	Canada Lynx Analysis Area: 656,493 acres NIDGS Analysis Area: 17,917 acres Wolverine Analysis Area: 316,035 acres	Canada Lynx Direct Impacts: 283 acres NIDGS Direct Impacts: 55 acres Wolverine Direct Impacts: 2,572.3 acres	Canada Lynx Direct Impacts: 214 acres NIDGS Direct Impacts: 63 acres Wolverine Direct Impacts: 2,459 acres	Canada Lynx Direct Impacts: 281 acres NIDGS Direct Impacts: 55 acres Wolverine Direct Impacts: 2,669 acres	Canada Lynx Direct Impacts: 255 acres NIDGS Direct Impacts: 55 acres Wolverine Direct Impacts: 2,214 acres	No additional special-status wildlife habitats would be disturbed.
	Acres of disturbance and the proximity of the proposed mining operations to high-value habitats such as crucial and or high-value big game ranges, wetlands, and seep and spring areas.	Not applicable.	Direct Habitat Impacts: 3,476 acres Canada Lynx Direct Impacts: 283 acres NIDGS Direct Impacts: 55 acres Wolverine Direct Impacts: 2,572.3 acres	Direct Habitat Impacts: 3,368 acres Canada Lynx Direct Impacts: 214 acres NIDGS Direct Impacts: 63 acres Wolverine Direct Impacts: 2,459 acres	Direct Habitat Impacts: 3,573 acres Canada Lynx Direct Impacts: 281 acres NIDGS Direct Impacts: 55 acres Wolverine Direct Impacts: 2,669 acres	Direct Habitat Impacts: 3,153 acres Canada Lynx Direct Impacts: 255 acres NIDGS Direct Impacts: 55 acres Wolverine Direct Impacts: 2,214 acres Routing Meadow/Blowout Creek in a pipeline avoids impacts on forested wetlands, which could reduce impacts for amphibians.	No additional wildlife habitats would be disturbed.
	Change in noise levels (in decibels) in—or in proximity to—wildlife habitat	Existing ambient sound levels were measured at various noise-sensitive receptor sites and varied between 34 and 64 dBA.	Ongoing noise levels would attenuate to ambient levels within 1 to 2 miles of the disturbances. Temporary disturbances (e.g., blasting, winter road maintenance) would be audible further away. Construction: 2 miles from mine site and 2 miles from access road = 34 dBA Operations: 2 miles from mine site and 0.125 mile from access road traffic (Yellow Pine Route or Burntlog Route) = 38-39 dBA Operations: 2 miles from mine site and 2 miles from access road maintenance (summer and winter) = 38 dBA Operations: 2 miles from mine site (blasting) and 0.25 mile from utilities = 40 dBA Closure: 1 mile from mine site and 0.5 mile from access road = 50 dBA	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1, with the exception of the Burntlog Route – noise from traffic on Yellow Pine Route would be similar. Helicopter installation of utility structures would reduce habitat impacts but would introduce noise that could affect sensitive species. Construction: 1 mile from mine site or access road and 0.5 mile from helicopter utility construction = 58 dBA, which is an increase of 7 decibels over other construction methods.	There would still be some equipment noise under Alternative 5, because certain exploration and reclamation activities would continue.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Miles of new roads proposed for the SGP.	Access Roads – existing roads – 89 miles Utilities – existing roads – 30 miles	Access Roads – 15 miles new road on Burntlog Route Cabin Creek OSV route – 10.4 miles groomed OSV route OHV Connector – 3 miles new road Utilities – new utility access roads – 25 miles	Access Roads – 13.5 miles new road on Burntlog Route Cabin Creek OSV route – Same as Alternative 1 OHV Connector – same as Alternative 1 Utilities – new utility access roads – 26 miles	Access Roads – 19.6 miles new road on Burntlog Route Cabin Creek OSV route – Same as Alternative 1 OHV Connector – same as Alternative 1 Utilities – same as Alternative 1	Access Roads – No new access road miles No Cabin Creek OSV route No OHV Connector Utilities – same as Alternative 1	No new roads would be constructed.
	Acres of disturbance for new and upgraded transmission lines.	Existing transmission lines – 459 acres	New transmission lines – 115 acres Upgraded transmission lines – 158 acres	New transmission lines – 141 acres Upgraded transmission lines – 156 acres	New transmission lines – 121 acres Upgraded transmission lines – same as Alternative 1	Same as Alternative 1	No new transmission lines would be constructed, and transmission lines would not be upgraded.
The SGP may affect wildlife by introducing barriers to movement, including the mine site, infrastructure, new/existing maintained roads, new transmission line.	Length of potential movement barriers.	There are no known or designated wildlife corridors for big game species or listed species. Linkage areas for Canada lynx have been estimated to occur north to south across Warm Lake Road, and east to west across the South Fork of the Salmon River.	Potential barriers: Mine Site – 6 miles long x 1 mile wide Access Roads – new roads – 38 miles Utilities – new utility access roads: 25 miles and new transmission corridors: 115 acres Off-site Facilities – no barrier effects	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1, with the exception of the Burntlog Route, which would reduce new access road mileage as a barrier.	Existing activities at the different components may as a barrier to wildlife.
The SGP may affect wildlife by potentially increasing the risk of direct injury or mortality.	Amount of increased traffic along the access routes, or acres of ground disturbance for less-mobile species.	Baseline AADT: Warm Lake Road – 1,174 Johnson Creek Road – 57 Stibnite Road – 39 Burnt Log Road – 27 East Fork Road – 84	AADT – Construction through Post Closure: Warm Lake Road – 1,215 Johnson Creek Road – 73 Stibnite Road – 55 Burnt Log Road – 52 East Fork Road – 84	AADT – Construction through Post Closure: Warm Lake Road – 1,211 Johnson Creek Road – 73 Stibnite Road – 55 Burnt Log Road – 47 East Fork Road – 84	Same as Alternative 1.	AADT – Construction through Post Closure: Warm Lake Road – 1,215 Johnson Creek Road – 98 Stibnite Road – 80 Burnt Log Road – 27 East Fork Road – 84	Existing roads would likely continue to have AADT levels similar to those that currently exist.
	Miles of new roads and new transmission lines.	Access Roads – existing roads – 135 miles Utilities – existing roads – 30 miles	Access Roads – new roads – 28 miles Utilities – new utility access roads – 25 miles	Access Roads – new roads – 27 miles Utilities – new utility access roads – 26 miles	Access Roads – new roads – 33 miles Utilities – new utility access roads – 22 miles	Access Roads – new roads – 0 miles Utilities – same as Alternative 1	No new roads would be constructed.
	Miles of existing roads that are not currently plowed that would be plowed.	Currently plowed: Warm Lake Road – 26 miles Stibnite Road – 14 miles	Proposed (new) to be plowed: Burnt Log Road – 21 miles (currently groomed) Burnt Log Road Extension – 15 miles (proposed new)	Same as Alternative 1.	Same as Alternative 1.	Proposed (new) to be plowed: Johnson Creek Road – 17 miles (conversion of existing OSV portion of Johnson Creek Road)	Existing roads would likely continue to be maintained as they currently are in winter.

4.14 TIMBER RESOURCES

4.14.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to timber resources includes the following issue and indicators:

Issue: The Stibnite Gold Project (SGP) may change the availability of timber resources, including sawtimber and special forest products.

Indicators:

- Volumes and acres of timber resources removed.
- Acres of timberland (including land suited for timber production) converted to other, non-productive land uses.

Timber resources were analyzed using Geographic Information System (GIS) spatial analyses, scientific literature reviews, U.S. Forest Service (Forest Service) handbooks and manuals, Forest Service land and resource management plans, and other information and analysis documented in reports prepared by and for Midas Gold Idaho, Inc. (Midas Gold).

4.14.1.1 Methodology

The assessment of potential effects related to the timber issue and its associated indicators are organized and analyzed for each alternative by the underlying timber management responsibility (either Forest Service or other federal, state, and private). Where appropriate, the analysis is further organized by merchantable sawtimber versus sub-merchantable timber that could be sold as special forest products (e.g., Christmas trees, post and poles, and live transplants).

Analysis of direct effects on timber resources is limited to the analysis area as defined in Section 3.14.1, Timber Resources Introduction and Scope of Analysis. A qualitative analysis of indirect effects on timberlands also is included. Timeframes (i.e., durations) used for analysis of effects relate to the period during which timber resources would be prevented from growing in the analysis area.

In addition to duration of effect, the analysis considers the following metrics to compare timber resources effects under each alternative:

- **Context**. This is defined as the conditions under which removal and recovery of timber resources are occurring.
- **Extent**. This is defined as the area experiencing timber removal and recovery (measured in acres).

- **Magnitude**. This is defined as the quantity of timber removed in volume of timber resources removed (measured in cubic feet [CF] or thousand board feet [MBF], as appropriate).

The methods used to estimate the quantity and extent of timber resources in the analysis area and the analysis of impacts on timber resources is summarized below and further detailed in Timber Resources Methodologies and Impact Analysis Report (AECOM 2020).

4.14.1.1.1 INFORMATION SOURCES

To map the extent of existing timber resources and acres impacted, the following data were used:

- Forest Service Vegetation Classification Mapping and Quantitative Inventory (VCMQ) existing vegetation mapping for the Payette National Forest (PNF) and Boise National Forest (BNF) (Forest Service 2016a, 2017a)
- Payette Vegetation Keys (Forest Service 2012)
- LANDFIRE Land Cover Map Unit Descriptions and GIS mapping (U.S. Geological Survey 2016, 2019)
- PNF and BNF Fire History data layers (Forest Service 2016b, 2017b)

To develop timber resource volume estimates and quantities impacted, the following sources were used:

- PNF 2001 Forest Inventory (Forest Service 2002)
- Local Volume Table Reports for “Meadow Slope 3” timber sale, Cruise #80302, and for “Rough Finn IRTC” timber sale, Cruise #15302 (Forest Service 2017c,d)
- PNF Strata (Forest Service 2004)

4.14.1.1.2 TIMBER VOLUME

Volume of timber was estimated in the analysis area by extracting sampled vegetation characteristics from the VCMQ mapping for the PNF and BNF, including timber dominance type, tree size, and canopy cover, from the GIS to create a set of unique stand conditions. The resulting 200 stand conditions represent all of the combinations of the eight timber types found in the analysis area, the five tree-size classes in the VCMQ (i.e., seedling, sapling, small, medium, and large); and the five canopy cover classes in the VCMQ (i.e., low, low-medium, medium, medium-high, and high). Only trees greater than 10 inches in diameter at breast height, which corresponds to medium and large trees, are considered merchantable sawtimber; seedling, sapling, and small trees are considered special forest products on the PNF and BNF.

To estimate average volume per acre for each of the 200 stand conditions, generalized forest strata data were combined with available Forest Service inventory data, which provided estimates of trees per acre in each stand type; and estimates of volume per tree, by species and size class (Forest Service 2017c,d). The resulting stand-volume table, containing volume-per-acre estimates for all 200 unique stand conditions, was applied to mapped timberlands in the analysis area[1]. Timber volumes presented in the discussions are distinguished between sawtimber and sub-merchantable trees; however, a breakdown by species is not provided.

4.14.1.1.3 ASSUMPTIONS

- All portions of the analysis area within the PNF and BNF boundaries were characterized by existing VCMQ vegetation dominance types, using spatial data developed by the PNF and BNF, with a minimum polygon size of 5 acres. These data were not developed to characterize timber resources, and therefore the conifer land form was used as a proxy for timberland but has associated limitations. Limitations include: 1) not all areas mapped as coniferous forest lifeform are productive timberlands; 2) many of the sparser conifer stands (10 to 30 percent canopy) may not have been mapped as coniferous forest lifeform, instead many of these fell into various shrubland categories or burned categories (Forest Service 2019); 3) the minimum mapping unit of 5 acres is not small enough to capture all developed roads and other narrow cleared corridors, and therefore the mapped extent of vegetation may extend across these developed, unvegetated areas; and 4) existing roaded areas fell below the minimum mapping unit and although they do not contain timber, some portions of mapped timber resource polygons include roaded areas devoid of trees.
- Beyond the limitations associated with VCMQ mapping accuracy on National Forest System (NFS) lands, these data were not available for portions of the SGP area on private, state, and other federal land. To characterize vegetation in these areas, publicly available vegetation community LANDFIRE data with a 30-square-meter minimum mapping unit were manually translated (“cross-walked”) to the closest corresponding NFS vegetation dominance type. LANDFIRE data are not ground-truthed; therefore, vegetation conditions on private, state, and other federal land may be less accurately represented than conditions on NFS lands.
- Although the Reclamation and Closure Plan, Stibnite Gold Project (RCP) (Tetra Tech 2019) indicates that some portion of forest resources in the analysis area would be used during mining operations, and some portion may be harvested for sale (as timber), Midas Gold does not provide an acreage estimate or indicate the location of forest resources intended for each use. In the absence of this information, all forested areas in the analysis area meeting the definition of timber resources were assumed to be harvested for sale during SGP construction and operations.

[1] Timber volume was estimated in cubic feet, which is a full-log volume measurement. The board foot is the unit of measure for wood intended for the finished wood product market, and the timber volume unit used in the Payette National Forest Land and Resource Management Plan (Payette Forest Plan) and Boise National Forest Land and Resource Management Plan (Boise Forest Plan). To compare estimates of timber volume to the PNF and BNF timber extraction goals, cubic feet of timber was converted to MBF using Cahill’s conversion factor for 16-inch log diameters. The factor is “5.24 cubic meters of wood per thousand board feet,” and is based on the Westside Scribner rule with log lengths up to 40 feet, and assumes no reduction in volume for defects (Spelter 2004).

- In the absence of timber cruises (i.e., a sample measurement of a stand used to estimate the amount of standing timber that the forest contains) for the SGP area, the volume and distribution of sawtimber and special forest products on the landscape can only be approximated from landscape-level vegetation mapping at a minimum mapping unit of 5 acres. Therefore, the data may indicate that some areas contain timber or special forest products, while a timber cruise of the area may reveal different conditions.

Additional analytical assumptions that were made in order to develop a consistent, repeatable analysis for the SGP are detailed in the *Timber Resources Methodology and Impact Analysis Report* (AECOM 2020).

4.14.2 Direct and Indirect Effects

The following Section presents a summary of the detailed analysis presented in *Timber Resources Methodologies and Impacts Analysis Report* (AECOM 2020).

The harvest and sale of timber is an intended use of NFS lands; however, to protect multiple uses and promote the sustained-yield of timber, the Forest Service provides detailed management direction for how and where harvesting on NFS lands is to occur. The effects of removing timber off NFS lands are examined in the context of how consistent the removal and regeneration methods are, as well as location and volume of timber removed, with NFS timber harvest rules and Forest Plan standards and guidelines. Timber removal from non-NFS lands in the analysis area are viewed in the context of state and local regulations governing removal and sale of wood products. Forest Service timber management guidelines do not apply on these lands.

Direct effects to timber resources on NFS-managed lands (“Forest Service timber”) would include timber removal volume, acreage, or practices that conflict with Forest Service direction. Specifically, direct impacts would include:

1. Removal of volume that exceeds annual harvest limits (Total Sale Program Quantity [TSPQ], Allowable Sale Quantity [ASQ], Wood Volume) set by each forest, as shown on **Table 3.14-5**.
2. Removal of timberland acreage from unsuited areas, or of a quantity that exceeds the acres suited for timber production designated in the Payette or Boise Forest Plans.
3. Regeneration of timber resources does not achieve adequate restocking within 5 years of final harvest (16 United States Code 1604(g)(3)(E)(ii)).

Direct effects to timber resources on other federal, state, and private lands may include timber harvest practices on commercial timberlands that conflict with the Idaho Forest Practices Act and associated guidelines. Specifically, direct effects would include:

1. Removal of timber from commercial timberlands in ways that conflict with standards for logging operations, soil protection, stream protection, and restocking of stands.
2. Timber harvest practices that generally do not maintain and enhance natural resources.

Indirect effects on timber resources could include delayed or prolonged growth and recovery of timber species because of removal of suitable soil, seed bank, and understory conditions during operations. Indirect impacts also could include development of unhealthy timber stands from the introduction of pathogens, including insects and disease; or the reintroduction of genetically unsuitable plantings or seed. Indirect effects would be a function of harvest method and reclamation strategy, which are anticipated to be the same across the entire SGP area. Therefore, indirect effects on timber resources are anticipated in all portions of the SGP area where timber removal would occur.

Direct and indirect effects associated with timber resources during construction and operations are based on management standards, which differ between the Forest Service and the State of Idaho or Valley County; the discussion below is organized to reflect those differences. Effective replanting and regeneration, and achievement of regeneration standards during closure and reclamation could decrease impacts to timber resources from operations and closure. However, inadequate efforts to return timberland to forested vegetation could increase the duration and extent of direct and indirect effects to the resource.

4.14.2.1 Summary of Effects to Timber Resources

4.14.2.1.1 Construction and Operations

Vegetation clearing from the analysis area for the action alternatives would impact between 322 acres containing 330,974 CF of sawtimber and sub-merchantable product under Alternative 2, and 501 acres containing 524,023 CF of sawtimber and sub-merchantable product under Alternative 4. The analysis area under action alternatives 1, 2, and 3 contains 38 acres of land suited for timber production, which is associated with the existing transmission line upgrade (within BNF management prescription category [MPC] 5.1 and 4.2) and contains 212 MBF of sawtimber. Alternative 4 contains 85 acres of lands suited for timber production, which include the 38 acres associated with the transmission line upgrade (within BNF MPC 5.1 and 4.2) plus an additional 47 acres associated with the Yellow Pine Route (within BNF MPC 5.1). The suited timberlands under Alternative 4 contain 292 MBF of sawtimber. There is no suited timberland in the analysis area on the PNF under any action alternative.

Timber resources under the action alternatives would be removed during the construction phase, and the soil surface cleared and grubbed to accommodate roads and infrastructure. Timber resources would be largely prevented from reestablishing through the operations period due to the ongoing need for the underlying ground to accommodate structures, facilities, and access routes. Exceptions to this timeline would occur at two mine site components: West End Development Rock Storage Facility [DRSF] and Fiddle DRSF, where concurrent reclamation includes a limited area of conifer replanting; and along Burntlog Route (Under Alternatives 1, 2, and 3), which would remain in use throughout the closure and reclamation phase. Construction and operations under all action alternatives would have long-term effects on the availability and extent of timber resources in the analysis area. These effects would be long-term because timber resources would be removed at the start of the SGP, during the construction period, and the disturbed areas would remain largely unavailable for planting or regrowth for over 15 years.

In addition, all action alternatives include permanent impacts on the availability and extent of timber resources through the permanent conversion of existing timber resources to other, non-timber uses, including the expanded right-of-way (ROW) for the existing transmission line under all action alternatives, the permanent, continued use of the new transmission line under Alternative 2, and the permanent, continued use of the upgraded Yellow Pine Route under Alternative 4.

Permanent loss of timber resources would occur on 89.4 acres under Alternatives 1 and 3. Under Alternative 2, permanent loss of timber resources would occur on 88.8 acres; despite the addition of 1.6 acres of permanent loss associated with retention of the new transmission line to the mine site. Under Alternative 4, approximately 192.1 acres of timber resources would be permanently lost with the additional retention of upgrades to the Yellow Pine Route. Under Alternatives 1, 2, and 3, approximately 38 acres of land suited to timber production would be cleared to accommodate construction and operations of the SGP, 34 acres of which would be permanently prevented from returning to timber vegetation following the SGP. Under Alternative 4, approximately 85 acres of land suited to timber production would be cleared during construction and operations of the SGP, 75 acres of which would be permanently prevented from returning to timber vegetation following the SGP. Under all action alternatives, approximately 38 percent of the permanent loss of timber resources occurs on lands suited to timber production.

The removal of timber resources from lands suited to timber production and unsuited lands, and the associated effect upon the PNF and BNF ASQ and TSPQ, are summarized in **Table 4.14-1**, which shows that Alternatives 1, 2, and 3 are almost indistinguishable in magnitude of effect to timber resources. Alternative 4 has the largest effect on the PNF TSPQ, but otherwise has an indistinguishable effect on the BNF ASQ and TSPQ from the other action alternatives, despite removing timber resources from an additional 47 acres of land suited to timber production.

Table 4.14-1 Comparison of Timber Resource Removal on Forest-Wide ASQ and TSPQ by Action Alternative

Harvest Metric	Alternative 1	Alternative 2	Alternative 3	Alternative 4
	Contribution Towards Annual Maximum (MBF), percentage	Contribution Towards Annual Maximum (MBF), percentage	Contribution Towards Annual Maximum (MBF), percentage	Contribution Towards Annual Maximum (MBF), percentage
PNF TSPQ	3,813 MBF, (9%)	2,369 MBF (6%)	3,808 MBF (9%)	4,313 MBF (11%)
PNF ASQ	0 MBF (0%)	0 MBF (0 %)	0 MBF (0%)	0 MBF (0%)
BNF TSPQ	647 MBF (2%)	648 MBF (2%)	648 MBF (2%)	671 MBF (2%)
BNF ASQ	212 MBF (1%)	213 MBF (1%)	213 MBF (1%)	292 MBF (1%)

Table Source: Compiled by AECOM in 2020 from Forest Service vegetation and fire data (Forest Service 2016a, b; 2017a, b), and Brown and Caldwell 2017

Table Notes:

MBF = thousand board feet; TSPQ = total sale program quantity; ASQ = allowable sale quantity

Timber resource removal geographic extent and magnitude is similar under Alternatives 1 and 3 (**Table 4.14-2a** and **Table 4.14-2b**). The main differences between these two alternatives (location of the Tailings Storage Facility [TSF] and alignment/location of the new transmission line into the mine site) are not reflected in the extent and magnitude of effects to timber resources due to the location of the timber resources. Both the TSF and new transmission line ROW are located largely outside the timber analysis area due to the extent of recent wildfire (i.e., wildfires reported and mapped by the PNF within the last 20 years).

The primary differences in the extent and magnitude of timber resource removal between the action alternatives relates to the removal of the West End DRSF and West End DRSF Diversion under Alternative 2, and the use of the Yellow Pine Route for mine site access under Alternative 4 instead of construction and use of the Burntlog Route. Alternative 2 and 4 also include additional small differences, such as the inclusion of public access roads through the mine site during mining. The elimination of the West End DRSF and West End DRSF Diversion under Alternative 2 accounts for approximately 70 acres of existing timber resources that are retained under that action. Under Alternative 4 the use of the Yellow Pine Route for construction, operations, and closure and reclamation and the development of a groomed over-snow vehicle route would increase the extent of timber resources removal by approximately 119 acres (most of which is on land managed by the Forest Service). The use and construction of the Burntlog Route under Alternatives 1, 2, and 3 would require removal of only 16 acres of timber resources. The larger magnitude of impact to timber resources from development of the Yellow Pine Route versus the Burntlog Route is partially explained by the extent of forest fire damage over the last 20 years, which severely limit the extent of the timber resources analysis area along the Burntlog Route, as shown on **Figure 3.14-1**.

Alternatives 2 and 4 also are differentiated from Alternatives 1 and 3 by the inclusion of public access roads through the mine site during construction, operations, and closure and reclamation. In addition, the Alternative 4 public access road also would serve as a mine delivery route. Timber resources removal associated with public access roads through the mine site is approximately 10 acres under Alternative 2 and approximately 13 acres under Alternative 4.

Tables 4.14-2a and **4.14b** show the area of timber resources and associated volume of wood removed during construction and operations under each of the action alternatives on NFS land as well as other public or private land.

Table 4.14-2a Impacts to Timber Resources by Action Alternative: Volume of Timber Removed (cubic feet)

Land Management	SGP Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Forest Service	Access Roads	22,593	22,596	22,556	71,321
Forest Service	Mine Site	338,078	211,473	337,234	344,573
Forest Service	Off-site Facilities	470	470	470	3,323
Forest Service	Utilities	43,906	44,020	44,165	44,022
Forest Service	*All Components, Subtotal*	*405,047*	*278,559*	*404,425*	*463,238*
Other Federal, State and Private	Access Roads	0	22	0	4,031
Other Federal, State and Private	Mine Site	32,135	32,830	32,268	35,210
Other Federal, State and Private	Off-site Facilities	*4,369*	4,369	4,369	4,369
Other Federal, State and Private	Utilities	17,180	15,195	17,256	17,175
Other Federal, State and Private	*All Components, Subtotal*	*53,684*	*52,416*	*53,893*	*60,785*
All Lands	**All SGP Components[1]**	**458,730**	**330,974**	**458,318**	**524,023**

Table Source: Compiled by AECOM in 2020 from Forest Service vegetation and fire data (2016a,b 2017a,b); Midas Gold Mine Claim spatial data (2017); and AECOM timber volume formulas

Table Notes:

1 All quantities have been rounded; therefore, column and row totals may not add up exactly due to rounding performed in source data.

Table 4.14 2b Impacts to Timber Resources by Action Alternative: Area of Timber Removed (acres)

Land Management	SGP Component	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Forest Service	Access Roads	32	32	32	122
Forest Service	Mine Site	220	152	220	230
Forest Service	Off-site Facilities	3	3	3	4
Forest Service	Utilities	86	86	85	86
Forest Service	*All Components, Subtotal*	*341*	*273*	*339*	*442*
Other Federal, State and Private	Access Roads	0	<1.0	0	6
Other Federal, State and Private	Mine Site	23	22	24	25
Other Federal, State and Private	Off-site Facilities	5	5	5	5
Other Federal, State and Private	Utilities	22	22	22	22
Other Federal, State and Private	*All Components, Subtotal*	50	49	*51*	*59*
All Lands	**All SGP Components[1]**	**392**	**322**	**391**	**501**

Table Source: Compiled by AECOM in 2020 from Forest Service vegetation and fire data (2016a,b 2017a,b); Midas Gold Mine Claim spatial data (2017); and AECOM timber volume formulas

Table Notes:

1 All quantities have been rounded; therefore, column and row totals may not add up exactly due to rounding performed in source data.

4.14.2.1.2 CLOSURE AND RECLAMATION

Reclamation of timber resources begins at the point when the analysis area can support the growth of timber species, the timing of which would vary spatially within the analysis area based on differing operations and closure timelines for different facilities and components. In areas where the ground surface would be cleared, grubbed, and graded during construction and operations, reclamation of timber resources would require the ground to be ripped, augmented with growth media (GM), and seeded/planted. In areas where minimal surface disturbance would be anticipated (i.e., the upgraded transmission line and associated tensioning/pulling areas), the removal of infrastructure would constitute the beginning of timber reestablishment. Activities under the action alternatives that could promote the re-growth of timber resources would start as early as Year 10, including concurrent reclamation of the West End and Fiddle DRSFs. Most reclamation would occur in Years 15 through 20, at which time replanting and site preparation at Yellow Pine pit, Hangar Flats DRSF, worker housing facility, and the new transmission line and associated infrastructure from Johnson Creek to the mine site would be initiated. As a result, timber resources would be absent from across the timber resources analysis area for more than 15 years until revegetation activities commence. Approximately 2 acres would be capable of natural regeneration from existing seedstock and seedlings (beneath the new transmission line) under Alternatives 1, 3, and 4 (under Alternative 2 the new transmission line would be retained and timber resources prevented from reestablishing permanently within its alignment), while the remaining acreage (390 acres under Alternative 1, 389 acres under Alternative 3, and 499 acres under Alternative 4) acres would require a combination of site preparation techniques to support forest resource re-growth due to the intensity of the disturbance to existing soil and vegetation. Although the West End and Fiddle DRSFs would be reclaimed concurrently during active mining operations, the RCP includes only limited timber resource planting in those footprints. Most disturbed areas planned for timber resource reclamation would not be prepared with GM or planted until operations are complete, including the Midnight Growth Media Stockpile area, haul roads, the Yellow Pine pit walls, and North Yellow Pine Growth Media Stockpile. The duration of impacts to timber resources, including lost timberland productivity, would be expected to persist for more than 15 years under all action alternatives.

To address losses of vegetation, 472 acres would be planted with conifer and other tree species. Areas identified for timber species replanting are entirely within the mine site, where lands would either be treated to regenerate forest conditions (planted at 81 trees per acre) or park-like conditions (planted at 170 trees per acre) under two conditions: cool aspect and general aspect. Planted timber species would include primarily Douglas-fir and lodgepole pine, with the inclusion of Engelman spruce on the cool-aspect sites (Tetra Tech 2019).

To prepare disturbed sites for timber replanting, upland portions of the mine site would have 6 inches of stockpiled GM applied. Areas with a base of development rock or development rock and tailings (DRSF and TSF) would have 12 inches of GM applied. Timber productivity generally correlates with soil depth and quality, which implies that the shallow depth of GM (6 inches) applied in most uplands where timber replanting is planned at final reclamation would likely limit native forest production. Productivity varies with other factors that are not equal across a site, such as moisture inputs, therefore an exact correlation between productivity and GM soil depth would not be expected. In addition, underlying “root zone material” influences productivity, because native forest trees may root several feet below the upper soil layers to exploit moisture and nutrients, and provide physical anchoring. In this case, the reclaimed sites over native soils or regolith material are therefore likely to be more productive than sites on DRSFs, despite the addition of 12 inches of GM on the DRSFs. Compared to native soils and regolith, mining substrates derived from deep in the earth present challenges to ecosystem reclamation (Cooke and Johnson 2002). These include physical characteristics of very coarse substrate in waste rock (development rock), and chemistry that is highly variable, but generally deficient in essential nutrients, and potentially high in other elements (metals) that may restrict plant growth. For more detail on the soil reclamation plan and resulting quality and content of reclaimed GM under the action alternatives, refer to Section 4.5.2, Soils, Direct and Indirect Effects: Quality and Suitability of Available RCM.

Of the approximately 472 acres planned for revegetation in conifer species, at most 78 acres fall within the timber resources analysis area (i.e., where existing timber resources are located as well as planned for removal). The remaining areas are on portions of the analysis area that support grasslands, shrublands, and hardwood forest; or that were burned in the past and currently do not support timber resources. **Table 4.14-3** presents the area of timber resources in the analysis area of each action alternative; the area that would be planted with timber species and other vegetation such as shrub or grassland species according to the RCP (Tetra Tech 2019); and the portion of each analysis area that would not be replanted (reclaimed). A minimum of 213 acres under Alternative 2, and as much as 320 acres under Alternative 4 would not be replanted under the SGP. The Alternative 4 timber analysis area would receive the largest replanting effort of all the action alternatives; however, it would involve the smallest timber resource reclamation effort, based upon reclamation area as a percent of disturbed area.

Given the existing disturbed quality of the ground surface in many areas, particularly at the mine site, timber regrowth would not be expected to occur for many years. The RCP does not include reclamation planting plans for disturbed portions of the utility corridor, at the off-site facilities, or along access roads; where 32 acres of timber resources in the analysis area under Alternatives 1, 2, and 3 would be removed. According to the RCP, the new road sections of Burntlog Route would be removed and ripped, while the upgraded portions would be narrowed to their current conditions, and the excess width would be reclaimed. However, due to the layout of the upgraded road sections (flatter grades and gentler curves), the post-mining condition would exceed the width of the existing condition, representing a small permanent loss of timber resources. Reclamation of new sections of Burntlog Route under Alternatives 1, 2, and 3 would not commence until all final closure/reclamation has been completed at the end of the post-closure phase. In the absence of planting and growth material placement, timberland regeneration along new sections of Burntlog Route would depend on natural seeding from adjacent forest and would likely take more than 20 years to establish.

Table 4.14-3 Existing Timber Resource Area and Planned Replanting in Analysis Area of the Action Alternatives

Action Alternative	Timber Resources in Analysis Area (acres)	Planted with Timber Species (acres)[1]	Planted with Shrub or Grassland Species (acres)[2]	Timber Resources not Reclaimed (acres)	Percent of Analysis Area not reclaimed (acres)
Alternative 1	392	77	102	213	54%
Alternative 2	322	52	53	217	67%
Alternative 3	391	77	101	213	54%
Alternative 4	501	78	102	320	64%

Table Source: Compiled by AECOM in 2020 from Forest Service vegetation and fire data (Forest Service 2016a,b; 2017a,b), and Brown and Caldwell 2017, 2019

Table Notes:

1 The area reclaimed to timber resources is based on the overlap of the analysis area for timber resources and the location of Forested and Parkland planting areas presented in the RCP (Tetra Tech 2019).

2 The area reclaimed to shrubs or grassland is based on the overlap of the analysis area for timber resources and the location of Shrubland areas, as well as areas designated for seeding of grasses and herbaceous species presented in the RCP (Tetra Tech 2019).

Approximately 100 acres in the analysis area for the action alternatives would be ripped, and receive other site preparation such as GM placement, but would not be planted with timber species. These areas would not be prevented from supporting timber species; however, the anticipated GM depths and subsurface materials in these locations would potentially be restrictive, particularly at providing rooting depths required by mature trees. Based on planting maps, and GM characteristics and placement plans, it is anticipated that at best, only 20 percent of the analysis area for the action alternatives could be adequately restocked within 5 years after final harvest. In most locations where timber resources would be removed, timber vegetation is not part of the planting plan (80 percent of the analysis area), and vegetation conditions would resemble either grasslands or shrublands, or remain bare for an extended period following closure and reclamation.

4.14.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.14.4 Cumulative Effects

The cumulative effects analysis area for timber resources is the entire area of the PNF and BNF, as well as any commercial timberlands in Valley County. The analysis focuses on current and future projects on the PNF and BNF as those forests have established harvest volume limits and spatially designated lands suitable for timber production. Timber harvest projects occurring on commercial timberlands in the analysis area are unknown at this time and are therefore unavailable to consider in the analysis of cumulative effects to timber resources.

Cumulative effects associated with the SGP consider the range of existing and foreseeable activities and their potential effects with respect to timber resources. This includes past and present actions that have, or are currently, affecting timber resources and areas from which timber is harvested, as well as reasonably foreseeable future actions (RFFAs) that could cumulatively contribute to timber resource impacts in the analysis area. This list of projects includes timber harvest sales, as well as mineral exploration and mining activities, transportation projects, hazardous fuels and noxious weed control projects, and wildfires that could occur within the same timeframe as the impacts of SGP. Projects with a vegetation management component that includes incidental removal of conifer tree species would not be considered to cumulatively contribute to timber resource impacts in the analysis area unless the project included sale of the cut conifer trees. The potential for cumulative effects associated with each project type, and example projects in the cumulative effects analysis area, are described below.

Forest Management. None of the current and future forest management projects within the timber resources cumulative effects analysis area include a commercial timber sale component and are therefore not considered to contribute to cumulative impacts on timber resources.

Mineral exploration and mining activities. None of the currently planned or future mine development projects in the cumulative effects analysis area include sale of cut trees at this time and therefore were determined to not contribute to potential cumulative effects on timber resources.

Transportation projects. Road maintenance, improvement (widening) projects, and bridge replacements are likely to occur in the future in the timber resources cumulative effects analysis area. Roadway projects could impact timber resources through removal of productive timber along roadways. Maintenance of existing roadways would likely be short-term, while new roadways could have a larger effect by removing timberland from permanent production, depending upon the location of the project and its proximity to land suited for timber production. Projects with a road improvement or transportation element include the East Fork Salmon River Restoration and Access Management Plan on the PNF, the Granite Meadows project on the PNF, and the South Fork Restoration and Access Management Plan on PNF as well as BNF. Only the Granite Meadows project includes an explicit discussion of commercial timber sales and therefore it is the only transportation project that could contribute to cumulative effects on timber resources.

Hazardous fuels reduction and noxious weed control projects. Wildfires have affected timber resources throughout the analysis area and will continue to do so in the future. Future wildfires may affect timber resources, in the event they occur on land suited for timber production, by applying hazardous fuels reduction treatments to the landscape. The damaging effect of wildfire may be mitigated and projects with this aim could contribute beneficially to the cumulative effect of timber removal in the analysis area. Similarly, control of invasive and noxious plant species is likely to benefit timber resources by improving stand productivity. Fuels management projects include Big Creek Fuels Reduction and the Granite Meadows Project. Both Big Creek Fuels Reduction and the Granite Meadows projects include explicit discussions of commercial timber sales associated with fuels reduction activities therefore they both could contribute to cumulative effects on timber resources.

Two known RFFAs (the Big Creek Fuels Reduction Project and Granite Meadows Project) could result in loss of timber resources. However, all projects (private or federal actions) would have to meet the requirements of either National Forest Management Act of 1975 or The State of Idaho and Valley County, which include appropriate planning and compliance to meet their standards for timber stand health and productivity (sustained yield). In addition, actions on NFS lands must meet the standards of the Forest Plan, which specifically addresses annual harvest limits for timber resources on suited and unsuited timberlands.

4.14.4.1 Alternative 1

Available information for RFFAs indicates timber harvest could occur on an additional 67,250 acres of the PNF with implementation of the Big Creek Hazardous Fuel Reduction Project and the Granite Meadows Project. It is unknown if any portions of these areas would occur on land suited for timber production, but if the entire acreage was on land suited for timber production, the combined harvest area would only represent 20 percent of the suited lands on the PNF. It also is not known what volume of timber resources these project areas support, but the projects are PNF-sponsored actions and therefore would be coordinated with the local silviculturalist on the PNF and designed to not exceed ASQ and TSPQ. In addition, these projects would not remove suited lands from production, rather they would, by their intent, maintain forest health and productivity. Implementation of activities proposed under Alternative 1, when combined with other potential activities associated with projects in the cumulative impact analysis area would not exceed harvest volume limits or contribute significantly to removal of timber from land suited for timber production in the cumulative effects analysis area. Therefore, these activities would not result in impacts that would be considered to contribute to cumulative effect on timber resources.

4.14.4.2 Alternative 2

As described in Section 4.14.4.1, available information for RFFAs within the cumulative effects analysis area indicates timber harvests could occur on additional land suited for timber production. However, the quantity and extent of harvest would not result in impacts that would be considered to contribute a cumulative effect on timber resources. All RFFAs with a timber harvest component are planned and would be performed by the PNF on PNF lands, and therefore timber removal would adhere to approved harvest limits and occur on suited lands.

4.14.4.3 Alternative 3

As described in Section 4.14.4.1, available information for RFFAs within the cumulative effects analysis area indicates timber harvests could occur on additional land suited for timber production. However, the quantity and extent of harvest would not result in impacts that would be considered to contribute a cumulative effect on timber resources. All RFFAs with a timber harvest component are planned and would be performed by the PNF on PNF lands, and therefore timber removal would adhere to approved harvest limits and on suited lands.

4.14.4.4 Alternative 4

As described in Section 4.14.4.1, available information for RFFAs within the cumulative effects analysis area indicates timber harvests could occur on additional land suited for timber production. However, the quantity and extent of harvest would not result in impacts that would be considered to contribute a cumulative effect on timber resources. All RFFAs with a timber harvest component are planned and would be performed by the PNF on PNF lands, and therefore timber removal would adhere to approved harvest limits and on suited lands.

4.14.4.5 Alternative 5

Implementation of Alternative 5 would present no cumulative contribution to timber resources.

4.14.5 Irreversible and Irretrievable Commitments of Public Resources

4.14.5.1 Alternative 1

4.14.5.1.1 IRREVERSIBLE

An irreversible commitment of timber resources and land suited for timber production to other uses would occur in the expanded ROW associated with upgrades to the existing transmission line, which would not be returned to timberland at completion of the SGP. This permanent reduction of timberland would cover approximately 89 acres in the analysis area, approximately 74 acres of which are on NFS land and contain 34 acres of land suited for timber production in MPCs 5.1 and 4.2, with approximately 200 MBF of sawtimber.

Although most timber species are considered to be renewable, certain timber resources that would be impacted under Alternative 1 would be renewable only over long-time spans, including mature sawtimber. Growth of timber species in the analysis area would be affected and their growth particularly slowed, in highly disturbed portions of the mine site due to the loss of native soil resources and the long timespan required for replaced soil resources (GM) to recover productive capacity. In addition, some seedbanks and topsoil may have long recovery periods following the disturbance associated with Alternative 1. In most disturbed portions of the analysis area, timber re-growth would be prohibited for the duration of the construction and operations but would be encouraged to resume during the reclamation phase. During this phase, all facilities, structures, new access roads, and other components, excluding the expanded ROW around the transmission line upgrades, would be removed. Limited areas of previously occupied timberland at the mine site would be replanted, while much of the previously occupied timberland would be left to naturally re-seed from adjacent plant sources. Reestablishment of high-value timber resources may require decades or longer to return timber vegetation to the extent of the analysis area from which timber resources would be removed.

4.14.5.1.2 IRRETRIEVABLE

The removal of timber resources is an irretrievable commitment because of the long timespan required for timber resources renewal, particularly sawtimber. SGP-related activities throughout the analysis area would remove timber resources for 15 years at a minimum, and likely for as many as 50 years in some places. The removal of sub-merchantable product from the analysis area is an irretrievable commitment, because special forest products derived from those sub-merchantable trees would be unavailable during operations and construction, and likely for an additional 5 or more years after replanting. In MPCs 5.1 and 4.2 in the BNF, Alternative 1 would prohibit (but not permanently prevent) timber production on 4 acres of land suited for timber production over approximately 20 years. Sawtimber and special forest product resources in these areas would be irretrievably affected.

4.14.5.2 Alternative 2

4.14.5.2.1 IRREVERSIBLE

An irreversible commitment of timber resources and land suited for timber production to other uses would occur under Alternative 2 in the expanded ROW associated with upgrades to the existing transmission line and in the new transmission line alignment, both of which would not be returned to timberland at completion of the SGP. This permanent reduction of timberland constitutes 89 acres in the analysis area, approximately 75 acres of which are on NFS land and contain 34 acres of land suited for timber production in MPCs 5.1 and 4.2, with approximately 570 MBF of sawtimber.

In addition, an irreversible commitment of sawtimber from highly disturbed portions of the analysis area at the mine site, along access roads, and off site also would occur, as described under Alternative 1.

4.14.5.2.2 IRRETRIEVABLE

Irretrievable commitments of timber resources under Alternative 2 are the same as those descried under Alternative 1.

4.14.5.3 Alternative 3

4.14.5.3.1 IRREVERSIBLE

An irreversible commitment of timber resources and land suited for timber production to other uses would occur under Alternative 3 in the expanded ROW associated with upgrades to the existing transmission line, in the same manner as described under Alternative 1. An irreversible commitment of sawtimber from highly disturbed portions of the analysis area at the mine site, along access roads, and off site also would occur, as described under Alternative 1.

4.14.5.3.2 IRRETRIEVABLE

Irretrievable commitments of timber resources under Alternative 3 are the same as those descried under Alternatives 1 and 2.

4.14.5.4 Alternative 4

4.14.5.4.1 IRREVERSIBLE

An irreversible commitment of timber resources, and land suited for timber production to other uses would occur under Alternative 4 in the expanded ROW associated with upgrades to the existing transmission line and along the upgraded portions of the Yellow Pine Route which would not be returned to timberland at completion of the SGP. This permanent reduction of timberland would cover approximately 192 acres in the analysis area, approximately 170 acres of which are on NFS land and contain 75 acres of land suited for timber production in MPCs 5.1 and 4.2, with approximately 278 MBF of sawtimber. An irreversible commitment of sawtimber from highly disturbed portions of the analysis area at the mine site, along access roads, and off site also would occur, as described under Alternative 1.

4.14.5.4.2 IRRETRIEVABLE

In MPCs 5.1 and 4.2 in the BNF, Alternative 4 would prohibit (but not permanently prevent) timber production on 10 acres of land suited for timber production over approximately 20 years. Irretrievable commitments of timber resources under Alternative 4 are otherwise the same as those descried under Alternatives 1, 2, and 3.

4.14.5.5 Alternative 5

Under Alternative 5, the SGP would not be undertaken. Consequently, no change would occur in the current status of timber resource in the analysis area, and no irretrievable or irreversible commitments of timber resources would occur.

4.14.6 Short-term Uses versus Long-term Productivity

4.14.6.1 Alternative 1

Mine operations and connected actions would dominate land use, and predominantly prevent timber resources re-growth, on approximately 213 acres of land containing existing timber resources (as detailed in **Table 4.14-3**). After operations end, land uses affected by the mine, access roads, utilities, and off-site facilities would largely return to pre-SGP uses, except for the expanded ROW associated with the upgraded transmission line, which would be permanently removed from long-term timber productivity. The long-term productivity of most timberlands removed during construction and operations would therefore be temporarily reduced, but then would be facilitated through site preparation, seeding, and planting described in the RCP. The effectiveness of GM reclamation and planting mix, techniques, and maintenance, would determine the long-term productivity of disturbed timber resources in the Alternative 1 analysis area. Based on analyses presented in Section 4.5.2, Direct and Indirect Effects to Soils, the long-term productivity of timber resources would be closely tied to the success of soil and GM reclamation. Some portions of the analysis area containing existing timber resources, particularly those in the footprints of the TSF, DRSFs, and pits, would likely never return to their pre-SGP productive capacity due to limitation on rooting depth related to the depth of the GM and waste rock that would function as substrate for the foreseeable future.

4.14.6.2 Alternative 2

Mine operations and connected actions would dominate land use, and predominantly prevent timber resources re-growth, on approximately 217 acres of land containing existing timber resources (as detailed in **Table 4.14-3**). The type and intensity of impacts associated with short-term uses versus long-term productivity are the same as under Alternative 1. The extent of impacts is slightly larger, an additional 5 acres would be prevented from re-growing timber resources under Alternative 2, because of additional areas under Alternative 2 that fall outside of the planned replanting area presented in the RCP where SGP activities would permanently remove the land from long-term productivity (i.e. retention of the new transmission line and mine site access roads). The same short-term uses (sale and use of timber during the SGP) would occur. Long-term productivity is not anticipated to change under Alternative 2, because the same treatments and timelines used to re-initiate timber vegetation would be applied during closure and reclamation under all action alternatives.

4.14.6.3 Alternative 3

Mine operations and connected actions would dominate land use, and predominantly prevent timber resources re-growth, on approximately 213 acres of land containing existing timber resources (as detailed in **Table 4.14-3**). The type and intensity of impacts associated with short-term uses versus long-term productivity are the same as under Alternative 1. The same area of ROW associated with the existing transmission line upgrades would be permanently removed from long-term productivity, and the same short-term uses (sale and use of timber during the SGP) would occur. Long-term productivity is not anticipated to change under Alternative 3, because the same treatments and timelines used to re-initiate timber vegetation would be applied during closure and reclamation under all action alternatives.

4.14.6.4 Alternative 4

Mine operations and connected actions would dominate land use, and predominantly prevent timber resources re-growth, on approximately 320 acres of land containing existing timber resources (as detailed in **Table 4.14-3**). The extent and volume of timber resource removal is larger under Alternative 4, as compared to the other action alternatives, because the type and intensity of impacts associated with long-term productivity are greater: under Alternative 4 the ROW associated with the existing transmission line upgrades would be permanently removed from long-term productivity as would additional acreage associated with upgrades to the Yellow Pine Route. The short-term uses (sale and use of timber during the SGP) described under Alternative 1 also would occur under Alternative 4. Per-acre long-term productivity is not anticipated to change under Alternative 4, because the same treatments and timelines used to re-initiate timber vegetation would be applied during closure and reclamation under all action alternatives.

4.14.6.5 Alternative 5

Under Alternative 5, SGP activities related to construction, operations, closure and reclamation of the mine site and associated infrastructure would not be undertaken. Consequently, no change would occur in the extent or volume of timber resources or special forest products in the analysis area, and no impacts to productivity would occur.

4.14.7 Summary

Table 4.14-4 presents a summary of impacts to timber resources by alternative, as described in Section 4.14.2.

This page intentionally left blank

Table 4.14-4 Comparison of Impacts to Timber Resources by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may change the availability of timber resources, including sawtimber and special forest products.	Volumes of timber resources removed.	Not applicable for baseline conditions (Timber resources throughout the analysis area are currently not planned for removal).	458,730 CF (*total*) 405,047 CF (*Forest Service*) 53,684 CF (*Other Federal, State and Private Land*)	330,974 CF *(total)* 278,559 CF (*Forest Service)* 52,416 CF *(Other Federal, State and Private Land)*	458,318 CF *(total)* 404,425 CF *(Forest Service)* 53,893 CF *(Other Federal, State and Private Land)*	524,023 CF *(total)* 463,238 CF *(Forest Service)* 60,785 CF *(Other Federal, State and Private Land*)	0 CF *(total)*
	Acres from which timber resources removed.	Not applicable for baseline conditions (Timber resources throughout the analysis area are currently not planned for removal).	392 acres (total) 341 acres *(Forest Service)* 50 acres *(Other Federal, State and Private Timber)*	322 acres (total) 273 acres *(Forest Service)* 49 acres *(Other Federal, State and Private Timber)*	391 acres (total) 339 acres *(Forest Service)* 51 acres *(Other Federal, State and Private Timber)*	501 acres (total) 442 acres *(Forest Service)* 59 acres *(Other Federal, State and Private Timber)*	0 acres *(total)*
	Acres suited for timber production permanently converted to other, non-productive land uses.	Not applicable for baseline conditions (suited timberland is not currently planned for conversion to other, non-productive land uses).	34 acres (*BNF*) 0 acres (*PNF*)	34 acres (*BNF)* 0 acres (*PNF*)	34 acres *(BNF)* 0 acres (*PNF*)	75 acres *(BNF)* 0 acres (*PNF*)	0 acres *(total)*

This page intentionally left blank

4.15 LAND USE AND LAND MANAGEMENT

4.15.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to land use and land management includes the following issues and indicators:

Issue: The Stibnite Gold Project (SGP) would cause changes in land use or land management.

Indicators*:*

- Acres of land used for SGP components by land management agency.
- Acres of total and new land disturbance within SGP area.

Issue: The SGP would cause changes in or create new rights-of-way (ROWs) or easements.

Indicators:

- Miles or acres of new or changed ROWs or easements, regardless of jurisdiction.

Land use and land management were analyzed using geographic information system spatial analyses, U.S. Forest Service (Forest Service) land and resources management plans, the Valley County Comprehensive Plan, and information and analysis documented in reports prepared for the SGP.

4.15.2 Direct and Indirect Effects

The following analysis of effects associated with land use and land management is considered in the context of land use in the overall SGP area that is encompassed by all action alternatives. The analysis discusses impacts to land use and land management that would result from the implementation the SGP. Where applicable, the SGP phase in which the impacts would occur also is discussed. Elements of the overall SGP context for land use and land management include:

- Land management, including National Forest System (NFS), State of Idaho, Bureau of Reclamation, and private lands, as well as patented and unpatented mining claims; and
- Land use in the SGP area (mine site, access roads, utilities, and off-site facilities), including other land uses that may occur on public and private lands.

4.15.2.1 Alternative 1

Alternative 1 components and land management are shown in **Figure 2.3-1**.

4.15.2.1.1 LAND MANAGEMENT

Under Alternative 1, the SGP footprint would occupy approximately 3,533 acres. NFS lands would comprise approximately 2,566 acres, or 73 percent, of the total area, of which1,645 acres would be Payette National Forest (PNF)-administered lands and 921 acres would be Boise National Forest (BNF)-administered lands. Approximately 880 acres (25 percent) would be private lands, including lands owned by Midas Gold Idaho, Inc. (Midas Gold), and 62 acres (2 percent) would be public lands administered by the State of Idaho. Approximately 25 acres (1 percent) would be federal public lands administered by the Bureau of Reclamation. **Table 4.15-1** shows land management and acreage by major component.

Table 4.15-1 Alternative 1 Land Management and Acreage by Component

Component Subtotal	Private	State	Boise National Forest	Payette National Forest[3]	Bureau of Reclamation	Total Acres
Mine Site Subtotal	557	0	0	1,413	0	1,970
Access Roads Subtotal	10	0	395	140	0	545
Utilities Subtotal[1]	288	62	523	92	25	990
Off-site Facilities Subtotal	25	0	3	0	0	28
Total[2]	880	62	921	1,645[4]	25	3,533

Table Source: AECOM 2020

Table Notes:

1 Utilities acreages include upgrades to utilities that are part of the Connected Actions.

2 Subtotals may not add to totals due to rounding.

3 Approximately 65 acres associated with surface exploration pads and temporary roads (mine site component) have unknown land management breakdown, because the exact locations of these exploration areas are not yet known; however, these are included in the PNF mine site subtotal.

4 Approximately 5 acres of land listed under the PNF is administered by the PNF but is within the boundary of the Salmon-Challis National Forest.

4.15.2.1.2 LAND USE

4.15.2.1.2.1 Mine Site

Portions of the mine site have been subject to mining activities for over a century. The mine site footprint under Alternative 1 would occupy approximately 1,970 acres, 913 acres of which is historic disturbance and 1,057 acres of which would be new disturbance. Patented and unpatented mining claims are located in the analysis area, including within the mine site and throughout other areas of the Alternative 1 footprint. Under Alternative 1, SGP construction and operations would take place on approximately 2,215 acres of patented and unpatented mining claims (**Table 4.15-2**). This area includes approximately 567 acres of patented mining claims (private land) and approximately 1,648 acres of unpatented mining claims on NFS land (**Table 4.15-2**).

Table 4.15-2 Alternative 1 Patented and Unpatented Mining Claims

Patented Claims (Acres)	567
% Patented Claims	*26%*
Unpatented Claims (Acres)	1,648
% Unpatented Claims	*74%*
Total Area (Acres)	2,215

Table Source: AECOM 2020

The mine site and its immediate surroundings are highly disturbed by past mining activities and show evidence of long-term mining operations as a dominant land use. However, development of the mine site has not occurred in this location at the scale proposed for Alternative 1, and the SGP footprint would extend beyond areas that have been previously disturbed from mining activity. Implementation of Alternative 1 would change the land use from an area that has been intermittently disturbed and reclaimed (in some areas), to an expanded area of industrial development.

Public access to and through the mine site is currently allowed and used for dispersed recreation, as well as access to surrounding areas for recreation. During construction and operation of Alternative 1, public use would not be allowed within the Operations Area Boundary (see **Figure 2.3-1**). As discussed in Section 4.19.2.1, Direct and Indirect Effects of Alternative 1 on Recreation, approximately 13,446 acres of NFS lands within the Operations Area Boundary would be inaccessible to dispersed recreation during construction and operation of Alternative 1. Public access to the mine site also is used for timber harvest and designated tribal uses. See Section 4.14.2.1, Direct and Indirect Effects to Timber, and Section 4.24.2, Direct and Indirect Effects, Tribal Rights and Interests, for a more detailed discussion on how public access restrictions under Alternative 1 would impact land use for these resources.

Alternative 1 would expand on the past land use of mining and would restrict public access. This change in land use would be considered a direct impact. The duration of direct impacts to land use would be the approximately 20-year life of the SGP. Following closure and reclamation of the mine, land use would be restored to its current use (except at the development rock storage facilities and tailings storage facility [TSF]), with a landscape evident of past mining activity but open for public access for dispersed recreation and access to surrounding areas.

4.15.2.1.2.2 Access Roads

During the initial 1- to 2-year construction period, access to the mine site under Alternative 1 would use the current existing route (Yellow Pine Route) until the Burntlog Route is completed. For the remainder of the life of the mine, access would be via the Burntlog Route.

An off-highway vehicle (OHV) connector trail would be constructed from an improved transmission line access road to Meadow Creek Lookout Road (National Forest System Road [FR] 51290) and would be open to all vehicles. Over-snow vehicle (OSV) trail access would be maintained during construction through a new temporary groomed OSV trail adjacent to the western side of Johnson Creek Road (County Road 10-413) from Landmark to Trout Creek. Due to year-round access to the mine site along the Burntlog Route, an existing, approximately 11-mile groomed OSV route from Warm Lake to Landmark would be closed. The Cabin Creek Road Groomed OSV Route would be constructed with minor upgrades to approximately 10.4 miles of the existing Cabin Creek Road (FR 467), as well as a 1.5-mile segment of a groomer access trail from the Forest Service Warm Lake Project Camp.

Existing Roads

Land use along the Yellow Pine Route, existing segments of the Burntlog Route, and the OSV groomed routes includes roadway uses on private and NFS land. Improvements to existing access roads could indirectly alter land use in areas adjacent to roadways through increased vehicle use and recreational access, beginning during construction (see Section 4.16, Access and Transportation, and Section 4.19, Recreation).

Closure of the existing 11-mile OSV route under Alternative 1 would convert the land use from mainly recreation to mining land use. These changes in land use would be considered direct impacts. The duration of direct and indirect impacts to land use would be experienced during construction and operation and would be reclaimed after mine closure.

New Roads

Construction of the new roads under Alternative 1 would result in a change in use of approximately 300 combined acres of NFS and private land to roadway and trail uses. The Burnt Log Road (FR 447) extension for the Burntlog Route would result in a change of approximately 239 acres of NFS land, the OHV connector trail would result in a change of approximately 5 acres of NFS land, and access roads to the very high frequency (VHF) repeater sites and cell towers would result in a change of approximately 10 acres of NFS land and less than one acre of private land. The temporary Johnson Creek groomed OSV trail and Cabin Creek Road groomed OSV trail would result in a change in use of approximately 14 acres and 31 acres of NFS lands, respectively.

The new section of Burntlog Route, OHV trail, OSV trails, and VHF access roads would be authorized under 36 Code of Federal Regulations (CFR) 228A as a part of a plan of operations. The new roadway segments are considered a direct effect to NFS land use, resulting in a total change of approximately 300 acres of NFS land.

The construction and operation of the new extension of Burnt Log Road (FR 447) for the Burntlog Route would introduce new motorized access to an area where it currently does not exist. Recreational use and recreational special use areas adjacent to new roadway segments outside of the Operations Area Boundary could expand due to increased incidental public access. Collectively, these changes in land use would be considered an indirect impact. These indirect impacts would be experienced during construction, operation, and closure and reclamation of the mine site under Alternative 1.

Both the new OHV connector and the OSV groomed trails would introduce new recreational uses to the SGP area. These new recreational land uses would be considered a direct impact. Indirect impacts may result if new areas are accessed via these routes. The duration of these impacts would be during construction and operation of Alternative 1, and these roadways would be reclaimed following closure of the mine site.

4.15.2.1.2.3 Utilities

Transmission Lines

Alternative 1 would require upgrading existing 12.5-kilovolt (kV) and 69-kV transmission lines to a 138-kV system, and building 8.5 miles of new transmission line from the new Johnson Creek Substation to the mine site. Existing roads and approximately 4 miles of new spur roads would be used for access during construction and maintenance of the transmission line.

Transmission Line Upgrade

Approximately 63 miles of existing transmission line would require upgrading to a 138-kV system. Transmission line upgrades would involve replacement of existing structures with taller structures and widening the existing ROW to a width of 100 feet. The transmission line upgrade would result in a change of approximately 136 combined acres of land from undeveloped to utility use (**Table 4.15-3**).

Approximately 100 acres of the transmission line ROW associated with the upgrade would be on NFS lands. Idaho Power Company’s (IPCo’s) existing transmission line, its ROW, and access roads are currently authorized under the BNF special use permit #CAS400128. Upgrading the transmission line would require the BNF to amend the existing IPCo special use permit.

Approximately 26 acres of the transmission line ROW associated with the upgrade would be on private land in Valley County and would be associated with two Valley County land use designations: rural and city areas of impact. Construction of the transmission line upgrade on private land would require a conditional use permit from Valley County.

Approximately 8 acres of the transmission line ROW associated with the upgrade would be on state land. A new or amended easement would be required for the expansion of the ROW width to accommodate the upgraded transmission line. The existing transmission line is authorized to IPCo, and a portion of this ROW intersects State Endowment Lands. The Idaho Department of Lands (IDL) is responsible for granting or modifying the transmission line ROW on state-owned lands.

Approximately 3 acres of the transmission line ROW associated with the upgrade would be on Bureau of Reclamation land. Upgrading the transmission line would require the Bureau of Reclamation to amend the existing IPCo special use permit.

New Electric Transmission

Between the new Johnson Creek Substation and the mine site, approximately 8.5 miles of new 138-kV transmission line would be constructed. The ROW for the new transmission line would be approximately 100 feet wide. The new ROW corridor is considered a direct effect to land use, changing these areas to a utility use during construction, operation, and closure and reclamation. The ROW required for the new transmission line segment would result in a land use change of approximately 84 acres (assuming a final ROW width of 100 feet) of NFS and private land (**Table 4.15-3**) and would cross private lands and NFS lands administered by the PNF and BNF.

Table 4.15-3 Alternative 1 Acres of ROWs Required for Upgrading and New Transmission Line ROWs

Land Management	Transmission Line ROW (Existing)	Transmission Line ROW (Upgrade)	Transmission Line ROW (New)
Private	102	26	10
% Private	*32%*	*19%*	*11%*
State	18	8	0
% State	*6%*	*6%*	*0%*
NFS	190	100	74
% NFS	*59%*	*73%*	*89%*
Bureau of Reclamation	11	3	0
% Bureau of Reclamation	*3%*	*2%*	*0%*
Total Area (Acres)[1]	321	136	84

Table Source: AECOM 2020

Table Notes:

1 Subtotals may not add to totals due to rounding.

ROW = right-of-way.

Approximately 74 acres of the new transmission line ROW would be required on NFS lands. The new ROW would be authorized under 36 CFR 228A, Subpart A as a part of a plan of operations. Approximately 10 acres of a new ROW on private lands in Valley County would be associated with two Valley County land use designations: rural, and city areas of impact. Construction of the new transmission line ROW on private land would require a conditional use permit from Valley County.

The authorization of a new transmission line ROW would result in a land use change in the footprint of the ROW, as lands are converted from undeveloped forest land to a managed ROW. Recreational use and recreational special use areas adjacent to a new ROW could change due to increased access from new maintenance access roads. Changes in land use because of the new transmission line ROW would result in both direct and indirect impacts to land uses under Alternative 1. Direct effects to land use would be approximately 84 acres. Indirect impacts would be experienced through the conversion of undeveloped land in the SGP area that is commonly used for recreational, tribal, and other special uses. The duration of impacts would last through construction and operation, and continue post-closure until power is no longer needed at the mine site and the transmission line is reclaimed.

The duration of direct and indirect impacts to land use would last through construction and operation of the new transmission line. After mine closure activities requiring power are complete, the 8.5 miles of new transmission line, from the Johnson Creek Substation to the mine site, would be disassembled. The ROW from Johnson Creek Substation to the mine site and spur roads used to access power pole structures would be recontoured to match surrounding topography and revegetated. Land use in the ROW would be returned to undeveloped NFS and private lands after reclamation is complete. The upgraded transmission line from Lake Fork to the Johnson Creek substation would be retained and used by IPCo; therefore, the direct impact to land use along this ROW would continue beyond the life of the SGP until such time that IPCo decommissions the line.

Electrical Substations

The Johnson Creek substation would be built near the Johnson Creek airstrip on NFS lands, and would provide upgraded electricity to the mine site. The Mine Site substation would be constructed at the mine site to step-down voltage for distribution, and would be located on private lands (less than 1 acre within the mine site disturbance footprint). The Johnson Creek substation would be on NFS land (less than 1 acre). Construction and operation of the Johnson Creek substation would be managed under a Forest Service Special Use permit, and construction and operation of the Mine Site substation on private land may require a conditional use permit from Valley County.

Land use would change to accommodate the more industrial land use of the substations. This change in land use is considered a direct impact that would last through construction and operation, and would be reclaimed post-closure.

Communication Towers and Repeater Sites

Under Alternative 1, existing communication facilities would be expanded using a two-way, rapid communication system. The existing microwave relay tower on private land to the east of the mine site would be upgraded, but the area of disturbance would not change. The two-way radio system would be supported by a series of repeaters placed on public and private land. To maintain communications along the entire Burntlog Route, 10-foot-tall, VHF radio repeaters on 3-foot by 3-foot concrete pads would be placed near the existing Meadow Creek Lookout and Thunderbolt Lookout communication sites, the new Landmark Maintenance Facility, and on private parcels at the mine site, as needed. As an alternative to these locations, a combination of repeaters could be placed at a high point near the Trapper Creek/Burnt Log Road (FR 447) intersection, near the West End communications facility, and at the Landmark Maintenance Facility. No additional disturbance for equipment installation or access would be required. Additionally, a cell tower would be installed to facilitate safety and emergency communications. The disturbance area for the tower would be approximately 30 feet by 60 feet, including all required equipment, and would be near the Meadow Creek Lookout, on a summit east of Blowout Creek drainage, or near the proposed transmission line alignment upslope of the proposed Hangar Flats pit.

Although these communication sites would have small disturbance footprints (less than 0.1 acre each), they would be considered changes in land use from undeveloped to utility use. This change in land use is considered a direct impact that would last throughout construction and operation. Upon closure of the mine site, any communication facilities would be decommissioned and removed, and the ground would be contoured to blend into surrounding terrain.

4.15.2.1.2.4 Off-site Facilities

The Stibnite Gold Logistics Facility would be built on private land along Warm Lake Road and would require approximately 25 acres of disturbance. It would alter land use in this area from undeveloped land to developed land. This change in land use would be considered a direct impact of Alternative 1. The duration of these impacts would be the life of the SGP (approximately 20 years), and it would be returned to undeveloped land post-reclamation or sold and repurposed.

The Landmark Maintenance Facility would be near the intersection of Warm Lake and Johnson Creek roads on approximately 3 acres of NFS land. Operation of these facilities on NFS lands would be authorized under 36 CFR 228A as a part of a plan of operations. The off-site facilities would be considered a change in land use from open space to developed land. This change in land use would last through construction and operation, and would be returned to open space post-reclamation.

4.15.2.1.2.5 Other Land Uses

Construction of new infrastructure such as the mine site (1,057 acres), access roads (431 acres), utilities (84 acres), and off-site facilities (28 acres) would result in a change of approximately 1,600 acres of previously undisturbed private, state, NFS, and Bureau of Reclamation land. The conversion of land for these mining uses in the SGP area would decrease the amount of land available for other uses such as agriculture, fisheries, timber harvests, tribal uses, and recreation. These impacts would be experienced during construction and operation, and all areas except for the upgraded transmission line would be reclaimed post-closure.

4.15.2.2 Alternative 2

Alternative 2 includes modifications to the proposed operations described under Alternative 1. Modifications with the potential to impact land use and land management include rerouting a segment of the Burntlog Route, constructing a new public access road through the mine site, changing the location of the Landmark Maintenance Facility, and rerouting the transmission line in two locations. Alternative 2 SGP components and land management are shown in **Figure 2.4-1**.

4.15.2.2.1 LAND MANAGEMENT

Under Alternative 2, the SGP area would occupy approximately 3,423 acres. NFS lands would comprise approximately 2,473 acres, or 72 percent, of the SGP area, of which 1,542 acres would be PNF-administered lands and 931 acres would be BNF-administered lands. Approximately 854 acres (25 percent) would be private lands, including lands owned by Midas Gold, and 76 acres (2 percent) would be administered by the State of Idaho. Approximately 19 acres (1 percent) would be administered by the Bureau of Reclamation. **Table 4.15-4** shows land management and acreage by major component.

Table 4.15-4 Alternative 2 Land Management and Acreage by Component

Component Subtotal	Private	State	Boise National Forest	Payette National Forest[3]	Bureau of Reclamation	Total Acres
Mine Site Subtotal	554	0	0	1,325	0	1,879
Access Roads Subtotal	10	0	394	125	0	529
Utilities Subtotal[1]	265	76	532	92	19	985
Off-site Facilities Subtotal	25	0	5	0	0	30
Total[2]	854	76	931	1,542[4]	19	3,423

Table Source: AECOM 2020

Table Notes:

1 Utilities acreages include upgrades to utilities that are part of the Connected Actions.

2 Subtotals may not add to totals due to rounding.

3 Approximately 65 acres associated with surface exploration pads and temporary roads (mine site component) have unknown land management breakdown because the exact locations of these exploration areas are not yet known; however, these are included in the PNF mine site subtotal.

4 Approximately 5 acres of land listed under the PNF is administered by the PNF but is within the boundary of the Salmon-Challis National Forest.

4.15.2.2.2 LAND USE

4.15.2.2.2.1 Mine Site

The mine site footprint under Alternative 2 would occupy approximately 1,879 acres, and would create approximately 991 acres of new disturbance at the mine site. Mining methods as outlined for Alternative 1 would not change under Alternative 2, except a Centralized Water Treatment Plant would be included in the Alternative 2 mine site footprint. Patented and unpatented mining claims in the SGP area are located both in the mine site and in the overall Alternative 2 footprint. Alternative 2 construction and operations would take place on approximately 564 acres of patented mining claims, and approximately 1,515 acres of unpatented mining claims (**Table 4.15-5**) on NFS land.

Table 4.15-5 Alternative 2 Patented and Unpatented Mining Claims

Patented Claims (Acres)	564
% Patented Claims	*27%*
Unpatented Claims (Acres)	1,515
% Unpatented Claims	*73%*
Total Area (Acres	2,079

Table Source: AECOM 2020

Impacts to land use during construction, operation, and post-closure at the mine site under Alternative 2 would be the same as those described under Alternative 1.

4.15.2.2.2.2 Access Roads

Under Alternative 2, access to the mine site via the Burntlog Route would be provided as described in Alternative 1, except for an approximately 5.3-mile section in the Riordan Creek drainage. This Burntlog Route segment would be relocated to the southern side of the Riordan Creek drainage and would be shortened by approximately 1.3 miles. Restriction of public access within the Operations Area Boundary also would be the same as Alternative 1, except a new public access road would be constructed through the mine site to link the Stibnite Road portion of the McCall-Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) using one of two options as described in Section 2.4.4.2, Public Access.

Existing Roads

Impacts to land use along the Yellow Pine Route and the OSV groomed trails would be the same as described in Alternative 1. Impacts from improvements to existing access roads would be the same as those discussed under Alternative 1.

New Roads

Construction of new roads under Alternative 2 would result in a land use change of approximately 301 combined acres of NFS and private land. The relocated section of Burntlog Route would result in a land use change of approximately 222 acres of NFS land, and the new public access road through the mine site would result in a land use change of approximately 18 acres of NFS and private land. The OHV connector trail, access roads to the VHF repeater sites and cell towers, temporary Johnson Creek groomed OSV trail, and Cabin Creek Road groomed OSV trail would result in the same impacts as those described under Alternative 1.

The new section of Burntlog Route, the OHV trail, public access road, temporary Johnson Creek groomed OSV trail, Cabin Creek Road groomed OSV trail, and VHF access roads would be authorized under 36 CFR 228A as a part of a plan of operations. The new roadway segments are considered a direct effect to land use, resulting in a total change of approximately 298 acres of NFS land, including 222 acres for the Burntlog Route, 5 acres for the OHV trail, 16 acres for the public access road, 14 acres for the temporary Johnson Creek groomed OSV trail, 31 acres for the Cabin Creek Road groomed OSV trail, and 10 acres for the VHF access roads.

The duration of these impacts would be during construction and operation of Alternative 2. All new roadway segments would be reclaimed following closure of the mine site. Indirect impacts to land uses such as motorized access, recreation, and timber harvests would be the same as those described under Alternative 1.

4.15.2.2.2.3 Utilities

Transmission Lines

Alternative 2 would include rerouting the transmission line in two locations. Approximately 5.4 miles of the upgraded transmission line would be rerouted to avoid the Thunder Mountain Estates subdivision, and approximately 0.9 mile of the upgraded transmission line would be rerouted to use an abandoned railroad grade. Approximately 8.5 miles of new transmission line would be required for Alternative 2 from the Johnson Creek substation to the mine site. The addition of the Centralized Water Treatment Plant under Alternative 2 would require the new transmission line to remain in perpetuity for Water Treatment Plant operations.

Transmission Line Upgrade

The upgraded transmission line under Alternative 2 would impact 129 total acres (**Table 4.15-6**). Approximately 33 miles of transmission line would require upgrading. Transmission line upgrades are assumed to require a total ROW width of 100 feet. The transmission line upgrade would result in a change of approximately 129 combined acres of land from undeveloped to utility use, including 20 acres of private land, 100 acres of NFS land, 7 acres of state land, and 3 acres of Bureau of Reclamation land (**Table 4.15-6**).

Approximately 100 acres of the transmission line ROW associated with the upgrade would be on NFS lands. Upgrading the transmission line would require the Forest Service to amend the existing IPCo special use permit.

Approximately 20 acres of the transmission line ROW associated with the upgrade would be on private land in Valley County and would be associated with two Valley County land use designations: rural and city areas of impact. Construction of the transmission line upgrade on private land would require a conditional use permit from Valley County.

Approximately 7 acres of the transmission line ROW associated with the upgrade would be on state land. A new or amended easement would be required for the expansion of the ROW width to accommodate the upgraded transmission line. The existing transmission line is authorized to IPCo, and a portion of this ROW intersects State Endowment Lands. The IDL is responsible for granting or modifying the transmission line ROW on state-owned lands, if required.

Approximately 3 acres of the transmission line ROW associated with the upgrade would be on Bureau of Reclamation land. Upgrading the transmission line would require the Bureau of Reclamation to amend the existing IPCo special use permit.

New Electric Transmission

A new ROW authorization for the 8.5 miles of new transmission line is considered a direct effect to land use. The ROW required for the new transmission line segment would disturb approximately 105 acres (assuming a final width of 100 feet) of NFS, private, and state land (**Table 4.15-6**).

Approximately 80 acres of the new transmission line ROW would be required on NFS lands. The new ROW on NFS land would be authorized under 36 CFR 228A as a part of a plan of operations.

Approximately 13 acres of a new ROW on private lands in Valley County would be associated with two Valley County land use designations: rural, and city areas of impact. A ROW authorization on private land would require a conditional use permit from Valley County.

Approximately 11 acres of the new transmission line ROW would be on state-administered lands. A new easement would be required for the expansion of the ROW to accommodate the new transmission line. The IDL is responsible for granting or modifying the transmission line ROW on state-owned lands, if required.

Table 4.15-6 Alternative 2 Acres of ROWs Required for Upgrading and New Transmission Line ROWs

Land Management	Transmission Line ROW (Existing)	Transmission Line ROW (Upgrade)	Transmission Line ROW (New)
Private	84	20	13
% Private	*28%*	*16%*	*13%*
State	18	7	11
% State	*6%*	*6%*	*11%*
NFS	189	100	80
% NFS	*63%*	*77%*	*77%*
Bureau of Reclamation	8	3	<1
% Bureau of Reclamation	*3%*	*2%*	*0%*
Total Area (Acres)[1]	299	129	105

Table Source: AECOM 2020

Table Notes:

1 Subtotals may not add to totals due to rounding.

ROW = right-of-way.

Changes in land use from the new transmission ROW would be the same as described under Alternative 1; however, direct impacts would be experienced in perpetuity, because the transmission line would remain in operation for the Centralized Water Treatment Plant.

Electrical Substations

Land use impacts from the electrical substations in Alternative 2 would be the same as those described under Alternative 1, except the existing Cascade switching substation would be located along Warm Lake Road.

Communication Towers and Repeater Sites

Land use impacts from communication towers and repeater sites would be the same as those described under Alternative 1.

4.15.2.2.2.4 Off-site Facilities

Land use impacts from off-site facilities would be the same as those described under Alternative 1. Alternative 2 would include the new construction of a Burntlog Maintenance Facility; however, it would be within the disturbance limits of one of the Burntlog Route borrow sources and would not create additional changes to anticipated land use impacts.

4.15.2.2.2.5 Other Land Uses

Alternative 2 direct and indirect impacts to other land uses would be the same as those discussed under Alternative 1; however, construction of new infrastructure such as the mine site (991 acres), access roads (431 acres), utilities (105 acres), and off-site facilities (30 acres) would result in an overall change of 1,557 acres of previously undisturbed private, state, NFS, and Bureau of Reclamation land.

4.15.2.3 Alternative 3

Alternative 3 includes modifications to the proposed operations as described under Alternative 1. Modifications with the potential to impact land use and land management include relocating the Meadow Creek TSF and Hangar Flats development rock storage facility to the East Fork South Fork Salmon River drainage, which would require relocating all associated facilities, the worker housing facility, and a portion of the new transmission line. The Burntlog Route would remain as the mine access road and a segment would be rerouted through Blowout Creek valley to accommodate the TSF relocation. Alternative 3 SGP components and land management are shown in **Figure 2.5-1**.

4.15.2.3.1 Land Management

Under Alternative 3, the SGP area would occupy approximately 3,610 acres. Approximately 833 acres (23 percent) would be private lands, including lands owned by Midas Gold, and 62 acres (2 percent) would be administered by the State of Idaho. NFS lands would comprise approximately 2,689 acres, or 74 percent, of the SGP area (1,754 acres on PNF-administered lands and 935 acres on BNF-administered lands). Approximately 25 acres (1 percent) would be administered by the Bureau of Reclamation. **Table 4.15-7** shows land management and acreage by major component.

Table 4.15-7 Alternative 3 Land Management and Acreage by Component

Component Subtotal	Private	State	Boise National Forest	Payette National Forest[3]	Bureau of Reclamation	Total Acres
Mine Site Subtotal	511	0	0	1,560	0	2,071
Access Roads Subtotal	10	0	408	102	0	521
Utilities Subtotal[1]	287	62	524	92	25	990
Off-site Facilities Subtotal	25	0	3	0	0	28
Total[2]	833	62	935	1,754[4]	25	3,610

Table Source: AECOM 2020

Table Notes:

1 Utilities acreages include upgrades to utilities that are part of the Connected Actions.

2 Subtotals may not add to totals due to rounding.

3 Approximately 65 acres associated with surface exploration pads and temporary roads (mine site component) have unknown land management breakdown because the exact locations of these exploration areas are not yet known; however, these are included in the PNF mine site subtotal.

4 Approximately 19 acres of land listed under the PNF is administered by the PNF but is within the boundary of the Salmon-Challis National Forest.

4.15.2.3.2 LAND USE

4.15.2.3.2.1 Mine Site

The mine site footprint under Alternative 3 would occupy approximately 2,071 acres, and would create approximately 1,227 acres of new disturbance at the mine site. Alternative 3 would relocate the TSF and Hangar Flats development rock storage facility from the Meadow Creek drainage, to the East Fork South Fork Salmon River drainage. Impacts to land management is not expected from this relocation because both locations are on NFS land, partially managed as inventoried roadless areas (IRAs).

Patented and unpatented mining claims in the SGP area are located both within the mine site and in the overall Alternative 3 footprint. Alternative 3 mining operations would take place on approximately 520 acres of patented mining claims, and approximately 1,770 acres of unpatented mining claims (**Table 4.15-8**).

Impacts to land use during construction, operation, and post-closure at the mine site under Alternative 3 would be the same as those described under Alternative 1.

Table 4.15-8 Alternative 3 Patented and Unpatented Mining Claims

Patented Claims (Acres)	520
% Patented Claims	*23%*
Unpatented Claims (Acres)	1,770
% Unpatented Claims	*77%*
Total Area (Acres)[1]	2,291

Table Source: AECOM 2020

Table Notes:

1 Subtotals may not add to totals due to rounding.

4.15.2.3.2.2 Access Roads

Under Alternative 3, the Burntlog Route would remain as the mine access road, but an approximately 3.2-mile-long segment would be rerouted through Blowout Creek valley. There would be no public access through the mine site during operations, but the Burntlog Route would connect to Meadow Creek Lookout Road and could provide access around the mine site. The OHV Connector from the Horse Heaven/transmission line route to Meadow Creek Lookout Road would not be constructed. The temporary Johnson Creek groomed OSV trail, Cabin Creek Road groomed OSV trail, and Yellow Pine Route would be the same as described for Alternative 1.

Existing Roads

Impacts to land use along the Yellow Pine Route, existing segments of the Burntlog Route, and the OSV groomed trails would be the same as described in Alternative 1. Impacts from improvements to existing access roads also would be the same as those discussed under Alternative 1.

New Roads

Construction of the new roads under Alternative 3 would result in a land use change of approximately 386 combined acres on NFS and private land. The rerouted Burntlog Route segment would result in a land use change of approximately 331 acres of NFS land. Access roads to the VHF repeater sites and cell towers would result in a land use change of approximately 10 acres of private and NFS land. Improvements to the temporary Johnson Creek groomed OSV trail and Cabin Creek Road groomed OSV trail would result in a change of approximately 14 acres and 31 acres of NFS land; respectively.

The new section of the Burntlog Route, temporary Johnson Creek groomed OSV trail, VHF access roads, and Cabin Creek Road groomed OSV trail would be authorized under 36 CFR 228A as a part of a plan of operations. The new roadway segments are considered a direct effect to NFS land use, resulting in a total change of approximately 386 acres of NFS lands.

The duration of these impacts would last through construction and operation of Alternative 3. The roadway segments would be reclaimed following closure of the mine site. Indirect impacts to land uses such as motorized access, recreation, and timber harvests would be the same as those described under Alternative 1.

4.15.2.3.2.3 Utilities

Transmission Line

Alternative 3 would realign approximately 2.5 miles of the new transmission line from the Johnson Creek substation to the mine site through an existing corridor between the Horse Heaven and Meadow Creek IRAs.

Transmission Line Upgrade

The upgraded transmission line under Alternative 3 would result in the same acreage impacts as Alternative 1 (**Table 4.15-9**).

New Electric Transmission

Approximately 10.8 miles of new transmission line would be constructed for Alternative 3. The new ROW corridor is considered a direct effect to land use. The ROW required for the new transmission line segment would result in a change of approximately 101 acres (assuming a final width of 100 feet) of NFS and private land (**Table 4.15-9**). The new ROW on NFS land would be authorized under 36 CFR 228A as a part of a plan of operations.

Approximately 11 acres of a new ROW on private lands in Valley County would be associated with two Valley County land use designations: rural, and city areas of impact. The ROW authorization on private land would require a conditional use permit from Valley County.

Changes in land use because of the new transmission ROW would be the same as described under Alternative 1. The duration of direct impacts and reclamation efforts also would be the same as those described under Alternative 1.

Electrical Substations

Land use impacts from electrical substations in Alternative 3 would be the same as those described under Alternative 1.

Communication Towers and Repeater Sites

Land use impacts from communication towers and repeater sites would be the same as those described under Alternative 1.

Table 4.15-9 Alternative 3 Acres of ROWs Required for Upgrading and New Transmission Line ROWs

Land Management	Transmission Line ROW (Existing)	Transmission Line ROW (Upgrade)	Transmission Line ROW (New)
Private	102	26	11
% Private	*32%*	*19%*	*11%*
State	18	8	<1
% State	*6%*	*6%*	*0%*
NFS	190	100	90
% NFS	*59%*	*73%*	*89%*
Bureau of Reclamation	11	3	0
% Bureau of Reclamation	*3%*	*2%*	*0%*
Total Area (Acres)[1]	321	136	101

Table Source: AECOM 2020

Table Notes:

1 Subtotals may not add to totals due to rounding.

ROW = right-of-way.

4.15.2.3.2.4 Off-site Facilities

Land use impacts from off-site facilities would be the same as those described under Alternative 1.

4.15.2.3.2.5 Other Land Uses

Alternative 3 direct and indirect impacts to other land uses would be the same as those discussed under Alternative 1; however, construction of new infrastructure, such as the mine site (1,227 acres), access roads (517 acres), utilities (101 acres), and off-site facilities (28 acres) would result in an overall change of 1,873 acres of previously undisturbed private, state, NFS, and Bureau of Reclamation land.

4.15.2.4 Alternative 4

Alternative 4 includes modifications to the proposed operations described under Alternative 1. Modifications with the potential to impact land use and land management include not constructing the Burntlog Route, using Yellow Pine Route throughout the life of the mine, not constructing the OHV Connector trail or access roads to the communications towers, and relocating the maintenance facility. Alternative 4 SGP components and land management are shown in **Figure 2.6-1**.

4.15.2.4.1 LAND MANAGEMENT

Under Alternative 4, the SGP area would occupy approximately 3,219 acres. Approximately 884 acres (27 percent) would be private lands, including lands owned by Midas Gold, and

62 acres (2 percent) would be administered by the State of Idaho. NFS lands would comprise approximately 2,247 acres, or 70 percent, of the SGP area (1,553 acres on PNF-administered lands and 694 acres on BNF-administered lands). Approximately 25 acres (1 percent) would be administered by the Bureau of Reclamation. **Table 4.15-10** shows land management and acreage by major component.

Table 4.15-10 Alternative 4 Land Management and Acreage by Component

Component Subtotal	Private	State	Boise National Forest	Payette National Forest[3]	Bureau of Reclamation	Total Acres
Mine Site Subtotal	560	0	0	1,429	0	1,989
Access Roads Subtotal	11	0	168	38	0	217
Utilities Subtotal[1]	288	62	522	86	25	984
Off-site Facilities Subtotal	25	0	4	0	0	29
Total[2]	885	62	694	1,553	25	3,219

Table Source: AECOM 2020

Table Notes:

1 Utilities acreages include upgrades to utilities that are part of the Connected Actions.

2 Subtotals may not add to totals due to rounding.

3 Approximately 65 acres associated with surface exploration pads and temporary roads (mine site component) have unknown land management breakdown because the exact locations of these exploration areas are not yet known; however, these are included in the PNF mine site subtotal.

4.15.2.4.2 LAND USE

4.15.2.4.2.1 Mine Site

The mine site footprint under Alternative 4 would occupy approximately 1,989 acres. Alternative 4 would create approximately 1,070 acres of new disturbance at the mine site. Mining methods as outlined for Alternative 1 would not change under Alternative 4. Patented and unpatented mining claims in the SGP area are located both within the mine site and in the overall Alternative 4 footprint. Alternative 4 mining operations would take place on approximately 570 acres of patented mining claims, and approximately 1,481 acres of unpatented mining claims (**Table 4.15-11**).

Impacts to land use and during construction, operation, and post-closure under Alternative 4 would be the same as those discussed under Alternative 1.

Table 4.15-11 Alternative 4 Patented and Unpatented Mining Claims

Patented Claims (Acres)	570
% Patented Claims	*28%*
Unpatented Claims (Acres)	1,481
% Unpatented Claims	*72%*
Total Area (Acres)	2,051

Table Source: AECOM 2020

4.15.2.4.2.2 Access Roads

Under Alternative 4, the Burntlog Route would not be constructed, and the Yellow Pine Route would be used for access during mine construction, operations, closure and reclamation. Public access would be provided through the mine site similar to that described in Alternative 2. The temporary Johnson Creek groomed OSV trail from Trout Creek to Landmark would be used during mine construction, operation, and closure and reclamation (it would only be used during construction of the Burntlog Route under Alternatives 1, 2, and 3). Access roads for cell tower and VHF repeater sites in IRAs managed for Backcountry /Restoration would not be constructed under Alternative 4, and instead the sites would be accessed via helicopter. This would minimize changes to land use by requiring fewer new ROW corridors. The Cabin Creek Road groomed OSV trail would be the same as described under Alternative 1.

Existing Roads

Impacts to land use along the Yellow Pine Route, Johnson Creek groomed OSV trail, and the Cabin Creek Road groomed OSV trail would be the same as described in Alternative 1, except major improvements (i.e., widening and upgrading) to the Yellow Pine Route would impact land use on approximately 155 acres of private and NFS lands. This acreage includes development of borrow sources along the Yellow Pine Route for use in upgrading and maintaining the road throughout the life of the mine.

New Roads

Construction of the new roads under Alternative 4 would result in a land use change of approximately 78 combined acres on NFS and private land. The new public access road through the mine site would result in a change in use of approximately 21 acres of NFS and private land. Access roads to the VHF repeater sites and cell towers outside of IRAs would result in a land use change of approximately 4 acres of NFS and private land. Improvements to both the OSV trails would result in a land use change of approximately 53 acres of NFS land.

The new ROW for the public access road, Johnson Creek groomed OSV trail, and Cabin Creek Road groomed OSV trail would be authorized under 36 CFR 228A as a part of a plan of operations. The new ROW corridor is considered a direct effect to NFS land use, resulting in a total change in use of approximately 74 acres, including approximately 17 acres for the public access road, 22 acres for the Johnson Creek groomed OSV trail, 31 acres for the Cabin Creek Road groomed OSV trail, and 4 acres for the VHF access roads.

The duration of these impacts would last through construction and operation of Alternative 4. The new roadway segments would be reclaimed following closure of the mine site, except for the Yellow Pine Route which would remain as improved under Alternative 4. Indirect impacts to land uses such as motorized access, recreation, and timber harvests would be the same as those described under Alternative 1.

4.15.2.4.2.3 Utilities

Transmission Lines

Alternative 4 would be the same footprint (321 acres) for existing transmission lines as Alternative 1. Land use impacts from upgraded (136 acres) and new (84 acres) transmission lines under Alternative 4 also would be the same as described under Alternative 1.

Electrical Substations

Land use impacts from electrical substations in Alternative 4 would be the same as those described under Alternative 1.

Communication Towers and Repeater Sites

Land use impacts from communication towers and repeater sites would be the same as those described under Alternative 1.

4.15.2.4.2.4 Off-site Facilities

The maintenance facility under Alternative 4 would be relocated to the west of Landmark on the southern side of Warm Lake Road; however, this location would remain on NFS land and would require the same footprint (3 acres) as Alternative 1. Therefore, land use impacts from off-site facilities would be the same as those described under Alternative 1.

4.15.2.4.2.5 Other Land Uses

Alternative 4 direct and indirect impacts to other land uses would be the same as those discussed under Alternative 1. The construction of new infrastructure, such as the mine site (1,070 acres), access roads (233 acres), utilities (84 acres), and off-site facilities (29 acres) would result in an overall change of 1,416 acres of previously undisturbed private, state, NFS, and Bureau of Reclamation land to mining uses.

4.15.2.5 Alternative 5

Under Alternative 5, the SGP would not be implemented. The reclamation of historic mining areas associated would not occur under Alternative 5. The Golden Meadows Exploration Project would occur near and within the analysis area and would include exploration activities to better define mineral potential in the area. The proposed exploration drilling areas would occur on NFS lands for a period of at least 3 years. No changes to land use or land management would be expected under Alternative 5.

4.15.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.15.4 Cumulative Effects

The cumulative effects analysis area for land use and land management would be the same as the analysis area for direct and indirect effects.

Cumulative effects associated with the SGP consider the range of existing and foreseeable activities and their potential effects with respect to land use and management. Past and present actions that have, or are currently, affecting land use and land management include ongoing and planned mining activities, exploratory drilling (e.g., Golden Meadows Exploration Project), reclamation and closure of mining and processing facilities, road and airstrip maintenance, infrastructure management and development, noxious weed control, recreation and tourism, water diversion projects, firewood and timber harvest on public and private lands, wildlife conservation and rehabilitation plans, creek restoration, trail construction and maintenance, and hydroelectric projects. Reasonably foreseeable future actions that could cumulatively contribute to land use and land management impacts in the analysis area include: (briefly described in **Table 4.1-2**)

- South Fork Restoration and Access Management Plan
- East Fork Salmon River Restoration and Access Management Plan
- Wildlife Conservation Strategy
- Granite Meadows
- Big Creek Hazardous Fuel Reduction
- State Highway 55 Banks Beach Parking Study
- State Highway 55 Smiths Ferry Improvements
- Morgan Ridge Exploratory Drilling

4.15.4.1 Common to All Action Alternatives

Cumulative effects associated with the action alternatives would occur in combination with past, present, and future actions if these actions result in changes in land use and land management, or if additional ROW or easements were authorized by federal, state, or local entities.

Land use would be impacted by the action alternatives from construction and operations of the mine site and construction of associated facilities (access roads, utilities, and off-site facilities). The conversion of these lands to mine uses, combined with past, present, and planned mining activities, would result in a larger portion of the analysis area being used for mining land uses. Other activities that could change land management include ongoing and planned mining activities, exploratory drilling, reclamation and closure of mining and processing facilities, road and airstrip maintenance, infrastructure management and development, noxious weed control, recreation and tourism, water diversion projects, firewood and timber harvest on public and private lands, wildlife conservation and rehabilitation plans, creek restoration, trail construction and maintenance, and hydroelectric projects. Land use in the analysis area would change from existing conditions as a result of the action alternatives and land management activities associated with the reasonably foreseeable future actions.

4.15.4.2 Alternative 5

Cumulative impacts to land use and land management under Alternative 5 would result from the current ongoing activities combined with past and present actions, as well as the reasonably foreseeable future actions in the cumulative impacts analysis area. These include ongoing and planned mining activities, exploratory drilling, reclamation and closure of mining and processing facilities, road and airstrip maintenance, infrastructure management and development, noxious weed control, recreation and tourism, water diversion projects, firewood and timber harvest on public and private lands, wildlife conservation and rehabilitation plans, creek restoration, trail construction and maintenance, and hydroelectric projects.

4.15.5 Irreversible and Irretrievable Commitments of Public Resources

4.15.5.1 Common to All Action Alternatives

Land use would be altered permanently in the mine site. An area that has been historically used for mining would, after the closure of the mine and reclamation of the site, no longer be used for mining; this would be considered an irreversible commitment of land use. Areas where specific land uses for the action alternatives would be converted from their original land uses, such as recreational (including special uses), tribal, and timber harvests, to mining uses would be considered an irretrievable commitment of land use, because these areas would not be available for other land uses during the life of the SGP for any of the action alternatives.

4.15.5.2 Alternative 5

Under Alternative 5, the SGP would not be undertaken. There would be no irretrievable and irreversible commitment of public resources expected under Alternative 5.

4.15.6 Short-term Uses versus Long-term Productivity

4.15.6.1 Common to All Action Alternatives

Land use would change if any of the action alternatives are implemented. Long-term changes in land use could impact how the area is used for agriculture, fisheries, timber harvests, tribal, recreational, and other uses. However, on reclamation of the action alternatives, it is expected many of the original uses would be restored to areas impacted by the SGP.

4.15.6.2 Alternative 5

The SGP would not be implemented, and there would not be any impacts from short-term uses on long-term productivity associated with Alternative 5.

4.15.7 Summary

For all action alternatives, the SGP would primarily occupy NFS-managed lands, with the majority of impacts on PNF lands. The largest amount of NFS lands would be used under Alternative 3 at 2,689 acres (935 acres BNF; 1,754 acres PNF), and the lowest amount of private lands at 833 acres. Alternative 4 would be comprised of the least NFS acreage at 2,247 acres (694 acres BNF; 1,553 acres PNF), and the most private land acreage at 885 acres. Lands administered by the State of Idaho and Bureau of Reclamation combined would occupy less than 100 acres of the total SGP area for each action alternative.

Land use would be impacted by expansion of the mine site and associated mining activities and facilities (access roads, utilities, and off-site facilities). Other land uses (agriculture, fisheries, timber harvests, tribal, and recreational and special uses) would be impacted by the conversion of land to mine uses. **Table 4.15-12** shows the total acreage impacts from each mine component that would result from each action alternative.

Alternative 3 would require the greatest footprint with 3,610 total acres. Alternative 1 would require 77 acres fewer, and Alternative 2 would require 187 acres fewer than Alternative 3. Alternative 4 would have the smallest footprint at 3,219 acres, 391 acres fewer than Alternative 3.

All action alternatives would require new mine infrastructure to be built on previously undisturbed private, state, NFS, and Bureau of Reclamation lands. **Table 4.15-13** shows the acreage of impacts from the mine components, broken out by alternative.

Table 4.15-12 Total Mine Component Acreage Impacts by Alternative

Mine Component	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)
Mine Site	1,970	1,879	2,071	1,989
Access Roads	545	529	521	217
Utilities	990	985	990	984
Off-site Facilities	28	30	28	29
Total[1]	3,533	3,423	3,610	3,219

Table Source: AECOM 2020

Table Notes:

1 Subtotals may not add to totals due to rounding.

Table 4.15-13 New Mine Infrastructure Acreage Impacts on Previously Undisturbed Land by Alternative

Mine Component	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)
Mine Site	1,057	990	1,227	1,070
Access Roads	431	431	517	233
Utilities	84	105	101	84
Off-site Facilities	28	30	28	29
Total[1]	1,600	1,557	1,873	1,416

Table Source: AECOM 2020

Table Notes:

1 Subtotals may not add to totals due to rounding.

Alternative 3 would impact the largest amount of previously undisturbed land at 1,873 acres. Alternative 1 would require 273 acres fewer, and Alternative 2 would require 316 acres fewer than Alternative 3. Alternative 4 would impact the smallest amount of previously undisturbed land at 1,416 acres, 457 acres fewer than Alternative 3.

The action alternatives also would require new ROWs or easements to accommodate the construction of new and upgraded access roads and transmission lines. These impacts would be located on private and NFS lands; new transmission line ROW would not cross any state or Bureau of Reclamation lands for any action alternatives. New ROW on NFS lands is considered a direct effect to land use and would be authorized under 36 CFR 228A as a part of a plan of operations. ROW authorizations on private lands in Valley County would require a conditional use permit, and ROW authorizations on lands owned by the State of Idaho would require coordination with IDL. **Table 4.15-14** provides the acreage of new ROW required for each alternative.

Table 4.15-14 New Acres of ROW Required by Alternative

New ROW	Alternative 1 (acres)	Alternative 2 (acres)	Alternative 3 (acres)	Alternative 4 (acres)
Roads	431	431	517	233
Transmission Lines	84	105	101	84
Total[1]	515	536	618	317

Table Source: AECOM 2020

Table Notes:

1 Subtotals may not add to totals due to rounding.

ROW = right-of-way.

Alternative 3 would require the largest amount of new ROW at 618 acres. Alternative 2 would require 82 acres fewer, and Alternative 1 would require 103 acres fewer. Alternative 4 would require the smallest amount of new ROW at 317 acres, 301 acres fewer than Alternative 2.

Table 4.15-15 provides a summary comparison of land use and land management impacts by issues and indicators for each alternative.

This page intentionally left blank

Table 4.15-15 Comparison of Land Use and Land Management Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP would cause changes in land use or land management.	*Acres of land used for SGP components by land management agency.*	*(Analysis area)* Private: 925 acres State: 77 acres BNF: 1,027 acres PNF: 2,373 acres BoR: 25 acres	Private: 880 acres State: 62 acres BNF: 921 acres PNF[1]: 1,645 acres[2] BoR: 25 acres	Private: 854 acres State: 76 acres BNF: 931 acres PNF[1]: 1,542 acres[2] BoR: 19 acres	Private: 833 acres State: 62 acres BNF: 935 acres PNF[1]: 1,754 acres[3] BoR: 25 acres	Private: 885 acres State: 62 acres BNF: 694 acres PNF[1]: 1,553 acres BoR: 25 acres	No changes in land management would result.
	Acres of total and new land disturbance within SGP area.	Existing disturbance acreage within analysis area: 1,554 acres (includes historic mine disturbance, existing roads and utilities)	Disturbance acreage impacts: 3,533 total acres 45% (1,600 acres) of total is new disturbance	Disturbance acreage impacts: 3,423 total acres 45% (1,557 acres) of total is new disturbance	Disturbance acreage impacts: 3,610 total acres 52% (1,873 acres) of total is new disturbance	Disturbance acreage impacts: 3,219 total acres 44% (1,416 acres) of total is new disturbance	No changes in land use would result.
The SGP could cause changes in or create new ROWs or easements.	*Miles or acres of new or changed ROWs or easements, regardless of jurisdiction.*	Total existing ROW (transmission lines and roads): 666 acres	Total new ROW (transmission lines and roads): 515 acres	Total new ROW (transmission lines and roads): 536 acres	Total new ROW (transmission lines and roads): 618 acres	Total new ROW (transmission lines and roads): 317 acres	No changes in or new ROWs or easements would result.

Table Notes:

1 Approximately 65 acres associated with surface exploration pads and temporary roads (mine site component) have unknown land management breakdown because the exact locations of these exploration areas are not yet known; however, these are included in the PNF mine site subtotal.

2 Approximately 5 acres of land listed under the PNF is administered by the PNF but is within the boundary of the Salmon-Challis National Forest.

3 Approximately 19 acres of land listed under the PNF is administered by the PNF but is within the boundary of the Salmon-Challis National Forest.

This page intentionally left blank

4.16 ACCESS AND TRANSPORTATION

4.16.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to access and transportation includes the following issues and indicators:

Issue: The Stibnite Gold Project (SGP) may affect access to public lands during mine construction, operations, and closure and reclamation.

Indicator:

- Number, location, and description of changes in access due to new and improved roadways.

Issue: The SGP may change the miles of roads, the amount of use, and types of vehicles on each road.

Indicators:

- Miles of new road.
- Change in amount of use.
- Changes in frequency of rail, air, and water transportation.

Issue: The SGP may affect public safety on the roads used by mine vehicles during construction, operations, and closure and reclamation activities.

Indicators:

- Miles of roads used by mine vehicles.
- Change in traffic volume.
- Potential number of accidents, both current and projected.
- Change in emergency access.

Access and transportation were analyzed using the Payette National Forest Land and Resource Management Plan (2003), Boise National Forest Land and Resource Management Plan (2010), Payette National Forest (PNF) Forest-wide Travel Analysis Report (2015a), Boise National Forest (BNF) Forest-wide Travel Analysis Process Final Report (2015b), Valley County Master Transportation Plan, geographic information system spatial analyses, and information and analysis documented in reports prepared for the SGP. Incomplete and unavailable information related to access and transportation include certain traffic count data, traffic management, and road maintenance details.

Traffic count data was collected in 2015 through 2017 from various sources. This resulted in the use of different types of counters and timeframes, which varied in the specificity of vehicle types recorded (i.e., full-size vehicles only or full-size and light vehicles) and consistency of data collected. Additionally, the percentage of vehicles representing existing Midas Gold Idaho, Inc. (Midas Gold) exploration traffic on these roads is not reflected in the data collected.

A traffic management plan, which would include details for traffic management including road closures affecting public and mine traffic access, has not been submitted. Details of traffic management for public access on the proposed routes for construction, operations, and closure and reclamation, including through the mine site are general and will be developed before the record of decision for the SGP is signed.

For the purposes of this analysis assumptions include road design and engineering including grade changes and curve specifications would be finalized before SGP implementation. Also, zero percent population growth rate was used to analyze the action alternative impacts to access and transportation. Although Valley County assumes four percent population growth throughout the county in its Master Transportation Plan, Valley County is a rural county with land use designations comprised of rural cities, villages, and tourist hubs (Valley County 2008). Although the population in the area has been growing rapidly and is predicted to continue at a substantial rate, in general, rural areas have been static, and populations are predicted to remain the same or increase at a slower rate (U.S. Forest Service [Forest Service] 2010). Additionally, traffic volume within the analysis area can be mainly attributed to recreational activities. The quantitative analysis using a zero percent population growth rate provides a clearer understanding of the alternatives' direct contribution in relation to existing traffic and the transportation system.

4.16.2 Direct and Indirect Effects

The analysis of effects associated with access and transportation is considered within the overall context of the road system in the analysis area. Elements of this context include:

- Mine site access would be provided via the two-lane State Highway (SH) 55 to other access roads located on private and public lands within Valley County, the PNF, and the BNF. Three primary routes are currently used to access the SGP area from Cascade or McCall: Yellow Pine, Lick Creek, and South Fork Salmon River routes (see Section 3.16.3.2, Primary Routes).
- Road maintenance activities (including dust control, removal of debris from roadway and rights-of-way, road repair, and snow removal) for National Forest System (NFS) roads are coordinated between the Forest Service and Valley County through Forest Roads and Trails Act (FRTA) easements.
- Portions of Valley County roads located within the analysis area are open year-round to highway legal vehicles. Valley County plows portions of Johnson Creek Road (County Road [CR] 10-413), Warm Lake Road (CR 10-579), and McCall-Stibnite Road (CR 50-412), and all of South Fork Salmon River Road (National Forest System Road

[FR] 50674/474). Some sections of roads closed in the winter are groomed for over-snow vehicle (OSV) use. This includes portions of Johnson Creek Road, Warm Lake Road, and Burnt Log Road (FR 447).

- A majority of the FRs within the analysis area are open year-round (with some seasonal restriction due to snow) to all motorvehicles (i.e., including off-highway vehicles [OHVs]), except for South Fork Salmon River Road (FR 50674/474), which allows highway legal vehicles only.
- Traffic volume within the analysis area can be mainly attributed to recreational activities and residential traffic. Other activities could include fuels management, mineral exploration, road and utility maintenance activities, and timber harvest. Current traffic levels within the analysis area also can be attributed to the activities that have been ongoing for exploration, monitoring, and research purposes.
- Vehicle accidents occurring on the existing roadway network are caused by driver error, vehicle mechanical issues, and environmental factors such as poor road conditions due to weather and wildlife crossings. Warm Lake Road experiences the highest incidents of accidents within the forest transportation system due to the higher traffic volumes and higher speeds observed (DJ&A, PC 2017).
- Air transportation is a common mode of transportation for residents and visitors recreating in the surrounding region. There are seven public use airports and one private airstrip (Stibnite airstrip) located within the analysis area.
- The Port of Lewiston, Idaho's only seaport, handles barging of cargo shipments and is located approximately 245 road miles and approximately 135 air miles northwest of the mine site.
- The Idaho Northern and Pacific line runs from Cascade south along the Payette River to Emmett and west to Payette where it connects with the Union Pacific line (Idaho Transportation Department [ITD] 2016). The Idaho Northern and Pacific line previously hauled timber products between Emmett and Cascade; however, the use of that railroad line has stopped largely due to the closure of the Boise Cascade sawmill in Cascade (ITD 2013; Valley County 2018). No active rail transportation is located within the analysis area.

For specific discussions on the impacts associated with the construction and use of access roads and SGP-related traffic to the physical, biological, and social environments, refer to Sections 4.6, Noise; 4.7, Hazardous Materials; 4.12, Fish Resources and Fish Habitat; 4.13, Wildlife and Wildlife Habitat; 4.18, Public Health and Safety; 4.19, Recreation; 4.20, Scenic Resources; 4.21, Social and Economic Conditions; 4.22, Environmental Justice; 4.23, Special Designations; and 4.24, Tribal Rights and Interests.

The analysis of effects to access and transportation included in this section is focused on the main access routes to and from the mine in the summer and winter where the bulk of mine-related traffic would occur during construction, operations, and closure and reclamation and therefore could result in potential traffic, access, and safety issues. Thus, this section does not discuss traffic or public access impacts from SGP components such as the transmission line upgrades, the new transmission line to the mine site, communication facilities, or the maintenance facility where substantially less traffic would be anticipated in comparison to daily mine-related traffic on the main access routes to/from the mine site. Section 4.19, Recreation, discusses impacts from the OHV Connector Trail as this trail is for recreation-related vehicle traffic, as well as impacts to OHV use on roads and trails. In addition, because winter access east of Warm Lake and east and south of the village of Yellow Pine is primarily recreation-related, Section 4.19, Recreation, includes the discussion of winter public access impacts from new OSV routes and changes to existing winter access.

4.16.2.1 Alternative 1

4.16.2.1.1 CONSTRUCTION

Construction of Alternative 1 would last up to 3 years. Approximately 20 miles of existing Burnt Log Road (FR 447) would be widened and improved and approximately 15 miles of new road connecting to Meadow Creek Lookout Road (FR 51290) would be constructed within the first 2 years as part of the Burntlog Route. Approximately 1.3 miles of Meadow Creek Lookout Road and approximately 2 miles of Thunder Mountain Road (FR 50375) would also be upgraded. Improvements on Burnt Log Road are anticipated to be completed from May into November, depending upon road and weather conditions. Until the 73-mile Burntlog Route (including the Warm Lake Road from the SH 55 intersection) construction is completed (by the end of the second year), SGP-related traffic would primarily access the mine site via the Yellow Pine Route (refer to **Figure 3.16-1**; see also maps in **Appendix N-2**). Midas Gold would establish eight borrow sites along the Burntlog Route as needed to meet road construction and ongoing maintenance throughout the life of the operation and through closure and reclamation. Signs warning of construction activities would be placed along Burntlog Route.

The 70-mile Yellow Pine Route (Warm Lake Road from SH 55, Johnson Creek Road [CR 10-413], and the Stibnite Road portion of the McCall-Stibnite Road [CR 50-412]) would be used for summer and winter access until the Burntlog Route is constructed for long-term use. Minor surface improvements (e.g., ditch and culvert repair, adding gravel, winter snow removal, and summer dust suppression) would occur on the Yellow Pine Route to reduce sediment runoff and dust generation. There would be no road alignment modification or widening of these existing roads. The 83-mile South Fork Salmon River Route (including the Warm Lake Road from the SH 55 intersection), which is currently used for winter access to the mine site, would not be used as part of the SGP.

While the Yellow Pine Route is in use, Midas Gold would coordinate with Valley County on the use and maintenance of the route for year-round access in accordance with Valley County's public road FRTA easement stipulations. Valley County's use and maintenance requirements involve soil erosion control, vegetation maintenance on slopes associated with earth cut or fill, repair and cleanup of drainage facilities, removal and cleanup of hazardous spills originating from road use, removal of obstructions from the roadway (e.g., fallen trees, limbs), dust control, and snow removal. Revisions could be required to the existing Valley County road maintenance agreement for the Yellow Pine Route for use as a construction route under Alternative 1. Under a cooperative agreement with Valley County, Midas Gold maintenance measures would be performed to repair segments that have deteriorated over time. The aggregate source for Yellow Pine Route maintenance is unknown.

Warm Lake Road north of Cascade, Idaho intersects SH 55, a major transportation corridor throughout Valley County. Midas Gold would work with ITD to improve the Warm Lake Road intersection with SH 55 by adding left and right turning lanes. Improvements may include the addition of a northbound right turn lane, a southbound left turn lane, a new southbound through lane or an acceleration lane on SH 55; modified striping to reduce the skew angle to better accommodate heavier vehicles without additional improvements; and relocation of the 35-miles per hour to 50-miles per hour increase in speed limit on SH 55 at Warm Lake Road further north (Parametrix 2018).

The addition of turning lanes would allow for large trucks carrying equipment and supplies to make turns to/from SH 55 from/onto Warm Lake Road. The improvements also would require approval by Valley County.

4.16.2.1.1.1 Traffic Volumes

During construction, mine traffic under Alternative 1 would generate an estimated annual average daily traffic (AADT) of 65 vehicles (45 heavy vehicles and 20 light vehicles). Heavy vehicles typically travelling on the access roads would include mine supply and delivery trucks transporting materials, goods, equipment, and people. This would result in approximately five mine vehicles traveling to the mine site every hour during the 14 hours of vehicle movement outside the mine site (between 5:00 am and 7:00 pm). Mine haul trucks would only be used at the mine site on private mine haul roads not open to public use. **Table 4.16-1** shows the existing and Alternative 1 AADT for the public roads used during construction.

Table 4.16-1 Existing and Alternative 1 Construction AADT

Name	Existing AADT[1]	Construction AADT (% Increase from Existing)	% Heavy Vehicles[2]
Alternative 1 AADT	-	65	69.2
SH 55	4,127	4,192 (1.6%)	1.1
Warm Lake Road (CR 10-579)	1,174	1,239 (5.5%)	3.6

Name	Existing AADT[1]	Construction AADT (% Increase from Existing)	% Heavy Vehicles[2]
Johnson Creek Road (CR 10-413)	57	122 (114%)	36.9
Stibnite Road (village of Yellow Pine to mine site)	39	104 (166%)	43.3
Burnt Log Road (FR 447)	27	27[3]	-

Table Source: HDR 2017a,b; ITD 2017

Table Notes:

1 Data was collected in 2015 or 2016 except for Warm Lake Road (CR 10-579) data collected in 2017. AADT is calculated by Total Recorded Count/Number of Days Recorded. All figures have been rounded up to whole numbers.

2 The approximate minimum percentage of SGP-related heavy vehicles occurring on the roads.

3 Traffic volumes on Burnt Log Road also would increase from existing conditions due to the construction of the Burntlog Route.

AADT = Annual Average Daily Traffic; CR = County Road; FR = National Forest System Road; SH = State Highway; “-” = not applicable.

As shown in **Table 4.16-1**, traffic volumes associated with Alternative 1 construction would increase approximately 114 percent on Johnson Creek Road (CR 10-413) and approximately 166 percent on the Stibnite Road portion of McCall-Stibnite Road (CR 50-412) from Yellow Pine to the mine site. Over a third of the vehicles traveling on these one-lane, native surfaced roads would be comprised of heavy vehicles and would result in slower travel times for non-mine-related traffic and may deter travelers from using these roadways. Travelers may use alternative roadways, including McCall-Stibnite Road (CR 50-412) and South Fork Salmon River Road (FR 50674/474), to access Yellow Pine. Traffic volumes on Burnt Log Road also would increase from existing conditions due to the construction of the Burntlog Route. The roadways that are currently more traveled would have a less noticeable increase in daily traffic; Warm Lake Road (CR 10-579) traffic would increase by 5.5 percent and SH 55 traffic would increase by only 1.6 percent. Heavy vehicles would comprise less than 4 percent of the total traffic on these two roadways; however, due to the one-lane constraints on both roadways, non-mine-related vehicles may experience slower travel times.

Additionally, reconstruction of the transmission line to the mine site could overlap with the Alternative 1 construction traffic. Construction is planned to occur along the existing alignment and construction crews would be separated throughout the SGP area to minimize construction traffic (HDR, Inc. [HDR] 2017c). Reconstruction of the transmission line along Warm Lake Road and Johnson Creek Road to the mine site is estimated to occur in the third and fourth years of construction and would overlap at the end of the Alternative 1 construction period. Therefore, traffic interruption and delays associated with the reconstruction of the transmission line would increase overall SGP-related traffic on Warm Lake and Johnson Creek roads.

Additionally, there is a seasonal effect of traffic on these roads. Valley County has many summer recreational areas that attract visitors from May through October with peak AADT levels in June, July, and August. Winter driving conditions influence the amount of traffic and result in less AADT during the winter months. Therefore, the seasonal effect of traffic on these roads would show a noticeably greater increase in mine-related winter traffic (i.e., drivers would notice a higher ratio of mine-related traffic to general traffic).

Midas Gold would limit their vehicle traffic outside the mine site to between 5:00 am and 7:00 pm everyday resulting in approximately 5 mine-related vehicles traveling on the Yellow Pine Route per hour during the 2 years the Burntlog Route is constructed. Non-mine-related vehicles may experience slower travel times as mine-related vehicle transport would occur during the morning and evening peak hours and typical commute or travel times. However, once construction of Burntlog Route is completed, the Yellow Pine Route would no longer be used by mine-related traffic, and the AADT on Johnson Creek (CR 10-413) and Stibnite Road would return to the existing AADT traffic volume.

4.16.2.1.1.2 Public Access

During construction, the public would continue to have access to the PNF and BNF on NFS roads currently available to the public (**Figure 2.3-1**), including along Johnson Creek Road, Burnt Log Road, and through the mine site on Stibnite Road connecting to Thunder Mountain Road (FR 50375). Road closures from half-day to multiple-days may occur during construction on Stibnite Road between the village of Yellow Pine and the mine site, part of Thunder Mountain Road (FR 50375), and Burnt Log Road.

Once the Burntlog Route is constructed, access through the mine site from Stibnite Road to Thunder Mountain Road, from the confluence of Sugar Creek and the East Fork South Fork Salmon River (EFSFSR) to the worker housing facility would be closed to the public. Public access would be restricted within the Operations Area Boundary during construction, operations, and closure and reclamation by fencing near the security-monitored gates, and signs warning the public against entry into the Operations Area Boundary. The Burntlog Route would provide public access to the Meadow Creek Lookout and Thunder Mountain area, when other public access is not available, throughout operations and closure and reclamation.

The newly constructed Burntlog Route connecting to Thunder Mountain Road would be a temporary road that is necessary for mining purposes and would meet 36 Code of Federal Regulations (CFR) 228A requirements for environmental protection to assume that mining operations are conducted to minimize adverse environmental impacts to the extent feasible for roads. Accordingly, the road would not be designated for public motor vehicle use under 36 CFR 212.50 on the Motor Vehicle Use Map. Therefore, for public motor vehicle use to be allowed on the road when other public access roads are blocked by mine operations, one of the other exceptions from the prohibitions on motor vehicle use on NFS land at 36 CFR 261.13 must be met. The approved plan of operations would meet the exception for written Forest Service authorization under 36 CFR 261.13(h) by including a provision in the mine plan for public use of the road when other public road access is blocked by mining operations.

4.16.2.1.2 OPERATIONS

Operations under Alternative 1 are proposed for 12 years but could be extended to 15 years. Mine-related traffic would include transport of employees to and from the mine site, delivery of supplies, antimony concentrate trucks, and activities associated with road maintenance such as snowplowing and sanding.

Supplies and deliveries for the mine site during construction, operations, and closure and reclamation would use SH 55 to Warm Lake Road (CR 10-579) to access the Stibnite Gold Logistics Facility. Based on past material deliveries, an estimated two-thirds of all mine related traffic would originate south of Warm Lake Road (CR 10-579) on SH 55 and the other third of mine-related traffic would originate from the north.

4.16.2.1.2.1 Traffic Volumes

Upon completion of the Burntlog Route, mine vehicles would travel approximately 73 miles from the intersection of Warm Lake Road (CR 10-579) and SH 55 to the mine site. Approximately 15 miles of new private access roads managed by Midas Gold, but open to public access when other routes are not available, would be created as part of the Burntlog Route. No new NFS roads would be created during the life of the mine. During the 12 to 15 years of mine operations, Alternative 1 would generate a total estimated AADT of 68 vehicles (49 heavy vehicles and 19 light vehicles). Midas Gold would limit their vehicle traffic outside the mine site to between 5:00 am and 7:00 pm resulting in approximately five mine-related vehicles traveling on Burntlog Route per hour. **Table 4.16-2** shows the existing and Alternative 1 AADT for the main roadway segments in the access and transportation analysis area during operations.

Table 4.16-2 Existing and Alternative 1 Operations AADT

Name	Existing AADT[1]	Operations AADT (% Increase from Existing)	% Heavy Vehicles[2]
Alternative 1 AADT	-	68	72.1
SH 55	4,127	4,195 (1.6%)	1.2
Warm Lake Road (CR 10-579)	1,174	1,242 (5.8%)	3.9
Johnson Creek Road (CR 10-413)	57	57 (0%)	-

Name	Existing AADT[1]	Operations AADT (% Increase from Existing)	% Heavy Vehicles[2]
Stibnite Road (village of Yellow Pine to mine site)	39	39 (0%)	-
Burnt Log Road (FR 447)	27	95 (251.9%)	51.6

Table Source: HDR 2017a,b; ITD 2017

Table Notes:

1 Data was collected in 2015 or 2016 except for Warm Lake Road (CR 10-579) data collected in 2017. AADT is calculated by Total Recorded Count/Number of Days Recorded. All figures have been rounded up to whole numbers.

2 The approximate minimum percentage of SGP-related heavy vehicles occurring on the roads.

AADT = Annual Average Daily Traffic; CR = County Road; FR = National Forest System Road; SH = State Highway; “-” = not applicable.

As shown in **Table 4.16-2**, traffic volumes associated with Alternative 1 operations would increase traffic on the Burntlog Route. Specifically, the approximately 20-mile upgraded Burnt Log Road section of the Burntlog Route would experience a traffic increase of approximately 252 percent with over half of the traffic comprised of heavy vehicles. Heavy vehicles currently do not use Burnt Log Road, so the increase in mine-related vehicles (e.g., supply and delivery trucks, employee transport, or antimony concentrate transport offsite) on this roadway would result in a noticeable change in driver experience (e.g., driving among mine-related heavy vehicles and trucks along one-lane in each direction, native surfaced roads with steep slopes and sharp curves) and slower travel times. The more traveled roadways would have a less noticeable increase in daily traffic; Warm Lake Road traffic would increase by 5.8 percent and SH 55 traffic would increase by only 1.6 percent. Heavy vehicles would comprise less than 4 percent of the total traffic on these two roadways; however, due to the one-lane in each direction constraints on both roads, non-mine-related vehicles may experience slower travel times.

Traffic impacts during the winter would be the same as those discussed under Section 4.16.2.1.1.1, Traffic Volumes for Alternative 1 Construction.

4.16.2.1.2.2 Public Access

Public access within the analysis area would be the same as construction after the Burntlog Route is complete where access through the mine site from Stibnite Road to Thunder Mountain Road (FR 50375), from the confluence of Sugar Creek and the EFSFSR to the worker housing facility, would be closed to the public. The newly constructed Burntlog Route connecting to Thunder Mountain Road would allow public access when other routes are not available. Approximately 15 miles of new roads managed by Midas Gold, but open to public access, would be created.

4.16.2.1.3 CLOSURE AND RECLAMATION

Mine closure and reclamation activities of recontouring slopes, removing facilities, seeding and planting areas under Alternative 1 would require approximately 5 to 7 years. Any newly constructed roads for mine operations would be closed for any long-term use. Areas disturbed by the access and mine site roads would be contoured and graded to blend into surrounding terrain.

The Burntlog Route would be needed until the tailings storage facility (TSF) is fully reclaimed at the mine site. After reclamation of the TSF, the Burntlog Route would be decommissioned, and the existing upgraded sections of Burnt Log Road would be narrowed to their pre-mining widths while the new roadway portion of the Burntlog Route would be reclaimed. Once all final mine closure, reclamation, and related environmental closure monitoring work has been completed, the 20-foot roadway width of 20 miles of Burnt Log Road and 1.3 miles of Meadow Creek Lookout Road, and 2 miles along Thunder Mountain Road of the upgraded portion of Burntlog Route would be reduced to their approximate pre-mining width. Ditches, cross drains, culverts, safety berms, mile markers, guardrails, and signs on roads would be removed if these features are no longer needed upon permanent closure. These roads would retain their flatter grades and gentler curves constructed for mine operations.

Approximately 15 miles of Burntlog Route connecting to Meadow Creek Lookout Road and Thunder Mountain Road would be decommissioned, which would include pulling back and re-contouring road cuts to slopes, removing culverts and bridges from all stream crossings, and removing safety berms, retaining walls (although soil nail walls would remain), mile markers, guardrails, signs, and the roadbed.

Monitoring of all facilities and disturbance areas would be conducted following the completion of closure and reclamation to demonstrate compliance with permit requirements and to measure the success of reclamation. Midas Gold would continue baseline environmental monitoring including quarterly surface water sampling, twice annual groundwater wells sampling, annual aquatic resources monitoring, and wildlife at mine site facilities on a weekly basis. Reclamation success monitoring such as erosion and sediment control monitoring would be completed twice annually and after 4 and 5 years for performance monitoring purposes until success criteria are satisfied.

4.16.2.1.3.1 Traffic Volumes

During closure and reclamation, Alternative 1 would generate a total estimated AADT of 25 vehicles (13 heavy vehicles and 12 light vehicles). Refer to Section 2.3.7.17, Closure and Reclamation Traffic, for closure and reclamation traffic details associated with the workforce, supplies and support, and other miscellaneous traffic including road maintenance for Alternative 1. Post-closure monitoring activities would generate a total estimated AADT of six light vehicles as discussed in Section 2.3.7, Closure and Reclamation. **Table 4.16-3** shows the existing and Alternative 1 AADT for the main roadway segments in the access and transportation analysis area during closure and reclamation.

Table 4.16-3 Existing and Alternative 1 Closure and Reclamation AADT

Name	Existing AADT[1]	Closure and Reclamation AADT (% Increase from Existing)	% Heavy Vehicles[2]	Post-Closure AADT (% Increase from Existing)
Alternative 1 AADT	-	25	52	6
SH 55	4,127	4,152 (0.6%)	0.3	4,133 (0.1%)
Warm Lake Road (CR 10-579)	1,174	1,199 (2.1%)	1.1	1,180 (0.5%)
Johnson Creek Road (CR 10-413)	57	57 (0%)	-	63 (10.5%)
Stibnite Road (village of Yellow Pine to mine site)	39	39 (0%)	-	45 (15.4%)
Burnt Log Road (FR 447)	27	52 (92.6%)	25	33 (22.2%)

Table Source: HDR 2017a,b; ITD 2017

Table Notes:

1 Data was collected in 2015 or 2016 except for Warm Lake Road (CR 10-579) data collected in 2017. AADT is calculated by Total Recorded Count/Number of Days Recorded. All figures have been rounded up to whole numbers.

2 The approximate minimum percentage of SGP-related heavy vehicles occurring on the roads.

AADT = Annual Average Daily Traffic; CR = County Road; FR = National Forest System Road; SH = State Highway; "-" = not applicable.

As shown in **Table 4.16-3**, traffic volumes associated with Alternative 1 closure and reclamation would increase traffic on the Burntlog Route over existing conditions. Specifically, the upgraded Burnt Log Road section of the Burntlog Route would experience a traffic increase of approximately 92.6 percent. Only a quarter of the vehicles traveling this one-lane, native-surfaced road would be heavy vehicles that could result in slower travel times for non-mine-related traffic and may deter travelers from using this roadway. The more traveled roadways would have a less noticeable change in daily traffic; Warm Lake Road (CR 10-579) and SH 55 traffic would increase by less than one percent. Midas Gold would limit their vehicle traffic outside the mine site to between 5:00 am and 7:00 pm resulting in approximately two mine-related vehicles traveling on the Burntlog Route per hour during closure and reclamation. Heavy vehicles would comprise one percent or less of the total traffic on these two roadways during closure and reclamation; however, due to the one-lane constraints on both roadways, non-mine-related vehicles may experience slower travel times.

Closure and reclamation traffic impacts during the winter would be the same as those discussed under Section 4.16.2.1.1.1, Traffic Volumes for Alternative 1 Construction. Post-closure winter traffic would not be as noticeable, as closure and reclamation traffic heavy vehicle deliveries would not occur, and only approximately six mine-related vehicles per day would utilize the accessible roadways in the analysis area for monitoring and maintenance purposes.

4.16.2.1.3.2 Public Access

Public access during the closure and reclamation phase would be coordinated with the Forest Service and would involve reopening Stibnite Road and establishing a permanent service road through the backfilled Yellow Pine pit for public access through the mine site for dispersed recreation uses connecting to Thunder Mountain Road (FR 50375) (**Figure 2.3-2**; see also maps in **Appendix N-2**). This would result in a total of approximately 2.5 additional miles of new road for public access. Post-closure public access would require revision to the existing FRTA easement with Valley County regarding road maintenance.

4.16.2.1.4 Safety and Emergency Access

For the duration of Alternative 1, the increase in total volume of mine-related vehicles, specifically heavy vehicles or trucks, on the Yellow Pine and Burntlog Routes would result in a greater safety risk for accidents occurring between vehicles due to degradation of the road with more frequent heavy vehicle travel and the one-lane constraints (i.e., no passing lane) that restrict the passing of slower moving vehicles. Burnt Log Road (FR 447) would be widened to 26 feet (including 3-foot vegetated shoulders), tight corners would be straightened to allow for improved safety and traffic visibility, grades would be maintained at less than 10 percent in all practicable locations, and placement of sub-base material and surface with gravel would occur to provide a stable long-term roadway and reduce sediment. Side-ditching, culverts, guardrails, and bridges would be installed where necessary. During winter road maintenance, snow would be removed from the Burntlog Route, haul roads at the mine site, the temporary construction access, and the Yellow Pine Route. Although no road alignment modification or widening would occur to Johnson Creek Road (CR 10-413) and Stibnite Road as part of the Yellow Pine Route under Alternative 1, upgrades, including minor surface improvements (e.g., adding gravel, winter snow removal, and summer dust suppression), would occur to reduce dust generation from vehicles, indirectly improving visibility, and support safer road conditions.

Additionally, pilot cars would be used during equipment mobilization and demobilization along Burntlog Route and portions of Yellow Pine Route, as needed, to control speed and reduce potential for conflicts or incidents along these narrow access roads leading into the SGP area.

The increased heavy vehicle traffic would degrade the existing and proposed transportation system over the duration of the SGP. However, maintenance measures authorized under a cooperative agreement with Valley County and the Forest Service would be performed to repair segments that have deteriorated over time. The continued maintenance and improvements of the road system would help reduce dust and maintain public safety for the duration of the SGP.

Emergency access would be maintained throughout the analysis area. Emergency access would be provided on the Yellow Pine Route during the first two years of construction and then on Burntlog Route for the remainder of the SGP. In the event of an emergency or when a threat to human life is identified (e.g., fires), roads would be temporarily closed, as appropriate.

Measures would be implemented that would help reduce the incidence of accidents, including busing and/or van pooling to the mine site, housing workers at the mine site to minimize the frequency of SGP worker vehicle trips, driver training (e.g., use of truck compression brakes on steep sections and along areas where residences are located and familiarity with the travel routes including locations of steep slopes that require downshifting), and equipping staff traveling to and from the mine site with two-way radios to communicate positions, relay information about road conditions, and warn of public vehicles traveling on Burntlog Route (or Yellow Pine Route during construction). This also would allow for rapid response in the event of an accident.

Additionally, Midas Gold would adhere to SGP design features and resource protection measures, Forest Service-required measures, and permit stipulations, including, but not limited to: ensuring drivers and airplane/helicopter pilots are appropriately licensed; annual inspections of transport vehicles; observing county and state speed limits, road restrictions (e.g., use of tire chains for snow or icy road conditions), and load limits; and coordination with Forest Service (and Valley County as appropriate) on air and road operations to further reduce the incidence of accidents.

For additional discussion on geotechnical hazards and public safety, refer to Sections 4.2, Geologic Resources and Geotechnical Hazards and 4.18, Public Health and Safety, respectively.

4.16.2.1.5 OTHER MODES OF TRANSPORTATION

4.16.2.1.5.1 Air Transportation

Under Alternative 1, a helipad would be maintained in an area adjacent to the administration offices and warehouse facilities for mining and ore processing at the mine site for exploration and Medevac purposes (**Figure 2.3-2**). Helicopters would be used to deliver rigs and supplies for surface exploration drilling activities on an as needed basis when truck or crawler mounted rigs are unable to reach the drill site. Though drilling activities would typically occur 24 hours a day, helicopter support would only occur during daylight hours. Other potential indirect air traffic, such as spectators to the SGP, may occur during operation of Alternative 1. However, overall air traffic associated with Alternative 1 would be low in intensity and generate negligible changes in air traffic patterns.

The new substation at Johnson Creek would not impact air traffic use of the Johnson Creek airstrip.

4.16.2.1.5.2 Water Transportation

Under Alternative 1, approximately one round trip (two truck trips) of antimony concentrate would be hauled off-site daily to a commercial barge or truck loading facility depending on the refinery location. As previously discussed, the Port of Lewiston would be the closest port for transport by commercial barge. The daily shipment of antimony and the potential indirect transport of supplies and materials to and from the mine site would generate minimal to negligible changes in water transportation. The addition of associated impacts to transport by commercial barge from the Port of Lewiston to and from distributors, purchasers, and refineries under Alternative 1 would be considered very minimal and would blend into the typical traffic associated with this type of goods movement.

4.16.2.1.5.3 Rail Transportation

As discussed in Section 3.16.3.6.3, Rail Transportation, there are no rail transportation systems in the analysis area. However, there is a potential for trucks to transport antimony concentrate to rail lines located in Boise. Additionally, supplies and materials may be indirectly transported to and from the mine site by trucks originating from rail shipments. Nevertheless, these impacts would generate negligible changes to rail transport during operation of Alternative 1 and would not substantially alter the level of service for this mode of transportation.

4.16.2.2 Alternative 2

Under Alternative 2, project features associated with access and transportation would be the same as Alternative 1 except for:

- The routing of a 5.3-mile segment of the Burntlog Route (Riordan Creek Segment), resulting in 13.5 miles of new construction for the Burntlog Route;
- A public access road (one of two options) through the mine site connecting Stibnite Road to Thunder Mountain Road (FR 50375);
- The generation of lime and limestone at the mine site using development rock from the West End pit, resulting in fewer truck trips to and from the mine site; and
- An increase in the number of truck trips per year that would be required to deliver chemicals and remove waste from the mine site for water treatment in perpetuity (an additional 40 truck trips per year).

4.16.2.2.1 CONSTRUCTION

Traffic volume and public access impacts under Alternative 2 would be the same as those described under Alternative 1 for construction.

4.16.2.2.2 OPERATIONS

4.16.2.2.2.1 Traffic Volumes

Upon completion of Burntlog Route, mine vehicles would travel approximately 71 miles from the intersection of Warm Lake Road (CR 10-579) and SH 55 to the mine site. Approximately 13.5 miles of new private access roads would be created during the life of the mine. No new NFS roads would be created during the life of the mine. Due to the generation of lime at the mine site under Alternative 2, operational AADT would be 50 vehicles (33 heavy vehicles and 17 light vehicles) under Alternative 2. Midas Gold would limit their vehicle traffic outside the mine site to between 5:00 am and 7:00 pm, resulting in approximately four mine-related vehicles traveling on the Burntlog Route per hour. **Table 4.16-4** shows the existing and Alternative 2 AADT for the main roadway segments in the access and transportation analysis area during operations.

Table 4.16-4 Existing and Alternative 2 Operations AADT

Name	Existing AADT[1]	Operations AADT (% Increase from Existing)	% Heavy Vehicles[2]
Alternative 2 AADT[3]	-	50	66
SH 55	4,127	4,177 (1.2%)	0.8
Warm Lake Road (CR 10-579)	1,174	1,224 (4.3%)	2.7
Johnson Creek Road (CR 10-413)	57	57 (0%)	-
Stibnite Road (village of Yellow Pine to mine site)	39	39 (0%)	-
Burnt Log Road (FR 447)	27	77 (185.2%)	42.9

Table Source: HDR 2017a,b; ITD 2017

Table Notes:

1 Data was collected in 2015 or 2016 except for Warm Lake Road (CR 10-579) data collected in 2017. AADT is calculated by Total Recorded Count/Number of Days Recorded. All figures have been rounded up to whole numbers.

2 The approximate minimum percentage of SGP-related heavy vehicles occurring on the roads.

3 The additional 40 trucks per year required to deliver chemicals for water treatment would provide an increase in 0.1 AADT for operational traffic.

AADT = Annual Average Daily Traffic; CR = County Road; FR = National Forest System Road; SH = State Highway; “-” = not applicable.

As shown in **Table 4.16-4**, traffic volumes associated with Alternative 2 operations would increase traffic on the Burntlog Route. Specifically, the upgraded Burnt Log Road section of the Burntlog Route would experience a traffic increase of approximately 185 percent with approximately 42 percent of traffic comprised of heavy vehicles. Overall, there would be less mine-related traffic on the road during operations than during construction; however, the driver experience would still be noticeably different than existing conditions with an increase in mine-related heavy vehicles and slower travel times. The roadways currently more traveled would have a less noticeable increase in daily traffic; Warm Lake Road traffic would increase by 4.3 percent and SH 55 traffic would increase by only 1.2 percent. Additionally, as previously discussed, winter driving conditions influence the amount of traffic and typically result in less AADT. Therefore, the seasonal effect of traffic on these roads would show a noticeably greater increase in mine-related winter traffic (i.e., drivers would notice a higher ratio of mine-related traffic to general traffic).

4.16.2.2.2.2 Public Access

Under Alternative 2, public access would be the same as Alternative 1 (e.g., the newly constructed Burntlog Route connecting to Meadow Creek Lookout Road [FR 51290]), except public access also would be provided through the mine site from Stibnite Road to Thunder Mountain Road (FR 50375) during mining operations. The newly constructed Burntlog Route connecting to Meadow Creek Lookout Road and then Thunder Mountain Road would allow public access when other routes are not available (i.e., the public access route through the mine site). The newly constructed roadway portion of the Burntlog Route would be a temporary road that is necessary for mining purposes and would meet 36 CFR 228A requirements for environmental protection. Public motor vehicle use would be allowed on the newly constructed, private mining road when other public access roads are blocked by mine operations. Approximately 13.5 miles of new roads managed by Midas Gold, but open to public access when needed, would be created.

After mine construction is complete, a 12-foot-wide, approximately 3- to 4-mile gravel road connecting Stibnite Road to Thunder Mountain Road would be open to all vehicles year-round. Midas Gold would maintain the public access road under Valley County's FRTA easement; however, it would not be plowed. There are two options for public access through the mine site (refer to Section 2.4.4.2, Public Access). Under Option 1, an approximately 3-mile public access road through a widened portion of the western side of Yellow Pine pit and paralleling a mine haul road would be constructed. Under Option 2, an approximately 4-mile public access road west of the Yellow Pine pit and paralleling the same mine haul road as Option 1 would be constructed. The selected public access road option would be separated from the mine site roads by berms, security fencing, and underpasses. For added safety, the public access road would be temporarily closed during construction and maintenance activities of the public access road, and during other mining activities that would be considered public safety hazards (e.g., high wall scaling and blasting). Signs would be placed to inform the public of the closure. During closures on the road through the mine site, public use of the Burntlog Route would be allowed.

4.16.2.2.3 Closure and Reclamation

Impacts to traffic volume and public access under Alternative 2 would be similar to those described under Alternative 1 for closure and reclamation; however, Alternative 2 would require an additional 40 truck trips per year to deliver chemicals for water treatment in perpetuity. Like operations, 40 truck trips for water treatment would provide an increase of 0.1 AADT for closure and reclamation and post-closure traffic. Post-closure, traffic to the mine site (i.e., the additional 40 truck trips per year required to deliver chemicals for water treatment in perpetuity) would no longer utilize the Burntlog Route, but would use the Yellow Pine Route to access the mine site which would be plowed to provide year-round access for treatment plant workers. Water treatment-related deliveries would not occur during the winter; supplies and waste would be stockpiled on site. Public access to and through the mine site would remain post reclamation and would require revision to the existing FRTA easement with Valley County.

4.16.2.2.4 Safety and Emergency Access

Safety and emergency impacts under Alternative 2 would be similar to those described for Alternative 1. However, an alternate route through the mine site is proposed for public use thus reducing the potential for accidents on this route. During operations, public traffic would be separated from mine traffic on the road through the mine site thereby reducing potential safety issues. Post reclamation, there would be 40 truck trips per year to deliver water treatment materials. When these trips occur, there could be a slightly higher risk of accidents due to slow moving trucks on the Yellow Pine Route and road through the mine site (up to the water treatment plant).

4.16.2.2.5 Other Modes of Transportation

Air, water, and rail transportation impacts under Alternative 2 would be the same as those described under Alternative 1.

4.16.2.3 Alternative 3

Under Alternative 3, project features associated with access and transportation would be the same as Alternative 1 except for:

- An approximately 3.2-mile segment of Burntlog Route would be routed through Blowout Creek valley, resulting in 19.6 miles of new construction for the Burntlog Route. The mine security gate would be located along this segment and would restrict public access through the mine site.
- The OHV connector trail from a transmission line access road to Meadow Creek Lookout Road (FR 51290) would not be constructed. Public access around the mine site would be from the Burntlog Route to Meadow Creek Lookout Road which would be improved from the Burntlog Route turnoff at Blowout Creek to Thunder Mountain Road (FR 50375) to allow access to Thunder Mountain and Monumental Summit areas.

4.16.2.3.1 Construction

Traffic volume and public access impacts under Alternative 3 would be the same as those described under Alternative 1 for construction.

4.16.2.3.2 Operations

Traffic volume and public access impacts under Alternative 3 would be the same as those described under Alternative 1 for operations, except upon completion of the Burntlog Route, mine vehicles would travel approximately 75 miles from the intersection of Warm Lake Road (CR 10-579) and SH 55 to the mine site due to the rerouting of Burntlog Route through Blowout Creek valley. Approximately 19.6 miles of new private access roads managed by Midas Gold, but open to public access, would be created under Alternative 3. No new NFS roads would be created during the life of the mine under Alternative 3.

4.16.2.3.3 Closure and Reclamation

Traffic volume and public access impacts under Alternative 3 would be the same as those described under Alternative 1 for closure and reclamation, except upon closure and reclamation of the EFSFSR TSF, public access would be provided around the TSF using one of two options. Under Option 1, the temporary operational EFSFSR TSF access road along the TSF pipeline would be converted to a permanent public access route reconnecting Stibnite Road (CR 50-412) and Thunder Mountain Road (FR 50375). Under Option 2, the temporary mine access road segment of the Burntlog Route through Blowout Creek valley would be converted to a permanent public access road connecting to Meadow Creek Lookout Road (FR 51290) then to Thunder Mountain Road. This public access road would not be plowed during the winter. The new public access roads through the mine site post reclamation would result in approximately 7.6 to 9 miles of new roads available for public access.

Additionally, a permanent access road through the backfilled Yellow Pine pit for public access through the mine site for dispersed recreation uses connecting to Thunder Mountain Road through one of the two options would be established post closure. The new road for public access would require revision to the existing FRTA easement with Valley County.

4.16.2.3.4 Safety and Emergency Access

Safety and emergency impacts under Alternative 3 would be similar to those described under Alternative 1.

4.16.2.3.5 Other Modes of Transportation

Air, water, and rail transportation impacts under Alternative 3 would be the same as those described under Alternative 1.

4.16.2.4 Alternative 4

Under Alternative 4, the Yellow Pine Route would be used to access the mine site, and the Burntlog Route would not be constructed. Upon completion of the Yellow Pine Route, mine vehicles would travel approximately 70 miles from the intersection of Warm Lake Road (CR 10-579) and SH 55, to Johnson Creek Road (CR 10-479) and Stibnite Road (CR 50-412) to the mine site. Road widening and straightening, along with drainage and bridge improvements would be required for the Johnson Creek Road portion of the Yellow Pine Route. The Stibnite Road portion would be improved by straightening curves, constructing retaining walls, and installing 182 18-inch culverts and 2 60-inch culverts. In addition, the Stibnite Road portion also would be improved by widening curves to accommodate 55-foot semi-truck trailers. Approximately 1 mile of road through the village of Yellow Pine would be paved. Construction and improvements to the Yellow Pine Route would require approximately 4 years with a total construction schedule of 5 years (2 years more than the Burntlog Route).

4.16.2.4.1 CONSTRUCTION

4.16.2.4.1.1 Traffic Volume

Traffic volume impacts under Alternative 4 would be the same as those described under Alternative 1 for construction. Additionally, along the Yellow Pine Route, Johnson Creek Road would require periodic temporary road closures during mine construction during the first season of construction. Stibnite Road would have a daily closure from 10:00 am to 4:00 pm for the 3- to 4-year construction period for activities, including road grading, heavy equipment movement, etc. Residents would need to use SH 55 to Warren Wagon Road then to FR 340 to access the Edwardsburg/Big Creek area.

4.16.2.4.1.2 Public Access

The public would share the Yellow Pine Route with mine-related traffic through construction, operations, and closure and reclamation on Johnson Creek Road and Stibnite Road. As discussed above, Johnson Creek Road would require periodic temporary road closures, and Stibnite Road would require daily closures from 10:00 am to 4:00 pm for the 3- to 4-year duration of mine construction activities. Residents would need to use SH 55 to Warren Wagon Road then to FR 340 to access Edwardsburg/Big Creek.

Public access during mine construction and operations is shown on **Figure 2.6-3** and maps in **Appendix N-5**. As with Alternative 2, Alternative 4 would include public access through the mine site on the same road used to bring mine supplies and employees from the end of the Yellow Pine Route at the mine gate to the ore processing, administration, warehouse, and employee housing areas. Public access through the mine site would provide motorized access to Thunder Mountain Road (FR 50375).

4.16.2.4.2 OPERATIONS

4.16.2.4.2.1 Traffic Volume

Traffic volume impacts under Alternative 4 would be the same as those described under Alternative 1 for operations, except instead of the Burntlog Route, mine-related traffic would use the Yellow Pine Route for the duration of the SGP under Alternative 4. Public traffic and mine traffic would share the road from Landmark to the mine site. Mine vehicles would travel approximately 70 miles from the intersection of Warm Lake Road (CR 10-579) and SH 55 to the mine site. No new private access roads or NFS roads would be created under Alternative 4. **Table 4.16-5** shows the existing and Alternative 4 AADT for the main roadway segments in the access and transportation analysis area during operations.

Table 4.16-5 Existing and Alternative 4 Operations AADT

Name	Existing AADT[1]	Operations AADT (% Increase from Existing)	% Heavy Vehicles[2]
Alternative 4 AADT	-	68	72
SH 55	4,127	4,195 (1.6%)	1.2
Warm Lake Road (CR 10-579)	1,174	1,242 (5.8%)	3.9
Johnson Creek Road (CR 10-413)	57	125 (119.3%)	39.2
Stibnite Road (village of Yellow Pine to mine site)	39	107 (174.4%)	45.8
Burnt Log Road (FR 447)	27	27 (0%)	-

Table Source: HDR 2017a,b; ITD 2017

Table Notes:

1 Data was collected in 2015 or 2016 except for Warm Lake Road (CR 10-579) data collected in 2017. AADT is calculated by Total Recorded Count/Number of Days Recorded. All figures have been rounded up to whole numbers.

2 The approximate minimum percentage of SGP-related heavy vehicles occurring on the roads.

AADT = Annual Average Daily Traffic; CR = County Road; FR = National Forest System Road; SH = State Highway; "-" = not applicable.

As shown in **Table 4.16-5**, operations under Alternative 4 would result in increased traffic volumes on the Yellow Pine Route. Specifically, traffic on Johnson Creek Road and Stibnite Road would increase approximately 119 percent (32 percent heavy vehicles) and 174 percent (48 percent heavy vehicles), respectively. Heavy vehicles currently use the Yellow Pine Route to access the mine site in the summer; however, Alternative 4 operational traffic would result in a noticeable change in driver experience and slower drive times on the Yellow Pine Route due to the substantial increase in mine-related vehicles. Even though Johnson Creek Road would be upgraded under Alternative 4, the road would still have many curves and slopes, thus requiring slow speeds. Refer to Section 4.16.2.4.4, Safety and Emergency Access, for further discussion on safety.

The more traveled roadways would have a less noticeable increase in daily traffic; Warm Lake Road traffic would increase by approximately 5.8 percent and SH 55 traffic would increase by 1.7 percent. Midas Gold would limit their vehicle traffic outside the mine site to between 5:00 am and 7:00 pm, resulting in approximately five mine-related vehicles traveling on the Yellow Pine Route per hour.

4.16.2.4.2.2 Public Access

Public access through the mine site during operations would be similar to Alternative 2, except Alternative 4 would include one option for public access through the mine site, as discussed in

Section 2.6, Alternative 4. Approximately 4 miles of public access through the mine site would be provided. No new construction of mine access roads outside of the mine site would occur under Alternative 4.

4.16.2.4.3 CLOSURE AND RECLAMATION

4.16.2.4.3.1 Traffic Volume

Traffic volume impacts under Alternative 4 would be the same as those described under Alternative 1 for closure and reclamation, except instead of the Burntlog Route, mine-related traffic would use the Yellow Pine Route during closure, reclamation, and post-closure activities. **Table 4.16-6** shows the existing and Alternative 4 AADT for the main roadway segments in the access and transportation analysis area during closure andreclamation.

Table 4.16-6 Existing and Alternative 4 Closure and Reclamation AADT

Name	Existing AADT[1]	Closure and Reclamation AADT (% Increase from Existing)	% Heavy Vehicles[2]	Post-Closure AADT (% Increase from Existing)
Alternative 4 AADT	-	25	52	6
SH 55	4,127	4,152 (0.6%)	0.3	4,133 (0.2%)
Warm Lake Road (CR 10-579)	1,174	1,199 (2.1%)	1.1	1,180 (0.5%)
Johnson Creek Road (CR 10-413)	57	82 (43.9%)	15.9	63 (10.5%)
Stibnite Road (village of Yellow Pine to mine site)	39	64 (64.1%)	20.3	45 (15.4%)
Burnt Log Road (FR 447)	27	27	-	27

Table Source: HDR 2017a,b; ITD 2017

Table Notes:

1 Data was collected in 2015 or 2016 except for Warm Lake Road (CR 10-579) data collected in 2017. AADT is calculated by Total Recorded Count/Number of Days Recorded. All figures have been rounded up to whole numbers.

2 The approximate minimum percentage of SGP-related heavy vehicles occurring on the roads.

AADT = Annual Average Daily Traffic; CR = County Road; FR = National Forest System Road; SH = State Highway; “-” = not applicable.

As shown in **Table 4.16-6**, traffic volumes associated with Alternative 4 closure and reclamation would increase current volumes for the Yellow Pine Route. Specifically, traffic on Johnson Creek Road and Stibnite Road would increase approximately 44 percent (approximately 16 percent heavy vehicles) and 64 percent (approximately 20 percent heavy vehicles), respectively. Closure and reclamation mine-related traffic would be less than operational traffic with 25 AADT for closure and reclamation versus 68 AADT for operations. The driver experience would still include some heavy vehicles that result in slower drive times, but heavy vehicles would eventually decrease to one or none daily as closure and reclamation is completed. The roadways currently more traveled would have a less noticeable increase in daily traffic; Warm Lake Road traffic would increase by 2.1 percent and SH 55 traffic would only increase by 0.6 percent. Midas Gold would limit their vehicle traffic outside the mine site to between 5:00 am and 7:00 pm, resulting in approximately two mine-related vehicles traveling on the Yellow Pine Route per hour during closure/reclamation.

4.16.2.4.3.2 Public Access

As with Alternative 1, a new road would be constructed under Alternative 4 over the backfilled Yellow Pine pit connecting Stibnite Road to Thunder Mountain Road (FR 50375). A total of approximately 2.5 additional miles of new road for public access through the mine site would remain post closure and would require revision to the existing FRTA easement with Valley County.

4.16.2.4.4 Safety and Emergency Access

Alternative 4 would have greater safety and emergency impacts than Burntlog Route due to additional safety considerations required to use the Yellow Pine Route exclusively, which is in steeper terrain than the Burntlog Route and subject to avalanches and landslides.

Under Alternative 4, improvements to the Yellow Pine Route would include road widening and straightening, as well as drainage and bridge improvements to the Johnson Creek Road portion of the Yellow Pine Route. The Stibnite Road portion of the Yellow Pine Route would be improved by straightening curves, constructing retaining walls, and installing 182 18-inch culverts and 2 60-inch culverts. More cut and fill would be required for the Yellow Pine Route in comparison with the Burntlog Route. This would require additional safety considerations for geotechnical hazards, landslides, and avalanche zones and may result in periods of road closure. Additionally, access through the mine site under Alternative 4 would be through a single point of ingress and egress and would require safety considerations for mine deliveries and public access. The steep climb to provide access around the Yellow Pine pit would require a wider road with more switchbacks to accommodate the heavy trucks transporting mine supplies and may increase hazardous driving conditions for crew rotation, emergency responses, and wildfire evacuation. For additional discussion on hazards and safety, refer to Sections 4.2, Geologic Resources and Geotechnical Hazards; and 4.18, Public Health and Safety.

4.16.2.4.5 Other Modes of Transportation

Air, water, and rail transportation impacts under Alternative 4 would be the same as those described under Alternative 1.

4.16.2.5 Alternative 5

Under Alternative 5, no action would be undertaken for the SGP. Consequently, the current transportation systems for roads, air, and water would remain as they are under existing conditions and there would not be any SGP-related traffic on the roadways.

Valley County would continue to maintain the roads under the FRTA easements. Road maintenance activities would include blading and shaping the roadbed, ensuring proper moisture conditions of the road surface, cleaning and repairing drainage facilities, removal of obstructions, dust abatement, and snow removal (Lau 2018).

No direct or indirect effects on access and transportation from SGP-related activities would occur under Alternative 5.

4.16.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final Environmental Impact Statement.

4.16.4 Cumulative Effects

The cumulative effects analysis area for access and transportation that could be directly or indirectly affected by the SGP consists of the access roads located on private and public lands in Valley County, the PNF, and the BNF that would be used to access the SPG area, and extends out to and along SH 55 north to the Port of Lewiston and south to Boise.

Cumulative effects consider the range of existing and foreseeable activities and their potential effects with respect to access and transportation. Past and present actions that have, or are currently, affecting access and transportation include recreational activities, fuels management, road and utility maintenance activities, and timber harvest. In addition, some of the current traffic levels in the analysis area also can be attributed to activities at the mine site that have been ongoing for exploration purposes, monitoring, and background studies. Reasonably foreseeable future actions that could cumulatively contribute to access and transportation impacts in the analysis area include all the projects listed in **Table 4.1-2** pertaining to recreational management, watershed management, road management, fuels management, mineral exploration, residential development, and special use management.

4.16.4.1 Common to All Action Alternatives

Supplies and deliveries for the mine site during construction, operations, and closure and reclamation would go to the Stibnite Gold Logistics Facility using SH 55 to Warm Lake Road (CR 10-579). Approximately two-thirds of all mine-related traffic would originate south of Warm

Lake Road and would use SH 55 through the communities of Cascade, Banks, and Horseshoe Bend. Approximately one-third of all mine-related traffic would originate north of Warm Lake Road and would use SH 55 through the communities of Donnelly, Lake Fork, and McCall. Through McCall, mine-related traffic would use Deinhard Lane and Boydstun Street.

As previously discussed, the traffic for action alternatives would travel on SH 55 to Warm Lake Road then either along Johnson Creek Road (CR 10-413) to Stibnite Road (CR 50-412) or along the existing Burnt Log Road (FR 447) and newly constructed Burntlog Route to access the mine site. The SGP would generate considerable impacts to access and transportation as the action alternatives would individually add over 100 percent increase in traffic volume on Burnt Log Road, Johnson Creek Road, and Stibnite Road during construction and operations.

The local NFS roads within the analysis area are in a rural area, and traffic volumes are generally low. A higher percent increase in traffic volumes for the action alternatives would be likely the closer the roads are to the mine site. The South Fork Restoration and Access Management Plan, the East Fork Salmon River Restoration and Access Management Plan, and the Big Creek Hazardous Fuel Reduction projects are located closer to the mine site. The contribution to traffic volumes of the action alternatives which include traffic generated from the reconstruction of the transmission line combined with these projects would likely have a greater cumulative effect on the roadways closer to the mine site.

Contrary, the closer to the larger arterial (e.g., SH 55) and collector (e.g., Warm Lake Road) roads, the percent increase in traffic volume decreases to less than approximately four percent for the action alternatives. The Granite Meadows, SH 55 Banks Beach Parking Study, and SH 55 Round Valley Improvements projects are located along or accessed via SH 55 and would affect traffic along the major arterial and collector roads. The traffic contribution of the action alternatives combined with these projects would result in negligible changes to the overall traffic volume as the SGP-level volumes dissipate into the larger traffic volumes of other projects and general travel along these roads.

As such, the SGP combined with other reasonably foreseeable future projects would have a greater cumulative effect on roads closer to the mine site and less contribution on the larger arterials further from the mine site.

4.16.4.2 Alternative 5

Under Alternative 5, there would be no SGP. The effects of past mining activities and the current geophysical investigation activities would remain. The reasonably foreseeable future actions identified in **Table 4.1-2** including forest management, motorized use of road systems, fire suppression, prescribed fire and wildfire, dispersed camping, fishing, and hunting activities would continue in the cumulative effects area and vicinity, which could impact access and transportation in the cumulative effects analysis area. Under Alternative 5, the Golden Meadows Exploration Project would have an insignificant direct effect to access and transportation and, therefore, an insignificant cumulative contribution.

4.16.5 Irreversible and Irretrievable Commitments of Public Resources

4.16.5.1 Common to All Action Alternatives

The SGP would temporarily alter the land and roadway system within the analysis area; however, access and transportation would not be irreversible or irretrievable. The access roads and haul roads within the mine site would be reclaimed and put back to existing conditions. Access along the Burntlog Route would be removed.

However, consumption of renewable and non-renewable resources would be required for infrastructure development, including metals, aggregate, cement, wood, and other materials. Funds and labor would be irretrievably committed for project permitting and development. Raw materials needed for construction including crushed stone, sand, concrete, lumber, water, diesel fuel, gasoline, and steel would constitute an irretrievable commitment.

Additionally, non-renewable resources associated with transportation (including gasoline, diesel, natural gas, and electrical power generated from these fuels) would be irreversibly committed for project construction, operations, and closure. Fuels would be required to operate motor vehicles, machinery, and mining equipment.

4.16.5.2 Alternative 5

Under Alternative 5, the SGP would not be undertaken. Consequently, there would be no irreversible and irretrievable commitment of public resources as it relates to access and transportation.

4.16.6 Short-term Uses versus Long-term Productivity

4.16.6.1 Alternative 1

Development of Alternative 1 would result in short-term uses of the road system within the analysis area; however, under Alternative 1 the new and extended portions of Burnt Log Road (FR 447) and Burntlog Route would be reclaimed and decommissioned upon closure and reclamation and, therefore, would not result in a long-term loss of productivity. Public access would be expanded from existing conditions temporarily to additional roads and trails including Burntlog Route, the OHV Connector Trail, Johnson Creek Road temporary OSV route, and the Cabin Creek OSV route; however, the Warm Lake to Landmark groomed OSV route and Johnson Creek Road groomed portion from Landmark to Wapiti Meadows Ranch would be closed for the duration of Alternative 1. Upon completion of closure and reclamation of Alternative 1, a public access road would be located through the mine site to connect Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375), which would increase long-term productivity of the road system.

4.16.6.2 Alternative 2

Development of Alternative 2 would result in the same short-term uses and long-term productivity of the road system within the analysis area as described under Alternative 1 except for the extended use of public access to through the mine site from McCall-Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) starting from operations.

4.16.6.3 Alternative 3

Development of Alternative 3 would result in the same short-term uses and long-term productivity of the road system within the analysis area as under Alternative 1.

4.16.6.4 Alternative 4

Development of Alternative 4 would result in the same short-term uses and long-term productivity of the road system within the analysis area as under Alternative 1 except for Yellow Pine Route would be used for the duration of Alternative 4 and new and upgraded portions of Burnt Log Road/Burntlog Route would not be constructed. Additionally, public access through the mine site also would be provided by constructing a new road to link Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) that would be shared with mine-related traffic (e.g., supplies and deliveries).

4.16.6.5 Alternative 5

Under Alternative 5, the SGP would not be undertaken. Consequently, the temporary public access roads developed for the action alternatives would not create any short-term uses that would affect access and transportation. Additionally, long-term productivity associated with access and transportation may be affected without the creation of the permanent public access route connecting Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) through the mine site which would result from all of the action alternatives.

4.16.7 Summary

The following section provides a summary of the SGP impacts and a comparison of differences associated with each alternative. **Table 4.16-7** provides a summary comparison of access and transportation impacts by issues and indicators for each alternative.

4.16.7.1 Traffic Volumes

Under Alternatives 1, 2, and 3, Midas Gold would widen and improve the existing Burnt Log Road (FR 447) and construct approximately 15, 13.5, and 19.6 miles of new road, respectively, connecting with Meadow Creek Lookout Road (FR 51290) within the first 2 years of construction. With construction only occurring from May to November, SGP-related traffic to the mine site would primarily access the mine site via the Yellow Pine Route, until the Burntlog Route is completed (by the second year). Yellow Pine Route would be used for winter access until the Burntlog Route is constructed for long-term use. Aside from minor surface improvements, winter snow removal, and summer dust suppression, no road alignment modification or widening would occur for the Yellow Pine Route under Alternatives 1, 2, or 3. Under Alternative 4, Burntlog Route would not be constructed or used for the SGP and all SGP-related traffic would use Yellow Pine Route. Approximately 4 miles of public access through the mine site would be provided. Construction of the Yellow Pine Route would require approximately 4 years under Alternative 4, compared to 3 years of construction under Alternatives 1, 2, and 3 for the Burntlog Route.

During construction, mine traffic under all action alternatives (Alternatives 1, 2, 3, and 4) would generate an estimated AADT of 65 vehicles (45 heavy vehicles and 20 light vehicles). Construction traffic volumes on Johnson Creek Road (CR 10-413) and Stibnite Road would more than double. Over a third of the vehicles traveling on these one-lane, native surfaced roads would be comprised of heavy vehicles and could result in slower travel times for non-mine-related traffic and may deter these travelers from using these roadways. Travelers may use alternative roadways including McCall-Stibnite Road (CR 50-412) to South Fork Salmon River Road (FR 50674/474).

During operations, mine-related traffic would include transport of employees to and from the mine site, delivery of supplies, and activities associated with road maintenance such as snowplowing and sanding. During the 12 years of mine operations, Alternatives 1, 3, and 4 would generate a total estimated AADT of 68 vehicles (49 heavy vehicles and 19 light vehicles) resulting in approximately five mine-related vehicles traveling outside the mine site per hour between 5:00 am and 7:00 pm. Alternative 2 would generate less traffic than the other action alternatives due to the generation of lime at the mine site. Under Alternative 2, operational AADT would be 50 vehicles (33 heavy vehicles and 17 light vehicles), resulting in approximately four mine-related vehicles per hour traveling outside the mine site.

The upgraded Burnt Log Road and the newly constructed Burntlog Route would experience an increase in traffic of over 185 percent, under Alternative 2, and 250 percent, under Alternatives 1 and 3, with approximately half of the traffic comprised of heavy vehicles. Although heavy vehicles currently use Yellow Pine Route to access the mine site, Alternative 4 traffic would result in a noticeable change in driver experience and slower drive times due to the substantial increase in mine-related heavy vehicles along Yellow Pine Route during the life of the SGP. Even though upgrades to Johnson Creek Road and Stibnite Road would be made, these roads would still have many curves and slopes.

During closure and reclamation, activities including slope recontouring, facility removal, seeding and planting, and post-closure environmental monitoring would require approximately 7 years. Under Alternatives 1, 3, and 4, closure and reclamation would generate a total estimated AADT of 25 vehicles (13 heavy vehicles and 12 light vehicles). Post-closure monitoring activities would generate a total estimated AADT of six light vehicles. The duration of monitoring and monitoring requirements would be outlined in the final permit approval documents.

There would be greater traffic volume and public access impacts under Alternative 2 for closure and reclamation compared to the other action alternatives. There would be approximately 40 additional truck trips per year required to deliver chemicals for water treatment in perpetuity, which would provide an increase of 0.1 AADT for closure and reclamation and post-closure traffic under Alternative 2.

Furthermore, these roads experience a seasonal effect which results in noticeable differences in traffic. Valley County has many summer recreational areas that attract visitors from May through October with peak AADT levels in June, July, and August. Winter driving conditions influence the amount of traffic and result in lower AADT levels during the winter months. Therefore, the seasonal effect of traffic on these roads would show a noticeably greater increase in mine-related winter traffic (i.e., drivers would notice a higher ratio of mine-related traffic to general traffic) during construction, operations, and closure and reclamation. Post-closure winter traffic would not be as noticeable as heavy vehicle deliveries would not occur and approximately six mine-related light vehicles per day would utilize the accessible roadways in the analysis area for monitoring and maintenance purposes.

4.16.7.2 Public Access

Under Alternatives 1, 2, and 3, public access to the SGP area would essentially be the same; however, under Alternative 2 there would be a public access route through the mine site during the SGP construction, operations, and closure and reclamation phases. There also would be a public access route through the mine site under Alternative 4. Under Alternative 4, the Burntlog Route would not be constructed, and the Yellow Pine Route would be used for both public and SGP-related access.

4.16.7.3 Safety and Emergency Access

For the duration the SGP, the increase in total volume of mine-related vehicles, specifically heavy vehicles or trucks, on the Yellow Pine and Burntlog routes would result in a safety risk for accidents occurring between public and SGP-related traffic due to the one-lane constraints for passing slower moving vehicles and degradation of the road with more frequent heavy vehicle travel. There would be no increased risk on the Burnt Log Road (FR 447) under Alternative 4, because the Burntlog Route would not be constructed or used for the SGP. However, the steep terrain would be a greater risk to safety along the Yellow Pine Route under Alternative 4 as it would be the only route used for the life of the SGP and would require safety considerations for geotechnical hazards, landslides, and avalanche zones, including intermittent and extended road closures during the four years of construction. Additionally, access through the mine site under Alternative 4 would be through a single point of ingress and egress and would require safety considerations for mine deliveries and public access. The steep climb to provide access around the Yellow Pine pit would require a wider road with more switchbacks to accommodate the heavy trucks transporting mine supplies and may increase hazardous driving conditions for crew rotation, emergency responses, and wildfire evacuation.

4.16.7.4 Other Modes of Transportation

Under all action alternatives, a helipad would be located at the mine site for exploration during daylight hours and Medevac purposes. Approximately one round trip (2 truck trips) of antimony concentrate would be hauled off-site daily to a commercial barge located at the Port of Lewiston or truck loading facility depending on the refinery location. The daily shipment of antimony and the potential indirect transport of supplies and materials to and from the mine site would generate minimal to negligible changes in water transportation. Although there is no rail transportation system is in the analysis area, there is potential for the trucks to transport mine products to rail lines located in Boise or for supplies and materials to be indirectly transported to and from the mine site by trucks originating from rail shipments. Nevertheless, these impacts would generate negligible changes to rail transport during operation of the SGP and would not substantially alter the level of service.

This page intentionally left blank

Table 4.16-7 Comparison of Access and Transportation Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may affect access to public lands during mine construction, operations, and closure and reclamation.	Number, location, and description of changes in access due to new and improved roadways.	See **Table 3.16-1** and **Figure 3.16-1**	- Burnt Log Road (plowed) - No public access through the mine site during operations - Loss of winter groomed OSV trail on Warm Lake Road to Landmark	Same as Alternative 1 except: - Mine site public access during operations (Option 1 and 2) (not plowed) - Rerouted Riordan Creek Segment on Burntlog Route (plowed)	Same as Alternative 1 except: - EFSFSR TSF public access or mine access route upon closure and reclamation	Same as Alternative 1 except: - no BLR, only YPR (plowed)	No change from baseline conditions.
The SGP may change the miles of roads and trails, the amount of use, and types of vehicles on each road or trail.	Miles of new road for public use.	Forest Service = 1,557 miles Valley County = 278 miles State = 131 miles	Forest Service = no change Valley County = 2.5 miles[1] State = no change Private = 15 miles[2]	Forest Service = no change Valley County = 2.5 miles[1] State = no change Private = 13.5 miles (with an additional 3 to 4 miles through the mine site)[3]	Forest Service = 7.6-9 miles[4] Valley County = 2.5 miles[1] State = no change Private = 19.6 miles[2]	Forest Service = no change Valley County = 2.5 miles[1] State = no change Private = 4 miles through the mine site[5]	No change from baseline conditions.
	Change in amount of use.	See **Table 3.16-1** for existing roads.	**YPR** = 5 mine-related vehicles/hr (C) **BLR** = 5 mine-related vehicles/hr (O); 2 mine-related vehicles/hr (C-R)	Same as Alternative 1 except: **BLR** = 4 mine- related vehicles/hr (O)	Same as Alternative 1.	Same as Alternative 1 except all phases occurring on YPR.	No change from baseline conditions.
	Changes in frequency of rail, air, and water transportation.	**Rail** – no active lines **Air** – 7 public use airports **Water** – Port of Lewiston	**Rail** – No impact. **Air** – Helicopter usage for when roads are inaccessible. Recreators may spectate the mine site. **Water** – 1 roundtrip (2 truck trips) daily of antimony concentrate shipped by barge	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No change from baseline conditions.
The SGP may affect public safety on the roads used by mine vehicles during construction, operations, and closure and reclamation activities.	Approximate miles of roads used by mine vehicles.	YPR = 70 miles SFSRR = 83 miles BLR = 0 mile (does not exist)	YPR = 70 miles BLR = 73 miles	YPR = 70 miles BLR = 71 miles	YPR = 70 miles BLR = 75 miles	YPR = 70 miles BLR = 0 mile	No change from baseline conditions.
	Change in traffic volume. (AADT)	Refer to **Table 3.16-2**.	C = 65 (45 HV) O = 68 (49 HV) C-R = 25 (13 HV) Post Closure = 6 (0 HV)	C = 65 (45 HV) O = 50 (33 HV) C-R = 25 (13 HV) Post Closure = 6 (0 HV) *Additional 40 truck trips (O and C-R) per year required to deliver chemicals for water treatment.	Same as Alternative 1.	Same as Alternative 1.	No change from baseline conditions.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Number of accidents, both current and projected.	Warm Lake Road = 8/year Johnson Creek Road = 2/year Stibnite Road = 1/year	Midas Gold would implement safety measures to reduce accidents including radio communication.	On-site lime generation would result in fewer mine-related vehicle trips and a decrease in the likelihood of being in an accident.	Same as Alternative 1.	YPR has a steeper topography and terrain that would require wider roads, more cut/fill sections, and more switchbacks.	No change from baseline conditions.
	Change in emergency access.	N/A	Additional access routes via public access through the mine site upon closure (C-R). Removal of Warm Lake OSV (C/O/C-R) and Johnson Creek OSV (C).	Same as Alternative 1 except: public access through mine site	Same as Alternative 1.	Same as Alternative 1.	N/A

Table Notes:

1 Additional miles of new road for public access post closure would require revision to the existing FRTA easement with Valley County.

2 The newly constructed Burntlog Road would be a temporary road necessary for mining purposes (pursuant to 36 CFR 228A[f]). The duration for public access on private roads outside of the mine site (i.e., temporary mining access roads associated with the SGP) when other public access roads are blocked by mine operations would only occur during the life of the mine.

3 The newly constructed Burntlog Road would be a temporary road necessary for mining purposes (pursuant to 36 CFR 228A[f]). The duration for public access on private roads outside of and through the mine site (i.e., temporary mining access roads associated with the SGP) when other public access roads are blocked by mine operations would only occur during the life of the mine.

4 Additional miles of new road for public access post closure attributed to the EFSFSR TSF public access or mine access routes.

5 During the life of the mine, mine traffic would utilize the existing road network. No new roads would be constructed outside of the mine site; however, public access would be provided on private roads through the mine site (i.e., temporary mining access roads associated with the SGP) when other public access roads are blocked by mine operations for the duration of the SGP.

+ = includes; - = removes; AADT = annual average daily traffic; BLR = Burntlog Route; C = Construction; C-R = Closure and Reclamation; EFSFSR TSF = East Fork South Fork Salmon River Tailings Storage Facility; FRTA = Forest Roads and Trails Act; hr = hour; HV = heavy vehicles; N/A = not applicable; O = Operations; OHV = off-highway vehicle; OSV = over-snow vehicle; SFSRR = South Fork Salmon River Road; YPR = Yellow Pine Route.

4.17 CULTURAL RESOURCES

4.17.1 Effects Analysis Indicators and Methodology of Analysis

4.17.1.1 Issues and Indicators

The issues and indicators for cultural resources were developed from general issues identified by public and agency comments during the scoping process, consultation, and through professional research. The indicators are quantitative direct or indirect impacts when the appropriate information is available, or otherwise qualitative. The duration and geographic extent of an impact is the temporal and physical expanse of the impact, respectively. Context refers to the significance of an action within a setting, such as society as a whole (human, national), the affected region (regional), the affected interests, and the locality (local or site-specific). The analysis of effects to cultural resources includes the following issues and indicators:

Issue: The Stibnite Gold Project (SGP) would impact cultural resources through temporary or permanent ground disturbing activities during construction, operation, and closure and reclamation phases.

Indicators:

- Location and acres of ground disturbance.
- Number and location of historic properties, including traditional cultural properties (TCPs) and cultural landscapes (CLs).
- Significance of cultural resources that could be displaced, damaged, or destroyed.

Issue: The SGP may impact aboveground historic properties, TCPs, and CLs by introducing visual elements that could diminish the integrity of the resources.

Indicators:

- Locations of tall or massive SGP components in relation to aboveground historic properties, TCPs, and CLs.
- Number and location of aboveground historic properties, TCPs, and CLs that may have altered viewsheds.

Issue: The SGP would create noise and vibration that could impact fragile standing or partially standing historic properties, TCPs, and CLs.

Indicators:

- Vibration causing activities, including very high noise levels, and the locations of activities.
- Number and location of standing or partly standing historic properties, TCPs, and CLs in relation to noise and vibration causing activities.

Issue: The SGP may create increased visibility of cultural resources through increased public access via new roadways and improvements to existing roads, which could potentially lead to loss or destruction.

Indicators:

- Location of public access roads that would be improved, constructed, and remain in use following mine closure and reclamation.
- Number and location of historic properties, including TCPs and CLs, that may be impacted.

4.17.1.2 Data Sources

Cultural resources within the analysis area were identified and analyzed using records of previous cultural resource studies and previously recorded archaeological sites from the Idaho State Historic Preservation Office (SHPO), the Payette National Forest Heritage Program Office, and the Boise National Forest Heritage Program Office. Geographic Information System analyses, survey information, review of aerial photographs, cultural resource literature reviews, and information and analysis documented in reports on other resources prepared for the SGP also were used. This analysis includes field data collected up to October 2019. Per the National Historic Preservation Act (NHPA), only historic properties (any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places [NRHP]), which includes TCPs and CLs, were considered in the impact analysis.

As discussed in Section 3.17, Cultural Resources, the Nez Perce Tribe and the Shoshone-Paiute Tribes have completed ethnographies that discuss potential TCPs, CLs, resource collection areas, and sacred sites among other areas of concern (Battaglia 2018; Walker 2019). Specific spatial data for these resources are not currently publicly disclosed. The Shoshone-Bannock Tribes Cultural Department is still in the process of preparing their ethnographic work for the SGP, and there is currently no information available from their studies. Therefore, effects to potential TCPs and CLs are not able to be analyzed at this time. Data from ethnographies prepared by the tribes will be included prior to the Record of Decision.

There are parts of the analysis area where ground disturbance may occur from the SGP that have not been surveyed for cultural resources. Midas Gold Idaho, Inc.'s (Midas Gold's) resource environmental protection actions include continued cultural resources surveys in areas where SGP components would occur (Midas Gold 2016). Additionally, a SGP-specific Programmatic Agreement (PA) is being developed, and that legally-binding NHPA Section 106 document would include language that specifies how the United States Forest Service (Forest Service) will complete identification of the cultural resources Area of Potential Effects (APE), what the level of effort for identification of historic properties will be, how effects to historic properties will be assessed, and how specific effects will be resolved in consultation with SHPO, the Advisory Council on Historic Preservation, tribes and other consulting parties. Additionally, it will identify mitigation measures and how the Forest Service will ensure that they are carried out.

4.17.2 Direct and Indirect Effects

Analysis from the sources listed previously revealed six known historic properties within the analysis area plus one potential historic property. See Section 3.17, Cultural Resources.

Two historic properties are located at the mine site (Stibnite Historic District and the precontact site) and are common to all action alternatives. Two historic properties are linear sites that pass through and beyond the mine site (Old Thunder Mountain Road [National Forest System Road {FR} 440] and Idaho Power Company [IPCo] Line 328) and are common to all action alternatives. Two Forest Service administrative sites (Landmark Ranger Station and Meadow Creek Lookout) also are located along mine access routes under one or more of the action alternatives. In addition, Thunderbolt Mountain Lookout has not been recorded as a historic property; however, it does meet the age requirements, and its history suggests it could be eligible for listing on the NRHP. It is included in the analysis area, because, under all action alternatives, it is the potential location of a 10-foot-high very high frequency (VHF) radio repeater with solar panels.

The following analysis of effects associated with cultural resources is considered in the overall context of local, regional, and national history. This is particularly true for the NRHP-listed Stibnite Historic District, which was listed in the NRHP based on its significance within the context of World War II (under Criterion A). However, it is important to note that the Stibnite Historic District no longer contains any NRHP-eligible components, and the District could potentially be delisted, pending ongoing consultation between the Forest Service and Idaho SHPO.

Elements of this context include:

- The history of mining of central Idaho (local)
- Mining in the West (regional)
- The significance of mining at Stibnite in relation to World War II (national)
- The precontact history of central Idaho (local)
- Native American traditions (site-specific, local, regional, national)

4.17.2.1 Alternative 1

Alternative 1 has the potential to result in direct and indirect effects to cultural resources, because the SGP involves extensive ground, visual, and noise disturbance, as well as the potential for increased public use and future increased public access.

Direct effects to cultural resources from the SGP occur at the same time and place, with no intervening cause. They can stem from ground disturbance that includes physical removal of artifacts, features, or structures or otherwise displacing, damaging, or destroying these types of cultural resources. Direct effects also can come from altering the physical features of a historic property even if that alteration is temporary, such as attaching solar panels to historic structures. Direct effects also can be visual or noise related or can come from changes in access. For direct physical impacts, the magnitude of impact ranges from low to high and may be reduced by avoidance of known historic properties. Any direct impacts would be permanent, as impacts to historic properties (loss or destruction) cannot be reversed.

Indirect effects are effects caused by the SGP that occur later in time and/or farther removed in distance but are still reasonably foreseeable. For the SGP, there is one potential indirect effect identified for all cultural resources. It is the potential increase in public access into the analysis area when roads that were closed during the SGP are re-opened, because new and upgraded roads increase the likelihood of inadvertent damage or vandalism to historic properties due to increased exposure of these resources in a previously low-traffic area.

All areas of proposed ground disturbance in the mine site under Alternative 1 were surveyed for cultural resources between 2011 and 2019. Under Alternative 1, six historic properties would be impacted. These properties must be considered under the NHPA and the National Environmental Policy Act. Impacts under Alternative 1 to these historic properties are discussed below under each of the three proposed phases of the SGP (construction, operations, and closure and reclamation). Implementation of Alternative 1 also could cause impacts to potential TCPs, CLs, resource collection areas, and/or sacred sites, but effects on these types of resources cannot be analyzed at this time, because the nature and locations of these resources have not been made public by the tribes with interest in the area, including the Nez Perce Tribe, the Shoshone-Bannock Tribes, and the Shoshone-Paiute Tribes.

4.17.2.1.1 CONSTRUCTION

Direct effects to historic properties under Alternative 1 during the construction phase would be caused by ground disturbance. Direct effects to historic properties also would result from increased numbers of people in the SGP area for construction activities and, thus, potential for accidental or intentional harm to cultural resources by the general public; temporary noise from construction activities; and visual intrusions as new infrastructure, utilities, and roads are built. Restricted access to the mine site area during construction closures would restrict tribal access to potential TCPs and CLs. Impacts of access restrictions are addressed further in Section 4.24, Tribal Rights and Interests. Impacts from construction noise would be temporary and intermittent. However, many sites of religious and cultural significance, which may be defined as TCPs and CLs, depend on a sense of solitude in an area, and construction noise would potentially disrupt American Indian religious and cultural practices (see Section 4.24, Tribal Rights and Interests). No vibrations from blasting, drilling, or ore processing activities would occur in the construction phase, so no aboveground historic structures would be affected. Likewise, visual intrusions would be minimal during construction, as the major visual impacts would occur during the operations phase.

4.17.2.1.1.1 Mine Site

Activities proposed during the construction phase could cause direct impacts that can damage or displace historic properties. Ground disturbance at the mine site would impact the NRHP-listed Stibnite Historic District and the precontact site. These would be directly impacted due to ground disturbance under Alternative 1. Legacy tailings materials in the Meadow Creek Valley, within the Stibnite Historic District, would be removed. Construction phase impacts would directly impact some portions of the two linear historic properties (Old Thunder Mountain Road [FR 440] and IPCo Line 328) through transmission line upgrades and road improvements, discussed below. Direct ground disturbing impacts also could affect any TCPs or CLs, particularly if associated with religious or spiritual activities, not yet identified and/or disclosed in the mine site or along access roads or utilities routes (including communications tower locations).

Direct effects also could result from an increase in the number of people in the analysis area due to the temporary influx of construction workers and, later, a more permanent presence post-construction when workers are housed at the mine site. Though closures during construction, operations, and closure and reclamation would limit public access into the area, the number of workers (peak of 1,000, with an average 750-person work force) is well above the average number of visitors or recreationists in the area at any given time. This increase could lead to vandalism or unintentional disturbance or damage to historic properties. Restricted access to the mine site area during construction and subsequent phases would restrict tribal access to TCPs and CLs within the Operations Area Boundary. For more information on tribal rights and interests as they relate to restricted access by tribes, see Section 4.24, Tribal Rights and Interests.

4.17.2.1.1.2 Access Roads

The Burntlog Route would connect to a portion of the historic Old Thunder Mountain Road (FR 440), and this action has the potential to directly, though minimally, impact this historic property by overlapping the Old Thunder Mountain Road for approximately 3 miles of the over 25-mile-long historic route. Old Thunder Mountain Road is still frequently used as an all-terrain vehicle route maintained by the Forest Service. Because there would be no realignment, and only a relatively short segment of the entire Old Thunder Mountain Road would be impacted, there would be no adverse effects to Old Thunder Mountain Road as a result of implementation of Alternative 1.

Mine site access routes under Alternative 1 also pass near the Meadow Creek Lookout but would not physically impact the structure. The proposed groomed over snow vehicle (OSV) route on the west side of Johnson Creek Road between Warm Lake Road and Cabin Creek Road would require tree removal, which could potentially adversely affect culturally modified trees that may be present. This type of cultural resource is known to exist in other areas adjacent to Johnson Creek Road. Due to the possibility of modified trees, this area would require survey and be added to the cultural resources APE prior to SGP-related ground disturbing activities. Mitigation measures for effects to these resources would be stipulated in the PA.

Upgrades to roads could lead to an increase in public usage, and this could increase access to and vulnerability of cultural resources within the analysis area. These activities plus construction noise also could potentially impact TCPs or CLs not yet identified along the access road alignments.

4.17.2.1.1.3 Utilities

Transmission Line

Under Alternative 1, direct effects from ground disturbance and from increased visual intrusions would occur from construction of the utilities proposed under Alternative 1. Construction to upgrade the existing historic IPCo Line 328 and build a new transmission line segment would involve subsurface excavation to set poles, surface disturbance for pulling and tensioning the lines, and clearing and minor expansion of the right-of-way. Approximately 63 miles of the existing 12.5-kilovolt and 69-kilovolt transmission lines would need to be upgraded, and approximately 8 miles of new line would be constructed along portions of the historic route of IPCo Line 328 from Johnson Creek Substation to the mine. The transmission line itself is a historic property, and it would be impacted by the upgrade activities, including the removal and replacement of existing structures, insulators, and conductors. However, a portion of the IPCo Line 328 from the village of Yellow Pine to the mine site has been removed, and some of the line between the proposed Johnson Creek Substation and the mine site no longer exists, primarily due to weathering (Lahren 2016a, b; 2017). The condition of the transmission line would require further evaluation, and this evaluation would be included in the PA. Portions of the existing transmission line that have not already been surveyed or were not included in the cultural resources APE would be surveyed. This requirement also will be stipulated in the PA. However, because the transmission line is currently in operation, routine maintenance is performed on the line, and IPCo intends to keep materials and workmanship similar to the historic line, no adverse effect to the IPCo Line 328 is anticipated.

The viewsheds of both the Thunderbolt Mountain and Meadow Creek lookouts would be impacted by the transmission line upgrade and construction of new transmission line. However, the portion of the transmission line that would cause a visual intrusion on the Thunderbolt Mountain Lookout would be an upgrade of an existing line, so there would be no adverse effects, as existing conditions would only change due to an increase in the widening of the clearing and height of the poles needed for increased kilovolt capacity. For the Meadow Creek Lookout, the portion of the transmission line in that area would be new, and this would be a major change from the existing visual conditions. The cleared right-of-way for the new transmission line would appear as a light-colored, thin band following the ridgeline, creating a strong level of contrast against the rugged, vegetation-covered hillside. Although visually evident, it would appear subordinate to the tailings storage facility (TSF) that would dominate the landscape in the valley floor, as discussed in Section 4.20.2.1.3.2, Utilities Operations. Visual impacts would be permanent for the upgraded portion of the line, because that line would remain in place and be maintained by IPCo following the mine closure and reclamation phase. Visual intrusions to the setting of the Meadow Creek Lookout would be considered an adverse effect.

Communications Towers

Ground disturbance also would occur during construction of the communications towers, though the largest area of disturbance would be an 1,800-square-foot area for the cellular tower base, perimeter fencing, and associated equipment. Accessing new construction areas, such as those for the communications towers, requires trucks that could potentially damage cultural resources present within the construction access road. Three cell tower alternative locations are being considered, including near the Meadow Creek Lookout, on a summit east of Blowout Creek, or near Hangar Flats pit. There would be adverse effects to Meadow Creek Lookout if the 60-foot tall cellular tower were placed at this historic building.

VHF radio repeaters would be placed along the Burntlog Route as needed and near the Meadow Creek Lookout and Thunderbolt Lookout. Ground disturbance would be small and not permanent for the VHF radio repeaters, which are placed on a 3-foot-square concrete pads that require little excavation. However, VHF radio repeaters do require small solar panel arrays (2 feet by 3 feet in size) that would potentially be attached to the existing lookout towers. Under Alternative 1, there could be a 10-foot-tall VHF radio repeater placed directly adjacent to the historic Meadow Creek Lookout and associated solar panels attached to the roof of the lookout cabin. The VHF radio repeater also could potentially be placed on the lookout tower itself, or there could be a 60-foot-tall cellular monopole placed directly adjacent to the tower. Both types of communications towers would cause adverse visual impacts to the Meadow Creek Lookout. In addition, Meadow Creek Lookout has an unresolved adverse effect in place from a small utility building and associated solar array that currently obstructs the viewshed from the lookout (Osgood 2008). The SGP could compound the impacts to the lookout through installation of the radio repeater and/or cell tower.

Under Alternative 1, a VHF radio repeater also may be placed at Thunderbolt Mountain Lookout. As with Meadow Creek Lookout, the repeater would be placed directly adjacent to the lookout, and solar panels may be placed on the roof of the cabin. This would not be considered a direct physical impact, because the repeaters and their solar panels are not large and could be easily removed; however, it is a temporary but long-term direct visual impact that would last for approximately 20 years, or the life of the mine. Though not recorded as a historic resource, the Thunderbolt Mountain Lookout has been identified by the Forest Service as potentially eligible for listing on the NRHP based on its age of over 50 years and its history. Thunderbolt Mountain Lookout is located several miles southwest of Meadow Creek Lookout, closer to Cascade, Idaho (**Figure 3.17-1c**, Overview Map with Cultural Resources Analysis Area – Sheet 3 of 4). Without appropriate avoidance, minimization, or mitigation measures, there would be adverse effects to the Meadow Creek Lookout and the Thunderbolt Mountain Lookout, if either one is selected as a communications tower site under Alternative 1.

4.17.2.1.1.4 Off-site Facilities

Ground disturbing construction activities associated with the off-site facilities (the Stibnite Gold Logistics Facility and the Landmark Maintenance Facility) include construction of parking areas, buildings, and outdoor storage areas. These are small areas (less than 25 acres each) in relatively developed areas that are not likely to contain cultural resources, including TCPs or

CLs. An archaeological survey of the site proposed for the Stibnite Gold Logistics Facility was conducted in 2017. The SHPO has concurred that the Stibnite Gold Logistics Facility would have no adverse effect to historic properties (Davis 2018). The location of the Maintenance Facility at Landmark under Alternative 1has been surveyed for archaeological resources, and no historic properties were located (AECOM 2020; Lahren 2017).

Under Alternative 1, the Landmark Maintenance Facility would be constructed approximately 500 feet southwest of the Landmark Ranger Station (see **Figure 3.17-2b**). The maintenance facility would be visible from the Landmark Ranger Station and would have an adverse effect to the historic property due to the change in setting. However, the Forest Service anticipates that adverse effects could be avoided or mitigated through architectural design under the terms of the PA with the Idaho SHPO and other consulting parties.

4.17.2.1.2 OPERATIONS

Direct ground surface impacts to cultural resources would have already occurred during the construction phase as described above. Although active mining at the open pits would not begin until this phase, the footprint of disturbance would have already been impacted during construction, with the exception of vertical impacts below the ground surface, which would increase as mining progresses in the open pits and the underground Scout Portal.

There is the potential for activities under Alternative 1 to facilitate increased incidental public access to, and usage of, National Forest System lands due to access road improvements and construction that would be in use during the operations phase. This increased potential for public access, in addition to the SGP-related personnel (a consistent work force of between 475 and 525 people) and associated traffic in the area, could result in direct effects to cultural resources by intentional and unintentional displacement or damage due to the overall increase in people and traffic in the analysis area. However, public visits to sites in the Payette National Forest and Boise National Forest are in keeping with the desired conditions for the Heritage Program as described in the Forest Land and Resource Management Plans, which state, “People visiting the National Forest can find opportunities to explore, enjoy, and learn about cultural heritage...” (Forest Service 2003, 2010).

In Section 4.20.2, Direct and Indirect Effects for Scenic Resources, changes to characteristic landscapes were assessed by evaluating visual contrast (landform and vegetation, water form, and rock form alterations) that would occur through implementation of Alternative 1. The perception of visual contrast associated with Alternative 1 considered the alternative’s viewshed and associated viewshed limiting factors for sensitive use areas. This analysis was used to help determine the level of direct visual impacts to cultural resources from implementation of Alternative 1.

Historic properties in the mine site that would be directly impacted by changes to their viewsheds include Old Thunder Mountain Road (FR 440), IPCo Line 328, the Stibnite Historic District, Meadow Creek Lookout, and the precontact site. Alternative 1 would diminish the integrity of the historic properties by introducing visual elements that are not in keeping with their integrity of setting, feeling, or association.

Noise and vibrations from operations at the mine site would increase during this phase, and much of it would be constant during working or daylight hours. The increased noise levels could adversely impact some types of TCPs or CLs by causing distractions and changing natural conditions. Vibrations from the blasting, drilling, and ore processing activities during this phase could potentially cause accelerated collapse of any fragile standing or partially standing historic properties, including TCPs. There are no fully standing historic structures in the analysis area; however, there are several that are partially standing and fragile, such as the ore sorting structures in the Yellow Pine pit and some deteriorated foundations located in areas that were once residential and service neighborhoods associated with the Stibnite Historic District. None of the individual historic archaeological sites within the Historic District are historic properties, because they have all been determined not eligible for inclusion in the NRHP (Davis 2012, 2018). Therefore, there would be no effects on known historic properties from noise and vibrations under Alternative 1. However, TCPs that have not yet been publicly disclosed would likely be adversely affected.

4.17.2.1.3 Closure and Reclamation

Some of the impacts during this phase would be comparable to the construction phase for cultural resources as far as ground disturbance. For instance, buildings would be removed, and the Burntlog Route would be decommissioned and reclaimed within its original corridor, except for the short portions of Burnt Log Road (FR 50477) that were abandoned and reclaimed during construction. The Landmark Maintenance Facility also would be removed. During closure and reclamation, Alternative 1 would involve ground disturbance and noise impacts similar to the construction phase, but visual impacts would decrease as open pits are partially filled or completely filled and recontoured, as with the Yellow Pine pit, and as the Development Rock Storage Facilities (DRSFs) and the TSF are returned to natural looking contours and vegetation is established. This process would take a very long time, and the area would never be returned to existing conditions, as DRSFs and the TSF would remain noticeable in that they would never quite match the surrounding area. Public access through the mine site would be returned to pre-operations levels, although some access roads (Burntlog Route) would be reclaimed and allowed to return to a pre-construction, pre-mining state. The removal of access restrictions after the closure and reclamation phase also could constitute an indirect effect to cultural resources due to a resurgence of public access to the analysis area and potential impacts to TCPs, CLs, and other identified resources.

4.17.2.2 Alternative 2

Most actions during construction and operations phases under Alternative 2 are similar to those under Alternative 1 and would impact many of the same historic properties in the same way as under Alternative 1. However, there are a few changes during the construction and operations phases that would impact cultural resources differently as related to the access roads, off-site facilities, and the transmission line. These changes would be the same for the construction and operations phases.

4.17.2.2.1 Construction

4.17.2.2.1.1 Access Roads

Approximately 5.3 miles of the Burntlog Route would be located near Riordan Creek under Alternative 2. This route was surveyed for cultural resources by AECOM archaeologists in September 2019, and no historic properties were located (AECOM 2020). This route would bypass two crossings of the Old Thunder Mountain Road (FR 440) and avoid impacts at these locations (see **Figure 3.17-1a**).

Public access would be provided through the mine site via a new road that would link the Stibnite Road portion of the McCall-Stibnite Road (CR 50-412) at the northern portion of the mine site to current Thunder Mountain Road (FR 50375) where it comes in at the southeast end of the mine site. This would not impact the Native American trail route or the historic (wagon road) alignment of Old Thunder Mountain Road (FR 440). However, portions of this public access route via Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) have not been surveyed for cultural resources and would need to be surveyed prior to any SGP-related ground disturbance. This would be a provision in the PA.

4.17.2.2.1.2 Utilities

Transmission Line

The transmission line route under Alternative 2 would include a bypass around Thunder Mountain Estates subdivision in Cascade. This route would not impact any known historic properties; however, the transmission line route has not been surveyed for cultural resources, and there may be historic properties present that could be affected other than IPCo Line 328 itself, which is a historic property. This inventory would be completed prior to ground disturbing activities per stipulations in the PA. This change in alignment also would necessitate a relocation of the Cascade switching station from its current location at the intersection of Thunder City Road and Weant Lane to Warm Lake Road (**Figure 2.4-12**). Additionally, 0.9 mile of the existing transmission line also would be routed in the same general area in order to use an abandoned railroad grade. This grade no longer contains rails or ballasts and is not a historic property.

4.17.2.2.1.3 Off-site Facilities

The Burntlog Maintenance Facility would be located 4.4 miles northeast of the Landmark Ranger Station along Burnt Log Road (FR 50477). This area was surveyed in 2018 and did not contain any historic properties (AECOM 2020). This proposed location of the Burntlog Maintenance Facility would not affect known historic properties. However, information about TCPs or CLs along Burntlog Route is currently unknown.

4.17.2.2.2 Operations

The impacts to cultural resources under Alternative 2 do not change between the construction and operations phases.

4.17.2.2.3 Closure and Reclamation

Closure and reclamation phase activities for Alternative 2 would not impact cultural resources in any substantially different way than Alternative 1, as most of the differences relate to stream channel reroutes, the methods of partially or completely filling in the open pits, and types of materials used for capping the DRSFs prior to adding growth media and replanting.

4.17.2.3 Alternative 3

Actions during the construction and operations phases under Alternative 3 at the mine site would impact the same historic properties in the same way as described under Alternative 1, except additional historic properties may be impacted where the TSF and Hangar Flats DRSF would be located in the East Fork South Fork Salmon River (EFSFSR) drainage. The EFSFSR drainage in this area has not been surveyed for cultural resources; however, under provisions in the PA, it would be surveyed prior to any ground disturbing activities. Some mine site infrastructure (worker housing and associated water and sanitation facilities, the new transmission line into the mine site, and the mine access road in Blowout Creek drainage) also would be located in the Blowout Creek drainage under Alternative 3. In addition, the legacy tailings in Meadow Creek would not be re-processed. The location of the TSF and the worker housing facility also would necessitate approximately 2.5 miles of the new 8.3-mile-long 138-kilovolt transmission line be aligned to be coincident with a minimally developed access road in the Meadow Creek drainage (**Figure 2.5-2**). Additionally, under Alternative 3, there would be no public access through the mine site during the SGP.

4.17.2.3.1 Construction

4.17.2.3.1.1 Mine Site

Under Alternative 3, the legacy tailings in Meadow Creek drainage within the Stibnite Historic District would not be reprocessed. The location of the TSF and Hangar Flat DRSF in the EFSFSR would not impact known historic properties. However, the proposed location of the TSF/DRSF has not been surveyed for cultural resources. Under Alternative 3, the location of the TSF and the Hangar Flats DRSF could impact currently unidentified historic properties, including TCPs or CLs. However, as previously stated, stipulations in the PA would require that this area is surveyed prior to ground disturbance.

With the TSF located in the EFSFSR drainage, the worker housing facility would be located in the Blowout Creek drainage. An access road would be constructed during this phase. The area around Blowout Creek has been surveyed for archaeological resources at a reconnaissance level, and no historic properties were identified (see **Appendix L-1**). Locations of potential TCPs and CLs in this area are not publicly disclosed.

4.17.2.3.1.2 Access Roads

Changes to access roads under this alternative include not constructing the off-highway vehicle (OHV) Trail or Horse Heaven/Powerline access road connector, which would potentially result in fewer visitors in the area around Meadow Creek Lookout. Because the number of visitors in the area would potentially be decreased under Alternative 3, there are no anticipated impacts to Meadow Creek Lookout.

Not having a public access route through the mine site would block tribal access to TCPs and CLs (see more on access restrictions and its effect to tribal rights and interests in Section 4.24, Tribal Rights and Interests). It also would minimize the public visitor traffic in this already low-traffic area.

4.17.2.3.2 OPERATIONS

This phase would impact cultural resources in the same way as the construction phase described above, except for visual impacts to the precontact site. Under this alternative, because the site would be farther away in the EFSFSR drainage, with more upright topography between the precontact site and the mine site, it is anticipated that there would be no adverse visual effects to the precontact site under Alternative 3 in the operations phase.

4.17.2.3.3 CLOSURE AND RECLAMATION

Under Alternative 3, impacts to cultural resources during the closure and reclamation phases would be the same as described under Alternative 1, except the public access route would be provided around the EFSFSR TSF location either by retaining a portion of the mine access road that goes up Blowout Creek or by converting the temporary operational TSF access road along the TSF pipeline into a permanent public road connecting to the existing Thunder Mountain Road (FR 50375) at both ends. FR 50375 is not part of the historic property, which is only the Old Thunder Mountain Road (FR 440). Therefore, there would be no adverse effects to Old Thunder Mountain Road (FR 440) as result of implementation of Alternative 3.

4.17.2.4 Alternative 4

The primary difference under this alternative that affects cultural resources is the use of the Yellow Pine Route as access to the mine site. Under Alternative 4, the Yellow Pine Route would be used, and the Burntlog Route would not be constructed. Not all portions of Yellow Pine Route have been surveyed, and unidentified cultural resources could be present. Communications tower construction would be by helicopter under Alternative 4, and, therefore, associated access roads would not be needed for this project component, which eliminates ground disturbance in these locations. Also, the location of the off-site maintenance facility is distinct from the other action alternatives and has not been surveyed for cultural resources (**Figure 2.6-1**).

4.17.2.4.1 CONSTRUCTION

4.17.2.4.1.1 Access Roads

Under Alternative 4, access to the mine site would be via the Yellow Pine Route, which would be upgraded, including borrow sources along its route. Portions of this route have not been surveyed for cultural resources; however, they would be inventoried in accordance with PA stipulations prior to disturbance outside the existing roadbed. Public access would be via a new access road to link Stibnite Road (CR 50-412) with Thunder Mountain Road (FR 50375). The groomed OSV route west of Johnson Creek Road would be used from construction through mine closure. There would be no OHV Trail built at Horse Heaven, which would mean there would be no increased access to historic properties in that area.

4.17.2.4.1.2 Utilities

Communications Towers

Under Alternative 4, the potential communications tower locations at Meadow Creek Lookout and Thunderbolt Mountain Lookout would be constructed and maintained by helicopter. Although this would eliminate ground disturbance from access roads and, therefore, reduce incidental impacts near the lookouts in areas that have not all been surveyed for cultural resources, including TCPs or CLs, the direct impacts, such as attaching solar panels or other tower equipment to the lookouts, would be an adverse effect.

4.17.2.4.1.3 Off-site Facilities

The Landmark Maintenance Facility would be moved west of Landmark on the south side of Warm Lake Road farther from the historic Landmark Ranger Station. This would result in decreased visual impacts to the Ranger Station from the maintenance facility buildings, but there would still be an adverse effect to the Landmark Ranger Station due to visual effects. The area proposed for the Landmark Maintenance Facility under Alternative 4 has not been surveyed for cultural resources. Provisions in the PA would require survey of this area if this alternative is selected.

4.17.2.4.2 OPERATIONS

The impacts to cultural resources under this alternative would not change between the construction and operations phases.

4.17.2.4.3 CLOSURE AND RECLAMATION

Closure and reclamation phase cultural resources impacts under Alternative 4 would be to the same as described under Alternative 1, except there would be no impacts associated with reclamation of Burntlog Route.

4.17.2.5 Alternative 5

Alternative 5 is the No Action Alternative, and it would not involve mining at Stibnite. Cultural resources would continue to deteriorate at the current rate, and no structural remains would be preserved or stabilized. Existing roads would be maintained, but improvements and new road construction would not take place. Under Alternative 5, noise, vibration, and visual intrusions would not increase in the analysis area from current conditions.

However, other actions would continue, such as existing and approved exploration activities and reclamation obligations under Midas Gold's Golden Meadows Exploration Project Plan of Operations and Environmental Assessment (Forest Service 2015). These approved activities include the use of the existing road network, construction of several temporary roads (less than 0.5 mile total) to access drill sites, drill pad construction, and drilling on both National Forest System and private lands at and near the mine site. The continuation of existing and approved exploration activities at the mine site would result in the continued use of the existing administrative offices, the housing or man camp area, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip (located primarily on patented land).

Under Alternative 5, traditional cultural uses of the area would continue, including for tribal fishing, hunting, gathering, and spiritual practices. Access to public land in the area would continue as governed by law, regulation, policy, and existing and future landownership constraints.

Under Alternative 5, the existing historic properties located in the analysis area would remain in their current states and would be expected to experience natural deterioration over time. Under the No Action Alternative, there would be no SGP-related permanent ground disturbance or visual, noise, and vibration impacts, as no new facilities would be constructed, no large open pits would be created, no tailings storage or DRSFs would be formed, and blasting, drilling, and ore processing would not occur.

4.17.2.5.1 Mine Site

Because SGP-related activities would not take place, the structural and artifact remains in the mine site would be expected to continue along their current trajectory. Based on various site visits (including the archaeological evaluation of the Stibnite Historic District in 2018), available photo-documentation (from the 1940s, 1970s, 1980s, and 2000s), and the current rate of weather-related deterioration for the remaining structural remains and historic artifacts, it is estimated that all of the structures will be completely collapsed and dispersed within the next 20 years. The Meadow Creek Lookout would continue to be managed by the Boise National Forest as it is today. Likewise, Old Thunder Mountain Road (FR 440) would continue under its current management, as would IPCo Line 328.

4.17.2.5.2 Access Roads

Under Alternative 5, there would be no new or upgraded access roads, and the current access to the mine site on existing roads (Warm Lake, Johnson Creek, and Stibnite roads) would remain. Old Thunder Mountain Road (FR 440) and Meadow Creek Lookout would remain in the same setting and would continue to experience existing levels of traffic, maintenance, and recreational exposure. Midas Gold would continue road maintenance obligations along Stibnite Road under a cooperating agreement with Valley County per the Golden Meadows Exploration Environmental Assessment.

4.17.2.5.3 Utilities

Under Alternative 5, no new utilities, including new and upgraded transmission lines and communications towers, would be constructed. However, some impacts can be expected to the historic IPCo Line 328 as part of regular maintenance by IPCo. The four historic properties (the precontact site, Meadow Creek Lookout, IPCo Line 328, and Landmark Ranger Station) and the Thunderbolt Mountain Lookout located in the utilities and maintenance facilities' footprint under the SGP or in the visual and public access impact area would remain in the same setting and would continue to experience existing levels of deterioration and public use. The precontact site would remain in a relatively remote and inaccessible location without visual intrusions from new transmission lines and/or communications towers, although it would continue to be accessible to the public as a recreational/hunting area. The Landmark Ranger Station is not currently open to the public.

4.17.2.5.4 Off-Site Facilities

Under Alternative 5, the two off-site support facilities would not be constructed. Therefore, there would be no effects to historic properties at these locations under Alternative 5.

4.17.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final Environmental Impact Statement.

4.17.4 Cumulative Effects

The cumulative effects analysis area for cultural resources is the same area as the analysis area for direct and indirect effects. Past, present, and reasonably foreseeable future actions (RFFAs) include activities, developments, or events that have the potential to change the physical, social, economic, and/or biological nature of a specified area. This includes approved activities, such as continued mining and reclamation work on private land. Existing and future activities directly associated with a proposed action and other RFFAs provide the basis for defining and analyzing cumulative impacts. A cumulative effect must overlap in space and time with the direct and indirect effects of the action.

Past actions have impacted cultural resources in the cumulative effects analysis area. Mining activities have impacted archaeological and historic resources, as well as TCPs. Natural activities like wildfires also have impacted cultural resources and continue to do so. Many of the past human activities were conducted prior to statutory and regulatory protection measures for cultural resources resulting in the loss of unknown resources.

Descriptions of past and present actions and RFFAs considered as part of the cumulative effects analysis for all resources are discussed in Section 4.1.5, Cumulative Effects.

Table 4.17-1 summarizes impacts from these types of activities for cultural resources.

Table 4.17-1 RFFA and Potential Cumulative Effects to Cultural Resources

Cumulative Project Type	Potential Effects to Cultural Resources
Mineral exploration and mining activities	Historic mines in the analysis areas have changed the landscape over time through removal of vegetation and displacement of soils. Currently planned or future mine development would further alter the landscape from its pre-contact and historic state during exploratory drilling, development; and operations upon closure of the mine. During exploratory drilling, development, and operations, the increased ground disturbance may disturb cultural resources.
Closure and Reclamation Projects/Comprehensive Environmental Response, Compensation, and Liability Act Actions	Projects that are currently undergoing reclamation or will in the future would likely cause further damage to any cultural resources in the area. These projects would likely be closed, which involves the removal of some of the infrastructure and reclamation of the land to restore native wildlife and plant habitats that are important to Native American tribes. However, mature forest types wouldn't be available for decades. Several Comprehensive Environmental Response, Compensation, and Liability Act Removal Actions were conducted by the Forest Service, Environmental Protection Agency, and Exxon-Mobil Corporation. These actions also can impact cultural resources by removing potentially hazardous, but also historic, tailings and capping historic dumps.
Transportation projects	Road maintenance, improvement projects, and culvert replacements are likely in the analysis areas. These types of improvements cause ground disturbance that represents a potential impact to cultural resources. Maintenance of existing roadways would likely only be short-term, while new roadways would have a more permanent effect. Also related to transportation projects are gravel quarry or gravel pit development to provide fill material for road construction. This activity would be a potential impact to any cultural resources present in those areas.

Cumulative Project Type	Potential Effects to Cultural Resources
Infrastructure Development	Local communities preform or obtain permits to upgrade infrastructure, such as electrical transmission lines. These development activities can cause ground disturbance that could impact cultural resources, and they often involve physical upgrades to historic transmission lines.
Recreation and tourism	Recreational activities (i.e., camping, hiking, fishing, hunting, trapping, trail riding, firewood harvest, etc.) are likely to continue to affect cultural resources in the future. Increased road and trail networks open new wilderness areas to additional human disturbance, which can increase access to cultural resources in the Area of Potential Effect potentially leading to vandalism or accidental destruction of artifacts of site features.
Wildfire and noxious weed control projects	Wildfires and noxious weeds have affected cultural resources throughout the analysis area either by burning structures or by increasing visibility of pre-contact cultural resources. Additional wildfires are likely to affect cultural resources in the future in the same way. Control of invasive and noxious plant species is likely to have a minimal effect on cultural resources, as mechanical or hand-pulling would increase ground surface visibility and would cause some ground disturbance.
Development projects	Private residential developments are likely to impact cultural resources in the future. Pre-contact and historic landscapes would be lost, while additional human presence would potentially affect cultural resources through increased access.
Watershed Management	Watershed management can involve repairs and reclamation of roads and recreation site repairs to prevent erosion into watersheds, but many projects involve only monitoring of erosion of roadway sediments into watersheds, and this would not have an impact on cultural resources. Ground disturbance from road repairs or reclamation could impact unidentified cultural resources in those areas; however, the Forest Service Heritage Programs would generally complete archaeological surveys of any Forest Service roads or campsites being repaired or reclaimed so any cultural resources encountered during the surveys could be avoided.

4.17.4.1 All Action Alternatives

The action alternatives, taken together with other concurrent actions and RFFAs, would create an increase in ground disturbance and visual and noise intrusions along with increased public access in some areas and restricted access in other areas within the analysis area. These cumulative actions would increase the impacts to cultural resources within the cumulative effects analysis area. Cultural resources for all RFFAs on federally managed lands would be governed by the NHPA Section 106 process. RFFAs identified in the analysis area could generate incremental changes to cultural resources, exposing additional sites, or causing disturbance to the sites or their setting. Effects to cultural resources also would occur due to physical disturbance or changes to the character or setting of cultural resources. There would be adverse cumulative effects on cultural resources.

4.17.4.2 Alternative 5

Cumulative effects associated with the No Action Alternative could occur with approved activities associated with the Golden Meadows Exploration Project, such as exploratory drilling for mineral resources and construction of support facilities either by Midas Gold or other groups on private land. Impacts to cultural resources would be governed by the NHPA cultural resources process, and, therefore, minimal impacts are anticipated.

4.17.5 Irreversible and Irretrievable Commitments of Public Resources

The Council on Environmental Quality guidelines require an evaluation of "any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented" (40 Code of Federal Regulations Part 1502.16). Resources that would be irreversibly or irretrievably used during implementation of the SGP would include a range of natural, physical, human, and financial resources. Irreversible commitments occur when a resource is permanently affected, consumed, or renewable only over lengthy time spans. An irretrievable commitment occurs when a resource is not consumed or destroyed, but rather becomes unavailable for use for the foreseeable future. Cultural resources are considered a public resource, and their destruction (partial or complete) is a permanent and irreversible effect. They are non-renewable resources. Uses of cultural resources include recreational destinations, public displays, research by universities and cultural resource professionals, and tribal use of TCPs or CLs. If historic properties are disturbed, damaged, or destroyed by ground disturbance or restricted access due to implementation of the proposed action or any alternatives, these uses becomes permanently unavailable. If traditional use areas become unavailable for use for the foreseeable future by tribes in the SGP area, this would constitute an irretrievable commitment of resources (see Section 4.24, Tribal Rights and Interests for more information on irretrievable commitments of public resources).

4.17.5.1 All Action Alternatives

4.17.5.1.1 IRREVERSIBLE

Historic properties that could be impacted by the action alternatives constitute an irreversible commitment, regardless of mitigation. Once gone, only the data collected remains; the resources cannot be used for any additional purposes.

4.17.5.1.2 IRRETRIEVABLE

Under the action alternatives, the restriction of public access in the operations area would remove the land from other uses while the mine is in operation, but the use would eventually be reversed through removal of the exclusion area and reclamation. Lack of access to TCPs and CLs by tribes would be an irretrievable commitment of resources, because a generation of tribal members is likely to lose traditional knowledge of these places; this is an impact to tribal rights and interests (see Section 4.24, Tribal Rights and Interests).

Implementation of any action alternatives could result in an irretrievable commitment of historic properties if avoidance and mitigation measures of the SGP are not implemented. If the Stibnite

Historic District remains a historic property[1], the SGP would result in an irretrievable and irreversible commitment of cultural resources.

4.17.5.2 Alternative 5

Under Alternative 5, the No Action Alternative, the SGP would not be undertaken. Consequently, there would be no irreversible and irretrievable commitment of cultural resources beyond that currently occurring.

4.17.6 Short-term Uses versus Long-term Productivity

This section evaluates the extent to which the alternatives would balance short-term uses of cultural resources with long-term productivity. The goal of this section is to provide a sense of the resilience or sustainability of cultural resources to short-term disturbances associated with the SGP. The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity is applicable only to action alternatives. Short-term refers to uses with duration of a few years or less.

The resilience of cultural resources is very low in comparison to other social or biological resources, because actions associated with the SGP (i.e., ground disturbance and road improvements that could increase access to the analysis area) that may affect cultural resources would be permanent. Once a cultural resource is disturbed or possibly damaged or destroyed through ground disturbance or through increased public use of the area, which can lead to ground disturbance, it cannot be replaced. The duration of the use is not important, because the damage to a cultural resource, such as a precontact archaeological site, can occur immediately. Additionally, restricted access in the operations area boundary during the operations phase would adversely affect long-term productivity, because, over the life of the mine, a generation of tribal members would experience loss of traditional knowledge and use of culturally significant resources and places. Short-term uses and uses such as temporary staging areas for reclamation material or access roads that would later be returned to their pre-construction state have the potential to permanently impact cultural resources. There is the potential for the loss of long-term productivity to any cultural resources subjected to short-term use.

4.17.6.1 Action Alternatives

Under the action alternatives, all short-term direct impacts to cultural resources would lead to a loss of long-term productivity. Some short-term protection measures could lead to long-term productivity (use of a cultural resource for data, interpretive, or cultural purposes) of resources.

[1] The Stibnite Historic District lacks the components that made it eligible for listing in the NRHP; however, it is still listed and must be considered a historic property.

If TCPs or CLs are identified, short-term use may be denied while protecting long-term productivity.

4.17.6.2 Alternative 5

Under Alternative 5, the SGP would not be undertaken. Consequently, there would be no short-term use that would affect cultural resources and no effect on long-term productivity.

4.17.7 Summary

Table 4.17-2 provides a summary comparison of cultural resources impacts by issues and indicators for each alternative. The table discusses six known historic properties within the analysis area for cultural resources. As discussed in Section 4.17.2, Direct and Indirect Effects, these six properties are all the known historic properties within the footprint of Alternative 1. All SGP components of Alternative 1 have been surveyed for archaeological resources. Therefore, the number and locations of historic properties affected, except TCPs and CLs, are known for Alternative 1.

All action alternatives have an undisclosed number of potential TCPs and CLs. The Forest Service is in ongoing consultation with the Nez Perce Tribe and the Shoshone-Paiute Tribes to determine what protected information can be made public. The Shoshone-Bannock Tribes' ethnographic report is in progress.

Two historic properties are at the mine site (Stibnite Historic District and the precontact site). These historic properties would be adversely impacted under all action alternatives due to construction impacts. Alternative 3 differs from the other action alternatives at the mine site, because it would not disturb legacy tailings at Meadow Creek, and it would locate the Hangar Flats DRSF and the TSF in the EFSFSR. This is not a substantial difference in the amount of ground disturbance but would impact different portions of the Stibnite Historic District. However, the net impact of disturbances to the Stibnite Historic District remains adverse for all action alternatives.

Two historic properties (Old Thunder Mountain Road [FR 440] and IPCo Line 328) are linear sites that pass through and beyond the mine site. Impacts to these resources are common to all action alternatives. Although the alternatives vary in the length of miles or number of crossings of these linear resources, effects are not anticipated to be adverse. For example, the Burntlog Route access road proposed under Alternatives 1 and 3 would overlap 3 miles of the 25-mile long Old Thunder Mountain Road (FR 440), which was originally a Native American travel route before becoming a historic road (Battaglia 2018; Walker 2019). Alternatives 2 and 4 would impact less of Old Thunder Mountain Road by using the Burntlog Route Riordan Creek Segment or Yellow Pine Route, respectively. Regardless, Old Thunder Mountain Road is currently part of FR 440 (an all-terrain vehicle road) and would not be realigned by the SGP. Therefore, no adverse effect would occur. All action alternatives also would impact segments of the IPCo Line 328, and additional characterization of the historic transmission line would be undertaken. However, because the transmission line is currently in operation, routine maintenance is performed on the line, and IPCo intends to keep materials and workmanship similar to the historic line, no adverse effect to the IPCo Line 328 is anticipated under any of the action alternatives.

The remaining two of the six historic properties are Forest Service administrative buildings (Landmark Ranger Station and Meadow Creek Lookout) located along mine access routes under one or more of the action alternatives. The SGP would impact these buildings through direct alterations to the buildings and/or through alterations to their integrity. Landmark Ranger Station would have adverse impacts under Alternatives 1, 3, and 4 because of changes in setting caused by construction of the Landmark Maintenance Facility within its viewshed. At the Meadow Creek Lookout, a new transmission line, new potential communications tower, and other components added to the building would cause an adverse effect under all action alternatives. In addition, the Thunderbolt Mountain Lookout, a potential historic property that has not been formally inventoried, would be subject to similar impacts if selected as a location for a communications tower under all action alternatives.

The introduction of visual elements would alter the integrity of setting, feeling, and/or association of certain historic properties. The effects are exacerbated by the locations of some historic properties on high points in the landscape with full 360-degree views of the surrounding landscape. In contrast, the magnitude of direct visual impacts to the Stibnite Historic District would be low, partly because there are very few standing aboveground historic resources and because the stockpiles, open pits, DRSFs, and the TSF that would fill drainages would be in keeping with the Historic District's historical association with mining. The exception would be the cellular tower, which would be 60 feet tall and visible from the entire analysis area at the mine site. Because most aboveground historic resources in the Stibnite Historic District no longer exist, there would be no adverse visual impacts to these resources under any action alternative. Under Alternatives 1 and 3, the Meadow Creek Lookout, Landmark Ranger Station, and the precontact site would be subject to altered viewsheds. There would be no impact to Landmark Ranger Station under Alternative 2, and Alternative 4 would have less visual impact than Alternatives 1 and 3 on this same resource and on the precontact site. Under all action alternatives, effects from increased visual intrusions also are of concern for TCPs or CLs that could be present in the APE.

The potential impact for noise is the same for all action alternatives. The SGP could introduce noise and vibrations that could affect standing historic structures through blasting, drilling, and ore crushing. The number and locations of standing or fragile partially standing structures that could be impacted by an increase in vibrations is the same for all action alternatives and includes four ore sorting structures at Yellow Pine pit. These are within the Stibnite Historic District but are not individual historic properties. Noise levels higher than ambient also could affect use of TCPs or CLs by creating a distraction and altering the sense of solitude and feeling of the natural environment.

Ground disturbance totals vary between the action alternatives. Alternative 4 has the least amount of acreage subject to ground disturbance (3,219 acres), with nearly 400 fewer acres than Alternative 3, which has the most ground disturbance (3,610 acres). In general, reduced ground disturbance lowers the potential for impacts and for inadvertent cultural resources discoveries during construction.

In summary, direct impacts to cultural resources caused by ground disturbance, new visual elements, and/or noise and vibration disturbances do not vary substantially among the action alternatives. Direct impacts would affect between five (Alternative 2) and six (Alternatives 1, 3, and 4) historic properties that include the Stibnite Historic District, two Forest Service administrative buildings, a transmission line, a historic road/Native American travel corridor, and a precontact site. Visual impacts could adversely affect between 2 to 3 historic properties that include a lookout, ranger station, and precontact site. Another potential historic property, the Thunderbolt Mountain Lookout, could be visually impacted. Audible and vibration disturbance could affect four standing structures at the Yellow Pine pit, but these are not historic properties. All of these types of impacts, as well as access restrictions caused by the SGP for a period of 20 years, could affect integrity of TCPs and CLs and the ability of tribes to access these resources under all alternatives. See also Section 4.24, Tribal Rights and Interests, for further consideration of impacts to tribal resources of concern and tribal access.

Under Alternative 5 (No Action), there would be far fewer ground disturbing activities within the analysis area than under the other alternatives. Alternative 5 is the only alternative with no adverse effects to historic properties.

The indirect effect from possible future increased access to the analysis area following the closure and reclamation phase is the same under all action alternatives. After the access restrictions are removed, traffic may increase over current use, and this could possibly create an indirect effect to cultural resources by making them more visible and more vulnerable to damage or vandalism.

Areas that have not been surveyed are those under Alternatives 2, 3, and 4 that are outside the footprint of Alternative 1, primarily the EFSFSR area at the southeast end of the mine site where the TSF and DRSF would be located under Alternative 3, the groomed OSV route on the west side of Johnson Creek Road proposed under Alternative 4, portions of the Yellow Pine Route, and the Landmark Maintenance Facility under Alternative 4 south of Warm Lake. Any areas within the APE that have not been surveyed would be inventoried prior to SGP-related ground disturbing activities that may impact historic properties in accordance with stipulations in the PA. The PA also will include provisions for identifying TCPs and CLs prior to ground disturbance associated with the SGP. Additionally, it will identify mitigation measures for historic properties and how the Forest Service will ensure that they are carried out.

Table 4.17-2 Comparison of Cultural Resources Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may affect historic properties through ground disturbance.	Acres and locations of ground disturbance	Not applicable	3,533 acres Ground disturbance at the mine would impact Stibnite Historic District and the precontact site. Access road disturbance overlaps 3 miles of the 25-mile Old Thunder Mountain Road. Transmission line disturbance overlaps the IPCo Line 328. See **Table 2.3-1**, *Land Management and Acreage by Component, Alternative 1*	3,423 acres Same as Alternative 1 except: • Reduces ground disturbance (eliminate West End DRSF) • Impacts less of Old Thunder Mountain Road (re-routes approximately 5.3 miles of the Burntlog Route) • Routes 0.9 mile of IPCo Line 328 to a former railroad grade. (The grade is not a historic property.) See **Table 2.4-2**, *Land Management and Acreage by Component for Alternative 2*	3,610 acres Same as Alternative 1 except: • Does not disturb legacy tailings at Meadow Creek • Locates the Hangar Flats DRSF and the TSF in the EFSFSR. This is not a substantial difference in the amount of ground disturbance but would impact different portions of the Stibnite Historic District. See **Table 2.5-2**, *Land Management and Acreage by Component for Alternative 3*	3,219 acres Same as Alternative 1 except: • Makes groomed OSV route on west side of Johnson Creek Road permanent, not temporary as with other action alternatives. This could affect unknown cultural resources (not surveyed). • Reduces ground disturbance via helicopter installation of communications towers instead of roads. See **Table 2.6-2**, *Land Management and Acreage by Component for Alternative 4*	Approved activities would continue.
	Number of cultural resources	Six historic properties are present within the APE: • Stibnite Historic District • Old Thunder Mountain Road (FR 440) • IPCo Line 328 • Landmark Ranger Station • Meadow Creek Lookout • Precontact site One potential historic property also is present: • Thunderbolt Mountain Lookout Numbers and locations of potential TCPs and CLs have not been publicly disclosed	Alternative 1 would directly impact: Six historic properties: • Stibnite Historic District • Old Thunder Mountain Road (FR 440) • IPCo Line 328 • Landmark Ranger Station • Meadow Creek Lookout • Precontact site One potential historic property: • Thunderbolt Mountain Lookout Unknown number of TCPs and CLs	Same as Alternative 1 except: Avoids Landmark Ranger Station	Same as Alternative 1 except: There is an unknown number of historic properties at TSF and DRSF at EFSFSR (not surveyed).	Same as Alternative 1 except: There is an unknown number of cultural resources at Landmark Maintenance Facility and along portions of Yellow Pine Route (not surveyed).	Existing historic properties located in the analysis area would remain in their current states and would be expected to experience natural deterioration over time.
	Significance of cultural resources that could be displaced, damaged, or destroyed.	Only historic properties or significant cultural resources are considered in the analysis.	Same as baseline.	Same as baseline.	Same as baseline.	Same as baseline.	Not applicable.
The SGP may affect aboveground resources, TCPs, and CLs by introducing visual elements.	Locations of tall or massive SGP components where screening landscape features are lacking.	The existing Yellow Pine pit is massive.	Three open pits during operations, four DRSFs, a TSF, and several other mining facilities would be present at the mine site and off-site facilities.	Same as Alternative 1, except there would only be three DRSFs.	Same as Alternative 1, except the Hangar Flats DRSF and the TSF would be in the EFSFSR drainage instead of Meadow Creek valley.	Same as Alternative 1.	No new visual intrusions.
	Number and types of cultural resources including TCPs and CLs that would have viewshed altered.	Most of the aboveground resources in the Stibnite Historic District no longer exist. Meadow Creek Lookout, Landmark Ranger Station, and Thunderbolt Mountain Lookout are standing. The integrity of the precontact	Most of the aboveground historic sites in the Stibnite Historic District no longer exist. Visual impacts would occur to:	Same as Alternative 1 except: Landmark Ranger Station would not be impacted.	Same as Alternative 1 except: There would be less of a visual impact to the precontact site due to location of SGP components in EFSFSR drainage.	Same as Alternative 1 except: There would be less of a visual impact, but still an adverse visual impact, to Landmark Ranger Station due to slightly increased distance from Landmark Maintenance Facility.	No new impacts to the viewshed of cultural resources.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
		site is sensitive to visual intrusions. Numbers and locations of potential TCPs and CLs have not been publicly disclosed.	• Meadow Creek Lookout • Landmark Ranger Station • Precontact site • Thunderbolt Mountain Lookout potential historic property • Unknown number of TCPs and CLs				
The SGP may affect aboveground resources, TCPs, and CLs through noise and vibration disturbance.	Noise levels and locations of activities that would produce high noise levels and ground vibrations.	Current noise levels are intermittently louder than ambient due to approved activities.	Vibrations would be caused by blasting, drilling, and ore crushing. Haul trucks would cause high noise levels, but these would be much shorter term and more intermittent.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as baseline.
	Number and location of standing or fragile partially standing structures, TCPs, and CLs that could be impacted by increase in noise and vibrations.	There are only a few partially standing structures located within the Stibnite Historic District, and none of them are historic properties. Numbers and locations of potential TCPs and CLs have not been publicly disclosed.	Yellow Pine pit ore sorting structures (total of four) located in the pit would be impacted. These are not historic properties. An unknown number of TCPs and CLs could be impacted.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No increase in vibrations and no new blasting noise or vibrations.
The SGP may cause increased visibility of cultural resources through increased public access via new roadways and improvements to existing roads.	Number and location of public access roads improved or constructed.	There are existing roads that currently access the mine site.	Yellow Pine Route, Burntlog Route, OHV Trail from Horse Heaven to Powerline access road, Cabin Creek OSV route, and Johnson Creek OSV route from Trout Creek to Warm Lake Road. The OHV Trail would increase access to the Meadow Creek Lookout.	Same as Alternative 1, except: There would be a reroute of an approximately 5.3-mile segment of the Burntlog Route near Riordan Creek.	Same as Alternative 1 except: The OHV Trail would not be constructed, and, thus, there would be no chance of increased public access to Meadow Creek Lookout.	Same as Alternative 1 except: The Burntlog Route would not be implemented, and the Yellow Pine Route would be used for public access.	No increased public access – no roads would be upgraded or constructed.
	Number of cultural resources including TCPs and CLs that may be affected.	There are two historic properties (Old Thunder Mountain Road and Meadow Creek Lookout) along proposed new roadways and improvements to existing roads. Numbers and locations of potential TCPs and CLs have not been publicly disclosed.	Increased public access would occur in proximity to two historic properties (Old Thunder Mountain Road and Meadow Creek Lookout) along proposed new roadways and improvements to existing roads, as well as to an unknown number of potential TCPs and CLs.	Same as Alternative 1 except: There would be less of an impact to Old Thunder Mountain Road due to fewer road crossings.	Same as Alternative 1 except: The OHV Trail would not be constructed, and, therefore, there would be no increased public access to the Meadow Creek Lookout.	Same as Alternative 1 except: There would be increased public access beyond baseline conditions along Yellow Pine Route, which has not been surveyed in its entirety.	No increased public access – no roads would be upgraded or constructed, and no cultural resources would be impacted.

4.18 Public Health and Safety

4.18.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to public health and safety from the Stibnite Gold Project (SGP) includes the following issues and indicators:

Issue: The SGP may affect public safety on the roads used by mine vehicles during construction, operation, and closure activities.

Indicators:

- Number of SGP-related vehicles trips on public roads.

Issue: The SGP may affect human health or exposure to hazards.

Indicators:

- Change in public health statistics.
- Changes in health metrics such as soil, air, and water quality.
- Quantity of hazardous materials transported on access roads.
- Risk of natural hazards (wildfire, avalanche, landslide).

Issue: The SGP may affect infrastructure and services as related to emergency services, medical services, utilities, sanitation, and wastewater treatment.

Indicators:

- Capacity of existing infrastructure and services to meet anticipated increased use.

Issue: The SGP may cause public health effects related to changing environmental conditions.

Indicators:

- Changes in soil, air, and water quality.
- Disruption at recreational areas during construction, operation, and closure and reclamation.
- Psychological effects due to noise.

Public health and safety was analyzed using baseline health statistics obtained from federal, state, and local government agencies, scientific literature reviews, and information and analysis documented in reports prepared for the SGP. The evaluation of public health and safety effects relies heavily on the analyses conducted for other resources as they relate to public health impacts.

In assessing the potential for health impacts due to the SGP, the types of health impacts (e.g., chronic disease, injury, well-being, etc.) selected and described in the affected environment discussion in Section 3.18, Public Health and Safety Affected Environment, are evaluated and the magnitude of the health impact is assessed. In assessing the magnitude of the impact (high, medium, low, or none), several factors are evaluated: the actual consequence (e.g., minor injury/illness or severe injury or death), the duration of the exposure, and the number of people potentially affected. In addition to categorizing the magnitude of the impacts, effects are categorized as positive or negative, with information on potential mitigation provided (see **Table 4.18-1**).

Table 4.18-1 Definitions of Magnitudes of Health Impacts

Magnitude of Health Impact	Positive Effect	Negative Effect	Mitigation
None	No discernible or measurable impacts	No discernible or measurable impacts	None
Low	Low level quality-of-life impacts, low/short exposures, limited area/people affected	Low level quality of life impacts, low/short exposures, limited area/people affected	Mitigation measures possible
Medium	Significant quality-of-life enhancement, or reduced exacerbation of existing illness, or reduced disease incidence; Moderate, intermittent, exposures, relatively localized	Exacerbations of existing illness, reduction in quality of life (e.g., increase in "nuisance" factors such as noise/odors); Moderate, intermittent, exposures, relatively localized	Mitigation measures possible, but minor residual negative effects may remain
High	Prevent deaths/prolong life	Increase deaths, increase chronic or acute diseases, increase mental illness; High/long duration exposures, over a wide area	Mitigation measures possible, but residual negative effects may remain

Table Source: International Council on Mining and Metals (ICMM) 2010

As described in the ICMM 2010, when analyzing the overall public health impact, the magnitude of the consequence is combined with the possibility that the consequence will occur. There is no universally agreed upon formula for assessing overall public health impact (ICMM 2010). Characterization of public health effects relies on qualitative and quantitative evidence (National Resource Council of the National Academies [NRC] 2011) and the assessments of the magnitude of the impact or possibility of occurrence are often based on a subjective judgement (ICMM 2010). Both NRC and ICMM recommend the use of a matrix to organize the results of the public health analysis and to convey results of the overall public health impacts in a manner that is easy to understand. Overall impact rating on public health is assigned using the following matrix, which was adapted from the ICMM and NRC. The matrix is supplemented in the following sections with an explanation of the evidence used to develop the ratings in each public health category. The characterization of the magnitude of action is determined by using the descriptions of public health impact ratings provided in **Table 4.18-2**. The number of persons affected, and the spatial impact is considered when determining the magnitude of action.

Table 4.18-2 Public Health Impact Rating Matrix

Magnitude of Health Impact	Low Possibility of Health Impact Occurrence (unlikely to occur)	Medium Possibility of Health Impact Occurrence (likely to occur sometimes)	High Possibility of Health Impact Occurrence (likely to occur often)
None	negligible	negligible	negligible
Low	negligible	minor	moderate
Medium	minor	moderate	major
High	moderate	major	major

Table Source: ICMM 2010; NRC 2011

4.18.2 Direct and Indirect Effects

The following analysis of effects associated with public health and safety is focused on the potentially affected local population of Valley County, particularly the residents of the village of Yellow Pine, the nearest residential community to the mine site area, as well as recreational visitors who frequent the area. The scope of this analysis is limited to affected communities outside of the mine site and associated facilities. Accordingly, this analysis does not include a direct evaluation of the anticipated workforce safety and health issues that could occur at the mine site, because the action alternatives would be governed by the Occupational Safety and Health Administration and Mine Safety and Health Administration regulations in the areas where mining and mining-related activities would occur.

This analysis evaluates the magnitude of the potential health issues (both positive and negative) on the local community and the cumulative impacts. Each action alternative section below includes a table that summarizes the assessed impacts described and presents the overall public health impact rating of each impact. Elements of this context include potential public health impacts regarding environmental quality, economy, public services/infrastructure, and demographics.

4.18.2.1 Alternative 1

Alternative 1 has the potential to result in direct and indirect effects to public health and safety through alterations in environmental conditions; economic conditions; local public services and infrastructure; and land use and demographics.

This analysis evaluates the public health impacts related to environmental conditions, economy, public services/infrastructure, and demographics, and evaluates the magnitude of the potential health issues (both positive and negative) on the local community. **Table 4.18-3** summarizes the assessed impacts described in the following sections and presents the overall public health impact rating of each impact.

Table 4.18-3 Summary of Public Health Impacts for Alternative 1

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Environment	Air	Localized impacts to air quality from fugitive dust and particulate emissions during mining operations; diesel emissions from vehicle traffic and machinery	-Inhalation of pollutant emissions	-Chronic Disease -Well-Being/ Psychosocial	Negative	Direct – Pollutant Inhalation	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Negligible Operation Phase: Negligible Closure and Reclamation Phase: Negligible
Environment	Soil	Deposition impacts to soil from proposed mining operations	-Direct contact with hazardous pollutants	-Chronic Disease-Well-Being/ Psychosocial	Negative	Direct - Contact	Construction Phase: Medium Operation Phase: Medium Closure and Reclamation Phase: Low	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Minor Operation Phase: Minor Closure and Reclamation Phase: Negligible

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Environment	Groundwater	Leaching of contaminants to groundwater from proposed mining operations	-Degraded environmental quality	Well-Being/ Psychosocial	Negative	Indirect	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Negligible Operation Phase: Negligible Closure and Reclamation Phase: Negligible
Environment	Soil	Reclamation of legacy mining materials	-Minimizes direct contact with hazardous pollutants -Improved environmental quality	-Chronic Disease -Well-Being/ Psychosocial	Positive	Direct - Contact	Closure and Reclamation Phase: Medium	Closure and Reclamation Phase: High	Closure and Reclamation Phase: Moderate
Environment	Soil	Uptake of contaminants from soil into subsistence foods (berries and plants)	-Ingestion of contaminants from edible plants and berries	-Chronic Disease -Nutrition -Well-Being/ Psychosocial	Negative	Indirect - Bioaccumu lation	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Negligible Operation Phase: Negligible Closure and Reclamation Phase: Negligible

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Environment	Surface Water/ Sediment	Direct contact with hazardous pollutants released to surface water	- Direct contact with hazardous pollutants - Ingestion of hazardous pollutants in fish harvested from local waterbodies	-Chronic Disease -Nutrition -Well-Being/ Psychosocial	Negative	Direct	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Negligible Operation Phase: Negligible Closure and Reclamation Phase: Negligible
Environment	Surface Water/ Sediment	Reclamation of surface conditions, re-vegetation to reduce run-off of hazardous pollutants to streams and rivers	-Minimization of direct contact with hazardous pollutants -Reduction of hazardous pollutants in fish harvested from local waterbodies - Improved environmental quality	-Chronic Disease -Nutrition -Well-Being/ Psychosocial	Positive	Direct and Indirect	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Negligible Operation Phase: Negligible Closure and Reclamation Phase: Negligible

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Environment	Existing Terrain and Features	Disturbance of existing terrain and features	-Injury due to natural hazards - avalanche, land slide, flash flooding and water hazards, wildfires	-Injury -Well-Being/ Psychosocial	Negative	Direct - Injury	Construction Phase: High Operation Phase: High Closure and Reclamation Phase: High	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Moderate Operation Phase: Moderate Closure and Reclamation Phase: Moderate
Economy	Personal (income, employment)	Increase in local employment	-Increased income -Increased food security/ improved nutrition -Increased access to health care through employee benefits, including insurance	-Chronic Disease -Well-Being/ Psychosocial	Positive	Indirect	Construction Phase: Medium Operation Phase: Medium Closure and Reclamation Phase: Medium	Construction Phase: High Operation Phase: High Closure and Reclamation Phase: Medium	Construction Phase: Major Operation Phase: Major Closure and Reclamation Phase: Moderate

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Economy	Personal (income, employment)	Decrease in local employment	-"boom and bust" impact -reduced demand for private and public goods and services -reduction in demand for labor	-Chronic Disease -Well-Being/ Psychosocial	Negative	Indirect	Closure and Reclamation Phase: Medium	Closure and Reclamation Phase: Medium	Closure and Reclamation Phase: Moderate
Public Services and Infrastructure	Need for new infrastructure	Worker Housing Facility	-Increased access to health care and emergency service support -Increased emergency services in remote area	-Chronic Disease -Infectious Disease -Injury -Well-Being/ Psychosocial	Positive	Indirect	Construction Phase: Medium Operation Phase: Medium Closure and Reclamation Phase: Medium	Construction Phase: Medium Operation Phase: Medium Closure and Reclamation Phase: Medium	Construction Phase: Moderate Operation Phase: Moderate Closure and Reclamation Phase: Moderate
Public Services and Infrastructure	Need for new infrastructure	Worker Housing Facility	-Potential transmission of infectious disease	-Infectious Disease	Negative	Indirect	Construction Phase: medium Operation Phase: Medium Closure and Reclamation	Construction Phase: low Operation Phase: low Closure and Reclamation Phase: low	Construction Phase: Minor Operation Phase: Minor Closure and Reclamation Phase: Minor

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
							Phase: medium		
Public Services and Infrastructure	Roads	Construction of improved mine access road	-Improved access to remote area for emergency responders	-Injury -Well-Being/ Psychosocial	Positive	Indirect	Operation Phase: Medium Closure and Reclamation Phase: Medium	Operation Phase: High Closure and Reclamation Phase: High	Operation Phase: Moderate Closure and Reclamation Phase: Moderate
Public Services and Infrastructure	Roads	Construction of improved mine access road, Increased trucking traffic on mine access routes	-Increased potential for hazardous waste spill -Increased potential for traffic accidents	-Injury -Well-Being/ Psychosocial	Negative	Direct	Construction Phase: High Operation Phase: High Closure and Reclamation Phase: High	Construction Phase: Medium Operation Phase: Medium Closure and Reclamation Phase: Medium	Construction Phase: Major Operation Phase: Major Closure and Reclamation Phase: Major

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Public Services and Infrastructure	Transmission Lines	Increased power demand to support mining operations	-Increased exposure to electro-magnetic field (EMF) along transmission lines	-Chronic Disease -Injury -Well-Being/ Psychosocial	Negative	Direct	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Negligible Operation Phase: Negligible Closure and Reclamation Phase: Negligible
Demographics	Land use	Disturbance of current recreational land use	-Alteration or elimination of recreational sites	-Well-Being/ Psychosocial	Negative	Indirect	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Negligible Operation Phase: Negligible Closure and Reclamation Phase: Negligible

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Demographics	Land use	Noise disturbances during mine blasting and vehicle noise along access routes	-Psychological effects due to noise	-Well-Being/ Psychosocial	Negative	Indirect	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Low Operation Phase: Low Closure and Reclamation Phase: Low	Construction Phase: Negligible Operation Phase: Negligible Closure and Reclamation Phase: Negligible

4.18.2.1.1 ENVIRONMENT AND PUBLIC HEALTH

As indicated in Section 3.18, Public Health and Safety, possible public health impacts associated with the following environmental resources were noted: air, soil, groundwater, and surface water quality. In addition, possible public health impacts due to disturbance of existing terrain and features were noted.

4.18.2.1.1.1 Air Quality

Health impacts associated with air emissions can result from inhalation of criteria air pollutants, such as particulate matter with a diameter of 2.5 microns or less ($PM_{2.5}$) and nitrogen oxides (NO_X), as well as inhalation of hazardous air pollutants (e.g., metals, polycyclic aromatic hydrocarbons). This section discusses the possible public health impacts associated with predicted air quality impacts.

Section 4.3.2.1, Direct and Indirect Effects, details the potential impacts to air quality associated with Alternative 1 and assumes that the SGP would be designed, constructed, and operated in compliance with appropriate air pollution controls to comply with applicable regulations and any air quality permits issued by the Idaho Department of Environmental Quality. Dust control, dust suppression, and/or dust abatement measures would be implemented. Air emissions were estimated for each activity and process source included in Alternative 1 for all phases of the SGP. The highest combined pollutant annual emissions (including fugitive dust) were predicted to occur for Alternative 1 in mine year 7 (after up to 3 years of construction and pre-production activities and during the 4th year of mining). The predicted emissions of particulate matter (PM) (PM with a diameter of 10 microns or less [PM_{10}], and $PM_{2.5}$) modeled for mine year 7 represent the largest contributor to overall emissions. As discussed in Section 4.3.2.1, the locations of the predicted concentration maximums during mine year 7are located along the SGP Operations Area Boundary, or within one mile of the boundary.

Criteria air pollutants, including carbon monoxide (CO), NO_X, $PM_{2.5}$, PM_{10}, and sulfur dioxide (SO_2), would be directly emitted from mine site activities. Air quality impacts would decrease with increasing distance from the mine site. Ozone, an additional criteria pollutant, is not emitted directly, but forms from the precursors of volatile organic compounds and NOx that would be emitted. Predicted ambient air concentrations at the Operations Area Boundary, where the public is not restricted, were shown to be below the National Ambient Air Quality Standards (NAAQS). The NAAQS (described in Section 3.18, Public Health and Safety, and Section 3.3, Air Quality) are allowable air concentration limits adopted by the State of Idaho into the Rules for the Control of Air Pollution in Idaho and are considered protective of public health. hazardous air pollutants emissions are not predicted to exceed air quality regulatory levels requiring additional analysis. Screening modeling of mercury deposition indicated that the maximum additional deposition from the SGP would be less than 1 percent above background for the west side of the SGP and below the modeled limits for all other subbasins modeled.

The existing background 24-hour $PM_{2.5}$ concentration is approximately 18.9 micrograms per cubic meter ($\mu g/m^3$), based on air quality levels collected at the Midas Gold Idaho, Inc. (Midas Gold) Stibnite monitoring station. The predicted primary and secondary source emissions associated with construction and operations of Alternative 1 at mine year 7would result in predicted 24-hour $PM_{2.5}$ concentrations of 3.1 μg/m^3 (primary) and 0.15 μg/m^3 (secondary) and would increase the total 24-hour $PM_{2.5}$ concentrations to 22.2 μg/m^3. Though the maximum impacts associated with Alternative 1 could potentially increase the current 24-hour $PM_{2.5}$ concentrations by 16 percent, the maximum cumulative impact on 24-hour $PM_{2.5}$ concentrations of 22.2 μg/m^3 would not exceed the NAAQS criteria for 24-hour $PM_{2.5}$ of 35 μg/m^3. Likewise, the predicted primary and secondary source emissions impacts of Alternative 1 on the annual average $PM_{2.5}$ concentrations also would meet the NAAQS criteria for annual $PM_{2.5}$ of 12 μg/m^3. Specifically, the existing background annual average $PM_{2.5}$ concentration is 3.4 μg/m^3, based on current air quality levels measured from the Midas Gold Stibnite monitoring station. Predicted emissions would result in predicted annual average $PM_{2.5}$ concentrations of 1.2 μg/m^3 (primary) and 0.01 μg/m^3 (secondary), which would increase the total annual average $PM_{2.5}$ concentrations to 4.6 μg/m^3, which is only 38 percent of the NAAQS criteria of 12 μg/m^3. Because criteria pollutant concentrations would meet NAAQS criteria, air emissions resulting from operation of Alternative 1 are expected to have little to no effect on the health of the general population.

The SGP is not required to show compliance with the Prevention of Significant Deterioration increments because it is considered a minor source for New Source Review, due to its proximity to the Frank Church River of No Return Wilderness area and Nez Perce Tribal Land. Section 4.3.2.1, Direct and Indirect Effects for Air Quality, compared predicted ambient air concentrations to the Class II Prevention of Significant Deterioration increments. The results of the Class II near field air quality analysis show that predicted ambient concentrations of the criteria pollutants are below the Class II increments.

Sensitive Subpopulations

The NAAQS are set at a level expected to protect public health with an adequate margin of safety, taking into consideration effects on susceptible populations (U.S. Environmental Protection Agency [EPA] 2012). A broad range of health effects have been associated with ambient particulate matter. While air emissions from operation of Alternative 1 are expected to have little to no effect on the health of the general population, because criteria pollutant concentrations would meet NAAQS criteria, it is still not clear whether there is a threshold concentration below which adverse health effects are not seen, even for sensitive populations. The detection of a threshold level for the effects of particulate matter on mortality has proven to be very difficult.

The current evidence shows limited support for use of a “no-threshold” model (EPA 2009, 2012). Because individual thresholds vary from person to person due to individual differences in susceptibility and pre-existing disease conditions (e.g., asthma or reactive airway disease), it is extremely difficult to mathematically demonstrate that a clear threshold exists in population studies. This is especially true if the most sensitive members of a population (generally children and the elderly) have pre-existing conditions (e.g., asthma) that make them unusually sensitive even down to very low concentrations. Because of these issues with determining a threshold, there may be some health effects associated with $PM_{2.5}$ for sensitive susceptible individuals even if ambient $PM_{2.5}$ levels meet the air quality criteria (EPA 2009, 2012). Levy et al. (2002) estimated that a 1 $\mu g/m^3$ increase in daily $PM_{2.5}$ concentration could result in a 1 percent increase in asthma- related emergency room visits.

Uncertainty remains regarding associations between long-term exposure and adverse health effects, and between short-term exposures and adverse health effects. In addition, as presented in Section 4.3.2.1, Direct and Indirect Effects, maximum $PM_{2.5}$ impacts at the Operations Area Boundary are largely influenced by ambient background $PM_{2.5}$ concentrations and total impacts are well below the ambient air quality criteria. While small increases in ambient $PM_{2.5}$ concentrations over existing background concentrations could potentially exacerbate existing health conditions of sensitive subpopulations, Valley County ranks fourth best in the state for overall health factors, based on weighted scores for health behaviors, clinical care, social and economic factors, and the physical environment. In addition, Valley County has better health outcomes than the state overall, as well as the U.S. median, in most categories measured. Therefore, the magnitude of the health impact of air quality is rated as “low” on **Table 4.18-3** (because some minor impacts could potentially occur for sensitive subpopulations), and the possibility of the impacts also is rated as “low” on **Table 4.18-3** (because concentrations are predicted to be well below the NAAQS criteria). This results in an overall public health rating of “negligible.” There are no differences in impact findings between the construction, operation, and closure and reclamation phases of the SGP.

4.18.2.1.1.2 Soil Quality

As described in Section 3.7, Hazardous Materials, past mining activities at the mine site have deposited metals, ore, waste rock, and mine tailings throughout the mine site. Previous studies at the mine site have assessed potential soil contamination resulting from legacy mining activity (URS Corporation 2000). Soils were sampled in areas suspected to contain mining or ore processing contamination. The samples showed elevated levels of arsenic, antimony, and mercury relative to background concentrations in areas disturbed by legacy mining. Some known contaminated soil was removed in 2002. Legacy mine tailings are known to contain elevated levels of arsenic and antimony (Midas Gold 2016). As described in Section 4.5.2, Direct and Indirect Effects, significant soil disturbance is expected during construction and operation. Thus, additional soil contaminants may be exposed during the construction and operation phases of the SGP. However, these soil impacts would be limited to the active mining areas, with restricted public access.

As discussed in Section 4.7.2, Direct and Indirect Effects, a release of hazardous materials could range from a minor fuel spill within the boundaries of the mine site or the off-site facilities, where cleanup equipment would be readily available, to a large spill of hazardous materials along access routes, at the mine site, or off-site facilities. A release could potentially lead to exposures to contaminants in soil. The direct and indirect effects of a spill may range from negligible to major depending on the spill incident. As discussed in Section 4.7.2, Direct and Indirect Effects, based on the planned infrastructure specifically designed for the storage and management of hazardous materials, a large release to the environment within the mine site or off-site facilities is not likely to occur. In the event a release was to occur, it would likely be relatively small in volume based on estimated container volumes and would be addressed promptly as per the Spill Prevention, Control, and Countermeasure Plan and Spill Response Plan. The Spill Prevention, Control, and Countermeasure Plan would address site-specific spill prevention measures, fuel haul guidelines, fuel unloading procedures, inspections, secondary containment of all onsite fuel storage tanks, and staff training. The Solid and Hazardous Materials Handling and Emergency Response Plan would address response and cleanup for any spill of hazardous materials, including concentrate, on all transport routes. The plan would include a sampling plan to assure that all spilled material is cleaned up and would include contingency plans for remediation of potential impacts to soil, wetlands/riparian, and water resources.

In the event that large quantities of hazardous materials are spilled into the environment from a storage tank release or transport truck accident, or in the event that a spill is not immediately discovered or addressed, the impact could be more substantial.

For these reasons, the magnitude of the health impact related to soil quality is rated as “medium” on **Table 4.18-3**, because some exposure of legacy contamination and/or a release of hazardous materials (ranging from small to large quantities) is possible. However, the possibility of the impacts on public health is rated as “low” on **Table 4.18-3**, because the public access is restricted in the active mining area, public access would be limited during response actions along access routes, and the probability of a large spill is low. This results in an overall public health rating of “minor.” There are no differences in impact findings between the construction and operation phases of the SGP.

During closure and reclamation, reclamation cover material (RCM) would be used as surface material to support vegetation growth and slope stability. The Reclamation and Closure Plan (RCP) would consider appropriate types and concentrations of material that would be protective of human receptors when identifying suitable RCM. The reclamation process is expected to lead to an overall reduction in chemical impacts to surface soil. As described in Section 4.5.2, Direct and Indirect Effects, reclamation activities would include removal and reprocessing of historical tailings, planting of trees in mining-impacted areas, removal of potentially contaminated soils, and repair of Blowout Creek (i.e., the result of a 1960s dam failure on the East Fork of Meadow Creek, also known as Blowout Creek) to recover wetlands and reduce sedimentation, among other goals. These proposed activities directly relate to soil quality by removing potential sources of metals leaching into the soils, removing sources of erosion and sedimentation (e.g., development rock adjacent to the East Fork South Fork Salmon River [EFSFSR]), reducing erosion of soils and sedimentation, and reducing downstream sediment transport. Thus, potential negative impacts to soil during mining could be off set by positive impacts from reclamation of legacy contamination. Therefore, the evaluation of the potential public health and safety impacts associated with exposure to contaminants in soil during the closure and reclamation phase resulted in a “negligible” negative impacts rating (**Table 4.18-3**).

4.18.2.1.1.3 Reclamation Cover Materials

As stated in the RCP (Tetra Tech 2019), the overall purpose of the RCP is to reclaim areas impacted by historical exploration, mining, and processing activities, as well as to return SGP impacted areas to stabilized and productive conditions for long-term, post-SGP protection of wildlife, fisheries, land, and water resources in a sustainable environment. The RCP will continue to be updated throughout the planning and permitting process.

During closure and reclamation, RCM would be used as surface material to support vegetation growth and slope stability. In addition, the RCP would consider concentrations protective of human receptors when identifying suitable RCM. Reclamation activities are assumed to lead to an overall reduction in chemical impacts to surface soil. Reclamation activities would include removal and reprocessing of historical tailings, planting of trees in mining-impacted areas and removal of potentially contaminated soils (Tetra Tech 2019).

The mine site occurs in a highly mineralized zone, and natural background concentrations of some metals are known to be relatively high in some soils compared to regional natural background metals concentrations. In addition, elevated levels of arsenic, antimony, and mercury have been observed in soils disturbed by legacy mining operations (URS Corporation 2000). Known locations of contamination were cleaned up in the past, but it is possible that additional areas of contamination would be exposed and observed during SGP-related construction and operations. If these existing elevated levels of metals were left exposed following closure and reclamation, impacts to recreationists could be higher than assumed.

Idaho Department of Health and Welfare (IDHW) reviewed available information from the proposed RCP for the SGP to consider whether potential health risks from metals in soils exist for future site users. The IDHW Letter Health Consultation stated that based on information available in the RCP, concentrations of arsenic and antimony in surface soil adjacent to the site may exceed the health-based screening values. The IDHW included recommendations for additional characterization to adequately assess risks to public health and recommended that potential human exposure following closure and reclamation should be considered when identifying RCM to ensure protection of recreational receptors (IDHW 2019).

To mitigate this concern, a proposed risk-based soil screening level (RBSL) has been calculated for metals of primary concern (arsenic, antimony, and mercury) that is protective of recreational exposures. RBSL(s) protective of human receptors, such as the ones calculated in **Table 4.18-4** should be considered in the development of the RCP and the identification of RCM in order to ensure that public health is protected. The proposed RBSLs, or another agreed upon RBSL protective of recreational exposures to surface soils for this SGP area, are recommended to be used to screen the RCM for suitability and protection of public health. The reclamation material samples that would be compared to RBSLs should be analyzed by EPA-approved analytical methods, to ensure consistency with risk evaluation guidance. RBSLs have been calculated using assumptions regarding media intake (in this case, soil ingestion), exposure frequency and exposure duration. RBSLs presented in **Table 4.18-4** were calculated using EPA's default assumptions for a residential scenario (EPA 2014) but adjusting the exposure frequency and duration to be more applicable to a recreational visitor. The exposure duration was assumed to be 16 days per year, which is the Payette National Forest camping stay limit for individual campground sites. The exposure duration assumed for recreational visitors, 26 years, is the default exposure duration recommended by EPA for residents. It was further assumed that two years of the exposure occur as a child (4 to 6 years old) and 24 years as an adult (>6 years of age).

RBSLs were calculated based on EPA's range of acceptable excess lifetime cancer risk (ELCR) level range of 10^{-6} to 10^{-4} for carcinogenic endpoints and a target hazard quotient of 1 for noncarcinogenic endpoints. Arsenic is associated with both carcinogenic and noncarcinogenic endpoints. At any specified target ELCR level, the lower RBSL between carcinogenic endpoints and noncarcinogenic endpoints was selected as the most conservative arsenic RBSL. At the 10^{-4} target ELCR level, noncarcinogenic effects become the driving health endpoint for the RBSL.

The suitability of RCM for arsenic could be categorized as follows: RCM containing concentrations of arsenic at the RBSL based on a target ELCR of 10^{-6} or lower is "optimal," between 10^{-6} and 10^{-5} is "acceptable," between 10^{-5} and 10^{-4}, but below the target hazard quotient of 1 is "poor," and greater than the target hazard quotient of 1 is "unsuitable." No range of RBSLs are presented for non-carcinogens. The RBSLs calculated for antimony and mercury are based on the target hazard quotient of 1. Exceedance of the target hazard quotient of 1 is generally considered unacceptable. The detailed calculations and assumptions used to derive these RBSLs are included in **Appendix M**.

These proposed RBSLs, or another agreed upon RBSL, are intended to be used to determine the suitability of RCM for protection of public health. That is, they are intended to be used to screen samples from various potential reclamation areas to determine whether the material is suitable or not suitable for RCM where human exposure could occur (i.e., materials approaching and exceeding the "Do Not Exceed" RBSL are not suitable for RCM where human exposure could occur). The RBSLs are calculated independently of existing site soil concentrations and final surface cover concentrations of reclaimed areas. Furthermore, they are not intended to represent acceptable exposure point concentrations of final cover material. These proposed RBSLs should be considered as a starting point. In addition, natural background levels of metals in soils also should be considered when identifying suitable RCM. The IDHW (2019) recommendations should be considered and a site-specific study on how RCM is identified, allocated, and used should be conducted, with agency consultation, to ensure protection of public health.

Identification of RCM that is suitable for protection of human health would have a positive impact on public health during the closure and reclamation phase. The magnitude of the positive health impact during the closure and reclamation phase is rated as "medium" and positive on **Table 4.18-3**, and the possibility of the impacts is rated as "high." This results in an overall public health rating of "moderate" positive significance.

Table 4.18-4 Proposed Recreational Risk Based Screening Levels for Reclamation Cover Material

Metals	Optimal RBSL (mg/kg)	Acceptable RBSL (mg/kg)	Do Not Exceed RBSL (mg/kg)
Arsenic	27	268	763
Mercury	240	240	240
Antimony	684	684	684

Table Source: AECOM 2020

Table Notes:

RBSLs were calculated based on EPA's target health goals for non-carcinogens of target hazard quotient of 1 and for carcinogens of a ELCR range of 1×10^{-6}, 1×10^{-5}, and 1×10^{-4}. Arsenic is associated with both carcinogenic and noncarcinogenic endpoints. At any specified target ELCR level, the lower RBSL between carcinogenic endpoints and noncarcinogenic endpoints was selected as the most conservative arsenic RBSL. At the 10^{-4} target ELCR level, noncarcinogenic effects become the driving health endpoint for the RBSL. The RBSLs calculated for antimony and mercury are based on the target hazard quotient of 1 (see **Appendix M** for details).

mg/kg = milligrams per kilograms.

4.18.2.1.1.4 Surface Water Quality

As discussed in Section 4.9.2.1.2, Direct and Indirect Effects, the inventoried waterbodies at the mine site have designated beneficial uses of “cold water communities,” “salmonid spawning,” and “primary contact recreation.” All waterbodies except Sugar Creek have additional designated beneficial uses of “drinking water supply” and presumed beneficial uses of “secondary contact recreation.” Sugar Creek has additional beneficial uses of “agricultural water supply” and “wildlife habitat.” Each of these inventoried waterbodies (except for West End Creek) are listed as impaired for specific uses in accordance with Clean Water Act Section 303(d). The causes for listing of these waters are associated with arsenic, for exceedances of Idaho's human health criterion for consumption of water and organisms. The EFSFSR downstream of Meadow Creek also is listed for antimony for exceedances of Idaho's human health criterion for consumption of water and organisms. Sugar Creek also is listed for mercury, unrelated to human health criteria (the impairment listing is for cold water aquatic life and salmonid spawning, for exceedances of Idaho's aquatic life chronic criterion. Post-closure concentrations of these elements in the EFSRSR with water treatment have not been modeled for Alternative 1 and are not known at this time. The Idaho Department of Environmental Quality may identify goals towards developing a water quality improvement plan/total maximum daily loads for the EFSRSR. However, the modeled post- closure decreases of antimony and arsenic relative to baseline concentrations may help with progress toward beneficial use attainment that led to the listing of arsenic and antimony for the EFSFSR and its tributaries.

Long-term passive water treatment as proposed by Midas Gold is predicted to improve surface water quality conditions throughout much of the watershed following closure and reclamation, and any public exposures to surface water are expected to be of limited magnitude and short duration. **Table 4.18-3** assigns the magnitude of the health impact related to surface water quality is rated as “low” and the possibility of the impacts as “low.” This results in an overall public health rating of “negligible.” There are no differences in impact findings between the construction, operation, and closure and reclamation phases of the SGP. These findings are consistent with the conclusions of the Agency for Toxic Substances and Disease Registry (ATSDR) Public Health Assessment that states risks to recreational receptor exposures from surface waters in the Stibnite Area are not expected to be a public health concern (ATSDR 2003).

4.18.2.1.1.5 Groundwater Quality

As discussed in Section 3.9.3.2, Groundwater Quality, contaminant levels in groundwater samples collected from the alluvial and bedrock wells in the analysis area were detected at concentrations that meet regulatory criteria (EPA’s maximum contaminant levels) for most constituents. As discussed in Section 4.9.2.1.3, Direct and Indirect Effects, groundwater quality beneath the mine site is expected to either be the same or similar to existing groundwater chemistry during both the operational and post-closure periods, and in some areas, groundwater quality in the post-closure period would improve from existing conditions to below regulatory criteria.

There are three permitted wells on the mine site and are controlled by Midas Gold: the Gestrin Airstrip mining well, the original temporary camp water supply well, and the new camp water supply well. As stated in Section 3.8, Surface and Groundwater Quantity, as of June 2017, the original camp water supply well has not been used since 2013 and the new camp well has never been used, except to test the drinking water system. There are no active domestic groundwater wells used for residential drinking water within 15 miles of the mine site. Yellow Pine’s public water system uses surface water from Boulder Creek, which is located approximately 15 miles downstream of Yellow Pine. Because groundwater is not currently used as a public drinking water source at the mine site and is assumed to be unlikely to be used as a drinking water source in the future, the ATSDR Public Health Assessment conducted for the existing mine site eliminated the groundwater as drinking water pathway from consideration as a public health concern (ATSDR 2003). It is currently unknown how Idaho Department of Environmental Quality would regulate groundwater quality standards. This would be determined after submission of the Idaho Pollutant Discharge Elimination System permit application.

Concentrations of constituents in groundwater in excess of maximum contaminant levels may represent an adverse effect for drinking water users, however, groundwater in the area is currently not used as drinking water by recreators or nearby residents. Because groundwater quality conditions are expected to be the same as existing conditions or may improve following closure and reclamation and no direct exposures to groundwater beneath the mine site are expected, the magnitude of the health impact related to groundwater quality is rated as “low” on **Table 4.18-3**, and the possibility of the impacts also is rated as “low.” This results in an overall public health rating of “negligible.” There are no differences in impact findings among the construction, operation, and closure and reclamation phases of the SGP.

4.18.2.1.1.6 Existing Terrain and Features

Potential public health and safety impacts can result from hazards associated with disturbance of existing terrain and features, including flash flood, wildfires, avalanches, and landslides. Steep slopes and uneven terrain also present potential hazards for recreational visitors. The SGP is not expected to exacerbate any of these existing hazards, but could increase the risk of damage, injury, or loss of life from the hazards due to the increased number of people traveling through the area to the mine site.

Regarding avalanches, as detailed in Section 4.2, Geologic Resources and Geotechnical Hazards, construction and/or use of roads is not expected to exacerbate existing avalanche hazards, but would increase the risk of damage, injury, or loss of life from such hazards by allowing additional people and facilities into avalanche susceptible areas. Existing avalanche hazards on the Yellow Pine Route would continue to exist and could impact travel along this route during the construction period; however, construction of the SGP would not increase the avalanche hazard. The risk of damage, injury, or loss of life from such existing avalanche hazards would increase temporarily during the construction period but would decrease following transition to use of the Burntlog Route for operational access. Conversely, the risks from existing avalanche hazards along the Burntlog Route would increase due to increased vehicular traffic during mine operations and closure/reclamation activities. However, as discussed in Section 4.2, Geologic Resources and Geotechnical Hazards, the Burntlog Route has less susceptibility to avalanche hazards than the Yellow Pine Route.

The risks to public safety from existing terrain and features such as wildfires, avalanches or landslides due to the SGP is “low,” because the possibility of occurrence due to the SGP is low. However, if a wildfire, avalanche, or landslide were to occur, the potential injury to the individual could be severe; therefore, the magnitude of effect is rated as “high.” This results in an overall public health rating of “moderate.” There are no differences in impact findings among the construction, operation, and closure and reclamation phases of the SGP.

4.18.2.1.2 ECONOMY AND PUBLIC HEALTH

Potential positive health impacts associated with the SGP on local economic conditions are indicated on **Table 4.18-3**. Section 4.21.2, Direct and Indirect Effects to Social and Economic Conditions, presents a detailed analysis of the impacts that the SGP would have on the socioeconomic conditions of the local communities. The SGP would make a significant contribution to the Valley County economy in terms of direct and indirect employment and wages during the life of the SGP. In addition, the SGP would generate significant tax revenues for various levels of government. The economic benefits associated with increased employment opportunities and tax revenues could lead to continued or improved access to health services, better nutrition, and better overall well-being for the local community. Also, if the new fulltime positions include health insurance and improved access to health care, this may have a positive effect on chronic and infectious disease and injury categories for both the employees and their families.

Overall the SGP is expected to result in economic benefits to the local community which would indirectly lead to positive public health impacts. The magnitude of impact shown on **Table 4.18-3** is “medium” and positive, and the possibility is rated as “high,” with an overall public health rating of “major” positive significance. There are no differences in impact findings between the construction and operation phases of the SGP. During the closure and reclamation phase and as discussed in Section 4.21.2, Direct and Indirect Effects, dislocation resulting from 75 to 83 percent of the SGP work force reduction from operations phase levels could offset the benefits noted during the construction and operation phases. However, the SGP closure and reclamation phase would result in net increases in local employment compared to baseline conditions. Thus, the magnitude of positive impact during and after the closure and reclamation phase shown on **Table 4.18-3** is “medium” and the possibility is rated as “medium,” with an overall public health rating of “moderate” positive.

Conversely, the decrease in mine-closure related local employment and labor income also could have significant adverse effects on the local economy. Section 4.21.2, Direct and Indirect Effects, discusses the potential for adverse economic impacts on the local area’s economy from the “bust” following the prior “boom.” While there could be some residual economic benefit to the community following closure and reclamation, there also could be an indirect or induced negative impact associated with the reduction in work force resulting from mine closure. Such potential “boom and bust” effects from a mine’s closure are commonly recognized as potential source of adverse socioeconomic impacts on the local area economy. The impacts on the local area’s economy depend on employees’ responses after their mine employment ends as well as their other employment opportunities. If the local area’s economy is strong and there are sufficient job opportunities with adequate earning potential for the unemployed mine workers, then the adverse economic impacts on the local economy could be limited as the unemployed mine operations workers are re-employed locally elsewhere. While it may be difficult for the displaced mine workers to find equally high-paying replacement jobs, some individuals may be willing to accept less wages for job positions with more traditional work schedules, working conditions, and duties. Midas Gold has indicated that they could ramp up and ramp down employment in a measured way to reduce the “bust” effects on the local residents and economy (AECOM 2018). However, given the local analysis area’s largely rural and small economy, in the absence of adequate economic transition mitigation, the mine-closure related decrease in local employment and income could have a substantial medium-term adverse impact on the local area’s residents, businesses and overall economy, which would indirectly lead to negative public health impacts. Thus, the magnitude of impact from the “boom and bust” shown on **Table 4.18-3** is “medium” and negative, and the possibility is rated as “medium,” with an overall public health rating of “moderate” during and after the closure and reclamation phase.

4.18.2.1.3 Services/Infrastructure And Public Health

The demand on existing public services and infrastructure as it relates to public health and safety was evaluated for the SGP. The most significant demands on the existing services and infrastructure relate to the access roads and other roads, transmission lines and utilities, and the need for worker housing.

4.18.2.1.3.1 Roads

Section 4.16, Access and Transportation, characterizes existing roads and transportation resources within the potentially affected area and analyzes potential effects on roads and transportation resources that would occur under implementation of Alternative 1.

Alternative 1 would add traffic volumes to various roadways in the analysis area during construction, operation, and closure. During construction, Warm Lake (County Road [CR] 10-579), Johnson Creek (CR 10-413), and the Stibnite segment of the McCall-Stibnite (CR 50-412) roads would be affected during the first 3 years of the SGP by construction activities until the Burntlog Route is completed. Once Burntlog Route is completed, the substantial increase in traffic volume would shift to exclusively Warm Lake and Burnt Log (National Forest System Road [FR] 447) roads as they are parts of the Burntlog Route.

As discussed in Section 3.16.3, Existing Conditions, existing traffic volumes on Warm Lake Road are at least 15 times greater than the other access roads. Due to the higher traffic volumes and higher speeds observed relative to other access roads, Warm Lake Road currently experiences the most accidents of the existing access roads in the analysis area. As discussed in Section 4.16.2, Direct and Indirect Effects, mine-related traffic on Warm Lake Road would increase by approximately 5 percent during construction and operation activities, and traffic volume on Burntlog Route would more than triple during the operation phase. While increases in traffic volume are expected due to SGP-related activities, overall traffic volume on these access roads are low due to the remote location and low-density population in the area. While the potential for accidents could increase due to the increased SGP-related traffic volume, the predicted 5 percent increase in traffic volume due to SGP activities on Warm Lake Road is minimal.

Accidents on area roads from 2000 through 2016, as detailed in Section 3.16.3, include: Warm Lake Road experienced an average of eight accidents per year; South Fork Salmon River Road (FR 50674/FR 474) had an average of three accidents per year; the Lick Creek segment of the McCall-Stibnite Road (CR 50-412) had two accidents per year; Johnson Creek Road (CR 10-413) had two accidents per year; and the Stibnite Road segment of McCall-Stibnite Road (CR 50-412) had one accident per year (DJ&A, PC 2017). Increase in traffic volume has the potential to increase the vehicle accident incidence rate. Thus, the possibility that an increase in traffic related accidents could affect public health and safety is rated as “medium” and the magnitude of impact shown on **Table 4.18-3** is “high” (because injuries from of an accident could be severe), resulting in an overall public health rating of “major.” As traffic impacts would be minimal even during the construction phrase, there are no differences in impact findings among the construction, operation, and closure and reclamation phases of the SGP.

Upon completion of the Burntlog Route, the public could access Thunder Mountain Road (FR 50375) using the Burntlog Route when access from Stibnite Road (CR 50-412) would not be permitted. This could provide improved access to remote recreational areas and better access for emergency responders, which could result in positive impacts to public health and safety. Thus, the magnitude of impact of the Burntlog Route shown on **Table 4.18-3** is “medium” and positive and the possibility is rated as “high,” with an overall public health rating of “moderate” positive. There are no differences in impact findings between the operation and closure and reclamation phases of the SGP.

4.18.2.1.3.2 Power and Utilities

Alternative 1 would require upgrades to an existing 69-kilovolt transmission line to 138-kilovolt to support mining operations. No power is currently supplied via a transmission line to the mine site. Midas Gold would contract with the Idaho Power Company to supply electric service to the mine site from the upgraded 138-kilovolt transmission line, installed from an existing Lake Fork substation along existing transmission line rights-of-way to the new Johnson Creek substation and a new approximately 8.5-mile transmission line to the mine site. The magnetic field generated by a power line depends on both the current in the line and the distance from it. When the voltage of a line is increased, it requires greater clearance and, thus, must be installed at a greater distance from the ground. When voltage is doubled, as in this case, the current drops by half. When combined with the increased distance, the magnetic field at ground level is reduced by two-thirds (Idaho Power Company 2013). As discussed in Section 3.18, Public Health and Safety, research is inconclusive regarding potential public health risks from exposure to EMFs, and existing data do not provide evidence to conclude that EMF causes cancer. No EPA or State of Idaho limits for EMF exposure have been issued (Idaho Power Company 2013). Thus, the magnitude of impact of the upgraded transmission lines shown on **Table 4.18-3** is “low” and the possibility is rated as “low,” with an overall public health rating of “negligible.” Local communities may indirectly benefit from improved utilities, such as upgraded transmission lines, that could indirectly lead to positive public health impacts, which could offset any negative public health concerns related to these upgrades.

4.18.2.1.3.3 On-Site Facilities and Worker Housing Facility

On-site facilities at the mine site would include a worker housing facility with recreation resources, water storage and distribution facilities, fuel storage and dispensing facilities, communication infrastructure, and sewage disposal facilities (Midas Gold 2016). In addition, on-site facilities would include a safety department with the primary function of ensuring worker safety and training. Emergency medical technicians and emergency equipment and supplies would be on-site, including an ambulance, first aid and medical supplies. These facilities would minimize the demand on the local services and provide medical services for workers and site-visitors in an otherwise remote area. There could be an indirect positive benefit for the local communities because employees from the local community could use the mine site services; SGP employees not relying on the existing infrastructure or local services could indirectly allow more local access.

However, with 500 or more employees living and dining in relatively close quarters, the potential for transmission of infectious diseases exists. Employees from the local community who lodge at the on-site facility could potentially transmit infectious diseases to the local communities upon return from the on-site housing facility. However, worker safety protocols include basic measures for good hygiene and protection of infectious disease transmission; and on-site health care services will provide basic treatments for worker illnesses. In addition, while dining and recreational areas will be common spaces, the personal spaces/sleeping quarters are designed for individual employees (Midas Gold 2016). Thus, while the magnitude of possible infectious disease transmission is “medium,” the possibility of occurrence is “low” due to worker health and safety protocols, on-site health services, and single-employee personal spaces/sleeping quarters.

For these reasons, the overall public health rating associated with the on-site facilities is “moderate” and positive; and the possible negative impact associated with transmission of infectious diseases from the housing site to the local community is “minor.” There are no differences in impact findings among the construction, operation, and closure and reclamation phases of the SGP.

4.18.2.1.4 Demographics And Public Health

This section discusses the potential health impacts related to land use, noise, and nutrition.

4.18.2.1.4.1 Land Use

Section 3.18.3, Existing Conditions, summarizes the current land use patterns and demographics as relevant to public health and safety. The closest (non-Midas Gold) occupied residence is in Yellow Pine, approximately 14 miles west of the mine site. Most of the SGP area is currently open to the public, as most of the land is public land managed by the Forest Service. Common users of the SGP area include Forest Service employees, Midas Gold employees and contractors, residents of Yellow Pine, and recreationists. Recreation is a major use throughout much of the SGP area. Participation in recreational activities can result in positive effects on physical and mental health. Physical activity can lower body mass and improve blood pressure; and leisure and recreational activities can help manage stress and reduce depression. As discussed in Section 4.19.2, Direct and Indirect Effects to Recreation, several facets of Alternative 1 could directly or indirectly impact the access, use, and quality of the recreational sites in the SGP area. While no direct health impacts are anticipated from impacts to recreation sites, it is possible that there could be emotional stress associated with displacement that could occur for some recreationists, affecting the overall well-being of those individuals. Loss of recreational sites could result in less opportunity for the local community to engage in recreational activities, which could reduce positive health benefits. As discussed in Section 4.19.2, most of the impacts to the recreational sites relate to restricted access or visual impacts affecting the recreational setting. However, there are other nearby recreational sites that are unimpacted by Alternative 1. In addition, as discussed in Section 4.19.2.1, Direct and Indirect Effects to Recreation, improved road conditions and some of the road re-alignments could result in increased access to additional recreational activities, particularly in the winter, with snow-plowed roads improving access to remote areas. Thus, the magnitude of impact on recreation as it relates to public health is “low” and the possibility is rated as “low,” with an overall public health rating of “negligible.” There are no differences in impact findings among the construction, operation, and closure and reclamation phases of Alternative 1.

4.18.2.1.4.2 Noise

As discussed in Section 4.6.2, Direct and Indirect Effects, noise at the mine site and access roads would consist of an assortment of sounds at varying frequencies from typical operations, as well as noise associated with road construction and SGP-related traffic. As discussed in Section 3.6.3, Affected Environment, EPA guidance for an acceptable noise level for outdoor use areas is 55 decibels on the A-weighted scale (dBA) for day-night (measured between 10:00 pm and 7:00 am outdoors at residences, farms, and other areas where people spend varying amounts of time, where quiet is a basis for the use of such areas). For comparison, 40 dBA is relatively quiet and can be equated to the noise level of a residence at night, while 60 dBA is comparable to a normal conversation and is considered a comfortable noise level. As discussed in Section 4.6.2, noise levels were predicted for anticipated noise sources during the construction, operations, and closure and reclamation phases of the SGP at 12 noise receptor locations in the SGP area, as well as at various locations in the Frank Church River of No Return Wilderness Area at a range of distances from the mine access road (Burntlog Route). Of these noise receptor locations, Site 2 (the Miller Residence) and the locations in the Frank Church River of No Return Wilderness Area are the most relevant to the public health evaluation, as these are the locations where human receptors are most likely to be present.

During the construction phase, Alternative 1 would have a temporary impact on the noise environment at Site 2, the Miller Residence, while transmission line work is occurring in the immediate vicinity of the residence. Absent transmission line work, daytime noise levels at the Miller Residence are estimated at 41 dBA and average day-night noise levels are estimated at 39 dBA during the construction phase, below the outdoor threshold of 55 dBA.

During the construction phase, borrow area activities along the Burntlog Route would result in noise level increases above ambient noise levels within approximately 1,000 feet from a borrow area. Resulting noise levels would be at or above the recommended noise level of 55 dBA for outdoor use areas within 500 feet of a borrow area, but below this level farther way. Resulting noise levels approximately 3,000 feet from the roadway would be below the recommended noise level of 55 dBA for outdoor use areas. Direct effects on recreationists within 1,000 to 2,000 feet of borrow areas could include general annoyance or sleep disturbance at campsites in wilderness areas. Indirect effects could include a reduction in the overall quality of the remote wilderness experience. Overall, potential noise impact on recreationists from borrow areas would be limited to a discrete area within approximately 1,000 to 2,000 feet of borrow areas located along the Burntlog Route where it closely borders the adjacent wilderness area. Noise from these borrow areas would likely be periodic or intermittent, but ongoing throughout the construction phase. Although there are small increases of noise during the construction phase, they are temporary and intermittent. Therefore, the magnitude of impact on public health as it relates to noise is “low,” and the possibility is rated as “low” with an overall public health rating of “negligible.”

During the operations or closure and reclamation phases, Alternative 1 would have negligible to no effect on the noise environment at Site 2 or the various locations in the Frank Church-River of No Return Wilderness Area. For these reasons, the magnitude of impact on public health as it relates to noise is “low” and the possibility is rated as “low,” with an overall public health rating of “negligible.”

4.18.2.1.4.3 Nutrition

Activities in the SGP area related to nutrition include fishing, hunting, or gathering of berries (or other edible vegetation). Contaminants in surface water could potentially bioaccumulate in the edible tissues of fish in impacted surface water or in wildlife that drink impacted surface water. Likewise, contaminants in soil could potentially bioaccumulate in plants growing in impacted soils. As discussed above, implementation of controls and surface water management during mine operations and the closure and reclamation activities would likely decrease concentrations of contaminants in soil and surface water relative to existing conditions. In addition, recreational exposures are expected to be of limited frequency and short duration (the Payette National Forest camping stay limit for individual campground sites is 16 days). For these reasons, the magnitude of impact on public health as it relates to nutrition is “low” and the possibility is rated as “low,” with an overall public health rating of “negligible.” There are no differences in impact findings among the construction, operation, and closure and reclamation phases of Alternative 1.

4.18.2.2 Alternative 2

Alternative 2 is similar to Alternative 1 with the main differences consisting of re-routing of a segment of the Burntlog Route, allowing public access through the mine site during operations, change in the location of the maintenance facility, re-routing a portion of the transmission line to be upgraded around the Thunder Mountain Estates, generating lime at the mine site, and establishment of a Centralized Water Treatment Plant. These changes are intended to reduce potential effects on surface water quality, reduce potential traffic related issues by providing public access through the mine site and potentially decreasing incidental public use of Burntlog Route, reduce SGP-related annual average daily traffic to the mine site during operations (through on-site lime generation) and reduce overall disturbance in the SGP area. However, Alternative 2 also would include an on-site propane-fired lime kiln and has higher air emissions than Alternative 1.

As discussed in Section 4.3.2, Direct and Indirect Effects on Air Quality, the $PM_{2.5}$ “annual” average (computed as the mean values from April through November) and PM_{10} 24-hour average concentrations (12.8 $\mu g/m^3$ and 179.7 $\mu g/m^3$, respectively) are predicted to be slightly over the respective NAAQS criteria at receptors along the public access road through the mine site (12 $\mu g/m^3$ and 150 $\mu g/m^3$, respectively). NAAQS are set at a level expected to protect public health with an adequate margin of safety, taking into consideration effects on susceptible populations. Signage and security checkpoints would alert the public to requirements for driving through the mine site, including check in and out at the checkpoints, no stopping or loitering while traversing the operations area, and restrictions would be enforced by signage, fencing, berms and/or gates to restrict travel to the designated route. The amount of time spent within the mine site on the public access road would be of limited duration. In addition, it is anticipated that people would only occasionally use the route through the mine site, such that the frequency of exposure would be limited. While air modeling results exceeded the NAAQS criteria during the operations phase along the public access road through the mine site, the limited duration and frequency of exposure to PM at modeled air concentrations would likely be minimal, which would significantly reduce the public health impact associated with air quality, even for sensitive subpopulations. The slight exceedances of the NAAQS criteria along the public access road are expected to have little to no effect on the health of the general population, however, sensitive susceptible populations are at greater risk of health effects associated with air quality conditions.

Overall, impacts to public health and safety under Alternative 2 would therefore be slightly improved compared to Alternative 1 for traffic-related issues and surface water quality impacts. However, on-site lime generation could lead to slightly greater air quality impacts along the public access route through the mine site, that could affect sensitive subpopulations.

4.18.2.3 Alternative 3

Alternative 3 is similar to Alternative 1 with the main differences being no construction of the Meadow Creek off-highway-vehicle Connector Trail, the tailings storage facility (TSF) constructed in the EFSFSR, and different access through the mine site after mine closure/reclamation. Impacts to public health and safety would be essentially the same as those described under Alternative 1.

4.18.2.4 Alternative 4

Alternative 4 is similar to Alternative 1 with the main differences being the use of the Yellow Pine Route for access to the mine for all phases, and public road access through the mine during operations (similar to Alternative 2). These changes would result in different impacts than Alternative 1, particularly the use of the Yellow Pine Route.

Under Alternative 4, the Yellow Pine Route would be used from construction through operations and closure and reclamation and the Burntlog Route would not be constructed. Use of Johnson Creek (CR 10-413) and Stibnite (CR 50-412) roads as the primary route to the mine site during construction, operations, and closure and reclamation would result in increased noise, traffic, and safety-related issues from mine-related traffic along the Yellow Pine Route. The Yellow Pine Route would route all mine-related traffic through the Village of Yellow Pine and public traffic and mine traffic would share the same road from Landmark to the mine site. Additionally, the Yellow Pine Route would result in one point of entry to the SGP, effectively combining public access with mining traffic for the life of the mine. This limited ingress/egress to the SGP site also will impact emergency vehicle access during periods of road blockage.

The steep terrain along the Yellow Pine Route would likely be a greater risk to public safety under Alternative 4, because it would be the only route used for the life of the SGP and would require safety considerations for geotechnical hazards, landslides, and avalanche zones (see Section 4.2, Geologic Resources and Geotechnical Hazards). Overall, Alternative 4 could lead to greater public health and safety impacts compared to Alternative 1 through use of the Yellow Pine Route (increase traffic-related issues and increased geotechnical, landslide, and avalanche hazards). The possibility of impacts to public safety due to Alternative 4 is increased from "low" to "medium-high" and if a wildfire, avalanche, or landslide were to occur, the potential injury to the individual could be severe; therefore, the magnitude of effect is rated as "high." This results in an overall public health rating of "major" for Alternative 4.

In addition, as discussed above for Alternative 2, modeled air quality receptors along the public access road through the mine site exceeded NAAQS. While air modeling results exceeded the NAAQS criteria during the operations phase along the public access road through the mine site, the limited duration and frequency of exposure to PM at modeled air concentrations would likely be minimal, which would significantly reduce the public health impact associated with air quality, even for sensitive subpopulations. The slight exceedances of the NAAQS criteria along the public access road are expected to have little to no effect on the health of the general population, however, sensitive susceptible populations are at greater risk of health effects associated with air quality conditions.

4.18.2.5 Alternative 5

Alternative 5 is the No Action Alternative. None of the action alternatives would be implemented and there would be no mine operation related to the SGP. Existing roads would be maintained, but improvements and new road construction would not take place.

Under Alternative 5, current land uses on patented mine and mill site claims and on the Payette National Forest and Boise National Forest would continue in compliance with all existing applicable codes and regulations. Current uses of National Forest System lands include mineral exploration and recreation, such as pleasure driving, hunting, off-highway-vehicle use, camping, hiking, snowmobiling, bird watching, target shooting, etc.

Under Alternative 5, no activities associated with the SGP would occur within the analysis area. However, previously permitted mineral exploration activities would continue along with any associated reclamation and monitoring requirements. Under the No Action Alternative, there would be no new permanent ground disturbance or visual and noise impacts, because no new utilities would be constructed, no large open pits would be created, no tall TSFs or development rock storage facilities would be formed, and blasting, drilling, and ore processing associated with the SGP would not occur. Past mining activities, however, have resulted in long-term impacts to soils, surface water, and groundwater quality.

Under the No Action Alternative, existing impacts of approximately 740 acres would remain as developed roads, existing waste piles (historic development rock and tailings), and other legacy mining features (Tetra Tech 2019). It is not anticipated that soils in most of these areas would recover naturally.

Under Alternative 5, all the negative health impacts associated with the SGP and identified on **Table 4.18-3** would not occur. In addition, the positive benefits on health associated with the improved socioeconomic condition, road improvements, and reclamation activities that the SGP would provide to the local community also would not occur under the No Action Alternative.

4.18.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final Environmental Impact Statement.

4.18.4 Cumulative Effects

The cumulative effects to public health and safety associated with the SGP are anticipated to provide an overall net benefit in the long term. Potential public health and safety impacts (both positive and negative) were evaluated. Several of the issues evaluated for public health and safety resulted in positive impacts, particularly those related to socioeconomics, road improvements, and reclamation activities. The SGP would improve access to remote recreational areas. In addition, the SGP would make a large contribution to the Valley County economy in terms of direct and indirect employment and wages, particularly during construction and operation phases of the SGP. The SGP also would generate tax revenues for the various levels of government. The economic benefits associated with increased employment opportunities and tax revenues, could lead to continued or improved access to health services (through employment insurance benefits and/or increased income), better nutrition, and better overall well-being for the local community. The potential negative effects from economic dislocation and disruption to local area economy after cessation of mine operations (“boom and bust” impacts) is somewhat offset by the residual positive impacts on social economic conditions, as discussed in the Section 4.21, Social and Economic Conditions. The SGP closure and reclamation phase would result in net increases in local employment compared to baseline conditions. In addition, post-mining economic expansion and investment may happen if tax revenue or fees from mining can be effectively re-invested in community services and infrastructure, which could create long-term economic growth. The potential negative effects to soil quality from open-pit mining are offset by the planned reclamation of the development rock storage facilities and the TSF, which would minimize direct contact with hazardous pollutants and lead to improved soil quality. Evaluation of the potential public health and safety impacts associated with injury from disturbance of existing terrain and features (i.e., landslides, avalanches, and wildfires) would result in moderate negative impacts on the overall public health and safety; and evaluation of the potential public health and safety impacts from accidents due to increasing traffic on access roads would result in major negative impacts on the overall public health and safety.

Reasonably foreseeable future actions that could cumulatively contribute to public health and safety impacts in the analysis area include all the projects listed in **Table 4.1-2** pertaining to land use management and development, road management, and hazardous materials management. Because of the size of the SGP, it is likely that cumulative impacts associated with other reasonably foreseeable future actions when added to the SGP would not be noticeable.

4.18.5 Irreversible and Irretrievable Commitments of Public Resources

No irreversible and irretrievable commitments of public resources would occur to the health and safety of the local community as a result of the SGP.

4.18.6 Short-term Uses versus Long-term Productivity

The SGP would reclaim historically damaged stream habitat, mitigate slope stability hazards, and perform post-mining reclamation. It also would improve access to remote recreational areas. In addition, the SGP would make a large contribution to the Valley County economy in terms of direct and indirect employment and wages during the life of the SGP. The SGP would generate tax revenues for various levels of government. The economic benefits associated with increased employment opportunities and tax revenues could lead to continued or improved access to health services, better nutrition, and better overall well-being for the local community.

4.18.7 Summary

Potential public health and safety impacts (both positive and negative) were evaluated. Several of the issues evaluated for public health and safety resulted in positive impacts, particularly those related to socioeconomics, road improvements, and reclamation activities. The potential negative effects from economic dislocation and disruption to local area economy after cessation of mine operations (“boom and bust” impacts) may be somewhat offset by the residual positive impacts on social economic conditions. The potential negative effects to soil quality are offset by the planned reclamation activities, which would lead to improved soil quality over current conditions and minimize direct contact with hazardous pollutants. Because of an increase in people traveling through the area to the mine site, potential public health impacts associated with injury from disturbance of existing terrain and features (i.e., landslides, avalanches, and wildfires) could result in moderate negative impacts. Injury from accidents due to increased traffic on mine access routes could result in major negative impacts on public health and safety.

Table 4.18-5 provides a summary comparison of public health and safety impacts by issues and indicators for each alternative.

This page intentionally left blank

Table 4.18-5 Comparison of Public Health and Safety Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may affect public safety on the roads used by mine vehicles during construction, operation, and closure activities.	Number of SGP-related vehicles and trips on public roads.	SGP area is dominated by unpaved roads, one state highway, and county roads. The road segment of highest safety and traffic concern is Warm Lake Road.	Major The increased mine-related traffic on Warm Lake Road and other access roads increases the potential for accidents	Same as Alternative 1, however slightly improved due to reducing potential traffic related issues.	Same as Alternative 1.	Major The use of Yellow Pine Route would increase safety issues by routing heavy truck traffic through the Village of Yellow Pine and the general public traveling on the same road as large mining equipment.	Same as Baseline.
The SGP may affect human health or exposure to hazards.	Current public health statistics and descriptors.	Valley County ranks sixth best in state for health outcomes and fourth best in the state for overall health factors	Major The economic benefits could lead to continued or improved access to health services, better nutrition, and better overall well- being for the local community. Potential negative economic impacts associated with “boom and bust” could result in negative health impacts during closure and beyond.	Same as Alternative, 1 however slightly improved.	Same as Alternative 1.	Same as Alternative 1.	Same as Baseline.
	Changes in health metrics such as soil, air, and water quality.	Baseline air quality measurements indicate current concentrations of the criteria air pollutants are well below the NAAQS. Soil - legacy mine tailings are known to contain elevated levels of arsenic and antimony. Surface Water – The chemicals of concern for public health were arsenic antimony, and mercury. Each of the inventoried waterbodies (except for West End Creek) are Clean Water Act Section 303(d) listed.The causes for listing of these waters are associated with arsenic, with the EFSFSR also being listed for antimony (downstream of Meadow Creek) and Sugar Creek also being listed for mercury.	Air - Negligible: predicted ambient air concentrations at boundary where public is allowed shown to be below NAAQS Soil - Minor: exposures by recreationists to impacted soil materials would be of relatively low frequency, short duration, and low magnitude during construction and operations of the SGP; closure and reclamation activities assumed to lead to overall reduction in chemical impacts to surface soil. Potential negative impacts are off-set by positive impacts from reclamation of legacy contamination. Surface Water - Negligible. Exposures are expected to be of limited magnitude and short duration. Water treatment systems during construction and operation, as well as for in perpetuity following closure and reclamation will maintain or improve overall progress toward beneficial use	Impacts to public health and safety would not be substantially different than those for Alternative 1 with the following exceptions. Air: Degraded air quality along the public access route could affect the public who elect to travel through the mine site, particularly sensitive subpopulations, though duration and frequency of exposure is expected to be minimal. Surface Water: Operation of the Centralized Water Treatment Plant in perpetuity. Meadow Creek is not diverted into the water treatment plant, but will flow directly into the EFSFSR (preserving fish passage through Meadow Creek). Passive treatment of TSF consolidation water into Meadow Creek until post-closure year 45, resulting in improved water quality conditions from baseline.	Same as Alternative 1.	Impacts to public health and safety would not be substantially different than those for Alternative 1 with the exception that degraded air quality along the public access route could affect the public who elect to travel through the mine site, particularly sensitive subpopulations, though duration and frequency of exposure is expected to be minimal.	Same as Baseline.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
			attainment for the EFSFSR and improved water quality conditions from baseline.				
	Transport of hazardous materials on access roads.	SGP area could currently be impacted by accidental releases of hazardous materials during transportation to and from the mine site.	Minor	Same as Alternative 1, however with slight improvements.	Same as Alternative 1.	Moderate Steeper topography and terrain and more areas of potential landslides and rockfalls along the Yellow Pine Route than along the Burntlog Route increase the possibility of overturning a truck transporting hazardous substances to and from the mine site.	Same as Baseline.
	Increased risk of natural hazards (wildfire, avalanche, landslide).	The entire SGP area presents potential flash-flood and debris-flow hazards that also can cause severe injury or death, or block access. Some portions of the mine site also are conducive to landslides and avalanches. Fires can cause severe injury or death for travelers, recreationists, and Forest Service and Midas Gold employees, as well as damage to property.	Moderate The SGP would increase the risk of damage, injury, or loss of life by allowing the increase in people traveling through the area to the mine site and construction and/or use of roads would increase the risk of damage, injury, or loss of life from such hazards by allowing additional people and facilities into avalanche susceptible areas.	Same as Alternative 1, however with slight improvements as it reduces overall disturbance of the area.	Same as Alternative 1 however with slight improvement by elimination of public access roads.	Major None of the positive impacts associated with improvement and development of the Burntlog Route. Yellow Pine Route has a steeper topography and terrain and there are more areas of landslides and rockfalls along the Yellow Pine Route than there are along the Burntlog Route. Safety issues also are increased by heavy truck traffic through the Village of Yellow Pine and the general public traveling on the same road as large mining equipment.	Same as Baseline.
The SGP may affect infrastructure and services as related to emergency services, medical services, law enforcement, social services, sanitation and wastewater treatment.	Capacity of existing infrastructure and services to meet anticipated increased use.	Due to the remote nature, most of the SGP area is located more than 30 miles from the nearest local emergency services.	Moderate and positive Emergency medical technicians and emergency equipment and supplies will be on- site, including an ambulance, first aid and medical supplies.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Baseline.
The SGP may cause public health effects related to changing environmental conditions.	Disruption of recreational areas during construction, operation, and closure and reclamation.	Recreation is a major use throughout much of the SGP area; activities commonly include hunting, fishing, sightseeing, hiking, camping, all-terrain vehicle use, snowmobiling, and horseback riding.	Negligible	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Baseline.
	Changes in health metrics such as soil, air, and water quality.	Baseline air quality measurements indicate current concentrations of the criteria air pollutants are well below the NAAQS. Soil - legacy mine tailings are known to contain elevated levels of arsenic and antimony.	Air - Negligible: predicted ambient air concentrations at boundary where public is allowed shown to be below NAAQS Soil - Minor: exposures by recreationists to impacted soil materials would be of relatively	Impacts to public health and safety would not be substantially different than those for Alternative 1 with the following exceptions. Air: Degraded air quality along the public access route could affect the public who elect to	Same as Alternative 1.	Impacts to public health and safety would not be substantially different than those for Alternative 1 with the exception that degraded air quality along the public access route could affect the public who elect to travel through the mine site, particularly sensitive subpopulations, though	Same as Baseline.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
		Surface Water – The chemicals of concern for public health were arsenic antimony, and mercury. Each of the inventoried waterbodies (except for West End Creek) are Clean Water Act Section 303(d) listed. The causes for listing of these waters are associated with arsenic, with the EFSFSR also being listed for antimony (downstream of Meadow Creek) and Sugar Creek also being listed for mercury.	low frequency, short duration, and low magnitude during construction and operations of the SGP; closure and reclamation activities assumed to lead to overall reduction in chemical impacts to surface soil. Potential negative impacts are off-set by positive impacts from reclamation of legacy contamination. Surface Water - Negligible. Exposures are expected to be of limited magnitude and short duration. Water treatment systems during construction and operation, as well as for in perpetuity following closure and reclamation will maintain or improve overall progress toward beneficial use attainment for the EFSFSR and improved water quality conditions from baseline.	travel through the mine site, particularly sensitive subpopulations, though duration and frequency of exposure is expected to be minimal. Surface Water: Improved water quality conditions from baseline due to operation of Centralized Water Treatment Plant in perpetuity; Meadow Creek is not diverted into the water treatment plant, but will flow directly into the EFSFSR (preserving fish passage through Meadow Creek); Passive treatment of TSF consolidation water into Meadow Creek until post-closure year 45.		duration and frequency of exposure is expected to be minimal.	
	Psychological effects due to noise.	Sound levels at the 12 baseline noise measurement locations in the SGP area ranged from 34 dBA to 64 dBA.	Negligible Predicted noise levels would be under, at, or slightly over the outdoor threshold level of 55 dBA.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	Same as Baseline.

This page intentionally left blank

4.19 RECREATION

4.19.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to recreation includes the following issue and indicators:

Issue: The Stibnite Gold Project (SGP) may cause changes to recreation setting, access, facilities, and/or opportunities.

Indicators:

- Changes in motorized access (including restrictions and/or changes in maintenance) to recreation opportunities.
- Changes in recreation physical setting characteristics and related Recreation Opportunity Spectrum (ROS) class (by season) measured in acres.
- Changes in recreation facilities (trails, campgrounds, trailheads), including the level of development and setting.
- Changes in recreation use.
- Changes in recreation special use permits.
- Changes in recreation opportunities available.
- Changes in the ability to participate in recreation opportunities.

Recreation was analyzed using Geographic Information System (GIS) analyses, information, and analysis documented in reports prepared for the SGP, and existing studies and plans, including the Payette National Forest Land and Resource Management Plan (Payette Forest Plan) (U.S. Forest Service [Forest Service] 2003a) and Boise National Forest Land and Resource Management Plan (Boise Forest Plan) (Forest Service 2010), and the Valley County Comprehensive Plan (Valley County 2018). Recreation data managed by Payette National Forest (PNF) and Boise National Forest (BNF) include recreational use areas, such as roads and trails; developed recreational use areas, such as campgrounds and trailheads; groomed over-snow vehicle (OSV) trails; special management areas; special use permits; and ROS classifications. Data on existing ROS physical setting attributes were developed per the Recreation Opportunity Spectrum User Guide (Forest Service 1982) and National Recreation Opportunity Spectrum Mapping protocol (Forest Service 2003b).

For special use permits, the Idaho Outfitters and Guides Licensing Board (IOGLB) website provided information regarding permitted outfitters for each Idaho Department of Fish and Game, game management unit, in the area of analysis (the analysis area is defined in Section 3.19.1 and depicted on **Figure 3.19-1**). Although the number of outfitters permitted for each game management unit was available, as well as the activities and game species they are permitted for, detailed use data (number of customers) for these private outfitting companies were not publicly available and were not included in the analysis. The Forest Service also provided information on recreation-related special use permits.

The following assumptions were made in the evaluation of the environmental consequences related to recreation:

- Increased access (in the form of new/improved roadways or off-highway vehicle (OHV)/OSV routes, or a change in maintenance) is assumed to lead to an increase in visitor use.
- Impacts to recreation experiences are assumed to result if changes to the recreation setting occur.
- Forest Service and county roads would not be closed during transmission line upgrades, but access may be delayed or detoured during upgrade activities.
- All winter use is considered dispersed recreation.
- Mine site construction, operation, or closure/reclamation would not be expected to change the origin of visitors to the analysis area and would not encourage visitors' use in new areas.
- Even after access is restored and sites are reclaimed, some visitors may choose to remain at their displacement location rather than return to the mine site area, due in part to the length of time visitors have been displaced and the comfort level acquired at the displaced location.
- Sound from SGP activities at recreation sites/areas is based on estimated noise that does not consider the effects of topography or vegetation. Therefore, the noise impacts presented in the analysis may be more extensive than may actually occur given the topography and vegetation present in the analysis area. See Section 4.6.1, Effects Analysis Indicators and Methodology of Analysis (Noise), for more information on noise calculations.
- Plume visibility was evaluated for a hypothetical observer at the Frank Church-River of No Return Wilderness (FCRNRW) as part of the air quality analysis in Section 4.3. Results of this analysis and the corresponding impacts to recreation are discussed under operation of the mine site. Specifically modeling details related to plume visibility can be found in Section 4.3.2, Direct and Indirect Effects (Air Quality).
- Mine site workers would not be expected to substantially contribute to recreational use outside of the Operations Area Boundary. During operations, workers would be primarily expected to stay on site in the Operations Area Boundary and use the recreation facilities provided in this area. During construction and closure/reclamation, it is assumed that most workers would be working in the analysis area but may recreate near the temporary construction worker housing areas.

- As described in Section 4.21.2, Direct and Indirect Effects to Social and Economic Conditions, while there would be an increase in local jobs due to the SGP, there would be limited in-migration of workers during construction, operations, and closure/reclamation. Most of the new in-migrating workers would be expected to relocate to Cascade and McCall given the existing distribution of population and housing within the communities closest to the mine site location, as well as the expected employee shuttle location. Only a minor portion of employees might be expected to relocate to Council or New Meadows and few, if any, new employees and their families would be expected to relocate to the small communities of Yellow Pine or Donnelly, or elsewhere within Valley County's or Adams County's unincorporated and more rural areas. Therefore, the SGP would not be expected to generate a large increase in the number of full-time residents within the analysis area. Therefore, only a small increase in recreational use would likely occur during SGP construction, operations, and closure/reclamation due to a small increase in the full-time residential population, and local residents may notice slightly more people participating in recreation activities locally.

Because there are no specific recreational use and demand estimates for the analysis area, the discussion of changes to recreational use is qualitative, and describes potential changes in recreational use due to displacement, increased access, reduced acreage for recreation, and changes in the recreation setting.

It was assumed that designated ROS classes contained in the Payette Forest Plan (Forest Service 2003a) and Boise Forest Plan (Forest Service 2010) for the relevant management areas are current, and match ROS GIS data available between April 20 and September 25, 2017. Designated ROS classes were determined for the analysis area through review of the Payette Forest Plan and the Boise Forest Plan. ROS GIS data from the PNF and BNF were overlaid on the analysis area to determine applicable ROS designations in the analysis area. Assumptions in the analysis of ROS and ROS physical settings include:

- Changes in access could result in change in physical setting criteria, thereby affecting overall ROS physical setting.
- "Better than Primitive Roads" was assumed to include roads with a maintenance level of "Passenger Car."
- A designation of "Primitive" was given to the portion of the FCRNRW in the analysis area in the PNF for which there was no ROS classification in GIS to match the adjacent Salmon-Challis National Forest designation.
- Roads with a maintenance level of "Basic Custodial Care – Closed" were not included in the ROS physical setting analysis or included as part of existing motorized road or trail facilities.

To address the issue and indicators listed in this section, the impacts to recreation have been structured into three topics: 1) recreation opportunities, facilities, access, and use, which are all interdependent and therefore discussed together; 2) impacts to the ROS classes and physical setting; and 3) impacts to recreation special use permits.

To increase readability and avoid redundancy in the impact discussion for Alternatives 2 through 4, if the impacts on recreation (opportunities, facilities, access, and use) of an alternative component are the same as Alternative 1, this is stated and the impacts are not repeated. **Appendices N-2** through **N-5** (Chapter 4, Recreation Mapbooks and Figures, Alternatives 1 through 4) include maps of existing recreation facilities under operational conditions in both the summer and winter for each alternative and routes available in both the winter and summer under each alternative.

Effects on the physical ROS in the analysis area focus on two impacts: (1) identified inconsistencies with the existing designated ROS classes due primarily to changes in where motorized use would be allowed, or increased development/landscape modification with implementation of the action alternative; and (2) impacts to the estimated ROS physical setting. The estimated ROS physical setting class is not always the same as the designated ROS class of an area; therefore, there may be impacts to the physical setting that may not result in a change to the designated ROS class if the class allows more landscape modification than the physical setting currently includes. There also may be differences in impacts to both topics (designated ROS classes and estimated ROS physical setting) between winter and summer. These are noted in the discussion of impacts to designated ROS classes and impacts to the estimated ROS physical setting, where appropriate. Almost all impacts to designated ROS classes and the estimated ROS physical setting would occur from construction through closure and reclamation. Impacts after reclamation are described for those components that may have such impacts. Impacts that would only occur during construction are noted as well. Maps of estimated ROS physical settings are included in **Appendices N-2** through **N-5** for each alternative under both summer and winter conditions.

The impacts to recreation special use permits describe the impacts from construction, operations, and mine closure to the recreation–related special use permits approved for the analysis area.

4.19.2 Direct and Indirect Effects

The following analysis of effects associated with recreation is considered in the overall context of recreation within the analysis area. Elements of this context include:

- The analysis area includes over 170 miles of trails open to motorized use.
- In the winter, snowmobiling is popular on 96 miles of groomed OSV routes that branch off the plowed main routes through the analysis area.
- Recreation opportunities such as hunting, fishing, hiking, camping, and horseback riding also are popular throughout the analysis area, with opportunities available at developed facilities such as campgrounds and trails, and at dispersed locations such as dispersed

camping areas and specially designated areas such as inventoried roadless areas (IRAs), the FCRNRW, and Wild and Scenic Rivers.

- The Warm Lake area contains most of the developed recreation facilities (apart from trailheads) in the analysis area. Scattered campgrounds and other facilities also are located in the Big Creek and Landmark areas and along Johnson Creek Road (County Road [CR] 10-413) around and south of the village of Yellow Pine. Developed recreation facilities on the PNF and BNF primarily include campgrounds, cabins/lookouts, trailheads, and trails.
- Access to the analysis area is primarily from the west via paved roads that lead to unpaved county and Forest Service roads. The main access roads (from west to east) include State Highway 55 and Warm Lake Road (CR 10-579) to Landmark. From Landmark, the main access roads are county-maintained gravel roads that travel north to Yellow Pine and up to Big Creek. From these main roads, connecting unpaved Forest Service roads provide access to National Forest System (NFS) lands and facilities.
- The IOGLB issues state licenses to commercial outfitters and guides in the state of Idaho and is responsible for the administration of the Idaho Outfitters and Guides Act (Title 36, Chapter 21, Idaho Code), while the Forest Service authorizes outfitter/guide services and facilities on NFS lands. In 2019, special use permits issued by the Forest Service within the analysis area included three lodges, one bicycle event, four outfitters and guides, two organizational camps, and 62 recreation residences.
- Designated ROS classes in the analysis area vary by season, and include Rural, Roaded Natural, Roaded Modified, Semi-Primitive Motorized, Semi-Primitive Non-Motorized, and Primitive.

4.19.2.1 Alternative 1

This section discusses the impacts on recreation (opportunities, facilities, access, and use) from Alternative 1. A few facilities are not discussed for Alternative 1 because they would not impact recreation, including the Stibnite Gold Logistics Facility and modifications to existing substations and the new substation at the Stibnite Gold Logistics Facility (Scott Valley substation). The Stibnite Gold Logistics Facility would be entirely on private property and would not be visible or audible from any known developed recreation areas/sites in visual or audible distance of the facility.

The upgraded transmission line west of NFS lands would be on private property or Bureau of Reclamation lands at Lake Cascade. Although the transmission line would pass by Lake Cascade, the taller structures would not be visible from the lake or existing recreation sites around the lake, and therefore would not impact the recreation setting at the lake. Impacts to recreation related the transmission line outside of NFS lands are limited to temporary impacts to access roads used to reach recreation facilities and changes to the recreation setting near the transmission line.

4.19.2.1.1 Recreation Opportunities, Facilities, Access, and Use

4.19.2.1.1.1 Construction

Mine Site Facilities

In the mine site, public use would be restricted within the Operations Area Boundary during construction, operations, and closure and reclamation by fencing near the security-monitored gates, and signs warning the public against entry into the Operations Area Boundary. Therefore, beginning at construction, approximately 13,452 acres of NFS lands (and approximately 775 acres of private patented lands within the Operations Area Boundary) would be inaccessible to dispersed recreation (see maps in **Appendix N-2**). Existing dispersed recreational use and opportunities that occur in this area would be displaced to other locations in or adjacent to the analysis area. Construction at the mine site would result in moderate visual contrast primarily due to expansion of mining activities and introduction of nighttime lighting. Therefore, the recreation setting would be less-natural looking compared to the existing recreation setting, especially at night. Mine site construction noise could be heard up to 1.2 miles from the mine site based on noise modeling (AECOM 2019) of the distance at which noise levels could be above 40 decibels on the A-weighted scale (dBA) level (i.e., the lower end of the assumed baseline ambient level for wilderness areas; see Section 4.6, Noise). The distance of 1.2 miles would not extend beyond the Operations Area Boundary and, therefore, would be unlikely to reduce recreation opportunities outside the Operations Area Boundary. Wildlife in the analysis area would be affected by construction noise, traffic, and activities likely resulting in displacement of wildlife to areas away from the analysis area. Therefore, opportunities to participate in hunting, fishing, wildlife and bird watching would be displaced as well, relocating use related to these activities to locations away from the mine site within the analysis area, or possibly outside of the analysis area. Impacts on recreation opportunities at and around the mine site would begin during construction and continue until the mine was closed and reclaimed and the area reopened to dispersed recreation use, except for long-term water treatment facilities, which would not be removed and therefore would be permanently inaccessible to dispersed recreation use. Some visitors may choose to continue using their displacement locations rather than return to the mine site area due to permanent changes in the recreation setting within the Operations Area Boundary.

Burntlog Route

The Burntlog Route would include upgrades to 20 miles of the existing Burnt Log Road (National Forest System Road [FR] 447), including widening, resurfacing, and maintenance, and upgrades to Meadow Creek Lookout Road (FR 51290) and Thunder Mountain Road (FR 50375). These activities may require temporary road closures and/or detours along these roads, thereby temporarily reducing access along these roadways to both sites/areas along the roadway as well as trails/areas accessed from these roads and roads/trails that cross these roadways (see maps in **Appendix N-2**). This temporary reduction in access also may temporarily reduce recreation opportunities along Burnt Log Road, including at the Mud Lake and Burntlog dispersed camping areas, as well as on roads/trails and in the areas accessed from Burnt Log Road, including the Pistol Lake Trailhead into the FCRNRW.

Activities related to construction of the new sections of Burntlog Route (approximately 14.9 miles) including noise, use of borrow and staging areas, temporary trailer camps, vegetation clearing, road building, and traffic, may affect the recreation setting for users within visual (2 to 3 miles east and less than 1 mile west) and audible (1 mile) distance of construction activities and facilities, including the Mud Lake dispersed camping area, Burntlog dispersed camping area, Thunder Mountain/Riordan Trailhead, Meadow Creek/Summit Trailhead, Meadow Creek Lookout, and Landmark. Noise from construction activities related to building the Burntlog Route, access road traffic (including individual heavy and light trucks) and borrow areas could be above ambient levels (40 dBA) into the FCRNRW, primarily from the Black Lake area north to the mine site area (AECOM 2019).

Changes in the recreation setting along the Burntlog Route construction corridor (road corridor and surrounding areas) could lead to displacement of dispersed recreational use, particularly related to non-motorized activities, wilderness activities, wildlife-related recreation activities (due to wildlife displacement), and dispersed recreation camping at the Mud Lake and Burnt Log dispersed camping areas, which currently typically occur in a quieter, less-developed setting. Camping at Mud Lake would be particularly affected as construction activity would be located within 100 feet of the camping area. Impacts would be localized to the Burntlog Route area and recreation facilities/areas currently accessed from the Burnt Log Road. Impacts would begin during construction and would continue through operations and closure/reclamation.

Yellow Pine Route

Summer

Use of Johnson Creek Road (CR 10-413) and the Stibnite Road portion of the McCall-Stibnite Road (CR 50-412) as the primary route to the mine site during the construction of the Burntlog Route could result in temporary impacts (1 to 2 years) to motorized recreation access due to potential delays, traffic, and safety-related issues from mine-related traffic (please see Section 4.18, Public Health and Safety, and Section 4.16, Access and Transportation, for more information on safety impacts). Access delays and traffic would affect recreation sites/areas along these roads, as well as sites and areas accessed from these roadways, including the Big Creek area. The increase in traffic and noise along these roadways also may affect the recreation setting for recreation sites and areas along these roadways, leading to a change in recreation experience for some visitors. Traffic on Johnson Creek would more than double (annual average daily traffic [AADT] would rise from 57 to 122), thereby increasing the noise and activity near campgrounds and trailheads adjacent to this road. Recreation facilities potentially impacted by increased traffic and related noise along the Yellow Pine Route would include Quartz Creek, and Burntlog Trailheads; Buck Mountain, Trout Creek, Ice Hole, Golden Gate, and Yellow Pine Campgrounds; Twin Bridges dispersed camping area; and Johnson Creek Cabin. Therefore, the recreation setting of these facilities may be altered to a more developed setting due to a large increase in the sights and sounds of humans. Recreationists may be displaced to avoid noise associated with construction activities and/or construction traffic along Johnson Creek and Stibnite Roads, particularly recreationists participating in non-motorized activities, as the noise of a passing heavy truck could be heard up to 0.5 mile from the road (AECOM 2019). Wildlife-related recreation opportunities also may decrease along these roadways due to wildlife displacement from construction traffic and noise. Any displacement of dispersed recreation, reduction in recreation opportunities, or access delays would be temporary along Johnson Creek Road (CR 10-413) and Stibnite Road (CR 50-412) until Burntlog Route construction activities were completed (1 to 2 years).

Winter

Currently, Johnson Creek Road (CR 10-413) is plowed from Yellow Pine south to Wapiti Meadow Ranch (8.6 miles total). The remaining section of Johnson Creek Road to Landmark is a groomed OSV route (approximately 17 miles). During construction of the Burntlog Route, Johnson Creek Road would be plowed from Yellow Pine to Landmark; therefore, this road could not be used as a groomed OSV route from Wapiti Meadow Ranch south to Landmark. Plowing Johnson Creek Road would reduce the miles of groomed OSV facilities for 1 to 2 years and disrupt connections between OSV routes. To continue providing OSV access to Landmark during Burntlog Route construction, a groomed OSV route would be created adjacent to the western side of Johnson Creek Road between the proposed Cabin Creek Road groomed OSV route and Landmark (see maps in **Appendix N-2**).

Once the Burntlog Route was constructed, Johnson Creek Road would revert to a groomed OSV route from Wapiti Meadow Ranch to Landmark. The change in location of the groomed OSV route along Johnson Creek Road from the roadway to the western side of the road for approximately 7 miles would not be expected to alter recreational use of this route, although temporary use of Johnson Creek Road for mine access during construction of the Burntlog Route may alter recreation experiences for motorized users due to increased traffic along the roadway, leading to displacement of some users.

The plowing of Johnson Creek Road would provide additional motorized access and winter recreation opportunities along this road, thereby potentially increasing winter recreational use along this road. However, plowing and construction traffic on Johnson Creek Road and Warm Lake Road (described below) and the location of the temporary groomed OSV route along the western side of Johnson Creek Road may make it difficult and/or unsafe for OSV’s to cross Johnson Creek Road or Warm Lake Road to reach other OSV routes in the Landmark area, including along Sand Creek Road (FR 437), Burnt Log Road (FR 447), Horn Creek Road (FR 414), Warm Lake Road, or North Fork Sulphur Creek Road (FR 442). Therefore, plowing and construction traffic on Johnson Creek Road and Warm Lake Road would limit OSV access to the Sand Creek Road, Burnt Log Road, Horn Creek Road, Warm Lake Road, and North Fork Sulphur Creek Road OSV routes, resulting in reduced OSV opportunities and use. Impacts would be focused on the Johnson Creek Road corridor and would cease when the Burntlog Route is completed and plowing of Johnson Creek Road ceased.

Ditch Creek Road (FR 410) is a groomed OSV route for 2 miles and is located off Johnson Creek Road (CR 10-413) just north of Trout Creek Campground. Due to the plowing of Johnson Creek Road during the construction of the Burntlog Route, OSV access to Ditch Creek Road would not be feasible on Johnson Creek Road from the south; OSV access on the new Cabin Creek Road would get close to Ditch Creek Road, however, overland travel or travel on the plowed Johnson Creek Road with mine traffic would be needed to reach the Johnson Creek Road junction with Ditch Creek Road. Therefore, access and use of the 2-mile Ditch Creek Road OSV route would be greatly reduced, because the route would be cut off from other OSV routes until construction of the Burntlog Route was completed, and Johnson Creek Road reverted to a groomed OSV route. Impacts would begin with construction and end when the Burntlog Route was complete and plowing of Johnson Creek Road ceased.

Warm Lake Road

Summer

Impacts to recreation access, opportunities, settings, experiences and use from SGP-related traffic use of Warm Lake Road (CR 10-579) would be similar to those described above for the Yellow Pine Route (Johnson Creek and Stibnite Roads); however, Warm Lake Road (CR 10-579) would have a less substantial increase in traffic compared to Johnson Creek Road (CR 10-413) increasing by 5.5 percent from 1,174 to 1,239 AADT. Recreation facilities potentially impacted by increased traffic and related noise along Warm Lake Road (CR 10-579) include Big Creek Summit and Bear Creek/Warm Lake trailheads, as well as Summit Lake, Warm Lake, and South Fork Salmon River campgrounds. Impacts to recreation access, opportunities, settings, experiences and use along Warm Lake Road (CR 10-579) would begin during construction and would continue due to increased traffic through operations and closure/reclamation.

Winter

Approximately 11 miles of existing groomed OSV route from Warm Lake to Landmark on Warm Lake Road (CR 10-579) would be closed during construction and operation due to plowing of Warm Lake Road as a mine site access road. To continue providing OSV access to Landmark, a 10.4-mile groomed OSV route between Warm Lake and Trout Creek Campground on Cabin Creek Road (FR 467) would be created as part of Alternative 1 along with a parking area, resulting in a new winter access facility that would be maintained by Valley County (see maps in **Appendix N-2**). From Trout Creek Campground, OSV users could continue down Johnson Creek Road (CR 10-413) to Landmark on a groomed OSV route. It is expected that although the new OSV route to Landmark would be longer (via the new Cabin Creek Road groomed OSV route), existing use of the OSV route on Warm Lake Road would transfer to the new Cabin Creek Road route. In addition, the new 10.4-mile groomed OSV route along Cabin Creek Road may lead to dispersed winter recreational use along this new route, because the route would provide winter recreation opportunities in an area that currently does not have many winter opportunities due to lack of access and would be the only available easterly OSV route to Landmark. Impacts to winter recreation access, opportunities, and use would be focused on

Warm Lake Road (existing OSV route portion); the new OSV route corridor along Cabin Creek Road; and the Landmark area. Impacts would begin during construction and continue through operations and closure/reclamation until the existing 11-mile OSV route portion of Warm Lake Road reverted to an OSV route and use of the Cabin Creek Road OSV route ceased.

Temporary Road Closures of Stibnite and Thunder Mountain Roads Through the Mine Site

During construction (prior to the completion of the Burntlog Route) access through the mine site would continue, but there may be half-day to multiple day road closures of Stibnite Road (CR 50-412) and Thunder Mountain Road (FR 50375). During the summer, temporary closure of these roads could increase travel time to access to recreation areas and sites further east on Thunder Mountain Road (FR 50375). Lack of access to Thunder Mountain Road (FR 50375) would preclude recreationists from reaching recreation facilities, including Monumental Summit Interpretive Site, Monumental Trailhead, Lookout Mountain/Thunder Mountain Trailhead, the Idaho Centennial Trail, other dispersed recreation areas in the FCRNRW, and portions of the Meadow Creek, Sugar Mountain, and Horse Heaven IRAs via Stibnite Road (CR 50-412). Therefore, recreational use and opportunities in these areas/sites would be reduced in the summer due to reduced access during road closures. Impacts would be localized to Stibnite Road, Thunder Mountain Road, and areas/sites accessed from these roads. Closure of Stibnite and Thunder Mountain roads would affect recreationists that typically access areas/sites via Yellow Pine, and recreationists that use these roads/areas in the winter. Impacts to recreation access, use, and opportunities along Thunder Mountain Road (FR 50375) would begin during construction, and continue until the Burntlog Route was complete and open to public use when no other access is available to the Thunder Mountain area.

OHV Trail

The OHV Trail from a new transmission line access road to Meadow Creek Lookout Road (OHV Trail) would be constructed (approximately 3 miles of new trail) in an area that does not have existing motorized use trails. This OHV Trail would connect Meadow Creek Lookout Road (FR 51290) to a new transmission line access road on the PNF (see **Appendix N-2**, Operations Routes Summer East End map). The new transmission line access road would connect to the end of Forest Trail (FT) 233 (approximately 2 miles to the west) near the boundary between the BNF and PNF. FT 233 ends at the PNF and BNF boundary, and there would be an approximately 2-mile gap in public motorized use on roads and trails from the end of FT 233 to the OHV Trail.

Construction activities may affect the recreation setting for users within visual and audible distance of construction activities and facilities. Changes in the recreation setting along the trail corridor could lead to displacement of dispersed recreational use, particularly related to non-motorized activities, and wildlife-related recreation activities (due to wildlife displacement), which currently typically occur in a quieter, less-developed, and non-motorized setting. Impacts would be localized to the trail corridor. Impacts would begin during construction and would continue through operations.

Landmark Maintenance Facility

The Landmark Maintenance Facility would be located approximately 0.1 mile south of Landmark and the historic cabins in Landmark. Access to the maintenance facility would be off Warm Lake Road (CR 10-579). Construction activities may require temporary closure or delays on Warm Lake Road, which could adversely affect the recreation experience for some recreationists. It is assumed that construction equipment would travel east on Warm Lake Road. Therefore, delays would likely affect access to Horn Creek Road (FR 414), Rec Spur 579U2 (FR 579U2), 450 South (FR 450), and Burnt Log Road (FR 447), which are east of the maintenance facility site. If the maintenance facility was constructed in conjunction with the Burntlog Route and improvements on Burnt Log Road, there may be lengthier delays and additional traffic along Warm Lake Road in this area.

Noise associated with construction activities could reduce opportunities for noise-sensitive recreation activities at and around the maintenance facility location (up to 1.1 miles away) (AECOM 2019), including wildlife-related recreation activities, because wildlife may be displaced. Construction activities would not affect use of the historic cabins; however, construction noise at the site may affect the recreation setting of the cabins, because it may be audible from the cabin sites. Therefore, some recreationists may choose to visit other areas or sites to avoid delays or noise from construction activities. Any reduction in recreation opportunities, displacement of dispersed recreational use, or changes in access would be temporary until maintenance facility construction was completed. These impacts would be localized to the area surrounding the maintenance facility, and the roads/trails accessed east of the facility off Warm Lake Road.

Communications Facilities

There are three potential cell tower sites where a 60-foot-tall tower would be constructed. The two sites within the Operations Area Boundary would not result in additional recreation-related impacts besides those discussed above for construction of mine site facilities. The third site is on Meadow Creek Lookout Road (FR 51290) at the old Meadow Creek Lookout. Construction activities for this cell tower option could interfere with hiking use in the lookout area and construction activities may affect the recreation setting for users within visual and audible distance of construction activities and facilities. Impacts would begin during construction and would conclude with construction of the cell tower.

In addition, a series of 10-foot-tall repeaters would be constructed on 3-foot by 3-foot concrete pads. Sites within the Operations Area Boundary would not result in additional construction impacts besides those discussed above for construction of mine site facilities. Construction of repeaters at the Landmark Maintenance Facility would not result in additional construction impacts besides those discussed above for the Landmark Maintenance Facility. Construction of the repeaters at the Meadow Creek and Thunderbolt Lookouts would result in the same impacts described above for construction of the cell tower at the Meadow Creek Lookout. Construction of a repeater site at a high point near Trapper Creek/Burnt Log Road intersection may affect the recreation setting for users within visual and audible distance of construction activities and facilities. The repeater site would be located in an area that does not have existing road access.

Changes in the recreation setting along access route and repeater site could lead to displacement of dispersed recreational use, particularly related to non-motorized activities, and wildlife-related recreation activities (due to wildlife displacement), which currently typically occur in a quieter, less-developed, and non-motorized setting. Impacts would be localized to the access route and repeater site. Impacts would begin during construction and would conclude with construction of the repeater site.

Transmission Line Upgrades

Transmission line upgrades along Warm Lake Road (CR 10-579), Johnson Creek Road (CR 10-413), and Cabin Creek Road (FR 467) could result in temporary road detours or delays as a result of construction activities and traffic along these roads. There could be temporary delays in accessing other roads, trails, and facilities along these roadways, including the Big Creek Summit, Cabin Creek/Thunderbolt, and Trout Creek/Thunderbolt Trailheads; Burnt Log Trail (FT 075); South Fork Salmon River, Trout Creek, Ice Hole, Golden Gate, and Yellow Pine Campgrounds; Twin Bridges dispersed camping area; and Johnson Creek Cabin. Such delays could adversely affect the recreation experience for some recreationists.

Noise associated with construction activities could reduce opportunities for more noise-sensitive recreation activities along the corridor (for a distance of 0.6 to 1 mile) (AECOM 2019), including wildlife-related recreation activities, because wildlife may be displaced. Noise from transmission line upgrade construction activities and/or utility access spur road construction activities may be above ambient levels (above 40 dBA) at the Big Creek Summit Trailhead, Cabin Creek/Thunderbolt Trailhead, Trout Creek/Thunderbolt Trailhead, Trout Creek Campground, Twin Bridges dispersed camping area, Ice Hole Campground, and South Fork Salmon River Campground (AECOM 2019). The Ice Hole and Trout Creek Campgrounds in particular would have more construction noise impacts due to their close proximity to the transmission line.

Construction activities would not occur at night, and therefore would not affect overnight camping, but may affect the setting of campgrounds during the day, particularly at the Ice Hole and Trout Creek campgrounds, and Twin Bridges dispersed camping area where construction activities would be evident (visually or audibly). Therefore, some recreationists may choose to visit other areas or roads, or access facilities/trailheads from other roads to avoid delays or noise from construction activities. Any reduction in recreation opportunities, displacement of dispersed recreational use, or changes in access would be temporary until transmission line upgrades were completed (2 to 3 years). These impacts would be localized to portions of Warm Lake Road (CR 10-579), Johnson Creek Road (CR 10-413), and Cabin Creek Road (FR 467), as well as facilities and roads accessed from these roads. Impacts would be temporary and would conclude when the transmission line upgrades were completed.

Transmission line upgrades between Cascade and Donnelly also may lead to temporary road detours or delays at Stonebreaker Lane and Loomis Lane (see maps in **Appendix N-2**). These streets provide access to recreation sites at Lake Cascade, specifically Sugarloaf Campground and Boulder Creek Day Use Area, respectively. Such delays could adversely affect the recreation experience for some recreationists. Both recreation sites are over 0.5 mile from the transmission line and, therefore, would likely not be affected by construction noise or visibility of construction activities. However, road delays or detours may result in some recreationists choosing to visit other recreation sites at the lake. Any displacement of recreational use or changes in access would be temporary until transmission line upgrades were completed (2 to 3 years). These impacts would be localized to portions of Stonebreaker Lane and Loomis Lane, as well as facilities accessed from these roads. Impacts would be temporary and would conclude when the transmission line upgrades were completed. Recreation sites accessed from roads in Cascade and Donnelly would not be affected, as the transmission line is located on the east side of State Highway 55 and, therefore, would not result in traffic delays on the west side of the highway in these towns where the recreation site access roads are located.

New Transmission Line to Mine Site

A new transmission line and associated access road to the mine site would be located along Horse Heaven Road (FR 416W) and Trail FT 233, and then continue from FT 233 east to the mine site. Transmission line construction activities may result in temporary road detours or delays in accessing other trails/areas from Horse Heaven Road (Riordan Lake Trail FT 097 primarily and trails accessed from this trail). Such delays could adversely affect the recreation experience for some recreationists. Specifically, construction activities could temporarily affect access to and use of the Riordan Trailhead on Horse Heaven Road (FR 416W) that provides access to FT 097, which leads to Riordan Lake, a popular fishing location. Impacts to this trailhead could result in a temporary reduction in recreation opportunities from this trailhead and temporary decrease in use of this trailhead. Noise associated with construction activities could reduce opportunities for noise-sensitive recreation activities along the transmission line corridor (for a distance of 0.6 to 1 mile) (AECOM 2019), including wildlife-related recreation activities, because wildlife may be displaced. Noise from transmission line construction activities may be above ambient levels (above 40 dBA) at the Meadow Creek Lookout and Riordan Trailhead (AECOM 2019). Therefore, some recreationists may choose to visit other areas or trails to avoid delays or noise from construction activities. Displacement of dispersed recreational use, reduction in recreation opportunities, or changes in access would be temporary until the transmission line was constructed. These impacts would be localized to the transmission line corridor, including Horse Heaven Road (FR 416W) and trail FT 233, as well as trails and areas accessed from Horse Heaven Road (FR 416W), including the Riordan Trailhead.

Johnson Creek Substation

The Johnson Creek substation would be located along Johnson Creek Road (CR 10-413) approximately 0.8 mile south of the Johnson Creek airstrip. Construction of the substation would result in impacts similar to those described for transmission line upgrades, including potential temporary delays accessing Johnson Creek Road (CR 10-413) and the areas and sites along this road, which could affect the recreation experience for some users. Noise associated with construction of the substation could reduce opportunities for noise-sensitive recreation activities, including wildlife-related activities, because wildlife may be displaced from the area around the substation. Construction activities at the substation would not be expected to affect physical use (landing/taking off) at the airstrip; however, construction noise may affect the recreation experience for some users. Any reduction in recreation opportunities or changes in access would be temporary until construction of the substation was completed. These impacts would be localized to the substation area.

4.19.2.1.1.2 Operations

Mine Site Facilities

Helicopters used during drilling may be visible and/or audible from nearby recreation areas, including the FCRNRW, which would impact the recreation setting, particularly for wilderness users. The presence of helicopters nearby would reduce feelings of remoteness and solitude in the wilderness, potentially impacting the recreation experience of wilderness visitors. Impacts would be temporary, because helicopters would only be used during drilling exploration.

Impacts related to reduction in acreage for recreation, described under Construction for mine site facilities, also would apply to operations of the mine site, because land within the Operations Area Boundary would remain inaccessible to the public during mine site operations.

Operation of the mine also would likely reduce recreation opportunities from the area adjacent to the Operations Area Boundary due to a change in recreation setting from increased development and noise. Operation of the mine site would result in a less-natural looking and sounding recreation setting compared to the existing recreation setting and would have substantially more man-made development and activity within the Operations Area Boundary. The mine site would introduce additional modifications to the landscape similar to those present, which would further reduce the scenic integrity of the area. The mine site also would change the landscape character of the night sky by increasing sky glow or light pollution. Activities at the mine site would be visible from several recreation areas, roads, and trails including: Thunder Mountain Road (FR 50375), Meadow Creek Lookout Road (FR 51290), the Meadow Creek/Summit Trailhead, and Meadow Creek Lookout. Given the closeness of the mine site to the FCRNRW boundary, portions of the FCRNRW would have unobstructed views of the mine site, including nighttime lighting, at superior viewing locations such as mountain tops or ridgelines. Based on modeling results (see Section 4.3.2, Direct and Indirect Effect to Air Quality), an emissions plume would be visible within the FCRNRW for up to 30 percent of annual daytime hours, with greater potential for plume visibility at times of low sun angle and with terrain as the viewing background, compared to sky as the background. The plume also would be visible for 63 to 73 percent of post-sunset nighttime hours. Presumably, if the plume would be visible within the FCRNRW, it also would be visible from other nearby NFS lands outside the Operations Area Boundary, thus affecting the recreation setting for both wilderness and non-wilderness users.

Operational noise would be audible up to 1.7 miles 24 hours a day (blasting up to 2.1 miles) (AECOM 2019), which would slightly extend past the Operations Area Boundary mainly on the east side of the mine site, reducing recreation opportunities in these areas for activities that depend on a quiet, natural environment. Wildlife in the analysis area also would be affected by operational noise, traffic, and activities, likely resulting in displacement of wildlife away from the analysis area.

Due to the changes in the recreation setting from mine site operations, some visitors may choose to participate in recreation opportunities elsewhere in the analysis area or the surrounding management areas where mine site operations would not be visible or audible. Impacts on recreation opportunities at and around the mine site would begin during construction and continue until the mine was decommissioned and the area reopened to dispersed recreation use. Some visitors may choose to remain at their displacement location rather than return to the mine site area due to permanent changes in the recreation setting within the Operations Area Boundary. Implementation of Midas Gold Idaho, Inc. (Midas Gold) and Forest Service mitigation measures specific to lighting could reduce sky glow.

Burntlog Route

Year-Round

Use of the Burntlog Route as the primary route to the mine site during operations could result in potential displacement of motorized recreational use in the summer and winter from the existing Burnt Log Road (FR 447) to other roads due to the increased traffic on Burnt Log Road, and potential traffic delays and safety-related issues from mine-related traffic along the Burntlog Route. Traffic on the Burntlog Route would be over 3.5 times the existing traffic, with AADT rising from 27 to 95 during mining operations.

Use of the Burntlog Route from mine-related traffic and borrow source areas would result in increased noise and development along this route. Traffic and development would reduce opportunities for some recreation activities, particularly wildlife-based recreation activities, because wildlife would likely be displaced from the roadway area. In addition, the presence of a roadway in a previously roadless area would reduce opportunities for non-motorized activities for users that specifically prefer a roadless and/or quiet and undeveloped environment. Due to the potential increase in dispersed recreational use along the route and/or use of the Burntlog Route for mine traffic, as well as the less-natural looking and sounding recreation setting along the Burntlog Route (including nighttime lighting), some dispersed recreational users, particularly non-motorized users, may be displaced to other locations that are less noisy, used, accessible, and modified visually. Operational traffic noise on the roadway would be above background ambient levels (40 dBA) at the Mud Lake and Burntlog dispersed camping areas and Thunder Mountain/Riordan Trailhead, and within portions of the FCRNRW as noise from passing heavy trucks may be heard up to 0.5 mile away (AECOM 2019). Road maintenance noise would be above background ambient levels up to 0.8 mile from the road in the summer, and up to 1 mile in the winter with the additional road maintenance equipment used for snow removal, which would include at the Mud Lake and Burntlog dispersed camping areas and Thunder Mountain/Riordan and Meadow Creek/Summit Trailheads, as well as portions of the FCRNRW and Landmark (AECOM 2019). The Burntlog Route would generally be visible 2 to 3 miles east of the route, including some areas within the FCRNRW, and less than one mile west of the route and would introduce nighttime lighting to areas that currently do not have such lighting. The route would result in a moderate to strong level of visual changes, particularly for the Mud Lake and Burntlog dispersed camping areas, which would be located very close to the roadway. Wilderness users may be particularly affected by the Burntlog Route, because the recreation setting (including the nighttime setting) is of great importance for wilderness experiences and the primitive recreation opportunities provided by the FCRNRW. The miles of roads adjacent to the FCRNRW would increase, the setting would be altered, requiring users to penetrate further into the wilderness to achieve a primitive setting.

Fish adjacent to the Burntlog Route may be affected by increased sediment and could be affected if a spill were to occur. While there may be injury or mortality to individual fish, population-level effects are not expected. Therefore, there may be decreased fishing success immediately along the Burntlog Route, but there would continue to be opportunities for fishing within the creeks crossed by the Burntlog Route.

Burntlog Route also would convert 350 acres to use as a road, road slopes or borrow sources. The 14.9 miles of Burntlog Route would increase the area with a semi-primitive motorized recreation setting. This could increase dispersed recreation use in some areas along Burntlog Route. However, mine-related traffic could displace recreation to other locations in or adjacent to the analysis area. Impacts would generally be along the Burntlog Route corridor; would begin once the route was constructed; and continue until closure and reclamation activities are completed. Impacts during closure and reclamation are described in Section 4.19.2.1.1.3.

Summer

The Burntlog Route would result in direct impacts to recreation access due to the use of a new access facility. The Burntlog Route, including 20 miles of improved Burnt Log Road (FR 447) and 14.9 miles of new Burntlog Route roadway (see maps in **Appendix N-2**), would be open to the public when other public access routes are closed. Direct impacts to recreation would include a new access route; improved access to the existing Burnt Log Road (FR 447) and adjacent recreation areas/facilities (including the FCRNRW and Burnt Log IRA) for a wider variety of vehicle types, particularly low-clearance passenger vehicles; and access to areas that were previously not accessible to motorized vehicles. Therefore, this new route may increase recreational use in these newly accessible areas (e.g., Black Lake), and may lead to increased use of existing recreation facilities (roads, trails, trailheads, Meadow Creek Lookout, Riordan Lake, Mud Lake dispersed camping area, Burntlog dispersed camping area, etc.) and adjacent recreation areas such as IRAs. Therefore, the Burntlog Route would increase recreation opportunities for both motorized and non-motorized uses in areas where recreation opportunities were limited due to limited access. The Burntlog Route also would alter recreational use in the analysis area by offering substitute locations for visitors who are displaced from the mine site and areas accessed off Stibnite and Thunder Mountain Roads. These impacts would primarily affect recreationists originating from Yellow Pine, and recreationists using the FCRNRW and recreation areas along the existing Burnt Log Road (FR 447) and new Burntlog Route.

Winter

Burntlog Route would be plowed in the winter, potentially providing additional opportunities and access for winter motorized recreation, which may result in increased winter recreational use along the Burntlog Route corridor (see maps in **Appendix N-2**). However, the extent of potential increased winter use of the Burntlog Route may be limited by OSV mileage ranges.

Plowing of the approximately 38-mile Burntlog Route, which includes the existing Burnt Log Road, would result in the loss of 9.8 miles of infrequently groomed OSV route along the existing Burnt Log Road. Horn Creek Road (FR 414) is a groomed OSV route for 4 miles and is accessed from Johnson Creek Road (CR 10-413) and Burnt Log Road (FR 447). Sand Creek Road (FR 437) is a groomed OSV route for 2 miles and is accessed from Burnt Log Road (FR 447). Warm Lake Road east and south of the junction with Johnson Creek Road is a groomed snowmobile route for several miles and provides access to the North Fork Sulphur Creek Road (FR 442) 3.2-mile groomed route. Plowing of the Burntlog Route and Warm Lake Road would cutoff direct OSV access to the Horn Creek Road, Sand Creek Road, and Warm Lake Road (east/south of Landmark) OSV routes from Johnson Creek Road (CR 10-413), which would be the only publicly available winter route to the Landmark area as Warm Lake Road would be closed to public winter use. Direct OSV access to other OSV routes could be cutoff because any overland travel or OSV travel across or on the plowed Warm Lake Road and Burntlog Route would have to share the roadway with mine operation traffic also using this roadway. Therefore, it would be difficult for OSVs to connect to these OSV routes, which would limit access for OSVs, and therefore reduce OSV opportunities and use. Lack of access to the Warm Lake Road OSV route south of Landmark also would affect access to the North Fork Sulphur Creek Road OSV route.

Impacts to winter recreation opportunities, facilities, use, and access from use of the Burntlog Route during operations would focus on the Burntlog Route corridor and connecting OSV routes, and would continue until the Burntlog Route was decommissioned (and therefore no longer plowed); Burnt Log Road (FR 447) returned to a groomed OSV route; and public access to Stibnite Road (CR 50-412) was reopened.

Closure of Stibnite and Thunder Mountain Roads Through the Mine Site

After construction of Burntlog Route and as part of public access control within the mine site and Operations Area Boundary, about 4.7 miles of Stibnite Road (CR 50-412) and 5.4 miles of Thunder Mountain Road (FR 50375) would be closed to public use. Therefore, the public would not be able to reach the Stibnite Mining District Interpretive Site, effectively closing this site to the public throughout operations. Impacts would be localized to just the interpretive site and would begin with the completion of Burntlog Route and conclude when access through the mine site was returned. The combined 10.1 miles of Stibnite and Thunder Mountain roads would not be closed until the Burntlog Route was constructed and available for public use.

Recreation areas and sites beyond the mine site accessed from Stibnite and Thunder Mountain roads would be available via the new Burntlog Route. Using the Burntlog Route would result in a long detour for recreationists traveling from Yellow Pine to Monumental Summit, Thunder

Mountain Road, and Meadow Creek lookout. The distance from Yellow Pine to Thunder Mountain Road under existing conditions is 13.7 miles and would be approximately 61.3 miles via the Burntlog Route. Therefore, there could be a decrease in summer and winter use of the impacted sites/areas, even with the Burntlog Route, if displaced recreationists decide to forego visiting these destinations due to added travel time. Recreational use would likely be displaced to other locations in or adjacent to the analysis area that would be more accessible from Yellow Pine in the summer and winter. These could include other portions of the FCRNRW with more accessible wilderness trailheads (such as the Big Creek area), and areas with a similar recreation setting and opportunities such as the South Fork Salmon River area. Impacted areas would include facilities and areas accessed from Thunder Mountain Road (FR 50375) and would occur from operations until Stibnite Road (CR 50-412) was reopened to public use.

OHV Trail

The OHV Trail (approximately 3 miles of new trail) would be open to all vehicles and would provide a new facility for motorized recreation. This OHV Trail would connect Meadow Creek Lookout Road (FR 51290) to a new transmission line access road on the PNF. The new transmission line access road would connect to the end of FT 233 (approximately 2 miles to the west) near the boundary between the BNF and PNF (see maps in **Appendix N-2**). FT 233 ends at the PNF and BNF boundary, and there would be an approximately 2-mile gap in public motorized use on roads and trails from the end of FT 233 to the OHV Trail. The OHV Trail would introduce new opportunities for motorized recreation use in areas that currently do not have motorized trails. Therefore, this new trail may increase recreation use in these newly accessible areas and could increase use of existing recreation facilities (e.g. roads, trails, trailheads, Meadow Creek Lookout, Riordan Lake). The new OHV Trail also would alter recreational use in the analysis area by offering a substitute motorized trail for forest visitors who are displaced from the mine site and areas accessed from either Stibnite or Thunder Mountain roads. Although the OHV Trail would provide more motorized recreation opportunities, motorized use on the trail would reduce non-motorized recreation opportunities due to changes in the recreation setting from motorized vehicle noise and presence. Changes in the recreation setting along the trail corridor could lead to displacement of dispersed recreational use, particularly related to non-motorized activities, wilderness activities, and wildlife-related recreation activities (due to wildlife displacement), which currently typically occur in a quieter, less-developed, and non-motorized setting. Impacts to recreation access, opportunities, and use would begin once the trail was open to the public and continue until the trail was decommissioned. There would be an approximately 2-mile gap in public motor use facilities between the end of FT 233 and the beginning of the OHV Trail. Because of this, the new OHV trail would not provide additional public motor use trail connections or loop opportunities (see maps in **Appendix N-2**).

Landmark Maintenance Facility

Development of the Landmark Maintenance Facility would reduce recreation opportunities due to physical removal of acreage for the facility (3.5 acres). Traffic due to maintenance activities and vehicles would not be expected to result in frequent traffic delays on Warm Lake Road (CR 10-579), but may result in occasional delays due to road plowing, grading, repairs, etc.

Traffic and other operational noise from the maintenance facility would generally not be audible from the facility. However, road maintenance activities would result in noise levels above background ambient noise levels of 40 dBA for up to 0.8 to 1 mile from the road (AECOM 2019). This would likely reduce opportunities for some recreational activities in this area, particularly wildlife-related recreation activities, because wildlife may be displaced from the general maintenance facility area. Operation activity noise from the maintenance facility would not be heard at the historic cabins at Landmark, although the large buildings and solar panels at the facility may be visible from the historic cabins and from nearby roads. The maintenance facility would increase man-made development in the Landmark area, including nighttime lighting, resulting in a moderate, long-term visual contrast. Such changes may affect the recreation setting of the general Landmark area, including the historic cabins and roads in the area, by decreasing the feeling of remoteness and thus affect the recreation experience for visitors to Landmark. Impacts would generally be limited to the area within visual and audible distance of the maintenance facility, and would begin once the facility was operational, and conclude once the facility was decommissioned.

Communications Facilities

Of the three potential cell tower sites, two of the sites would be within the Operations Area Boundary. Therefore, at 60 feet tall, either of these towers would not be visible to recreationists in the FCRNRW. However, both cell tower locations would be visible from portions of Thunder Mountain Road (FR 50375). The third site is on Meadow Creek Lookout Road (FR 51290) and, given its location adjacent to the lookout, would be visible to visitors to the old lookout and the area surrounding the lookout, including at the Meadow Creek/Summit Trailhead. For dispersed area visitors in the area surrounding the lookout, presence of the cell tower would have an adverse effect on the recreation setting due to the addition of modern man-made development adjacent to a historic building, thereby impacting visitor’s recreation experiences. In addition, new cellular coverage along the Burntlog Route and on other NFS lands in the analysis area would increase visitor safety; however, additional cellular coverage would detract from primitive recreation experiences. Impacts would begin once the cell tower was constructed and would conclude with closure and reclamation of the site.

Due to the small size of the repeater sites, locations within the Operations Area Boundary would not be visible to recreation areas outside the boundary, including the FCRNRW, and therefore would not affect the recreation setting. Repeaters at the Landmark Maintenance Facility would be included in the general recreation setting impacts described above for the maintenance facility. Repeater sites at the Meadow Creek and Thunderbolt Lookouts would result in the same impacts described above for the cell tower at the Meadow Creek Lookout. A repeater site at Trapper Creek/Burnt Log Road intersection would have an adverse effect on the recreation setting due to the addition of man-made development in a semi-primitive area, thereby impacting visitor’s recreation experiences. Repeater facilities could assist with reducing the risk of vehicle collisions on the Burntlog Route, and may accelerate accident response, which would provide benefits to recreation visitors along the Burntlog Route. Impacts would begin once the repeaters were constructed and would conclude with closure and reclamation of these sites.

Upgraded Transmission Line

The upgraded transmission line would be a wider and taller (by 30 feet) facility with an expanded right-of-way (ROW) (by 50 feet, for a total ROW of up to 150 feet), and therefore may become more noticeable in the recreation setting, particularly for recreationists at campgrounds along Johnson Creek Road (CR 10-413) and at the South Fork Salmon River Campground near Warm Lake Road (CR 10-579), due to the static views of recreationists from these locations. The recreation setting of the South Fork Salmon River, Trout Creek, and Ice Hole Campgrounds, and Twin Bridges dispersed camping area could be affected by the upgraded transmission line. The upgraded transmission line may result in a more developed recreation setting for these facilities, particularly the Trout Creek Campground and Twin Bridges dispersed camping area, from which the existing transmission line is already visible and ROW expansion may affect existing tree screening. This change in recreation setting would affect recreation experiences and may result in some recreationists choosing to visit other campgrounds or dispersed camping areas with a less-developed setting either within the analysis area or adjacent to the analysis area, such as in the South Fork Salmon River area. The larger transmission line facilities also would affect the recreation setting for dispersed recreation areas along Warm Lake Road (CR 10-579), Johnson Creek Road (CR 10-413), and Cabin Creek Road (FR 467). Trail and trailhead facilities from which the upgraded transmission line would be visible would include Burnt Log Trail (FT 075), Cabin/Thunderbolt Trail (FT 086), Trout/Thunderbolt Trail (FT 091), Big Creek Summit Trail (FT 150), Trout/Thunderbolt Trailhead, Cabin Creek/Thunderbolt Trailhead, and the Thunderbolt Lookout. Dispersed recreation users would be able to move away from the transmission line; therefore, this change in the recreation setting may not influence their recreation experience to the same extent. Impacts would be permanent, because the transmission line would remain after closure and reclamation.

New Transmission Line to Mine Site

The new transmission line to the mine site would reduce recreation opportunities due to physical removal of acreage for transmission line facilities (approximately 115 acres). Although recreation could still occur underneath the transmission line, the recreation setting would change due to the increased presence of man-made development and the clearing of existing vegetation along the ROW, including within view of Thunder Mountain Road (FR 50375), Meadow Creek Lookout Road (FR 51290), Riordan Lake Trail (FT 097), Riordan Trailhead, Meadow Creek/Summit Trailhead, and the Meadow Creek Lookout. Trail FT 233 would be upgraded for use as a transmission line access road, which would make the trail passable for a wider range of vehicles, resulting in impacts to recreation access, and potentially new recreation opportunities and use, due to increased access. The upgraded FT 233 would connect to trail FT 097 and Horse Heaven Road (FR 416W). However, there would be a 2-mile gap in public motor use facilities between the end of FT 233 and the beginning of the OHV Trail and thus the upgraded FT 233 would not provide additional trail connections or loop opportunities (see maps in **Appendix N-2**). The remainder of the transmission line access road from the end of FT 233 would available for administrative use and would not be available for public motorized recreation. Unauthorized public motorized use of the transmission line access road may occur to reach the OHV Trail. Impacts from the transmission line and associated access roads would begin when the portion of the transmission line road on FT 233 was open to the public, and end with closure and reclamation of the transmission line and access road, and FT 233 improvements were removed.

Johnson Creek Substation

Development of the Johnson Creek substation would reduce recreation opportunities due to physical removal of acreage for the substation (0.4 acre). Therefore, dispersed recreational use that may occur at this location would be displaced to other locations in the analysis area. The substation also would increase man-made development in this area of Johnson Creek Road (CR 10-413) and may affect the recreation setting of the nearby Johnson Creek airstrip, because flyers could see the substation as they approach the airstrip. This may decrease the feeling of remoteness when flying into the airstrip, thereby affecting the recreation experience for airstrip visitors. Impacts would be limited to the area within visual distance of the substation and would begin once the substation was constructed.

4.19.2.1.1.3 Closure and Reclamation

Mine Site Facilities

Impacts during closure and reclamation of the mine would be the same as those described for construction: no recreation uses within the Operations Area Boundary and corresponding displacement of dispersed recreation, noise, and setting-related reduction in recreation opportunities, including wildlife-related recreation activities around the mine site. Closure and reclamation noise would be audible up to 1.2 miles (AECOM 2019), therefore reducing recreation opportunities in these areas for activities that depend on a quiet, natural environment, such as wilderness or primitive recreation activities.

If wildlife does not re-populate the mine site after reclamation, there would be a reduction in wildlife-related recreation opportunities. Fish species composition and/or relative populations within the creeks in the mine site area may change after reclamation, as anticipated habitat may favor steelhead over Chinook salmon, and there would be a decrease in habitat for bull trout and westslope cutthroat trout and Chinook salmon. Therefore, fishing opportunities may be altered after reclamation as well.

Though nighttime lighting would cease, post-mine reclamation, the mine site would have a less natural looking recreation setting compared to the existing recreation setting. The mine site would have substantially more man-made development present that would be noticeable to visitors because the mine site access road would require visitors to pass over and next to former mine site facilities that would dominate the setting. Reclaimed facilities from the mine site would be visible from portions of the FCRNRW at superior viewing locations, such as mountain tops or ridgelines, as well as from the Meadow Creek/Summit Trailhead and Meadow Creek Lookout. It would take a long time for the mine site area to fully revegetate and vegetation that grows may not resemble the structure and density of existing vegetation (e.g., timber), and the landscape for humans may never return to existing levels. Therefore, the recreation setting of the mine site would likely be permanently altered. Although some dispersed recreation use may return to the mine site area after reclamation, due to the changes in the recreation setting, some visitors may choose to participate in recreation opportunities elsewhere in the analysis area or the surrounding management areas where the recreation setting is more natural. Overall, impacts to recreation would occur during closure/reclamation, and would continue after reclamation was completed.

Burntlog Route

As part of decommissioning the Burntlog Route, 20 miles of Burnt Log Road (FR 447) would be reduced in width to the pre-mining width, along with 0.7 mile of Meadow Creek Lookout Road (FR 51290), and 1.9 miles of Thunder Mountain Road (FR 50375). However, these roads would retain flatter grades and gentler curves. In addition, the 14.9 miles of new roadway would be recontoured; with culverts and bridges removed, and 6 inches of growth media placed on the roadway and seeded.

Impacts during the 2-year decommissioning of the roadway would be the same as those described for construction: temporary access reductions along Burnt Log Road (FR 447), Meadow Creek Lookout Road (FR 51290), and Thunder Mountain Road (FR 50375) and trails/areas accessed from these roadways; related temporary reduction in recreation opportunities along Burnt Log Road (FR 447) and areas accessed from this road; impacts to the recreation setting along the Burntlog Route corridor due to reclamation activity noise and related potential displacement of dispersed recreation use (particularly related to non-motorized activities), wilderness activities, wildlife-related recreation activities (due to wildlife displacement); and camping at the Mud Lake and Burnt Log dispersed camping areas. In addition, there could be substantial traffic on the Burntlog Route (52 AADT, a 93 percent increase from existing traffic) until it was decommissioned, resulting in traffic-related impacts to recreation described under Operations. Noise from decommissioning of the Burntlog Route would be above ambient levels (40 dBA) within portions of the FCRNRW and at Mud Lake and Burntlog dispersed camping areas, Thunder Mountain/Riordan Trailhead, Meadow Creek/Summit Trailhead, Meadow Creek Lookout and Landmark (AECOM 2019).

Once decommissioned, year-round operational impacts from the route would cease, including displacement of motorized recreational use in the summer and winter due to increased traffic, reduced recreation opportunities due to increased noise and development along the route, reduced opportunities for non-motorized use due to presence of a roadway, and physical reduction in area for recreation and related displacement of dispersed recreational use. Operational summer impacts also would cease, including new motorized access facility, access to recreation areas adjacent to the new roadway portion of the route, and increased recreational use of previously inaccessible areas. Winter-related operational impacts would cease as well, including additional opportunities and access for winter motorized recreation; related potential increased winter use of the route area; loss of 6 miles of groomed OSV route; and lack of OSV route connectivity to the OSV routes east and south of Landmark.

Although the width of 20 miles of Burnt Log Road (FR 447) would be reduced, the retention of flatter grades and gentler curves may allow continued access on this road by a wider variety of vehicle types. Therefore, impacts to access on Burnt Log Road may continue after decommissioning. Related increased recreational use of existing recreation facilities and areas along this road (e.g. trails, trailheads, Mud Lake dispersed camping area, Burntlog dispersed camping area) also may continue past decommissioning. Although the new roadway would be recontoured and seeded, it would take many years for trees (20+ years) for recontoured and seeded areas to appear as natural vegetation. In addition, 1.5 miles of soil nail walls would remain along the roadway after decommissioning. Therefore, the recreation setting in this area would likely appear disturbed for a long time. Due to the closeness of the FCRNRW to the Burntlog Route new roadway, this modified recreation setting could detract from the recreation setting for some forest visitors and require users to go further to achieve semi-primitive non-motorized or primitive recreation setting.

As stated above, it may take many years for the Burntlog Route roadway to completely revegetate. Therefore, evidence of a roadway would remain for some time, potentially receiving unauthorized use after decommissioning.

Public Access After Reclamation

Under Alternative 1, public access through the mine site after reclamation/closure would be on a reopened Stibnite Road (CR 50-412), which would include a permanent road through the backfilled Yellow Pine pit (see maps in **Appendix N-2**). Access to recreation sites/areas off Stibnite Road (CR 50-412) and Thunder Mountain Road would no longer be via the Burntlog Route (because this would be decommissioned) but would be via a reopened and reclaimed Stibnite Road. Reopening Stibnite Road would reverse impacts described under operations: closure (due to inaccessibility) of the Stibnite Mining District Interpretive Site; elimination of access to Thunder Mountain Road (FR 50375) and the sites/areas accessed from this road; and related reduction in recreational use and opportunities at these sites/areas. Displaced visitors that avoided the Thunder Mountain Road (FR 50375) sites/areas due to the long Burntlog Route detour during mine site operations could now visit these sites from Yellow Pine on a much shorter route (via Stibnite Road). The availability of access on Stibnite Road (CR 50-412) after closure and reclamation would likely transfer some recreational use that was previously displaced during construction and operations back to the analysis area; specifically, the Stibnite and Thunder Mountain Road areas. Impacts to recreation access, opportunities, and use from public access through the mine site via a reopened Stibnite Road would continue beyond closure and reclamation.

OHV Trail

The OHV Trail would be closed, recontoured, and seeded. Impacts during closure and reclamation of the trail would be the same as those described for construction: impacts to the recreation setting for users within visual and audible distance of reclamation activities; and potential related displacement of dispersed recreational use, particularly non-motorized activities, wilderness activities, and wildlife-related recreation activities. Closure and reclamation of the trail would cease operational impacts of the trail, including new opportunities for motorized recreation; increased dispersed recreational areas accessible from Meadow Creek Lookout Road (FR 51290) and the larger Burntlog Route, and related potential increased recreation use within these newly accessible areas and increased use of existing recreation facilities; and reduced non-motorized recreation opportunities due to changes in the recreation setting from motorized vehicle noise and presence, and related displacement of dispersed recreational use, particularly related to non-motorized activities, wilderness activities, and wildlife-related recreation activities. Reduced motorized access, reduced opportunities for motorized recreation, reduced recreational use of existing sites and sites along the Burntlog Route, and return of non-motorized recreation opportunities to the area would continue after decommissioning of the trail. Although the trail would be recontoured and seeded, unauthorized use of this facility may continue after reclamation.

Landmark Maintenance Facility

As part of closure and reclamation, the Landmark Maintenance Facility would be removed, the site graded, and drainage would be reclaimed. It is assumed that the approximately 3.5-acre site also would be seeded and become available for public recreational use following decommissioning. Impacts to recreation during closure and reclamation would be the same as those described for construction: potential temporary closure or delays on Warm Lake Road (CR 10-579) resulting in impacts to recreation experiences; reduction in some recreation opportunities due to noise; and potential recreation setting impacts to historic cabins in Landmark due to noise. Any reduction in recreation opportunities, displacement of dispersed recreational use, or changes in access would be temporary until the maintenance facility was closed and reclaimed. Once the facility was closed and the site reclaimed, impacts related to loss of acreage for recreation, and changes to the recreation setting of the historic cabins and roads in the area, would cease. These impacts would be localized to the area surrounding the maintenance facility and the roads/trails accessed east of the facility off Warm Lake Road (CR 10-579).

Communications Facilities

For the two cell tower sites within the Operations Area Boundary, impacts from closure and reclamation would not result in additional impacts besides those discussed above for closure and reclamation of mine site facilities. The third site is on Meadow Creek Lookout Road (FR 51290) at the old lookout. Closure and reclamation activities for this cell tower would result in the same impacts as those described for construction. The reduction in cellular coverage in portions of the analysis area near the mine site area and along the Burntlog Route would be the same as existing conditions after the cell towers are removed. Although areas that were previously inaccessible to vehicles would generally return to being inaccessible as the Burntlog Route was decommissioned, there may be some unauthorized use of the route that may persist after decommissioning. The loss of cellular coverage also would aid in returning primitive recreation experiences to the FCRNRW areas adjacent to the Burntlog Route and mine site.

Reclamation of repeater sites within the Operations Area Boundary would not result in additional impacts besides those discussed above for closure and reclamation of mine site facilities. Reclamation of repeaters at the Landmark Maintenance Facility would not result in additional impacts besides those discussed above for the Landmark Maintenance Facility. Reclamation of repeater sites at the Meadow Creek and Thunderbolt Lookouts and Trapper Creek/Burnt Log Road intersection would result in the same impacts as those described for construction.

Upgraded Transmission Line

The upgraded transmission line from Lake Fork to Johnson Creek substation would be retained and used by Idaho Power Company. Therefore, impacts described under Operations for the upgraded transmission line would be permanent, which includes impacts to the recreation setting and recreation experiences.

New Transmission Line to Mine Site

The new transmission line to the mine site would be disassembled, and the ROW would be recontoured and seeded. The improvements made to FT 233 and Horse Heaven Road (FR 416W) also would be removed. Impacts during decommissioning of the transmission line, transmission line road, and road/trail improvements would be the same as those described for construction: potential temporary closure or delays on Horse Heaven Road (FR 416W) and FT 233 resulting in impacts to recreation experiences; and reduction in some recreation opportunities due to noise. Once the mine is closed, operational impacts from the new transmission line would cease, including loss of physical acreage for recreation, and trail access, use, and opportunities for a wider range of vehicles due to road improvements. Although the transmission line access road would be recontoured and seeded, unauthorized use of this facility may continue after closure. Displacement of recreation access, use, and opportunities from the improved FT 233 would continue beyond closure, and unauthorized use of the transmission line road may continue beyond closure.

Johnson Creek Substation

The upgraded transmission line from Lake Fork to Johnson Creek substation would be retained and used by Idaho Power Company, and the Johnson Creek substation would remain in place and would not be decommissioned. Therefore, impacts described under Operations for the Johnson Creek substation would remain after mine closure, which include loss of acreage for recreation, and impacts to the recreation setting and recreation experiences.

4.19.2.1.2 ROS CLASSES AND PHYSICAL SETTING

4.19.2.1.2.1 Designated ROS Classes

Mine Site Facilities

During construction, operations, and closure/reclamation, public recreation would not be allowed within the Operations Area Boundary surrounding the mine site facilities. Public closure of this area would not result in inconsistencies with the existing ROS designation classes (Roaded Modified, Roaded Natural, and Semi-Primitive Non-Motorized) within the Operations Area Boundary during construction, operations, and reclamation/closure. Due to setting alterations during construction, operation and mine closure and reclamation as described in

Section 4.19.2.1.1.3 above, the mine site post-reclamation may be inconsistent with Roaded Natural and Semi-Primitive Non-Motorized designations and could be more consistent with a Roaded Modified designation.

Public Access After Reclamation

Public access through the mine site would be located in an area currently designated as Roaded Natural, which allows for some landscape modification from roads. Therefore, public access through the mine site after reclamation would not result in inconsistencies with the existing ROS designation.

Burntlog Route

Summer

Burntlog Route would be in areas designated currently as Roaded Modified, Roaded Natural, and Semi-Primitive Non-Motorized. The Burntlog Route in areas designated as Roaded Modified and Roaded Natural would not result in inconsistencies with the existing ROS designation classes because they already account for landscape modification from roads. The Burntlog Route within the area currently designated as Semi-Primitive Non-Motorized (approximately 86 acres) would not be consistent with this designation and would be more consistent with a designation of Roaded Natural. This impact would occur from construction and would continue after closure and reclamation of the road due to the length of time it would take for the road to return to a natural-appearing condition.

Winter

The Burntlog Route would be plowed, and the area surrounding plowed roads is typically designated as Roaded Natural or Rural in the winter. The Burntlog Route alignment including the existing Burnt Log Road and unroaded areas is currently designated as Semi-Primitive Motorized in the winter. Therefore, plowing Burntlog Route including the 9.8 miles of infrequently groomed OSV route would not be consistent with the existing winter ROS designation class surrounding Burntlog Route, and would be more consistent with a designation of Roaded Natural. This impact would occur from construction through closure and reclamation. After closure and reclamation of the route, plowing would end; therefore, the route would not continue to be inconsistent with the existing ROS designation of Semi-Primitive Motorized.

Yellow Pine Route

Summer

The areas surrounding roads that would be used as part of the Yellow Pine Route are currently designated as Roaded Natural; therefore, increased traffic on these roads as part of construction would not result in inconsistencies with the existing ROS designation surrounding the roads.

Winter

During construction of the Burntlog Route, Johnson Creek Road (CR 10-413) from Wapiti Meadow Ranch to Landmark would be plowed and, and as currently occurs, Stibnite Road (CR 50-412) from Yellow Pine to the mine site would be plowed. The area surrounding plowed roads is typically designated as Roaded Natural or Rural in the winter. The area along Johnson Creek Road (CR 10-413) south of Wapiti Meadow Ranch is currently designated as Semi-Primitive Motorized in the winter. In the winter, the area along Stibnite Road is designated as Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Modified and Roaded Natural. Therefore, plowing 6.7 miles of Johnson Creek Road (CR 10-413) and existing and continued plowing of Stibnite Road would not be consistent with the existing winter ROS designation classes of Semi-Primitive Motorized and Semi-Primitive Non-Motorized along these roadways, and would be more consistent with a designation of Roaded Natural. This impact would end once the Burntlog Route was operational. Creating a temporary groomed OSV route just west of Johnson Creek Road (CR 10-413) (due to the plowing of the road) would not be inconsistent with the existing winter ROS designation of Semi-Primitive Motorized surrounding Johnson Creek Road (CR 10-413).

Warm Lake Road

Summer

The area surrounding Warm Lake Road (CR 10-579) is currently designated as Roaded Natural and Rural; therefore, increased traffic on this road would not result in inconsistencies with the existing ROS designations.

Winter

Warm Lake Road (CR 10-579) from Warm Lake to Landmark also would be plowed under Alternative 1. However, this section of road is currently a groomed OSV route and is in an area designated as Semi-Primitive Motorized in the winter. Therefore, plowing Warm Lake Road (CR 10-579) from Warm Lake to Landmark would not be consistent with the existing winter ROS designation class for the area surrounding the roadway, and would be more consistent with a designation of Roaded Natural. This impact would occur from construction through closure and reclamation.

As part of Alternative 1, a new groomed OSV route along Cabin Creek Road from Warm Lake to Trout Creek Campground would be created along with a parking area in the Warm Lake area. This groomed OSV route would be in an area currently designated as Semi-Primitive Motorized in the winter, which is typically what the area around a groomed OSV trails is designated. Therefore, a new groomed OSV route along Cabin Creek Road would not result in inconsistencies with the existing ROS designation class. The parking area would be located in an area currently designated as Roaded Natural and therefore would not result in inconsistencies with the existing ROS designation class.

Closure of Stibnite and Thunder Mountain Roads Through the Mine Site

Closure of these road portions during construction, operations, and reclamation/closure would not result in inconsistencies with the existing ROS designation class of the area surrounding either road.

Meadow Creek OHV Connector Trail

The Meadow Creek OHV Connector Trail would be in an area currently designated as Semi-Primitive Non-Motorized. Allowing motorized use along the trail (approximately 5.4 acres) would be inconsistent with this ROS designation and would be more consistent with a designation of Semi-Primitive Motorized. This impact would occur from construction through closure and reclamation. After closing the trail, the area would presumably return to being non-motorized; and therefore, would again be consistent with the existing ROS designation.

Landmark Maintenance Facility

The Landmark Maintenance Facility would be in an area currently designated as Roaded Natural, which can have limited modifications that are visually subordinate to viewers. Therefore, the maintenance facility in this area would not result in inconsistencies with the existing ROS designation class.

Communications Facilities

Two of the three proposed cell tower locations and several of the repeater sites would be within the mine site Operations Area Boundary. Impacts to existing ROS designations at the mine site are discussed above. The third cell tower site would be along Meadow Creek Lookout Road (FR 51290). The lookout area is currently designated as Roaded Natural. Therefore, a cell tower would be consistent with the existing ROS designation class. One of the repeater site locations would be at the Landmark Maintenance Facility. Impacts to the existing ROS designation at this facility location are described above and would apply to adding a repeater at this location. A repeater site at the existing Meadow Creek Lookout or the old Thunderbolt Lookout would not result in inconsistencies with the existing ROS designation classes for these areas as they both allow modifications (Roaded Natural and Roaded Modified, respectively). A repeater site at the Trapper Creek/Burnt Log Road intersection would not result in inconsistency with the existing ROS designation class as it is currently designated as Roaded Modified, which allows for some landscape modification.

Upgraded Transmission Line

The transmission lines to be upgraded along Warm Lake Road, Cabin Creek Road, and Johnson Creek Road (CR 10-413) are in areas currently designated as Roaded Modified and Roaded Natural. Therefore, upgrades to these transmission lines would not result in inconsistencies with the existing ROS designation classes in the transmission line ROWs because these classifications allow moderate evidences of the sights and sounds of man.

New Transmission Line to Mine Site

The new transmission line and access road in PNF Management Area (MA) 13 would be in an area designated as Semi-Primitive Non-Motorized. Allowing motorized use for transmission line construction and maintenance along the new access roads would be inconsistent with the existing ROS designation and would be more consistent with a designation of Semi-Primitive Motorized or Roaded Natural. This impact would occur from construction through closure and reclamation. After decommissioning of the transmission line and closure of the associated road, the area would presumably return to being non-motorized, and therefore would again be consistent with the existing ROS designation.

The new transmission line and access road in BNF MA 21 would be in areas currently designated as Roaded Modified, which is a subclassification of Roaded Natural, where there is more landscape modification (roads, management activities) than under Roaded Natural, but not enough modification to qualify as Rural. Therefore, creation of the transmission line and associated road in this classification would not result in inconsistencies with the existing ROS designation class for the transmission line ROW in BNF MA 21.

Johnson Creek Substation

The new substation would be located in an area currently designated as Roaded Modified (along Johnson Creek Road [CR 10-413]) and, therefore, would not result in inconsistencies with the existing ROS designation class as this class allows for moderate evidences of the sights and sounds of man.

4.19.2.1.2.2 Estimated ROS Physical Setting

Mine Site Facilities

During construction, operations, and closure/reclamation, public recreation would not be allowed within the Operations Area Boundary surrounding the mine site facilities. Public closure of this area would not result in changes to the existing estimated ROS physical settings within the Operations Area Boundary (Rural, Roaded Natural and Semi-Primitive Non-Motorized). However, the recreation setting would be changed from construction, mining operations, and closure/reclamation. Due to setting alterations and the increased evidence of humans as described in Section 4.19.2.1.1.3 above, the existing estimated ROS physical setting class of Semi-Primitive Non-Motorized within the mine site area would be altered to Roaded Natural. Changes to the recreation setting within the mine site area would be consistent with the existing estimated ROS physical settings of Rural and Roaded Natural. Graphical representations of the estimated ROS physical settings are shown in **Appendix N-2,** Chapter 4, Recreation Mapbooks and Figures, Alternative 1.

Public Access After Reclamation

Public access through the mine site would be located in an area with an existing estimated ROS physical setting of Rural, which allows for strong evidence of designed roads. Therefore, public access through the mine site after closure and reclamation would not result in a change to the existing estimated ROS physical setting.

Burntlog Route

Summer

The Burntlog Route would decrease remoteness and increase the evidence of humans along the roadway; in particular, along the new roadway segments. Therefore, the existing estimated ROS physical settings of Semi-Primitive Motorized and Semi-Primitive Non-Motorized along the Burntlog Route would be altered to Roaded Natural, because Roaded Natural has a remoteness criteria of within 0.5 mile from “better than primitive” roads, and the Burntlog Route would be considered a “better than primitive” road (see **Table 4.19-1**). In addition, the Burntlog Route would increase the evidence of humans along the route due to the large amount of mine traffic that would be present on the road. There are a few areas where presence of the new roadway would alter an area near the roadway from an existing estimated ROS physical setting of Semi-Primitive Non-Motorized to Semi-Primitive Motorized or Primitive to Semi-Primitive Non-Motorized due to a decrease in remoteness. The Burntlog Route in areas with an existing estimated ROS physical setting of Roaded Natural would not result in inconsistencies with this setting.

Table 4.19-1 Comparison of Existing and Alternative 1 Estimated ROS Physical Setting Classes in the Analysis Area – Summer

Estimated ROS Physical Setting Class	Existing Acreage – Summer	Operational Acreage – Summer	Total Change in Acreage	Locations of Changes
Primitive	17,278	16,838	-440	Burntlog Route
Semi-Primitive Non-Motorized	218,512	207,209	-11,303	Mine Site, Burntlog Route, area west of Mine Site, OHV Trail, new transmission line to Mine Site
Semi-Primitive Motorized	83,497	86,324	2,827	Lost acreage: Burntlog Route, Mine Site Gained acreage: OHV Trail, area west of Mine Site, new transmission line to Mine Site
Roaded Natural	140,594	138,136	-2,458	Lost acreage: Mine Site Gain acreage: Burntlog Route
Rural	81,450	79,379	-2,071	Mine Site
Mine Site	0	13,446	13,446	Mine Site (acreage removed from other classes for the Mine Site)

Table Source: AECOM 2020

Winter

In the winter, the Burntlog Route area has an existing estimated ROS physical setting of Semi-Primitive Motorized, because a portion of the route is currently a groomed OSV route. However, the plowing of Burntlog Route would alter the physical setting of this roadway area to Roaded Natural in the winter (see **Table 4.19-2**), because the area surrounding plowed routes is considered Rural or Roaded Natural. Although the setting of the route would become less remote and the evidence of humans would be more noticeable, the road would still be in a fairly remote area away from other plowed routes or groomed snowmobile routes. Therefore, the setting would not change enough to be considered Rural.

Table 4.19-2 Comparison of Existing and Alternative 1 Estimated ROS Physical Setting Classes in the Analysis Area – Winter

Estimated ROS Physical Setting Class	Existing Acreage – Winter	Operational Acreage – Winter	Total Change in Acreage	Locations of Changes
Primitive	21,370	20,930	-440	Burntlog Route
Semi-Primitive Non-Motorized	245,210	233,645	-11,565	Mine Site
Semi-Primitive Motorized	240,387	219,254	-21,133	Burntlog Route, Mine Site, Cabin Creek Road
Semi-Primitive Motorized Groomed	50,436*	46,135	-4,301	Lost acreage: Warm Lake Road, Burnt Log Road Gained acreage: Cabin Creek Road
Roaded Natural	7,511	23,244	15,733	Lost acreage: Mine Site Gained acreage: Burntlog Route
Rural	26,853	30,813	3,960	Warm Lake Road from Warm Lake to Landmark, Burntlog Route
Mine Site	0	13,446	13,446	Mine Site (acreage removed from other classes for the Mine Site)

Table Source: AECOM 2020

Table Notes:

*This acreage overlaps other features.

Yellow Pine Route

Summer

The areas surrounding roads that would be used as part of the Yellow Pine Route have an existing estimated ROS physical setting of Roaded Natural and Rural. Therefore, increased traffic on these roads as part of construction would not alter the existing estimated ROS physical setting for the areas surrounding these roads.

Winter

During construction of the Burntlog Route, Johnson Creek Road (CR 10-413) from Wapiti Meadow Ranch to Landmark and, and as currently occurs, Stibnite Road (CR 50-412) from Yellow Pine to the mine site would be plowed. Currently, the estimated ROS physical setting of the area surrounding this portion of Johnson Creek Road (CR 10-413) is Semi-Primitive Motorized. Stibnite Road currently is within an area with an estimated ROS physical setting of Roaded Natural in the winter. Continued plowing of Stibnite Road would not alter this estimated ROS physical setting. However, plowing of Johnson Creek Road (CR 10-413) from Wapiti Meadow Ranch to Landmark would alter the physical setting of the area surrounding this road to Rural (due to the closeness to other plowed routes), but only temporarily; therefore, acreage related to this change is not reflected in **Table 4.19-2**.

Warm Lake Road

Summer

The area surrounding Warm Lake Road (CR 10-579) has an existing estimated ROS physical setting of Rural. Therefore, increased traffic on this road would not alter the existing estimated ROS physical setting for the area surrounding this road.

Winter

Under Alternative 1, Warm Lake Road (CR 10-579) would be plowed from construction through mine closure and reclamation. Currently, the portion of Warm Lake Road that is not plowed (from Warm Lake to Landmark), but is a groomed OSV route, is within an area with an estimated ROS physical setting of Semi-Primitive Motorized. Plowing this portion of Warm Lake Road would alter the estimated ROS physical setting of the area surrounding this portion of the roadway to Rural in the winter (see **Table 4.19-2**), because it would be adjacent to other plowed routes.

As part of Alternative 1, a new groomed OSV route along Cabin Creek Road (FR 467) from Warm Lake to Trout Creek Campground would be created along with a parking area in the Warm Lake area. This OSV route would be in an area with an estimated ROS physical setting of Semi-Primitive Motorized, which is typical for areas surrounding groomed OSV routes. Therefore, the addition of a groomed OSV route along Cabin Creek Road would not alter the estimated ROS physical setting of the roadway area in the winter. The parking area would be located in an area with an estimated ROS physical setting of Rural and therefore would not alter the estimated ROS physical setting of the parking area.

Closure of Stibnite and Thunder Mountain Roads Through the Mine Site

Closure of Stibnite and Thunder Mountain roads through the mine site during construction, operations, and closure/reclamation would not result in changes to the estimated physical ROS setting of the area surrounding either road (Rural and Roaded Natural).

OHV Trail

The OHV Trail would be a motorized trail in an area with an existing estimated ROS physical setting of Semi-Primitive Non-Motorized. Therefore, the trail would alter the estimated ROS physical setting of Semi-Primitive Non-Motorized to a Semi-Primitive Motorized physical setting (see **Table 4.19-1**).

Landmark Maintenance Facility

The new Landmark Maintenance Facility would be in an area with an existing estimated ROS physical setting of Roaded Natural, and therefore would not result in any alterations to the existing estimated ROS physical setting.

Communications Facilities

Two of the three proposed cell tower locations and several of the repeater sites would be within the mine site Operations Area Boundary. Impacts to existing estimated ROS physical settings in the mine site are discussed above. The third cell tower site, and a repeater site, would be along Meadow Creek Lookout Road at the old lookout. This cell tower and repeater site would be in an area with an existing estimated ROS physical setting of Roaded Natural, and therefore would not result in any alterations to the existing estimated ROS physical setting. One of the repeater site locations would be at the Landmark Maintenance Facility. Impacts to the existing estimated ROS physical setting at this facility location are described above and would apply to adding a repeater at this location. A repeater site at the old Thunderbolt Lookout would be in an area with an existing estimated ROS physical setting of Semi-Primitive Motorized. Due to the small size of the repeater site, the repeater would not result in any alterations to the existing estimated ROS physical setting. A repeater site at the intersection of Trapper Creek and Burnt Log Road (FR 447) would be in an area with an existing physical setting of Roaded Natural and therefore would not result in any alterations to the existing estimated ROS physical setting.

Upgraded Transmission Line

The transmission lines to be upgraded along Warm Lake Road (CR 10-579), Cabin Creek Road, and Johnson Creek Road (CR 10-413) would be in areas with an estimated ROS physical setting of Rural, Semi-Primitive Motorized, and Roaded Natural, respectively. Therefore, upgrades to transmission lines along Warm Lake, Cabin Creek, and Johnson Creek Roads would not alter the estimated ROS physical setting surrounding these roadways.

New Transmission Line to Mine Site

The new transmission line and associated access road to the mine site would be in areas with an estimated ROS physical setting of Semi-Primitive Motorized and Semi-Primitive Non-Motorized. The creation of a new road and transmission line facility would alter the Semi-Primitive Non-Motorized setting to Semi-Primitive Motorized (see **Table 4.19-1**).

Johnson Creek Substation

The new substation would be in an area with an existing estimated ROS physical setting of Roaded Natural (along Johnson Creek Road [CR 10-413]), and therefore would not result in any alterations to the existing estimated ROS physical setting.

4.19.2.1.3 RECREATION SPECIAL USE PERMITS

4.19.2.1.3.1 Construction

As shown in **Table N-13** in **Appendix N**, there are several current recreation-related special use permits in the analysis area. Recreation-related special use permits within the PNF include Big Creek Lodge, Elk Springs Outfitters, Flying Resort Ranches, Idaho Wilderness Company, and 4 Summit Challenge bike event. In the BNF, recreation-related special use permits include Juniper Mountain Outfitters, North Shore Lodge, Warm Lake Lodge and Resort, Warm Lake Camp, Youth with a Mission (YWAM), and recreation residences.

There are no Alternative 1 components that would directly impact the Big Creek Lodge during construction. However, Alternative 1 components may affect recreation opportunities, access, and experiences in areas south of the lodge in the analysis area, as described in Section 4.19.2.1.1 above. For instance, there may be more traffic or delays on Stibnite Road (CR 50-412) due to the use of the Yellow Pine Route for mine access, which could result in temporary impacts to motorized recreation access and recreation experiences. Impacts to lodge customers would depend on their recreation location away from the lodge.

Alternative 1 components that would affect the Elk Springs Outfitters operating area during construction include the new transmission line to the mine site, Burntlog Route (Thunder Mountain Road and Meadow Creek Lookout Road improvements), closure of Stibnite and Thunder Mountain roads through the mine site, OHV Trail, communication facilities, and mine site facilities. Construction of these components would affect the ability of Elk Springs Outfitters to access approximately half of their operating area, provide IOGLB licensed activities, and may degrade recreation experiences for customers participating in guided activities near construction of these components due to construction noise and activity. Impacts to recreation from construction of Alternative 1 components are described in Section 4.19.2.1.1 above. The portion of the Elk Springs Outfitters operating area north and west of Yellow Pine would be accessible, and free of Alternative 1 construction activities; therefore, permitted use may be displaced to this area, as well as recreational use from the analysis area.

There are no Alternative 1 components that would impact the Flying Resort Ranches operating area during construction; there are no planned activities in or adjacent to their route through the FCRNRW to Big Creek.

Alternative 1 components that would affect the Idaho Wilderness Company operating area during construction include Burntlog Route (Thunder Mountain Road improvements), closure of Stibnite and Thunder Mountain roads through the mine site, and mine site facilities. Construction of these components would affect the ability of the Idaho Wilderness Company to access approximately 25 percent of the southern portion of their operating area, provide IOGLB licensed activities, and may degrade recreation experiences for customers participating in guided activities near construction of these components due to construction noise and activity. Impacts to recreation from construction of these Alternative 1 components are described in Section 4.19.2.1.1 above. The portion of the Idaho Wilderness Company operating area in the FCRNRW northeast of the mine site would be available for any displaced permitted use. However, access to this portion of the operating area may need to be relocated to be out of Big Creek, rather than Thunder Mountain Road, due to the closures and improvements on this road.

Construction activities to upgrade the transmission line crossing at South Fork Salmon River Road and upgrade the transmission line along Warm Lake Road (CR 10-579) could impact 4 Summit bike event activities if construction occurred on the bike event day, including potentially interfering (stopping or rerouting) the event if bikers could not use either roadway on event day. Additional visitors also could be present along South Fork Salmon River Road due to displacement of recreational use from the analysis area.

Construction of all Alternative 1 components would affect the Juniper Mountain Outfitters operating area either directly or indirectly due to recreation displacement from other areas. Construction of Alternative 1 components would affect the ability of Juniper Mountain Outfitters to access approximately 50 percent of their operating area; provide IOGLB licensed activities; and may degrade recreation experiences for customers participating in guided activities near construction of Alternative 1 components due to construction noise, traffic, and activity. Impacts to recreation from construction of Alternative 1 components are described in Section 4.19.2.1.1 above. The portion of the Juniper Mountain Outfitters operating area north and south of Warm Lake surrounding the South Fork Salmon River would be accessible and free of Alternative 1 construction activities; therefore, permitted use may be displaced to this area, as well as other recreational use from the analysis area.

Alternative 1 components that would affect the North Shore and Warm Lake Lodges, Warm Lake Camp, YWAM, and Warm Lake recreation residence tract during construction include transmission line upgrades and summer use of Warm Lake Road (CR 10-579). Construction of these components would affect traffic, noise, and vehicular access and thus could adversely affect the recreation experience for some recreationists as well as the recreation setting, particularly for Warm Lake Lodge, Warm Lake Camp, and YWAM as these facilities are located close to Warm Lake Road, which would have an increase in traffic and traffic noise due to use of this road for the SGP. Impacts to recreation from construction of these Alternative 1 components are described in Section 4.19.2.1.1 above. It is not anticipated that transmission line upgrade activities, including work at the Warm Lake substation, would be visible or audible from the lodges or camps or from the Warm Lake recreation residence tract as this area is over 0.5 mile away from the transmission line and substation with intervening vegetation. There would be no winter access changes on Warm Lake Road in the area near the lodges, Warm Lake Camp, or Warm Lake recreation residence tract. Changes to plowing and public use of Warm Lake Road would occur just west of YWAM; however, there is no winter use of the YWAM facility and thus changes to winter use and maintenance of Warm Lake Road west of the facility would not affect use of the facility.

The Cabin Creek OSV route may result in more winter motorized use north of the lodges, camps and Warm Lake recreation residence tract. Alternative 1 components that would affect the Paradise Valley recreation residence tract include transmission line upgrades, summer use of Warm Lake Road (CR 10-579), and development and use of the Cabin Creek Road OSV route. Construction of these components would affect traffic, noise, and vehicular access and thus could adversely affect the recreation experience for some recreationists as well as the recreation setting. Impacts to recreation from construction of Alternative 1 components are described in Section 4.19.2.1.1 above.

Noise from transmission line upgrade construction activities and/or utility access spur road construction activities may be above ambient levels (above 40 dBA) at the Paradise Valley recreation residence tract (AECOM 2019). The Cabin Creek OSV route would be located near the Paradise Valley recreation residence tract. The new 10.4-mile groomed OSV route along Cabin Creek Road may lead to dispersed winter recreational use along this new route, because the route would provide winter recreation opportunities in an area that currently does not have many winter opportunities due to lack of access and would be the only available easterly OSV route to Landmark. Therefore, there may be more traffic, noise, and recreation use within the area around the Paradise Valley recreation residence tract in the winter, potentially resulting in a change to a more developed recreation setting at the residence tract in the winter. The parking area for the new Cabin Creek OSV route would be located west of the Paradise Valley recreation residence tract near South Fork Salmon River Road (FS 474) and would therefore not affect the recreation residence tract.

4.19.2.1.3.2 Operations

There are no Alternative 1 components that would directly impact the Big Creek Lodge during operations. However, Alternative 1 components may affect recreation opportunities, access, and experiences in areas south of the lodge in the analysis area, as described in Section 4.19.2.1.1 above. Impacts to lodge customers would depend on their recreation location away from the lodge.

Alternative 1 components that would affect the Elk Springs Outfitters operating area during mining operations include the new transmission line to the mine site, Burntlog Route, closure of Stibnite and Thunder Mountain roads through the mine site, OHV Trail, communication facilities, and mine site facilities. Operation of these components would affect the ability of Elk Springs Outfitters to access their operating area, provide IOGLB licensed activities, and may degrade recreation experiences for customers participating in guided activities near these components due to noise and activity (mining activity, mine traffic, new motorized use, reduction of acreage available for recreation, etc.). There may be some beneficial impacts to Elk Springs Outfitters from increased cell coverage in their operating area and resulting customer safety improvements. Impacts to recreation from operation of these Alternative 1 components are described in Section 4.19.2.1.1 above. The portion of the Elk Springs Outfitters operating area north and west of Yellow Pine would be accessible and free of Alternative 1 activities; therefore, permitted use may be displaced to this area, as well as other recreational use from the analysis area.

There are no Alternative 1 components that would impact the Flying Resort Ranches operating area during mine operations; there are no activities in or adjacent to their route through the FCRNRW to Big Creek.

Alternative 1 components that would affect the Idaho Wilderness Company operating area during mining operations include Burntlog Route, closure of Stibnite and Thunder Mountain roads through the mine site, communication facilities, and mine site facilities. Operation of these components would affect the ability of the Idaho Wilderness Company to access their operating area; provide IOGLB licensed activities; and may degrade recreation experiences for customers participating in guided activities near these components due to noise and activity (mining activity, mine traffic, reduction of acreage available for recreation, etc.). There may be some beneficial impacts to the Idaho Wilderness Company from increased cell coverage in their operating area and resulting customer safety improvements. Impacts to recreation from operation of these Alternative 1 components are described in Section 4.19.2.1.1. The portion of the Idaho Wilderness Company operating area in the FCRNRW northeast of the mine site would be available for any displaced permitted use. However, access to this portion of the operating area may need to be relocated to be out of Big Creek, rather than Thunder Mountain Road, due to the closure of a portion of the road and detour needed to get to sites/areas along Thunder Mountain Road (FR 50375).

There are no Alternative 1 components that would directly impact the 4 Summit bike event permit during mine operations; there are no activities planned that would use South Fork Salmon River Road. However, additional visitors could be present along this roadway due to displacement of recreational use from the analysis area.

Operation of all Alternative 1 components would affect the Juniper Mountain Outfitters operating area either directly or indirectly due to recreation displacement from other areas. Operation of Alternative 1 components would affect the ability of Juniper Mountain Outfitters to access their operating area; provide IOGLB licensed activities; and may degrade recreation experiences for customers participating in guided activities near Alternative 1 components due to noise and activity (mining activity, mine traffic, new motorized use, reduction of acreage available for recreation, etc.). Impacts to recreation from operation of Alternative 1 components are described in Section 4.19.2.1.1 above. The portion of the Juniper Mountain Outfitters operating area north and south of Warm Lake surrounding the South Fork Salmon River would be accessible and free of Alternative 1 facilities and activities; therefore, permitted use may be displaced to this area, as well as recreational use from the analysis area.

There are no Alternative 1 components that would impact the North Shore or Warm Lake Lodges, Warm Lake Camp, YWAM, or Warm Lake recreation residence tract during operations. The Warm Lake recreation residence tract is over 0.5 mile from the upgraded transmission lines and substation with intervening vegetation. Therefore, it is unlikely that the modified transmission line and substation facilities would be visible from the recreation residence tract.

Winter use of the Cabin Creek Road OSV route during operations would continue to impact the Paradise Valley recreation residence tract as described in Section 4.19.2.1.3.1 above. The upgraded transmission lines also may be visible from the residence tract, though there would be some intervening vegetation. Impacts to recreation from operation of Alternative 1 components are described in Section 4.19.2.1.1 above.

4.19.2.1.3.3 Closure and Reclamation

There are no Alternative 1 components that would directly impact the Big Creek Lodge during or after closure and reclamation. However, Alternative 1 components may affect recreation opportunities, access, and experiences in areas south of the lodge in the analysis area as described in Section 4.19.2.1.1. Impacts to lodge customers would depend on their recreation location away from the lodge.

Alternative 1 components that would affect the Elk Springs Outfitters operating area during closure and reclamation include the new transmission line to the mine site, Burntlog Route, public access after reclamation, OHV Trail, communication facilities, and mine site facilities. The ability of Elk Springs Outfitters to access their operating area, provide IOGLB licensed activities, and the quality of recreation experiences for customers participating in guided activities near these components may be impacted during decommissioning of these components due to noise and reclamation activity. Impacts to recreation from reclamation/closure of these Alternative 1 components are described in Section 4.19.2.1.1 above. The loss of cellular coverage on portions of the analysis area may impact customer safety in the mine site area. The loss of cellular coverage also would aid in returning primitive recreation experiences to the FCRNRW areas in the Elk Springs Outfitters operating area. Providing public access through the mine site after closure and reclamation would restore the ability for Elk Springs Outfitters to reach portions of their operating area without a detour. The portion of the Elk Springs Outfitters operating area north and west of Yellow Pine would be accessible and free of Alternative 1 activities; therefore, permitted use may be displaced to this area, as well as recreational use from the analysis area. Displacement of permitted use may continue past reclamation due to permanent changes in the recreation setting within the Operations Area Boundary (see Section 4.19.2.1.1.3) and potential changes to wildlife present in the area, as some species sensitive to human presence may not return to the area for years after the mine is closed.

There are no Alternative 1 components that would impact the Flying Resort Ranches operating area during or after closure and reclamation; there are no activities in or adjacent to their route through the FCRNRW to Big Creek.

Alternative 1 components that would affect the Idaho Wilderness Company operating area during closure and reclamation include Burntlog Route, public access after reclamation, communication facilities, and mine site facilities. The ability of the Idaho Wilderness Company to access their operating area, provide IOGLB licensed activities, and the quality of recreation experiences for customers participating in guided activities near these components may be impacted during closure and reclamation due to noise and reclamation activity. Impacts to recreation from reclamation/closure of these Alternative 1 components are described in Section 4.19.2.1.1 above. The loss of cellular coverage on portions of the analysis area may impact customer safety in the mine site. The loss of cellular coverage also would aid in returning primitive recreation experiences to the FCRNRW areas in the Idaho Wilderness Company operating area. Providing public access through the mine site after closure and reclamation would restore the ability for the Idaho Wilderness Company to reach portions of their operating area without a detour. The portion of the Idaho Wilderness Company operating area in the FCRNRW northeast of the mine site would be available for any displaced permitted use. Displacement of permitted use may continue past reclamation due to permanent changes in the recreation setting within the Operations Area Boundary (see Section 4.19.2.1.1.3) and potential changes to wildlife present in the area, as some species sensitive to human presence may not return to the area for years after the mine is closed.

There are no Alternative 1 components that would directly impact the 4 Summit bike event permit during closure and reclamation; there are no activities planned that would use South Fork Salmon River Road. However, additional visitors could be present along this roadway due to displacement of recreational use from the analysis area.

Closure and reclamation of all Alternative 1 components would affect the Juniper Mountain Outfitters operating area either directly or indirectly due to recreation displacement from other areas. The ability of Juniper Mountain Outfitters to access their operating area, provide IOGLB licensed activities, and the quality of recreation experiences for customers participating in guided activities near these components may be impacted during closure and reclamation due to noise and reclamation activity. Impacts to recreation from closure and reclamation of these Alternative 1 components are described in Section 4.19.2.1.1 above. The portion of the Juniper Mountain Outfitters operating area north and south of Warm Lake surrounding the South Fork Salmon River would be accessible and free of Alternative 1 facilities and activities; therefore, permitted use may be displaced to this area, as well as recreational use from the analysis area. Displacement of permitted use may continue past reclamation due to the changes in the recreation setting in the mine operations area, and potential changes to wildlife present in the area, as some species sensitive to human presence may not return to the area for years after the mine is closed.

There are no Alternative 1 components that would impact the North Shore or Warm Lake Lodges, Warm Lake Camp, YWAM, or Warm Lake recreation residence tract during closure and reclamation.

Winter use of the Cabin Creek Road OSV route during closure and reclamation would continue to impact the Paradise Valley recreation residence tract as described in Section 4.19.2.1.3.1.

4.19.2.2 Alternative 2

Alternative 2 is very similar to Alternative 1, with the main differences that affect recreation consisting of re-routing a segment of the Burntlog Route, new public access road through the mine site during operations, a change in the location of the maintenance facility, and re-routing a portion of the upgraded transmission line. Additionally, Alternative 2 would permanently retain the new transmission line to the mine site to power the Centralized Water Treatment Plant at the mine site in perpetuity as part of the Water Quality Management Plan. These changes would result in different impacts than Alternative 1, and in different locations.

4.19.2.2.1 Recreation Opportunities, Facilities, Access, and Use

4.19.2.2.1.1 Construction

Impacts of Alternative 2 during construction would be the same as those described under Alternative 1 for the mine site facilities, Yellow Pine Route, Warm Lake Road, OHV Trail, communication facilities, new transmission line, and Johnson Creek substation. Impacts would be different for the Burntlog Route, closure of Stibnite and Thunder Mountain roads through the mine site, public access roads through the mine site, the maintenance facility, and transmission line upgrades.

Burntlog Route

Impacts would be similar to those described under Alternative 1. The re-routed segment of Burntlog Route near Riordan Creek and Black Lake could provide more extensive changes in the recreation setting for wilderness activities compared to existing conditions and Alternative 1. The re-routed segment would be closer and increase the miles of roads within 0.5-mile of the FCRNRW border (see maps in **Appendix N-3**).

Closure of Stibnite and Thunder Mountain Roads Through the Mine Site

Direct impacts would be the same as those described under Alternative 1, except impacts would have a different duration. Impacts to recreation area and site access, use, and opportunities along Thunder Mountain Road (FR 50375) would begin during construction and continue until a new public access road through the mine site was constructed.

Impacts to recreation along Stibnite Road (CR 50-412) and Thunder Mountain Road through the mine site would be the same as Alternative 1 during construction and conclude when a public access road is constructed, and public use would be allowed in the Operations Area Boundary after closure/reclamation.

Burntlog Maintenance Facility

Under Alternative 2, the maintenance facility would be 4.4 miles east of the Johnson Creek Road (CR 10-413) and Warm Lake Road (CR 10-579) intersection in a borrow area created for the Burntlog Route. Construction of the maintenance facility may require temporary road closures and/or detours along Burnt Log Road (FR 447), thereby temporarily reducing access to recreation sites and areas along this roadway and trails/areas accessed from this road (see maps in **Appendix N-3**).

Noise associated with construction activities could reduce opportunities for noise-sensitive recreation activities at and around the maintenance facility location, including wildlife-related recreation activities, because wildlife may be displaced. Noise from construction activities related to the Burntlog Maintenance Facility would be above ambient levels (40 dBA) at the Mud Lake dispersed camping area (AECOM 2019). Therefore, some recreationists may choose to visit other areas or sites to avoid delays or noise from construction activities. Any reduction in recreation opportunities, displacement of dispersed recreational use, or changes in access would be temporary until maintenance facility construction was completed. These impacts would be localized to the area surrounding the maintenance facility, and the roads/trails accessed from Burnt Log Road (FR 447).

Transmission Line Upgrades

Impacts would be similar to those described under Alternative 1. In addition, a portion of the transmission line would be re-routed near Thunder Mountain Estates to be along the Warm Lake Road ROW and the edge of NFS and State lands. The re-routed portion along the road would not be in a recreation area. Noise associated with construction of the portion along the NFS and State lands could reduce opportunities for more noise-sensitive recreation activities along the corridor, including wildlife-related recreation activities, because wildlife may be displaced.

There is a motorcycle trail (Eagle Nest) on the NFS lands that intersects the re-routed location of the upgraded transmission line. Construction of the upgraded transmission line in this location may result in delays or detours accessing this trail. The re-routed segment of the transmission line could adversely affect the recreation experience for users of this trail compared to existing conditions (see maps in **Appendix N-3**). Therefore, some recreationists may choose to visit other areas or trails to avoid delays or noise from construction activities. Any reduction in recreation opportunities, displacement of dispersed recreation use, or changes in access would be temporary until the transmission line was completed. These impacts would be localized to the Thunder Mountain Estates re-route section of the transmission line. Impacts would be temporary and conclude when the re-routed portion of the transmission line was completed.

4.19.2.2.1.2 Operations

Impacts of Alternative 2 during operations would be the same as those described under Alternative 1, except for the Burntlog Route, public access through the mine site, Burntlog Maintenance Facility, and upgraded transmission line.

Burntlog Route

Impacts would be similar to Alternative 1; however, motorized public use (not including special use permit holders) of the Burntlog Route would only be allowed when the public access route through the mine site was closed, which would occur during some mining activities that would be considered public safety hazards (e.g., high wall scaling, blasting). Therefore, there could be less potential increase in dispersed recreational use along the Burntlog Route under Alternative 2 than under Alternative 1.

Under Alternative 2, the re-routed portion of Burntlog Route near Riordan Creek could provide more extensive changes in the recreation setting for wilderness activities compared to existing conditions as the re-routed segment would be much closer to the FCRNRW border (see maps in **Appendix N-3**). Recreation setting changes would require wilderness users to penetrate further into the wilderness to achieve a primitive setting. The re-routed section also could induce increased recreation use in the Black Lake area compared to existing conditions, because the roadway would be very close to this lake. Similarly, the new segment of the Burntlog Route passes very close to the FCRNRW border and may induce increased use of the wilderness area, and potentially unauthorized motorized use due to the very close proximity of the roadway to the wilderness boundary.

Unlike Alternative 1, operational traffic noise and road maintenance noise in the winter would not be above ambient levels at the Thunder Mountain/Riordan Trailhead (AECOM 2019) because the new segment of the Burntlog Route would be further east adjacent to the wilderness boundary. Operation of the lime kiln at the mine site under Alternative 2 would reduce the number of trucks on the Burntlog Route from 65 to 50 per day and therefore slightly reduce operational traffic and noise impacts.

Public Access through the Mine Site

During mining operations, public access would be allowed through the mine site under Alternative 2 via a 12-foot gravel road that connects Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) (see maps in **Appendix N-3**). This road would be open to all vehicles year-round but would not be plowed during the winter. Because the road would be within the Operations Area Boundary, there would be no public use allowed off the road; the road would only be for public access to the recreation sites/areas accessed via Thunder Mountain Road (FR 50375). The public access road through the mine site would return access to these recreation sites/areas after Stibnite Road (CR 50-412) is no longer available. In addition, the public access road would allow visitors from Yellow Pine to reach the Thunder Mountain Road sites/areas substantially faster than taking the Burntlog Route, which may result in less displacement of use at these sites/areas during operations. For visitors that pass through the mine site on the public access road, the recreation setting would be very developed and substantially modified; however, this would likely be expected, because the road would be passing through an active mine site. Although the public access road would return access to recreation sites/areas accessed via Thunder Mountain Road (FR 50375), there would be temporary closures of this route during some mining activities that would be considered public safety hazards (e.g., high wall scaling, blasting). When such road closures would occur, the closures would result in reduced access to recreation sites/areas off Thunder Mountain Road (FR 50375); reduced recreation opportunities and use due to a lack of access; and impacts to recreation experiences due to visitor expectations regarding site/area availability. Impacts from road closures would affect recreation sites/areas off Thunder Mountain Road (FR 50375) and may ultimately lead to continued displacement of visitors from the Thunder Mountain Road sites/areas. Impacts would persist throughout operations and closure and reclamation until a relocated Stibnite Road (CR 50-412) was available to the public, and the mine access road was decommissioned.

Burntlog Maintenance Facility

Development of the Burntlog Maintenance Facility would reduce recreation opportunities due to physical removal of acreage for the facility (3.8 acres). Impacts from operational traffic and road maintenance activities (and associated noise) are included in the impacts from the Burntlog Route, which would occur immediately adjacent to this facility. Operational noise at the maintenance facility by itself would be substantially less than the immediately adjacent traffic and/or road maintenance noise. Noise could reduce opportunities for some recreation activities in this area; particularly wildlife-related recreation activities, because wildlife may be displaced from the general maintenance facility area. The maintenance facility would increase man-made development in the area surrounding the facility, including nighttime lighting. These changes may affect the recreation setting of this general area by decreasing the feeling of remoteness, thereby affecting the recreation experience for visitors to the area. Impacts would generally be limited to the area within visual and audible distance of the maintenance facility; and would begin once the facility was operational and conclude once the facility was closed and reclaimed.

Upgraded Transmission Line

Impacts would be similar to those described under Alternative 1. In addition, the re-routed portion of the transmission line along the NFS and State lands around the Thunder Mountain Estates, would alter the recreation setting of these lands, and the motorcycle trail that leaves from Warm Lake Road on the NFS lands in this area. The new transmission line in this area would result in a more developed recreation setting for these lands and the trail; however, dispersed users and motorcyclists would generally be able to move away from the transmission line; therefore, this change in the recreation setting may not greatly influence their recreation experience. Impacts would be permanent, because the transmission line would remain after closure/reclamation.

4.19.2.2.1.3 Closure and Reclamation

Impacts of Alternative 2 during closure and reclamation would be the same as those described under Alternative 1, except for mine site facilities, the Burntlog Maintenance Facility, upgraded transmission line, and new transmission line to the mine site.

Mine Site Facilities

Impacts to recreation would be the same as Alternative 1, except the recreation setting also would be permanently altered by the Centralized Water Treatment Plant, which would remain on site after mine reclamation activities occurred. A small amount of mine-related truck trips would continue to occur to operate the Centralized Water Treatment Plant. Although there would be an increase in traffic on Stibnite Road (CR 50-412) compared to existing conditions, the number of truck trips would be very low per month and would not affect recreation access through the mine site after reclamation.

Burntlog Maintenance Facility

As part of closure and reclamation, the Burntlog Maintenance Facility would be removed, the site graded, and drainage would be reestablished. The approximately 4.6-acre site would be seeded and become available for public recreational use following reclamation. Impacts to recreation during decommissioning would be the same as those described for construction: potential temporary closure or delays on Burnt Log Road (FR 447) resulting in impacts to recreation experiences, and reduction in some recreation opportunities due to noise. Any reduction in recreation opportunities, displacement of dispersed recreational use, or changes in access would be temporary until the maintenance facility was closed and reclaimed. Once the facility was closed and the site was reclaimed by vegetation, operational impacts related to loss of acreage for recreation and changes to the recreation setting of the general area surrounding the facility would cease. These impacts would be localized to the area surrounding the maintenance facility, and the roads/trails accessed from Burnt Log Road (FR 447).

Upgraded Transmission Line

The upgraded transmission line from Lake Fork to Johnson Creek substation would be retained and used by Idaho Power Company. Therefore, impacts described under Operations for the upgraded transmission line would remain after mine closure, which include impacts to the recreation setting and recreation experiences.

New Transmission Line to Mine Site

Impacts described under Operations of Alternative 1 would continue to occur indefinitely as the power would be needed at the mine site for operation of the Centralized Water Treatment Plant in perpetuity. The new transmission line and transmission line access roads would not be decommissioned under Alternative 2. Thus, the physical removal of 115 acres for recreation for transmission line facilities, changes to the recreation setting due to the increased presence of man-made development and the clearing of existing vegetation along the ROW, and impacts to recreation access, opportunities and use due to the improvements to FT 233 would become permanent. In addition, unauthorized use of the portion of the transmission line road that does not overlap with FT 233 could continue.

4.19.2.2.2 ROS CLASSES AND PHYSICAL SETTING

4.19.2.2.2.1 Designated ROS Classes

Impacts of Alternative 2 on designated ROS classes would be the same as those described under Alternative 1, except for the closure of Stibnite and Thunder Mountain roads through the mine site, the road through the mine site, the Burntlog Maintenance Facility, and the new transmission line to the mine site.

Closure of Stibnite and Thunder Mountain Roads Through the Mine Site

Impacts would be similar to those described under Alternative 1, although under Alternative 2, the roads would only be closed during construction.

Road Through Mine Site

Public access through the mine site would be located in an area currently designated as Roaded Natural. This designation allows for some landscape modification from roads and therefore public access through the mine site would not result in inconsistencies with the existing ROS designation.

Burntlog Maintenance Facility

The Burntlog Maintenance Facility would be in an area currently designated as Roaded Modified, which can have modifications that are visually subordinate to viewers. Therefore, the maintenance facility in this area would not result in inconsistencies with the existing ROS designation class.

New Transmission Line to Mine Site

Impacts would be similar to those described under Alternative 1, however, the inconsistency of the new transmission line and access road in an area designated as Semi-Primitive Non-Motorized in PNF MA 13 would be permanent as the transmission line would be needed in perpetuity to operate the Centralized Water Treatment Plant and therefore would not be decommissioned.

4.19.2.2.2.2 Estimated ROS Physical Setting

Impacts of Alternative 2 on estimated ROS physical settings would be the same as those described under Alternative 1, except for the closure of Stibnite and Thunder Mountain roads through the mine site, the road through the mine site, the Burntlog Maintenance Facility, and the new transmission line to the mine site. **Tables 4.19-3** and **4.19-4** show the acreage changes to estimated ROS physical settings under Alternative 2 from existing conditions; graphical representations of the estimated ROS physical settings are shown in **Appendix N-3**, Chapter 4 Recreation Mapbooks and Figures, Alternative 2.

Closure of Stibnite and Thunder Mountain Roads Through the Mine Site

Impacts would be similar to those described under Alternative 1, although under Alternative 2, the roads would only be closed during construction.

Road Through Mine Site

Public access through the mine site would be located in an area with an existing estimated ROS physical setting of Rural, which allows for strong evidence of designed roads. Therefore, public access through the mine site would not result in inconsistencies with the existing estimated ROS physical setting.

Burntlog Maintenance Facility

The new Burntlog Maintenance Facility would be in an area with an existing estimated ROS physical setting of Rural, and therefore would not result in any alterations to the existing estimated ROS physical setting.

New Transmission Line to Mine Site

Impacts would be similar to those described under Alternative 1, however, the creation of a new road and transmission line facility would alter the Semi-Primitive Non-Motorized setting to Semi-Primitive Motorized, would be permanent as the transmission line would not be decommissioned.

Table 4.19-3 Comparison of Existing and Alternative 2 Estimated ROS Physical Setting Classes in the Analysis Area – Summer

Estimated ROS Physical Setting Class	Existing Acreage – Summer	Operational Acreage – Summer	Total Change in Acreage	Locations of Changes
Primitive	17,278	16,124	-1,154	Burntlog Route
Semi-Primitive Non-Motorized	218,512	207,140	-11,372	Mine site, Burntlog Route, area west of Mine Site, OHV Trail, new transmission line to Mine Site
Semi-Primitive Motorized	83,497	86,189	2,692	Lost acreage: Burntlog Route, Mine Site Gained acreage: Area west of the Mine Site, OHV Trail, new transmission line to Mine Site
Roaded Natural	140,594	139,031	-1,563	Lost acreage: Mine Site Gain acreage: Burntlog Route
Rural	81,450	79,401	-2,049	Mine Site
Mine Site	0	13,446	13,446	Mine Site (acreage removed from other classes for the Mine Site)

Table Source: AECOM 2020

Table 4.19-4 Comparison of Existing and Alternative 2 Estimated ROS Physical Setting Classes in the Analysis Area – Winter

Estimated ROS Physical Setting Class	Existing Acreage – Winter	Operational Acreage – Winter	Total Change in Acreage	Locations of Changes
Primitive	21,370	20,216	-1,154	Burntlog Route
Semi-Primitive Non-Motorized	245,210	233,581	-11,629	Mine Site
Semi-Primitive Motorized	240,387	220,712	-19,675	Burntlog Route, Mine Site, Cabin Creek Road
Semi-Primitive Motorized Groomed	50,436*	46,135	-4,301	Lost acreage: Warm Lake Road, Burnt Log Road Gained acreage: Cabin Creek Road
Roaded Natural	7,511	22,563	15,052	Lost acreage: Mine Site Gained acreage: Burntlog Route
Rural	26,853	30,813	3,960	Warm Lake Road from Warm Lake to Landmark, Burntlog Route
Mine Site	0	13,446	13,446	Mine Site (acreage removed from other classes for the Mine Site)

Table Source: AECOM 2020

Table Note:

*This acreage overlaps other features.

4.19.2.2.3 RECREATION SPECIAL USE PERMITS

4.19.2.2.3.1 Construction

Impacts from construction of Alternative 2 on the recreation-related special use permits currently approved in the analysis area would be similar to those described under Alternative 1, except for the impacts from closure of Stibnite and Thunder Mountain roads on the Elk Springs Outfitters, Idaho Wilderness Company, and Juniper Mountain Outfitters would be as described in Section 4.19.2.2.2.1, and the Burntlog Maintenance Facility would impact the Juniper Mountain Outfitters (rather than the Landmark Maintenance Facility).

4.19.2.2.3.2 Operations

Impacts from mine operations under Alternative 2 on the recreation-related special use permits currently approved in the analysis area would be similar to those described under Alternative 1, except the impacts from the closure of Stibnite and Thunder Mountain roads on the Elk Springs

Outfitters, Idaho Wilderness Company, and Juniper Mountain Outfitters would not occur, because a road through the mine site would provide access to Thunder Mountain Road, as described in Section 4.19.2.2.2.1 above, and the Burntlog Maintenance Facility would impact the Juniper Mountain Outfitters, rather than the Landmark Maintenance Facility. Impacts from the Burntlog Route under Alternative 2 may have an increased impact on the ability of the Elk Springs Outfitters and Juniper Mountain Outfitters to provide IOGLB licensed activities due to impacts on wilderness activities. However, special use permit holders would be allowed to use the Burntlog Route under Alternative 2 when the public could not and; therefore, may have vehicular access to areas when the public does not.

4.19.2.2.3.3 Closure and Reclamation

Impacts from closure/reclamation of Alternative 2 on the recreation-related special use permits currently approved in the analysis area would be similar to those described under Alternative 1, except the Burntlog Maintenance Facility would impact the Juniper Mountain Outfitters, rather than the Landmark Maintenance Facility. In addition, the permanent retention of the new transmission line to the mine site would permanently impact the recreation setting of the operating area for Elk Springs Outfitters and Juniper Mountain Outfitters. In addition, the Centralized Water Treatment Plant would provide additional man-made development impacts to the recreation setting for the Elk Springs Outfitters operating area and would be visible when accessing the Idaho Wilderness Company’s operating area off Thunder Mountain Road.

4.19.2.3 Alternative 3

Alternative 3 is similar to Alternative 1, with the main differences that affect recreation being no construction of the OHV Trail, some mine facilities and the new transmission line would be in a different location, improvements to Meadow Creek Lookout Road, and a different public access road through the mine site after closure/reclamation. The Operations Area Boundary also would be larger under Alternative 3 due to the change in location of the TSF.

4.19.2.3.1 Recreation Opportunities, Facilities, Access, and Use

4.19.2.3.1.1 Construction

Impacts of Alternative 3 during construction would be the same as those described under Alternative 1, except for the mine site facilities and widening Meadow Creek Lookout Road. Widening 7.6 miles of Meadow Creek Lookout Road (FR 51290) adjacent to the FCRNRW could result in additional changes to the recreation setting for wilderness activities. Widening Meadow Creek Lookout Road could induce an increase in recreation use in the Monumental Summit area.

Mine Site Facilities

Impacts to recreation would be similar to those described under Alternative 1 although the Operations Area Boundary would be 17,034 acres and would therefore incur more extensive impacts to recreation opportunities due to a larger area removed from recreational use.

4.19.2.3.1.2 Operations

Impacts of Alternative 3 during operations would be the same as those described under Alternative 1, except for the location of mine site facilities, segment of Burntlog Route in Blowout Creek valley, and new transmission line to the mine site. Similar to Alternative 1, during mine operations there would be no public use road through the mine site. The OHV Trail would not be constructed under Alternative 3; therefore, there would be no operational impacts related to use of this trail. Visitors to recreation sites off Thunder Mountain and Meadow Creek Lookout roads would have to use the entire Burntlog Route to reach these sites.

Mine Site Facilities

Impacts would be the same as those described under Alternative 1. In addition, the East Fork South Fork Salmon River Development Rock Storage Facility and Tailings Storage Facility (TSF) would be visible from the Mule Hill Trail (FT 4219) within the FCRNRW under Alternative 3 (see Section 4.20.2.3.1.1). Thus, Alternative 3 may have additional impacts on recreation setting within the FCRNRW due to changes in the recreation setting compared to existing conditions and Alternative 1.

Burntlog Route

Impacts on recreation during mine operation would be similar to Alternative 1 except there would be no traffic related to mine operations on Meadow Creek Lookout Road (FR 51290) east of the new Blowout Creek Valley road segment. This would result in fewer impacts to the recreation setting along Meadow Creek Lookout Road and Thunder Mountain Road, and therefore fewer impacts to recreation experiences for visitors to these roads and the sites/areas accessed from these roads. Visitors to Monumental Summit would use Burntlog Route including the improved 7.6-mile section of Meadow Creek Lookout Road. In addition, the OHV Trail, which would not be built under Alternative 3, therefore would not contribute to potential new increases in recreation use in this area.

New Transmission Line to Mine Site

Impacts would be similar to those described under Alternative 1; however, the 10.8 miles long new transmission line would in a different location under Alternative 3. The new transmission line and associated access road to the mine site would be located along Horse Heaven Road (FR 416W) and Trail FT 233, and then continue from FT 233 east to the mine site between two IRAs. The new transmission line to the mine site would reduce recreation opportunities due to physical removal of acreage for transmission line facilities (approximately 124 acres).

4.19.2.3.1.3 Closure and Reclamation

Impacts of Alternative 3 during closure and reclamation would be the same as those described under Alternative 1, except for the location of public access after reclamation.

Public Access After Reclamation

Under Alternative 3, there would be two options for public access through the mine site after closure and reclamation of the mine (see maps in **Appendix N-4**). One option would be to connect the existing Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) over a portion of the TSF and East Fork South Fork Salmon River Development Rock Storage Facility. Reopening Stibnite Road (CR 50-412) and its connection to Thunder Mountain Road (FR 50375) would result in the same reclamation/closure impacts as described under Alternative 1. The second public access option is to retain a segment of Burntlog Route through Blowout Creek Valley and convert it to a road available for public use connecting to Meadow Creek Lookout Road (FR 51290). This option would be a slightly longer way to reach Thunder Mountain Road (FR 50375) and the recreation sites/areas accessed from this road, because visitors would have to travel south through the entire mining area, and then east on Meadow Creek Lookout Road (FR 51290) until the junction with Thunder Mountain Road (FR 50375). This option would result in impacts similar to Alternative 1, except it may encourage less return of displaced recreation use due to the slightly longer distance to reach Thunder Mountain Road compared to the first option. The Blowout Creek Valley road option may encourage more use of the mine site, because it would require visitors to pass through the entire mine site from north to south and would bring visitors closer to the Hangar Flats pit and decommissioned transmission line access road. Impacts to recreation access, opportunities, and use from public access through the mine site would continue beyond closure and reclamation.

New Transmission Line to Mine Site

Impacts would be similar to those described under Alternative 1; however, the new transmission line to the mine site would be 10.8 miles long.

4.19.2.3.2 ROS Classes and Physical Setting

4.19.2.3.2.1 Designated ROS Classes

Impacts of Alternative 3 on designated ROS classes would be the same as those described under Alternative 1, except for the OHV Trail and public access after reclamation. The OHV Trail would not be constructed under Alternative 3, and therefore, there would be no impacts related to inconsistency with the existing ROS designation.

Public Access After Reclamation

Public access through the mine site would be located in areas currently designated as Roaded Natural and Semi-Primitive Non-Motorized. The road through the mine site after reclamation within the Roaded Natural area, which allows for some landscape modification from roads, would not result in inconsistencies with this existing ROS designation. However, the road would be inconsistent with the Semi-Primitive Non-Motorized designation and would be more consistent with a Roaded Natural designation.

4.19.2.3.2.2 Estimated ROS Physical Setting

Impacts of Alternative 3 on estimated ROS physical settings would be the same as those described under Alternative 1, except for the OHV Trail and public access after reclamation. The OHV Trail would not be constructed under Alternative 3; therefore, there would be no impacts related to existing estimated ROS physical settings. **Tables 4.19-5** and **4.19-6** show the acreage changes to estimated ROS physical settings under Alternative 3 from existing conditions; graphical representations of the estimated ROS physical settings are shown in **Appendix N-4**, Chapter 4 Recreation Mapbooks and Figures, Alternative 3.

Public Access After Reclamation

Public access through the mine site would be located in areas with existing estimated ROS physical settings of Rural, Roaded Natural, and Semi-Primitive Non-Motorized. The road through the mine site after reclamation in areas with estimated ROS physical settings of Rural and Roaded Natural, both of which allow for strong evidence of designed roads, would not result in inconsistencies with these existing estimated ROS physical settings. However, the road would be inconsistent with the existing estimated ROS physical setting of Semi-Primitive Non-Motorized and alter this setting to Roaded Natural, as the road would likely be considered a "better than primitive" road.

Table 4.19-5 Comparison of Existing and Alternative 3 Estimated ROS Physical Setting Classes in the Analysis Area – Summer

Estimated ROS Physical Setting Class	Existing Acreage – Summer	Operational Acreage – Summer	Total Change in Acreage	Locations of Changes
Primitive	17,278	16,838	-440	Burntlog Route
Semi-Primitive Non-Motorized	218,512	207,182	-11,330	Mine Site, Burntlog Route, area west of the Mine Site, new transmission line to Mine Site
Semi-Primitive Motorized	83,497	86,197	2,700	Lost acreage: Burntlog Route, Mine Site Gained acreage: Area west of the Mine Site, new transmission line to Mine Site
Roaded Natural	140,594	134,664	-5,930	Lost acreage: Mine Site Gain acreage: Burntlog Route
Rural	81,450	79,418	-2,032	Mine Site
Mine Site	0	17,034	17,034	Mine Site (acreage removed from other classes for the Mine Site)

Table Source: AECOM 2020

Table 4.19-6 Comparison of Existing and Alternative 3 Estimated ROS Physical Setting Classes in the Analysis Area – Winter

Estimated ROS Physical Setting Class	Existing Acreage – Winter	Operational Acreage – Winter	Total Change in Acreage	Locations of Changes
Primitive	21,370	20,930	-440	Burntlog Route
Semi-Primitive Non-Motorized	245,210	233,621	-11,589	Mine Site
Semi-Primitive Motorized	240,387	217,008	-23,379	Burntlog Route, Mine Site, Cabin Creek Road
Semi-Primitive Motorized Groomed	50,436*	46,135	-4,301	Lost acreage: Warm Lake Road (CR 10-579), Burnt Log Road Gained acreage: Cabin Creek Road
Roaded Natural	7,511	21,926	14,415	Lost acreage: Mine Site Gained acreage: Burntlog Route
Rural	26,853	30,813	3,960	Warm Lake Road (CR 10-579) from Warm Lake to Landmark, Burntlog Route
Mine Site	0	17,034	17,034	Mine Site (acreage removed from other classes for the Mine Site)

Table Source: AECOM 2020

Table Note:

*This acreage overlaps other features.

4.19.2.3.3 RECREATION SPECIAL USE PERMITS

4.19.2.3.3.1 Construction

Impacts from construction of Alternative 3 on the recreation-related special use permits currently approved in the analysis area would be similar to those described under Alternative 1, except the OHV Trail would not be constructed under Alternative 3; therefore, construction activities associated with this component would not impact the Elk Springs and Juniper Mountain Outfitters.

4.19.2.3.3.2 Operations

Impacts from mine operations under Alternative 3 on the recreation-related special use permits currently approved in the analysis area would be similar to those described under Alternative 1, except the OHV Trail would not be constructed under Alternative 3; therefore, this component would not impact access and recreation experiences for clients of the Elk Springs and Juniper Mountain Outfitters.

4.19.2.3.3.3 Closure and Reclamation

Impacts from closure and reclamation under Alternative 3 on the recreation-related special use permits currently approved in the analysis area would be similar to those described under Alternative 1, except the OHV Trail would not be constructed under Alternative 3; therefore, closure and reclamation activities associated with this component would not impact the Elk Springs and Juniper Mountain Outfitters. In addition, impacts related to the new transmission line and public access after reclamation would be slightly different, as discussed in Section 4.19.2.3.1.3, and therefore may have slightly different impacts on recreation opportunities, settings, and experiences for Elk Springs Outfitters clients.

4.19.2.4 Alternative 4

Alternative 4 is similar to Alternative 1, with the main differences that affect recreation consisting of use of the Yellow Pine Route for access to the mine for all phases (and therefore, no construction or use of the Burntlog Route); slight change in the location of the Landmark Maintenance Facility; public road access through the mine during operations (similar to Alternative 2); and use of helicopters for construction and maintenance of cell towers and repeater sites in IRAs managed for backcountry/restoration. These changes would result in different impacts than Alternative 1, particularly the use of the Yellow Pine Route.

4.19.2.4.1 RECREATION OPPORTUNITIES, FACILITIES, ACCESS, AND USE

4.19.2.4.1.1 Construction

Impacts of Alternative 4 during construction would be the same as those described under Alternative 1, except for the Burntlog Route, Yellow Pine Route, OHV Trail, Landmark Maintenance Facility, and communication facilities. The Burntlog Route and OHV Trail would not be constructed under Alternative 4; therefore, there would be no construction impacts related to these facilities.

Yellow Pine Route

<u>Year-Round</u>

Use of Johnson Creek (CR 10-413) and Stibnite Roads (CR 50-412) as the route to the mine site during construction, operations, and reclamation/closure would result in impacts to the recreation setting of the existing recreation sites/areas along these roads due to increased noise, traffic, and safety-related issues from mine-related traffic (please see Section 4.18, Public Health and Safety; and Section 4.16, Access and Transportation, for more information on increased traffic-related safety impacts under Alternative 4), leading to a change in recreation experiences for some visitors. Traffic on Johnson Creek and Stibnite Roads (CR 50-412) would substantially increase (more than 2 times the traffic on Johnson Creek Road (CR 10-413), and 2.5 times the traffic on Stibnite Road), thereby increasing the noise and activity near campgrounds and trailheads adjacent to these roads. AADT would rise from 57 to 122 during construction on Johnson Creek Road (CR 10-413) and go from 39 on Stibnite Road (CR 50-412) to 104 during construction.

Recreation facilities affected by the increase in traffic and traffic noise would include Burntlog and Quartz Creek Trailheads; Buck Mountain, Trout Creek, Ice Hole, Golden Gate, and Yellow Pine Campgrounds; Twin Bridges dispersed camping area; and Johnson Creek Cabin. Therefore, the recreation setting of these facilities would be altered to a more developed setting due to an increase in the sights and sounds of humans. Therefore, recreationists may be displaced to avoid noise associated with activities and traffic along Stibnite and Johnson Creek roads, particularly recreationists participating in non-motorized activities. Motorized users who use Johnson Creek and Stibnite Roads for recreation also may be displaced due to the increased traffic along the roadways. Wildlife-related recreation opportunities also would decrease along these roadways due to wildlife displacement from traffic and noise. Changes to the recreation setting, displacement of dispersed recreation, and reduction in recreation opportunities would begin during construction, and would continue through operations and closure/reclamation.

During construction, there would be periodic temporary road closures on Johnson Creek Road (CR 10-413). Such road closures would result in reduced access to recreation sites/areas, reduced recreation opportunities, and reduced use due to a lack of access, and impacts to recreation experiences due to visitor expectations regarding site/area availability. Impacts from road closures would affect recreation sites/areas along Johnson Creek Road (CR 10-413), as well as sites, trails, and areas accessed from this main route. Impacts would persist throughout construction.

There also would be daily closure of Stibnite Road (CR 50-412) for most of the middle of the day during mine construction. These daily closures would result in reduced access to recreation sites/areas off Stibnite Road (CR 50-412) and Thunder Mountain Road (FR 50375); reduced recreation opportunities and use due to temporary reductions in access; and impacts to recreation experiences due to delays in reaching destinations. Impacts from road closures would affect recreation sites/areas along Stibnite Road (CR 50-412), as well as sites, trails, and areas accessed from this main route, particularly sites off Thunder Mountain Road (FR 50375). Depending on where the closure started on Stibnite Road (CR 50-412), access to the Big Creek area north of the mine also may be affected. Impacts would persist throughout the 2- to 3-year mine construction period.

Although Stibnite Road (CR 50-412) would be open for public access as part of the Yellow Pine Route, the Stibnite Mining District Interpretive Site would not be available for public use, because it would be within the Operations Area Boundary where no public use would be allowed. Impacts to this facility would begin during construction and conclude when public use was allowed in the mine area after closure/reclamation.

Winter

Impacts from the plowing of Johnson Creek Road would the similar as those described for Alternative 1. However, the groomed OSV route along the western side of Johnson Creek Road would run from Wapiti Meadow Ranch to Landmark (approximately 17 miles) under Alternative 4 (see maps in **Appendix N-5**). Under allowing continued use of the Ditch Creek Road (FR 410) groomed OSV route. Also, the new groomed OSV route along Johnson Creek Road would remain through operations and closure/reclamation under Alternative 4 as the Yellow Pine Route would be used throughout the SGP. Therefore, impacts from the plowing of Johnson Creek Road under Alternative 4 would begin during construction, and would cease after mine reclamation/closure.

Landmark Maintenance Facility

Impacts from the construction of the Landmark Maintenance Facility would be similar to those described under Alternative 1; however, there would be no delays or additional traffic along Warm Lake Road (CR 10-579) in this area related to the construction of the Burntlog Route, but rather from all construction-related traffic using Warm Lake Road (CR 10-579) to Johnson Creek Road (CR 10-413). Noise-related construction impacts also would be similar to Alternative 1. Impacts would be localized to the area surrounding the maintenance facility, and the roads/trails accessed east of the facility off Warm Lake Road (CR 10-579).

Communications Facilities

Construction of repeater sites and cell tower sites not in an IRA managed for backcountry/restoration would result in the same impacts as those described under Alternative 1. Constructing repeater sites and the cell tower site in an IRA managed for backcountry/restoration, noise and disruption from the use of helicopters for construction may temporarily affect the recreation setting for users within visual and audible distance of the helicopters. Impacts would be localized to the cell tower and repeater sites in IRAs managed for backcountry/restoration. Changes in the recreation setting around these repeater and cell tower sites could lead to a temporary displacement of dispersed recreational use, particularly related to non-motorized activities, wilderness activities, and wildlife-related recreation activities (due to wildlife displacement), which currently typically occur in a quieter, non-motorized setting in these areas compared to existing conditions. Additionally, use of helicopters would eliminate the impacts of new access roads to the tower/repeater sites (e.g., changes in the recreation setting along access route that could lead to displacement of dispersed recreational use, particularly related to non-motorized activities, and wildlife-related recreation activities) as described under Alternative 1.

4.19.2.4.1.2 Operations

Impacts of Alternative 4 during operations would be the same as those described under Alternative 1, except for the Burntlog Route, Yellow Pine Route, public access through the mine site, OHV Trail, Landmark Maintenance Facility, and communication facilities. The Burntlog Route and OHV Trail would not be constructed under Alternative 4; therefore, there would be no operations impacts related to these facilities. Existing access and recreation opportunities and settings along the Burnt Log Road (FR 447) would remain as is. Because visitor road access would be allowed through the mine site under Alternative 4, the OHV Trail would not be necessary to provide alternative access to recreation sites off Thunder Mountain Road. Impacts from the new transmission line to the mine site would be the same as those described for Alternative 3.

Yellow Pine Route

Year-Round

Impacts described under construction for the Yellow Pine Route also would occur during operations, because Johnson Creek and Stibnite roads would continue to be used as the main access roads into the mine site and also would require periodic road maintenance activities. AADT for these roads would be slightly higher during operations than described under construction, but within 5 vehicles, thus resulting in the same impacts described under construction. However, impacts due to temporary closure of Johnson Creek and Stibnite Roads (CR 50-412) would not occur during operations. Impacts to recreation from use of the road through the mine site are described below.

Winter

Impacts described under construction for the Yellow Pine Route also would occur during operations, because Johnson Creek Road (CR 10-413) would continue to be plowed during operations.

Public Access Through the Mine Site

Impacts would be similar to those described under Alternative 2, but instead of restoring access that was closed during construction, the mine access road would provide access to recreation sites/areas via Thunder Mountain Road (FR 50375) (see maps in **Appendix N-5**). Therefore, the mine access road would allow continuous access to the Thunder Mountain Road sites/areas. However, as described under Alternative 2, there would be temporary closures of this route during some mining activities that would result in impacts to recreation.

Landmark Maintenance Facility

Impacts related to operation of the Landmark Maintenance Facility would be similar to Alternative 1, except traffic due to maintenance activities would be included under Yellow Pine Route operational impacts because the site would be accessed via the Yellow Pine Route.

Communications Facilities

Impacts from operation of cell tower and repeater sites not in an IRA managed for backcountry/restoration would be the same as those described in Alternative 1.

Noise and disruption from the use of helicopters for maintenance of cell tower and repeater sites in an IRA managed for backcountry/restoration may temporarily affect the recreation setting for users within visual and audible distance of the helicopters. Impacts would be localized to the cell tower and repeater sites in IRAs managed for backcountry/restoration. Impacts would be temporary during operations, and only occur when maintenance activities were conducted.

New cellular coverage in the analysis area would increase visitor safety on NFS lands; however, additional cellular coverage would detract from primitive recreation experiences. Impacts would begin once the cell tower was constructed and would conclude with decommissioning of the site.

4.19.2.4.1.3 Closure and Reclamation

Impacts of Alternative 4 during closure and reclamation would be the same as those described under Alternative 1, except for the Burntlog Route, Yellow Pine Route, public access after reclamation, OHV Trail, and communication facilities. The Burntlog Route and OHV Trail would not be constructed under Alternative 4; therefore, there would be no closure/reclamation impacts related to these facilities. Impacts from the new transmission line to the mine site would be the same as those described for Alternative 3.

Yellow Pine Route

Year-Round

Impacts described under construction for the Yellow Pine Route also would occur during closure/reclamation, because Johnson Creek and Stibnite roads would continue to be used as the main access roads into the mine during closure and reclamation. However, impacts due to temporary closure of Johnson Creek and Stibnite roads would not occur during closure/reclamation. Impacts to recreation from use of the road through the mine site following closure/reclamation are described below. Following closure/reclamation, impacts to Johnson Creek and Stibnite Roads would cease.

Winter

Impacts described under construction for the Yellow Pine Route also would occur during closure/reclamation, because Johnson Creek Road (CR 10-413) would continue to be plowed during closure and reclamation. Following closure/reclamation, impacts to Johnson Creek Road would cease as plowing of this road would cease.

Public Access After Reclamation

Under Alternative 4, public access through the mine site after closure/reclamation would be on a reopened Stibnite Road (CR 50-412), which would include a permanent road through the backfilled Yellow Pine pit like Alternative 1 (see maps in **Appendix N-5**). However, under Alternative 4, Stibnite Road (CR 50-412) would not be returned to its pre-mining width, and the 9-foot-high retaining walls and various culverts would remain after mine closure and reclamation. After closure and reclamation, traffic on Stibnite Road (CR 50-412) would be greatly reduced, which would benefit recreation experiences for visitors to the areas/sites east of the mine site off Thunder Mountain Road (FR 50375), and encourage the return of recreational use at these sites/areas that was displaced during mining operations due to increased road traffic and road closures. Retaining the increased width of the road would continue to allow a wider range of vehicles to use this road, potentially increasing access. The alterations to the road, including the large retaining walls, would continue to affect the recreation setting. Impacts to the recreation setting of the entire mine site area are described above. Impacts to recreation access, experiences, and use from public access through the mine site would continue beyond closure/reclamation.

Communications Facilities

Impacts from closure and reclamation of cell tower and repeater sites not in an IRA managed for backcountry/restoration would be the same as those described in Alternative 1.

Noise and disruption from the use of helicopters for closure and reclamation of cell tower and repeater sites in an IRA managed for backcountry/restoration may temporarily affect the recreation setting for users within visual and audible distance of the helicopters. Changes in the recreation setting around these repeater and cell tower sites could lead to displacement of dispersed recreational use, particularly related to non-motorized activities, wilderness activities, and wildlife-related recreation activities (due to wildlife displacement), which currently typically occur in a quieter, non-motorized setting in these areas. Impacts would be localized to the cell tower and repeater sites in IRAs managed for backcountry/restoration. Impacts would be temporary and conclude once the sites were closed and reclaimed.

The loss of cellular coverage on portions of the analysis area may impact visitor safety in the mine site area. The loss of cellular coverage also would aid in returning primitive recreation experiences to the FCRNRW areas adjacent to the mine site.

4.19.2.4.2 ROS CLASSES AND PHYSICAL SETTING

4.19.2.4.2.1 Designated ROS Classes

Impacts of Alternative 4 on designated ROS classes would be the same as those described under Alternative 1, except for the Burntlog Route, Yellow Pine Route, and OHV Trail. The Burntlog Route and OHV Trail would not be constructed under Alternative 4; therefore, there would be no impacts related to inconsistency with the existing ROS designation for these facilities. Impacts from public access through the mine site would be the same as those described for Alternative 2.

Yellow Pine Route

Impacts would be the same as those described under Alternative 1 for summer ROS designations. Impacts would be similar to those described under Alternative 1 for winter ROS designations; however, plowing of Johnson Creek Road (CR 10-413) and Stibnite Road would occur through closure/reclamation. Therefore, plowing 21 miles of Johnson Creek Road

(CR 10-413) and 10.8 miles of Stibnite Road would not be consistent with the existing winter ROS designation classes for the area surrounding these roads, and would be more consistent with a designation of Roaded Natural. This impact would continue through closure and reclamation.

4.19.2.4.2.2 Estimated ROS Physical Setting

Impacts of Alternative 4 on estimated ROS physical settings would be the same as those described under Alternative 1, except for the Burntlog Route, Yellow Pine Route, and OHV Trail. The Burntlog Route and OHV Trail would not be constructed under Alternative 4; therefore, there would be no impacts related to alterations of the existing estimated ROS physical setting for these facilities. Impacts from public access through the mine site would be the same as those described for Alternative 2. **Tables 4.19-7** and **4.19-8** show the acreage changes to estimated ROS physical settings under Alternative 4 from existing conditions; graphical representations of the estimated ROS physical settings are shown in **Appendix N-5** Chapter 4 Recreation Mapbooks and Figures, Alternative 4.

Yellow Pine Route

Impacts would be the same as those described under Alternative 1 for summer estimated ROS physical settings (Roaded Natural and Rural). Impacts would be similar to those described under Alternative 1 for winter estimated ROS physical settings; however, plowing of Johnson Creek Road (CR 10-413) would occur through closure/reclamation. Therefore, plowing of Johnson Creek Road would alter the existing estimated winter ROS physical setting of the area around this road to Rural. This impact would continue through closure and reclamation.

Table 4.19-7 Comparison of Existing and Alternative 4 Estimated ROS Physical Setting Classes in the Analysis Area – Summer

Estimated ROS Physical Setting Class	Existing Acreage – Summer	Operational Acreage – Summer	Total Change in Acreage	Locations of Changes
Primitive	17,278	17,278	0	None
Semi-Primitive Non-Motorized	218,512	208,434	-10,078	Mine Site, area west of the Mine Site, new transmission line to Mine Site
Semi-Primitive Motorized	83,497	86,549	3,052	Lost acreage: Mine Site Gained acreage: Area west of the Mine Site, new transmission line to Mine Site
Roaded Natural	140,594	136,251	-4,343	Mine Site
Rural	81,450	79,373	-2,077	Mine Site
Mine Site	0	13,446	13,446	Mine Site (acreage removed from other classes for the Mine Site)

Table Source: AECOM 2020

Table 4.19-8 Comparison of Existing and Alternative 4 Estimated ROS Physical Setting Classes in the Analysis Area – Winter

Estimated ROS Physical Setting Class	Existing Acreage – Winter	Operational Acreage – Winter	Total Change in Acreage	Locations of Changes
Primitive	21,370	21,370	0	None
Semi-Primitive Non-Motorized	245,210	234,849	-10,361	Mine Site
Semi-Primitive Motorized	240,387	235,610	-4,777	Mine Site, Cabin Creek Road
Semi-Primitive Motorized Groomed	50,436*	42,324	-8,112	Lost acreage: Warm Lake Road (CR 10-579), Johnson Creek Road Gained acreage: Cabin Creek Road
Roaded Natural	7,511	5,224	-2,287	Mine Site
Rural	26,853	40,284	13,431	Warm Lake Road (CR 10-579) from Warm Lake to Landmark, Johnson Creek Road
Mine Site	0	13,446	13,446	Mine Site (acreage removed from other classes for the Mine Site)

Table Source: AECOM 2020

Table Note:

*This acreage overlaps other features.

4.19.2.4.3 Recreation Special Use Permits

4.19.2.4.3.1 Construction

Impacts from construction of Alternative 4 on the recreation-related special use permits currently approved in the analysis area would be similar to those described under Alternative 1, except there would be no impacts from the closure of Stibnite and Thunder Mountain roads on the Elk Springs Outfitters, Idaho Wilderness Company and Juniper Mountain Outfitters. Rather, under Alternative 4, alternate impacts would occur to recreation (access, use, opportunities, experiences) from use of, and temporary closures on, the Yellow Pine Route as described in Section 4.19.2.4.1.1 above. There also would be no impacts to the Elk Springs Outfitters, Idaho Wilderness Company, and Juniper Mountain Outfitters from the Burntlog Route. The OHV Trail would not be constructed under Alternative 4; therefore, this component would not impact the Elk Springs and Juniper Mountain Outfitters.

4.19.2.4.3.2 Operations

Impacts from operations under Alternative 4 on the recreation-related special use permits currently approved in the analysis area would be similar to those described under Alternative 1, except the impacts from the closure of Stibnite and Thunder Mountain roads on the Elk Springs Outfitters, Idaho Wilderness Company, and Juniper Mountain Outfitters would not occur, because a road through the mine site would provide continuous access to Thunder Mountain Road, as described in Section 4.19.2.4.1.2.

There would be no impacts to the Elk Springs Outfitters, Idaho Wilderness Company, and Juniper Mountain Outfitters from the Burntlog Route. The OHV Trail would not be constructed under Alternative 4; therefore, this component would not impact the Elk Springs and Juniper Mountain Outfitters.

4.19.2.4.3.3 Closure and Reclamation

Impacts from closure and reclamation under Alternative 4 on the recreation-related special use permits currently approved in the analysis area would be similar to those described under Alternative 1, except the Elk Springs Outfitters, Idaho Wilderness Company, and Juniper Mountain Outfitters would be impacted from reclamation activities along the Yellow Pine Route instead of the Burntlog Route. The OHV Trail would not be constructed under Alternative 4; therefore, this component would not impact the Elk Springs and Juniper Mountain Outfitters. In addition, impacts related to the new transmission line and public access after reclamation would be slightly different, as discussed in Section 4.19.2.4.1.3, and therefore may have slightly different impacts on recreation opportunities, settings, and experiences for Elk Springs Outfitters clients.

4.19.2.5 Alternative 5

Under Alternative 5, the No Action Alternative, no construction, operation, or reclamation of the SGP components would occur. Previously approved surface exploration and associated activities on NFS lands would continue. There would be no surface (open-pit) mining or ore processing to extract gold, silver, or antimony; and no underground exploration, sampling, or related operations and facilities on NFS lands. Current uses on Midas Gold patented mine/mill site claims would continue, which include mineral exploration and dispersed recreation.

4.19.2.5.1 Recreation Opportunities, Facilities, Access, and Use

Current access to the area via Johnson Creek Road (CR 10-413) and Stibnite Road (CR 50-412) would remain unimpeded. Apart from the mine site area, existing recreation opportunities, access, and use would continue in the existing recreation setting. In the mine site, continued exploration may alter the recreation setting in limited areas to have a more elevated level of the sights and sounds of humans. Some unauthorized motorized use may continue to occur off existing roads and motorized trails but would likely continue to be fairly limited in extent. In general, areas that are inaccessible to motorized vehicles would continue to be inaccessible to vehicles or certain vehicle types in summer, both limiting the motorized recreation opportunities available in some areas and preserving the setting for non-motorized recreation opportunities in these areas. Motorized winter use has expanded in recent years, and may continue to expand in the future, resulting in additional OSV routes, winter recreation opportunities, and additional areas receiving winter motorized use.

4.19.2.5.2 ROS Classes And Physical Setting

Overall, impacts to recreation under Alternative 5 would include modifications to the recreation setting in the mine site area from continued surface exploration, continued low level of unauthorized motorized use, and increased winter motorized access and use. These impacts could lead to changes in the designated ROS class and/or ROS physical setting (towards Semi-Primitive Motorized or Roaded Natural from Semi-Primitive Non-Motorized) of some areas due to additional motorized use both in the summer and winter.

4.19.2.5.3 Recreation Special Use Permits

Activities, facilities, and uses allowed under current recreation-related special use permits would continue until the end of the permit term. Changes to the recreation setting due to additional motorized use may result in shifts in the use areas for permittees, particularly for non-motorized uses such as trail rides, fishing, hunting, etc.

4.19.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as SGP Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final Environmental Impact Statement.

4.19.4 Cumulative Effects

The cumulative effects analysis area for recreation is the same as the analysis area for direct and indirect effects to recreation and includes PNF MA 13 (Big Creek/Stibnite) and BNF MAs BNF MA 21 (Lower Johnson Creek), BNF MA 20 (Upper Johnson Creek), BNF MA 19 (Warm Lake), and a portion of BNF MA 17 (North Fork Payette River), as well as a 5-mile radius from the major SGP components to account for where the SGP could be visible within foreground or middle ground distances (see Section 3.20) and noise from SGP activities could be audible (see Section 3.6) and thus potentially affect recreation opportunities and settings. The 5-mile radius generally falls within the management areas listed above; however, it does extend outside the management area boundaries in some locations, particularly into adjacent wilderness where recreation could be affected. Other past, present, and reasonably foreseeable actions occurring on federal and non-federal lands, with similar effects that overlap in time and space include forest management, mining and mine reclamation, road maintenance, campground upgrades, and winter motorized use of forest roads.

Past and present mining and mining-related activities have occurred around the Stibnite Mining District for over 100 years. These activities have led to the existing recreation setting, which includes previous development and reclamation within the analysis area.

4.19.4.1 Alternatives 1, 2, and 3

4.19.4.1.1 Recreation Opportunities, Facilities, Use, And Recreation Special Use Permits

Reasonably foreseeable projects near Big Creek, including restoration and transportation improvements, could affect recreation access through additional route closures or re-routing of access. However, because these projects would be located north of the analysis area, cumulative effects to recreation access within the analysis area may be minimal.

In general, cumulative development conducted during construction of Alternatives 1, 2, or 3, could result in cumulative effects to the recreation setting due to additional noise and activity, cumulative effects to recreation experiences due to access delays, and further reduced recreation opportunities due to noise and wildlife displacement, but cumulative construction-related effects would be temporary and conclude when the Alternative 1, 2, or 3 construction activities concluded.

Other mining-related activities in the cumulative effects area would decrease the area for dispersed recreation due to physical development and wildlife displacement and also would decrease the overall area available for any recreation and permitted use displaced from the analysis area due to impacts to recreation from Alternative 1, 2, or 3. Development in the Big Creek area also may result in displacement of recreation and permitted use to other areas, possibly to campgrounds and wilderness trailheads south of Stibnite Road (CR 50-412). This displacement could increase recreation and permitted use within the analysis area, which may already see an increase in recreation use due to new motorized access, in addition to displacement of some recreation use to other areas. The South Fork Restoration and Access Management Plan, and the East Fork Salmon River Restoration and Access Management Plan, if approved, may in the short-term also reduce the area available for displaced recreation use from Alternative 1, 2, or 3 and could result in displaced recreation use during restoration and development activities. Therefore, the reasonably foreseeable projects in combination with Alternative 1, 2, or 3 may result in cumulative effects to recreation use, recreation opportunities, and recreation special use permits.

4.19.4.1.2 ROS Classes and Physical Setting

Planned restoration projects of forest and roads would enhance the natural appearance of the greater cumulative area. However, mining and other development projects would likely decrease the natural appearance of the area and may lead to a decrease in non-motorized areas due to mining operations and new access roads, particularly north of Stibnite Road (CR 50-412) towards Big Creek. Overall, the reasonably foreseeable projects in combination with Alternative 1, 2 or 3 could result in cumulative effects to the designated ROS classes and the estimated ROS physical setting by increasing development, resulting in an overall increase in more developed ROS settings and a decrease in less developed settings within the cumulative effects area.

4.19.4.2 Alternative 4

Cumulative effects would be similar to those described for Alternative 1; however, cumulative effects to recreation use, opportunities, and the recreation setting related to displaced use would be less due to use of the Yellow Pine Route instead of the creation of the Burntlog Route, which would both displace recreation use and increase recreation use in the analysis area. However, any cumulative effects along Johnson Creek Road would be increased due to use of this road as part of the Yellow Pine Route.

4.19.4.3 Alternative 5

Cumulative effects would be minimal as there would be no displaced recreation use or changes to recreation opportunities from the SGP. In the long term there would be some modifications to the recreation setting in the mine site area from continued surface exploration, continued low level of unauthorized motorized use, and increased winter motorized access and use. The reasonably foreseeable projects in combination with Alternative 5 could result in cumulative effects to the designated ROS classes and the estimated ROS physical setting by increasing development, resulting in an overall increase in more developed ROS settings and a decrease in less developed settings within the cumulative effects area. However, the extent of this change under Alternative 5 would be much less than under the action alternatives, and the SGP would not contribute to the cumulative effects.

4.19.5 Irreversible and Irretrievable Commitments of Public Resources

4.19.5.1 Alternatives 1, 2, 3, and 4

All action alternatives would affect recreation access in the analysis area from construction through closure and reclamation. This change in access, however, would not be irreversible or irretrievable, because existing access to Stibnite Road (CR 50-412) and Thunder Mountain Road sites/areas would be re-established (either through the mine site or on a portion of the Burntlog Route through the mine site), and winter OSV access would be re-established after reclamation. In terms of facilities, the only facility that would be closed (until mine site access was reclaimed) would be the Stibnite Mining District Interpretive Site. This would represent an irretrievable commitment of this resource. In addition, under Alternative 2 only, Centralized Water Treatment Plant would remain onsite after mine closure and would not be closed and reclaimed. This would represent an irretrievable commitment of this area as it would no longer be usable for recreation. Under Alternative 2, the new transmission line to the mine site also would remain onsite and not be reclaimed. However, recreation could still occur underneath the transmission line.

An irretrievable commitment of resources also would occur from the removal of SGP facility areas from recreational use from construction through closure and reclamation. In addition, the creation of motorized access to areas with no existing motorized access under Alternatives 1, 2, and 3 would be an irretrievable commitment of resources due to displacement of non-motorized recreation opportunities in these areas. Both irretrievable commitments also would affect the ability of recreation-related special use permittees to provide IOGLB licensed activities, and/or may change recreation experiences for customers.

Changes to the recreation setting due to construction, operation, and closure/reclamation, and the resulting potential displacement of recreational use to other locations, would be an irretrievable commitment of resources, particularly for FCRNRW areas where the recreation setting was affected. Changes to the recreation setting at the mine site and Burntlog Route (Alternatives 1 through 3), transmission line upgrade areas, and new transmission line to the mine site under Alternative 2 would be an irreversible commitment because the transmission line would be a permanent modification to the recreation setting of many areas and existing recreation facilities, and the mine site and Burntlog Route would be large reclaimed areas (except for the Centralized Water Treatment Plant under Alternative 2) that would take a long period of time to fully revegetate to the point where the sights and sounds of humans would return to existing levels (if ever). Therefore, the recreation setting of these areas would experience long-term alterations. Wildlife displaced from the affected habitat may relocate throughout the region, changing the availability of game for hunters and predators. The change could increase or decrease hunting success, but any reduction in game availability would represent an irretrievable loss of opportunity. Although wildlife species are expected to return following reclamation, some species sensitive to human presence may not return to the area for years after the mine is closed. If wildlife does not re-populate affected areas, there would be an irreversible commitment of resources in affected areas due to a reduction in wildlife-related recreation opportunities. Long-term impacts to the recreation setting and wildlife populations may affect the ability of recreation-related special use permittees to provide IOGLB-licensed activities and would affect the recreation experiences of customers.

4.19.5.2 Alternative 5

Under Alternative 5, no action would be undertaken. Consequently, no change would occur in the status of recreation resources in the analysis area.

4.19.6 Short-term Uses versus Long-term Productivity

4.19.6.1 Alternatives 1, 2, 3, and 4

All action alternatives would result in short-term use of the mine site area and construction of new roads in an IRA; however, the mine site and new roads would be closed and reclaimed at mine closure, except for the soil nail walls. Short-term use of the mine site and other facility locations on NFS lands would reduce acreage available for non-motorized recreation, and would result in displacement of recreational use, modified recreation access, motorized access to areas not currently accessible by motorized vehicles (Alternatives 1 through 3), and changes in recreation opportunities in several management areas. All these short-term impacts to recreation would affect the ability of recreation-related special use permittees to access their operating areas; provide IOGLB-licensed activities; and would affect the recreation experiences of customers.

Because areas would be open for recreation once reclamation was completed, there would not be impacts to long-term use of the mine site, access roads, and other facility locations for recreation after mine closure, although there would be long-term impacts to the recreation setting and recreation experiences. The exception would be the Centralized Water Treatment Plant and new transmission line to the mine site under Alternative 2, which would not be reclaimed and therefore would result in a long-term use of this area. Although wildlife species are expected to return following reclamation, some species sensitive to human presence may not return to the area for years after the mine is closed. If wildlife does not re-populate the area, there may be long-term impacts to recreation due to a reduction in wildlife-related recreation opportunities. Because Alternative 4 would have less new access road development, this alternative would have fewer long-term impacts to the recreation setting and recreation experiences; and less potential for a reduction in wildlife-related opportunities. Long-term impacts to the recreation setting and wildlife populations may affect the ability of recreation-related special use permittees to provide IOGLB-licensed activities and would affect the recreation experiences of customers.

4.19.6.2 Alternative 5

Under Alternative 5, no action would be undertaken. Consequently, there would be no short-term use that would affect recreation resources, and no effect on long-term productivity.

4.19.7 Summary

All action alternatives would result in impacts to recreation access, settings, opportunities, use, facilities, and recreation-related special use permits. Use of the mine site for the SGP would remove this area from recreation use and alter the recreation setting surrounding the mine site due to visual changes and noise. Use of Warm Lake Road (CR 10-579) and the Yellow Pine Route during construction would affect access and the recreation setting for facilities along Johnson Creek and Warm Lake Roads. Winter plowing of Johnson Creek Road (CR 10-413) during construction would affect access to other OSV routes. New winter motorized access would be provided on the Cabin Creek Road OSV route. Construction of many SGP facilities may have temporary impacts to recreation (access, opportunities, use) and may temporarily or permanently alter the recreation setting of the areas within and adjacent to these facilities. The SGP also would affect access to operating areas of three outfitters and guides, affect their ability to provide activities, and may degrade customer’s recreation experiences.

Under Alternative 1, temporary closure of Stibnite and Thunder Mountain roads through the mine site would affect access and use of sites off these roads until the Burntlog Route was constructed. The OHV Trail and Burntlog Route under Alternative 1 would offer new motorized access where such access does not currently exist and could increase recreation use in areas surrounding these facilities. These facilities also may displace wildlife-based and non-motorized recreation opportunities and would alter the recreation setting for the FCRNRW and two dispersed camping areas. In Alternative 1, new winter motorized access would be provided on the Burntlog Route; however, plowing of the Burntlog Route may result in loss of direct access to some OSV routes.

Impacts from Alternative 2 would be very similar to Alternative 1 with the main differences between the alternatives being a re-route of the Burntlog Route, road access through the mine site during operations, and a change in the maintenance facility location. Due to its closeness to the FCRNRW border, the re-routed portion of the Burntlog Route would result in additional change to the recreation setting for wilderness activities, potentially induce increased use of the Black Lake area and FCRNRW, and potentially result in unauthorized motorized use of the FCRNRW compared to Alternatives 1 and 3 when the Burntlog Route was available to public use (when the road through the mine site was not available). The re-routed Burntlog Route may have an increased impact on the ability of the two permitted outfitters to provide permitted activities due to the impacts on wilderness activities compared to Alternatives 1 and 3. Alternative 2 also would result in permanent impacts to the recreation setting due to permanent retention of the Centralized Water Treatment Plant and new transmission line to the mine site.

Providing road access through the mine site during operations under Alternative 2 could shorten the duration impacts to recreation access, use and opportunities along Thunder Mountain Road and potentially lessen displacement of recreation use in the Thunder Mountain Road area compared to Alternatives 1 and 3, though temporary road closures may lead to continued displacement. Road access through the mine site under Alternative 2 also would provide access to the Thunder Mountain Road area for the public and permitted outfitters in a much shorter amount of time compare to the Burntlog Route in Alternatives 1 and 3. The maintenance facility under Alternative 2 would be located further east, thus reducing recreation impacts to the Landmark area compared to Alternatives 1 and 3, but construction noise may affect the Mud Lake dispersed camping area, which also would be affected by construction of the Burntlog Route.

Unlike Alternatives 1 and 2, Meadow Creek Lookout road would be improved and the OHV Trail would not be constructed under Alternative 3. This would eliminate both adverse and beneficial impacts to recreation from this trail compared to Alternatives 1 and 2, including impacts on access, recreation use, recreation settings, motorized and non-motorized recreation opportunities, and impacts on recreation-related special use permits. The mine site Operations Area Boundary would be larger under Alternative 3 compared to the other action alternatives and would have the largest area removed from recreation use during the SGP. Compared to Alternatives 1 and 2, the Burntlog Route access to the mine site would be located further west (through Blowout Creek) under Alternative 3 and this could reduce impacts to the recreation impacts along Meadow Creek Lookout and Thunder Mountain Roads. However, improvements to Meadow Creek Lookout road could increase recreation use to sites and areas along or access from this road. Like Alternative 1 (and unlike Alternatives 2 and 4), there would be no public access through the mine site during the SGP under Alternative 3. Compared to Alternatives 1 and 2, after reclamation there would be a second option for access through the mine site through Blowout Creek Valley under Alternative 3. Impacts from this road option would be similar to the road option under Alternative 1, but this option would take longer to reach Thunder Mountain Road and may encourage more use of the mine site as visitors would pass through the entire mine site and closer to a pit lake and transmission line road.

The Burntlog Route would not be developed under Alternative 4. Therefore, there would be no adverse or beneficial impacts to recreation from this route compared to Alternatives 1, 2, and 3. Instead the Yellow Pine Route would be used. Construction impacts of using the Yellow Pine Route under Alternative 4 would be similar to Alternatives 1 through-3, except periodic temporary closures on Johnson Creek Road and daily closures on Stibnite Road would result in reduced access and recreation opportunities and impact to visitor experiences along Johnson Creek, Stibnite, and Thunder Mountain Roads and locations accessed from these roads, potentially including the Big Creek area depending on where the closure would be located along Stibnite Road. Unlike the other action alternatives, impacts from use of the Yellow Pine Route under Alternative 4 would continue through operations and closure/reclamation instead of ending once the Burntlog Route was completed (except for impacts from road closures as these would not occur during operations or closure/reclamation). Under Alternative 4, impacts to recreation in the winter from the Yellow Pine Route would be similar to Alternatives 1-3, except plowing of Johnson Creek Road and grooming of the OSV route along Johnson Creek Road would continue through closure and reclamation. In addition, under Alternative 4 the Johnson Creek OSV route would be longer (up to Wapiti Meadow Ranch). Similar to Alternative 3, the OHV Trail would not be constructed under Alternative 4 and therefore would not result in adverse or beneficial impacts to recreation like in Alternatives 1 and 2. After reclamation under Alternative 4, Stibnite Road alterations would remain and could increase access for more vehicles and affect the recreation setting.

Under Alternative 5, current recreation opportunities, access, and use would continue in the existing recreation setting. In general, areas that are inaccessible to motorized vehicles would continue to be inaccessible to vehicles or certain vehicle types in summer.

Table 4.19-9 provides a summary comparison of recreational impacts by issues and indicators for each alternative.

This page intentionally left blank

Table 4.19-9 Comparison of Recreational Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may cause changes to recreation setting, access, facilities, and/or opportunities.	Changes in motorized access (including restrictions and/or changes in maintenance) to recreation opportunities.	State and County roads provide access to connecting unpaved Forest Service roads, which provide access to NFS lands and facilities.	Access to the areas/facilities accessed from Thunder Mountain Road (FR 50375) east of the mine site would be modified due to closure of Stibnite Road (CR 50-412) and creation of the Burntlog Route, which would provide motorized access (year-round) to areas that currently do not have motorized access. Winter access would be increased along Cabin Creek Road due to new OSV route. Access to several OSV routes would be affected by plowing of Johnson Creek Road, Warm Lake Road and the Burntlog Route. Construction activities for transmission lines and the maintenance facility may result in delays or detoured access. The OHV Trail also would offer motorized access to areas that currently do not have motorized access. After mine reclamation, direct public access through the mine to Thunder Mountain Road would be restored.	Similar to Alternative 1, except there would be direct access to Thunder Mountain Road through the mine site during operations, in addition to access via the Burntlog Route (only available for public use when the public access road through the mine site was closed). The re-routed segment of the Burntlog Route would provide increased motorized access to areas without such access currently.	Similar to Alternative 1, except there would be OHV Trail and resulting new motorized access to areas from this route. There also would be different access thru the mine site to Thunder Mountain Road after mine reclamation.	Similar to Alternative 1, except there would be no OHV Trail or Burntlog Route and resulting new motorized access to areas from these facilities. There would be direct access to Thunder Mountain Road through the mine site during operations, similar to Alternative 2. Access to several OSV routes would be affected by plowing of Johnson Creek Road and Warm Lake Road.	Current access to the area via Johnson Creek Road and Stibnite Road would remain unimpeded. In general, areas that are inaccessible to motorized vehicles would continue to be inaccessible to vehicles or certain vehicle types in summer.
	Changes in recreation physical setting characteristics and related ROS class (by season) measured in acres.	Designated ROS classes in the analysis area vary by season, and include Rural, Roaded Natural, Roaded Modified, Semi-Primitive Motorized, Semi-Primitive Non-Motorized, and Primitive. Estimated existing ROS physical settings are similar.	Several components would result in inconsistencies with existing designated ROS classes including: Burntlog Route, plowing of the Burntlog Route, temporary plowing of the Johnson Creek Road and Stibnite Road, plowing of Warm Lake Road (CR 10-579), OHV Trail, new transmission line. **Table 4.19-1** and **Table 4.19-2** show acreages of changes to the estimated ROS physical setting, which are similar to the changes in ROS classes. Acreage of Estimated ROS Physical Setting Classes During Operations – Summer/Winter: Primitive: 16,838/20,930 acres Semi Primitive Non-Motorized: 207,209/233,645 acres Semi-Primitive Motorized:	Similar to Alternative 1. **Table 4.19-3** and **Table 4.19-4** show acreages of changes to the estimated ROS physical setting. Acreage of Estimated ROS Physical Setting Classes During Operations – Summer/Winter: Primitive: 16,124/20,216 acres Semi Primitive Non-Motorized: 207,140/233,581 acres Semi-Primitive Motorized: 86,189/220,712 acres Semi-Primitive Motorized Groomed (winter only): 46,135 acres Roaded Natural: 139,031/22,563 acres Rural: 79,401/30,813 acres Mine Site: 13,446/13,446 acres	Similar to Alternative 1, except there would be no inconsistencies with existing designated ROS classes related to the OHV Trail as this trail would not be built. **Table 4.19-5** and **Table 4.19-6** show acreages of changes to the estimated ROS physical setting. Acreage of Estimated ROS Physical Setting Classes During Operations – Summer/Winter: Primitive: 16,838/20,930 acres Semi Primitive Non-Motorized: 207,182/233,621 acres Semi-Primitive Motorized: 86,197/217,008 acres Semi-Primitive Motorized Groomed (winter only): 46,135 acres Roaded Natural:	Similar to Alternative 1, except there would be no inconsistencies with existing designated ROS classes related to the Burntlog Route, plowing of the Burntlog Route, or OHV Trail. Inconsistency with the existing designated ROS class for Johnson Creek and Stibnite Roads in the winter would not be temporary during construction (as in Alternative 1) but would continue through reclamation because the roads would be plowed as part of the Yellow Pine Route. **Table 4.19-7** and **Table 4.19-8** show acreages of changes to the estimated ROS physical setting. Acreage of Estimated ROS Physical Setting Classes During Operations – Summer/Winter:	Generally, existing designated ROS classes and physical recreation setting characteristics would remain as is. Modifications to the recreation setting in the mine site area from continued surface exploration, continued low level of unauthorized motorized use, and increased winter motorized access and use could lead to changes in the designated ROS class and/or ROS physical setting of some areas due to additional motorized use both in the summer and winter. Acreage of Estimated ROS Physical Setting Classes – Summer/Winter: Primitive: 17,278/21,370 acres Semi Primitive Non-Motorized: 218,512/245,210 acres Semi-Primitive Motorized:

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
			86,324/219,254 acres Semi-Primitive Motorized Groomed (winter only): 46,135 acres Roaded Natural: 138,136/23,244 acres Rural: 79,379/30,813 acres Mine Site: 13,446/13,446 acres		134,664/21,926 acres Rural: 79,418/30,813 acres Mine Site: 17,034/17,034 acres	Primitive: 17,278/21,370 acres Semi Primitive Non-Motorized: 208.434/234,849 acres Semi-Primitive Motorized: 86,549/235,610 acres Semi-Primitive Motorized Groomed (winter only): 42,324 acres Roaded Natural: 136,251/5,224 acres Rural: 79,373/40,284 acres Mine Site: 13,446/13,446 acres	83,497/240,387 acres Semi-Primitive Motorized Groomed (winter only): 50,436 acres (this acreage overlaps other features) Roaded Natural: 140,594/7,511 acres Rural: 81,450/26,853 acres
	Changes in recreation facilities (trails, campgrounds, trailheads), including the level of development and setting.	The Warm Lake area contains most of the developed recreation facilities (apart from trailheads). Scattered campgrounds and other facilities also are located in the Big Creek and Landmark areas and along Johnson Creek Road around and south of Yellow Pine. Developed recreation facilities primarily include campgrounds, cabins/lookouts, trailheads, and trails.	The Stibnite Mining District Interpretive Site would be closed until after mine reclamation. Many components would alter the setting of recreation facilities adjacent to them to a more developed setting due to increased man-made development, noise, traffic, etc. These components include the Burntlog Route, upgraded transmission lines, new transmission line to the mine site, Johnson Creek substation, mine site, cell tower on Meadow Creek Lookout Road, use of Warm Lake Road, and temporary use of the Yellow Pine Route. The OHV Trail would provide a new motorized trail facility.	Similar to Alternative 1, except the upgraded transmission line rerouted portion would affect the setting of an additional trail.	Similar to Alternative 1, except there would be no new motorized trail facility as the OHV Trail would not be built.	Similar to Alternative 1, except the Burntlog Route would not be built and therefore would not affect the setting of existing recreation facilities. There also would be no new motorized trail facility as the OHV Trail would not be built. In addition, changes to the setting of recreation facilities along the Yellow Pine Route would be affected through reclamation and not just temporarily during construction (as would be the case under Alternative 1).	Existing recreation facilities would continue in the existing recreation setting at their existing level of development.
	Changes in recreation use, potentially due to changes in recreation facilities, opportunities, access, and setting.	Developed recreation use is limited to the developed recreation sites (i.e., overnight facilities) located primarily in the Warm Lake, Landmark and Johnson Creek Road areas. Most recreation in the analysis area is dispersed use, which occurs outside of developed recreation sites.	Recreation use within the Operations Area Boundary would be displaced until after reclamation and may be displaced from around the mine site too during all SGP phases. Displacement of recreation use may result from construction, operation and reclamation of all components due to changes in access, and recreation opportunities and settings. The Burntlog Route and OHV Trail may increase recreation use along these routes. Some recreation use may return to the mine site area after reclamation; however, due to the changes in the recreation setting, some	Similar to Alternative 1, except there would be public access through the mine site, which may result in less displacement of use to areas/facilities accessed from Thunder Mountain Road (FR 50375). In addition, there would be less likelihood for increased dispersed recreation use along the Burntlog Route as this route would only be available for public use when the route through the mine site was closed.	Similar to Alternative 1, except the OHV Trail would not be built and therefore there would be no resulting displacement or increase in recreation use from this trail.	Similar to Alternative 1, except the OHV Trail and Burntlog Route would not be built and therefore there would be no resulting displacement or increase in recreation use from these routes. In addition, there would be public access through the mine site, which may result in less displacement of use to areas/facilities accessed from Thunder Mountain Road (FR 50375).	Existing recreation use would continue. Some unauthorized motorized use may continue to occur off of existing roads and motorized trails. Motorized winter use has expanded in recent years, and may continue to expand in the future, resulting in additional OSV routes and additional areas receiving winter motorized use.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
			use may be displaced to areas where the recreation setting is more natural.				
	Recreation special use permit use changes due to SGP construction, operation, or reclamation.	There are several current recreation-related special use permits in the analysis area for lodges, four outfitters and guides, one bike event, two organizational camps, and 62 recreation residences.	Construction, operations and reclamation activities would affect access to operating areas of three of the outfitters and guides, affect their ability to provide licensed activities, and may degrade customer's recreation experiences. Construction activities may interfere with the bike event. Permits in the Warm Lake area may be affected by traffic, noise and access changes from transmission line upgrades and use of Warm Lake Road. The recreation setting of the Paradise Valley recreation residence tract also may be affected by the Cabin Creek Road OSV route in the winter.	Similar to Alternative 1, except impacts to outfitters and guides from closure of Stibnite Road (CR 50-412) would not occur.	Similar to Alternative 1, except the OHV Trail would not impact access and recreation experiences for customers of two outfitters and guides.	Similar to Alternative 1, except impacts to outfitters and guides from closure of Stibnite Road (CR 50-412) would not occur, but there would be alternate impacts due to closure and use of the Yellow Pine Route. There would be no impacts to outfitters and guides from the Burntlog Route or the OHV Trail.	Activities, facilities, and uses allowed under current recreation-related special use permits would continue until the end of the permit term. Changes to the recreation setting due to additional motorized use may result in shifts in the use areas for permittees, particularly for non-motorized uses such as trail rides, fishing, hunting, etc.
	Changes in recreation opportunities available and/or the ability to participate in recreation opportunities.	Recreation opportunities such as hunting, fishing, hiking, camping, and horseback riding also are popular throughout the analysis area, with opportunities available at developed facilities, and at dispersed locations.	Recreation opportunities within the Operations Area Boundary would be eliminated until after reclamation and may be reduced from around the mine site too during all SGP phases. Construction, operation and reclamation of all components may affect wildlife-related opportunities due to displacement of wildlife. Non-motorized and wilderness-related opportunities could be reduced by the OHV Trail, mine site, new transmission line to the mine site, and the Burntlog Route. New access available from the OHV Trail and Burntlog Route may provide additional recreation opportunities.	Similar to Alternative 1, except the re-routed portion of the Burntlog Route would have additional impacts on wilderness-related opportunities as it would pass closer to the wilderness boundary.	Similar to Alternative 1, except there would be no impacts to recreation opportunities from the OHV Connector as this trail would not be built.	Similar to Alternative 1, except there would be no impacts to recreation opportunities from the OHV Trail and Burntlog Route as these facilities would not be built.	Existing recreation opportunities would continue to be available. In general, areas that are inaccessible to motorized vehicles would continue to be inaccessible to vehicles or certain vehicle types in summer, both limiting the motorized recreation opportunities available in some areas, and preserving the setting for non-motorized recreation opportunities in these areas. Motorized winter use has expanded in recent years, and may continue to expand in the future, resulting in additional winter recreation opportunities.

This page intentionally left blank

4.20 Scenic Resources

4.20.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to scenic resources includes the following issue and indicators:

Issue: The Stibnite Gold Project (SGP) may cause changes to scenic resources.

Indicators:

- Visual contrast.
- SGP component visibility.

Scenic resources were analyzed using geographic information system spatial analyses, scientific literature reviews, visual simulations, and information and analysis documented in reports prepared for the SGP.

Visual contrast and daytime/nighttime SGP visibility are the primary indicators used to evaluate potential impacts to scenic resources that could result from construction, operation, and closure and reclamation of the SGP, including:

- Change in landscape character and scenic quality of the analysis area.
- Change in distance zone.
- Change in nighttime lighting.
- Context of impacts, including that directed by forest plan standards and guidelines.
- Change in scenic integrity.

To evaluate the indicators and assess the potential consequences listed above, the scenic resources analysis included the following:

Visual Contrast Assessment. Visual contrast is defined as the degree of visual change that occurs in the characteristic landscape due to the introduction of SGP-related alterations. The assessment for visual contrast was performed by comparing visual elements (form, line, color, and texture) of the existing landscape with the alterations associated with the implementation of the proposed SGP. The visual contrast assessment informs change in landscape character and scenic quality. Visual contrast would primarily result from changes to landform from excavation and fill associated with mining activity; introduction of new or upgraded infrastructure; and removal of vegetation and grading activities for SGP components.

Viewshed Analysis. A viewshed analysis was completed using a geographic information system tool to identify locations where SGP components can theoretically be seen and areas where components would be obstructed by topography. This analysis was completed to help determine component visibility based on the relationship between the viewer and SGP components. The resulting viewshed represents the geographic area where one or more SGP components would theoretically be seen; however, it does not represent any measure of detectability of the components, nor does it account for vegetation that could screen SGP components from view. Actual visibility of SGP components also would be informed by viewer characteristics, described below.

Viewshed models were generated for the mine site, transmission line, communication sites, and primary access roads. Where specific information on alternatives design was not available, conservative assumptions were made based on professional judgement. Viewshed models assumed a viewer eye-level of 5.5 feet. Models were run using a 30-meter (98 feet) digital elevation model assuming bare ground and were clipped to a 25-mile radius. The model assumed all open pits, development rock storage facilities (DRSFs), and tailings storage facility (TSF) to full extent or build-out. The upgraded 138-kilovolt (kV) transmission line assumed the location of the current right-of-way (ROW) would be expanded to a 100-foot total width, and the structures would be spanned at an average of 600 feet at a height of 80 feet. The new transmission line structures from Johnson Creek substation to the mine site would be 80 feet tall within a 100-foot ROW. Communications towers at the mine site were modeled based on the assumption the existing site would not exceed 199 feet in height. The height of the Stibnite Gold Logistics Facility (SGLF) was modeled based on Midas Gold Idaho, Inc.'s (Midas Gold's) estimated height of 260 feet needed to communicate to the mine site. Access road upgrades were modeled at 26 feet wide.

Viewer Characteristics and Position. Viewer characteristics and position can affect the perception of visual contrast and a viewer's ability to discern objects inthe landscape (Bureau of Land Management 2013). Viewer characteristics pertain generally to one's visual acuity, engagement in the visual landscape, and viewer motion (moving or stationary). Viewer position includes consideration of viewer geometry and distance. Viewer geometry refers to the relative elevation of the viewing location as compared to landscape being viewed. A viewer's elevation to components of the SGP could range from superior, where the viewer is looking down at SGP component(s); to level views and inferior views, where the viewer is looking up. Distance affects the perception of visual contrast, because elements of form, line, color, and texture appear less detailed, as distance from a viewpoint increases. Distance zones were established to reflect visibility thresholds.

Key Observation Points. Key Observation Points (KOPs) were established at locations representing sensitive-use areas, such as travel routes, waterbodies, recreation areas (developed and dispersed), and residences. Data sources used to identify KOPs included viewshed analysis results, existing land use plans, recreation data, aerial photography, and Forest Plan Visual Quality Objective (VQO) data. These data were reviewed in conjunction with the alternatives to represent a comprehensive evaluation of the varied SGP components and their potential impacts to sensitive viewer locations in the analysis area, by alternative. Based on collected data sources, 17 viewpoints were identified (see **Figure 3.20-1** in Section 3.20).

Visualizations. Simulations (i.e., visualizations) were developed to characterize the anticipated level of visual change for the SGP. Simulations portray images of existing and proposed visual change to aid in visualizing the potential SGP effects for areas of high viewer sensitivity or concern. To generate the simulations, photographs were taken using a digital camera mounted on a tripod with a fixed 50-millimeter (equivalent) lens. At each KOP location, overlapping photographs were taken to allow for electronic conversion to a panoramic image representing the full human field of view. Global positioning system equipment was used to record the date, time, and location of each photographic series. Simulations were created using a scaled computer-generated model of proposed facilities that was developed in Autodesk Civil 3D. Geographic information system information from ESRI ArcMap software was imported into the 3D model. The model was then imported into Autodesk 3ds Max software where color and texture were added to resemble planned materials. The 3d model, the camera, and the lighting information was used to render a two-dimensional image of the proposed facility representing the view from the KOP for which simulations were developed. Simulations are used to evaluate the accuracy of predicted visual effects and are included in **Appendix O-1**.

VQO Classification Conformance. The results of the impact analysis were used to help determine SGP conformance with relevant VQO classifications for each alternative. As described in Section 3.20.3, Existing Conditions for Scenic Resources, VQOs establish minimum acceptable thresholds for landscape alterations from an otherwise natural-appearing forest landscape. The threshold of effects is exceeded when alterations do not meet the visual intensity and dominance criteria of the VQO.

4.20.2 Direct and Indirect Effects

The following analysis of effects associated with scenic resources is considered in the overall context of the Northern Rocky Mountain Province of the Rocky Mountain System in Idaho. The existing landscape in the analysis area is representative of the province, characterized as a continuous mountain landscape broken occasionally by wide valleys with flat or hilly floors. The Frank Church River of No Return Wilderness (FCRNRW) is renowned for its rugged and wild character. Its designation as a wilderness makes it, at a minimum, regionally significant. In addition, most of the analysis area is within the Preservation (P) and Partial Retention VQOs, indicating scenic integrity is generally high to moderate and that scenic resources in the analysis area are regionally important at a forest-wide scale.

Visual impacts from construction activities are short-term and typically arise from the presence, movement, and lighting associated with construction vehicles and equipment, dust plumes generated by grading, earthworks, or the movement of construction equipment and vehicles on unpaved surfaces. These types of visual impacts cease when the construction activities are finished.

Operational impacts are medium to long-term in duration and last at least through the operational phase of the SGP. These typically arise from the presence of new or larger buildings and built facilities, new or larger cleared ROWs for roads and utilities, lighting associated with facilities, equipment, and vehicles, dust plumes generated by earthworks or vehicle traffic on unpaved roads, and increased movement associated with mobile equipment or vehicle traffic.

Permanent effects to visual scenic resources would result from closure and reclamation, which would exist indefinitely.

4.20.2.1 Alternative 1

Consistency with Scenery Management Designations

Elements of Alternative 1 may be inconsistent with current VQOs as designated by the Payette National Forest (PNF) and the Boise National Forest (BNF). These are discussed under specific SGP elements in the text below. More specific details on acreages associated with these potential inconsistencies are provided in **Appendix O-6**.

4.20.2.1.1 MINE SITE

Based on the viewshed analysis, the mine site could be visible from two KOPs, where a detailed analysis was performed: KOP 1 and KOP 4. Although the viewshed analysis indicates the mine site also may be visible from KOP 2, a more in-depth review of site-specific photos indicate views of the mine site would be obstructed by intervening topography (see **Appendix O-2**, Viewshed Analyses and Key Observation Points, Alternative 1).

KOP 1: Meadow Creek Lookout

KOP 1 represents views experienced from Meadow Creek Lookout, directed northeast towards the proposed Hangar Flats DRSF and Meadow Creek TSF. Meadow Creek Lookout is not frequently visited by the general public due to its remoteness; however, it is one of the few recreational use areas with unobstructed superior (viewed from above) views of the mine site, as shown in the viewshed analysis (**Appendix O-2**). This location represents a moderate-sensitivity viewpoint that U.S. Forest Service (Forest Service) staff and recreational users would see when accessing this lookout through Meadow Creek Lookout Road (National Forest System Road [FR] 51290) and/or nearby Meadow Creek/Summit Trailhead and National Forest System Trail (NFST) 073. These areas are identified in the Boise National Forest Land and Resource Management Plan (Forest Service 2010) as level 2 sensitive use areas, which are associated with a moderate level of visual sensitivity.

KOP 4: Stibnite Road (CR 50-412)

KOP 4 represents views experienced from the Stibnite Road portion of McCall-Stibnite Road (County Road [CR] 50-412) directed east- southeast toward the Yellow Pine pit and DRSF. Stibnite Road (CR 50-412) is a sensitivity level 1 travel route that provides access to the mine site through the village of Yellow Pine. This road also provides access to Thunder Mountain Road (FR 50375) through the proposed mine site, and this viewpoint represents typical views that travelers would see from Stibnite Road (CR 50-412). This road would be closed to the public between the North Gate (approximately located at the confluence of Sugar Creek and CR 50-412) and South Gate during portions of construction and all of operations until closure and reclamation activities have been completed. Previous disturbance from historic mining activities is evident in the foreground, including light soil color contrasts from landform modifications. At this location, the road would be upgraded to accommodate mine traffic during construction, including a turnaround area at the North Gate.

4.20.2.1.1.1 Mine Site Construction

Effects to the Characteristic Landscape

Throughout construction and early mining, excavating pits and reprocessing the historic tailings would expose lighter-colored rock and some unweathered rock that would introduce strong visual contrast with existing rock, soils, and vegetation. Landform modifications associated with initial development during pre-production would result in a low level of visual contrast to the existing landscape, primarily due to historic mining disturbance and scale of construction activities during this timeframe. New disturbances in the footprint of existing modifications would introduce similar form, line, color, and textures.

As production moves into undisturbed areas, slope cuts and terraces associated with the open pits would remove vegetation, expose unweathered lighter-colored rock, and create unnatural horizontal lines in the landscape. At night, lighting from the mine facilities, including the communications tower to the east of the mine site, the pits, haul trucks, and traffic on access routes would change the character of the night sky by increasing sky glow or light pollution. However, these impacts would be reduced by implementing lighting mitigation measures, including directing lights downward, and shielding where appropriate. Overall, short-term visual contrast introduced to the characteristic landscape would be moderate, primarily due to the expansion of mining activities and introduction of nighttime lighting.

Effects by KOP

KOP 1: Meadow Creek Lookout

A portion of the mine site is visible from this viewpoint in the middle-ground distance zone, approximately 2.5 miles to the northeast. Short-term impacts visible from KOP 1 would be similar to those described above and would be seen from a superior vantage point. Visual impacts from construction would alter the experience for individuals at the lookout by transforming to a more industrial setting.

KOP 4: Stibnite Road (CR 50-412)

Short-term visual contrast from this viewpoint would result from construction activities at the mine site. Road widening and reconfiguration to accommodate a turnaround area at the North Gate would result in a low-moderate level of visual contrast, because similar form, line, and color would be introduced. Construction traffic, equipment, and staff would be evident from this travel route during construction/pre-production. The resulting level of short-term visual contrast would be perceived as moderate due to unobstructed views of vegetation removal and other construction activities in the foreground. Visual contrast of the mine site from Stibnite Road

(CR 50-412) would be localized to a small portion of the road near the mine site. Where visible near the North Gate, historic mining disturbances would remain visually dominant during construction at this isolated location. These impacts would alter the visual experience and setting for individuals traveling on the forest road by transforming the surrounding setting to a more industrial-like landscape.

4.20.2.1.1.2 Mine Site Operations

Effects to the Characteristic Landscape

Major landscape alterations associated with the mine site under Alternative 1 would expand on the existing mining landscape modifications through the operation of Yellow Pine pit, West End pit, Hangar Flats pit, DRSFs, and the TSF. Modifications that currently exist due to past mining activity include the introduction of monolithic landforms of an industrial scale that exhibit bold form, strong lines, contrasting color, and vegetation patterns and textures that do not blend into the natural landscape. Alternative 1 would introduce additional modifications to the landscape similar to those present, which would further reduce the scenic integrity of the area by introducing additional strong visual contrast and discordant elements. Other mine site support facilities, including ore-processing, storage areas, worker housing facility, and other administrative offices, also would modify the characteristic setting, but at a smaller scale.

Additionally, air quality modeling predicts visual impacts up to the distances modeled of 10 kilometers (approximately 6 miles). Actual visibility would depend on meteorological conditions. Visibility and associated impacts would lessen at distances greater than six miles from the mine site and visual contrast would appear strongest during times of low sun angle. See Section 4.3.2, Direct and Indirect Effects to Air Quality, for more information.

New disturbances in the footprint of existing modifications would introduce similar form, line, color, and textures. As production moves into undisturbed areas, slope cuts and terraces associated with the open pits would remove vegetation, expose unweathered lighter-colored rock, and create unnatural horizontal lines in the landscape. At night, lighting from the mine support facilities, including the communications tower, the pits, haul trucks, and traffic on access roads, would change the landscape character of the night sky by increasing sky glow or light pollution. Long-term visual contrast would be associated with the expansion of mining activities to full build-out and continued nighttime lighting. However, these impacts would be reduced by implementing lighting mitigation measures, including directing lights downward, and shielding where appropriate. The West End, Fiddle, and Hangar Flats DRSFs would be located in steep valleys between mountain ridges. The material would be placed on an active working base and expanded upward as the facilities are built out. As a result of storing development rock in valleys surrounded by mountainous terrain, the DRSFs would appear as wider valley basins, with terracing or sloping evident at the valley edges. As landform modifications proceed for all three open pits, the DRSFs, and the TSF, the visual contrast would be strong, and result in a high level of change to the existing characteristic landscape.

Under Alternative 1, the footprint of the mine site would be within areas managed as a VQO of Retention or Partial Retention. Where visible from viewing platforms, the mine site would not meet either of these VQOs as the mine site components would introduce form, line, color, and texture found infrequently or not at all in the characteristic landscape, and to a degree that would dominate the characteristic landscape. These effects could be visible from the Stibnite Road (CR 50-412) and the Meadow Creek Lookout viewing platforms.

Effects by KOP

KOP 1: Meadow Creek Lookout

Operational conditions at the end of mine operations were simulated from KOP 1, provided in **Appendix O-2**. Under Alternative 1, during operational conditions, the tailings from the mine site would appear as large, flat, smooth, and uniform at the bottom of the valley, which would result in strong visual contrast against the sloping, uneven texture of the surrounding mountains and valley. The flat top and monolithic form of the TSF would introduce strong contrast against the more complex, rough, rugged surrounding topography. The geometric formation and sharp escarpment created as a result of the Hangar Flats pit benches would strongly contrast with surrounding natural topography. Strong color contrast would result from the Hangar Flats pit wall face and unweathered tailings, which would appear as a lighter, more uniform color than the surrounding undisturbed landscape, with varied colors and textures. From this viewpoint, the TSF full build-out would consume most of the Meadow Creek valley, creating a wider basin between the mountain ranges, which is not typical for this landscape. The TSF would appear to be an artificially smooth, regular, and continuous form, contributing to a strong level of long-term visual contrast. Intervening terrain would obstruct views of the Yellow Pine pit, West End pit, and DRSFs. Only the TSF, Hangar Flats DRSF, and Hangar Flats pit would be visually dominant in the middle-ground distance zone. Due to their distance, mine support facilities may be visible but individual components would not be perceptible from KOP 1. A plume would be visible from KOP 1.

Nighttime lighting also would be perceptible during construction and operation, although implementation of Forest Service mitigation measures specific to lighting would reduce the magnitude of impacts from sky glow. Permanent contrast would be slightly reduced over time, because color contrasts of the TSF and Hangar Flats pit wall would gradually diminish through reclamation, revegetation, and rock weathering. The strong color contrast associated with the lighter-colored pit benches would be reduced through application of surface coloring treatments that are similar to the soil color of undisturbed areas. Unnatural linear landscape patterns may appear over time along the Hangar Flats pit benches where vegetation would likely grow denser; however, application of surface coloring treatments on vertical benches would reduce color contrast, resulting in a less-dominant line across the pit wall. The Hangar Flats pit would accumulate water, forming a lake over time that would have permanent visual contrast with the characteristic landscape. Strong line and color contrast would be created, which may be softened slightly as riparian vegetation establishes around the lake and becomes more diverse over time. Visual impacts from mine operation would alter the experience for individuals at the lookout by transforming to a more industrial setting.

KOP 4: Stibnite Road (CR 50-412)

The viewshed analysis results demonstrate that the mine site is completely obstructed by topography for most of this travel route between Yellow Pine and the mine site, and views of the mine site would be limited to a small portion of the road in the immediate vicinity of the mine site. Views experienced from KOP 4 under existing conditions are included in **Appendix O-1**.

During operations under Alternatives 1 2, and 3, the Stibnite Road (CR 50-412) would no longer serve as the primary access road for the mine, and the portion of Stibnite Road (CR 50-412) between the mine gates would be closed to the public under Alternatives 1 and 3. Traffic past the North Gate would be limited to administrative access as needed. Near the North Gate, the mine site would be visually dominant to receptors due to the scale of landform modifications visible in the foreground. A portion of the Yellow Pine pit would be visible once it is fully built out, but adjacent terrain and vegetation would screen most of disturbances at Yellow Pine pit. Where visible, the geometric formation and sharp color contrasts as a result of the Yellow Pine pit would strongly contrast with surrounding natural topography; however, during and after operations, the pit would be filled with development rock, and reclaimed. Color contrast associated with untreated development rock is anticipated to be strong, and would appear light tan in color, which is more uniform in appearance than the surrounding undisturbed landscape, which is primarily dark green.

However, because the mine site would not be visible along most of the Stibnite Road (CR 50-412), overall long-term visual contrast associated with road improvements would be low to moderate and remain subordinate to viewers along this travel route. Although minimized through mitigation measures, nighttime lighting would be perceptible to travelers from both the mine site and mine-related traffic on the road. The impacts visible from KOP 4 would alter the experience of individuals traveling on the road by transforming the surrounding setting to a more industrial-like landscape. A plume would be visible from KOP 4.

4.20.2.1.1.3 Mine Site Closure and Reclamation

Effects to the Characteristic Landscape

Permanent visual contrast associated with structures (i.e., buildings, communication facilities, transmission line) would be minimal, because mine support facilities would be dismantled, removed from the site, and landform would be regraded, and reclaimed with native vegetation. Closure of the mine site facilities also would eliminate the primary source of nighttime lighting. Once reclamation is completed and mine-related vehicle travel to the mine site has ceased, nighttime lighting would be similar to existing conditions. At closure, major landform modifications at the mine site, including the Yellow Pine pit backfill, the DRSFs, the TSF, and haul roads, would be contoured and graded to blend into the surrounding topography and terrain. Strong visual contrast would be permanent for a portion of all three pits where lighter-colored exposed rock and horizontal benches would remain in unnatural, geometric landforms. These lighter-colored landforms would contrast sharply with adjacent scenery that has been unmodified. The geometric form of the horizontal benches would still appear unnatural in this setting. The DRSFs and TSF would have rounded crests and variably shaped angles to more closely resemble natural landforms, which would help to reduce visual contrast. As mature vegetation establishes on reclaimed DRSFs and TSF landforms over time, visual contrast associated with lighter-colored soils would diminish for a large portion of these disturbed areas. Although reclamation and revegetation efforts may reduce color contrast over time, the TSF would require a substantial buttress to ensure long-term stability, which would introduce strong geometric lines and unnatural form into the landscape permanently.

The reconfiguration of the East Fork South Fork Salmon River (EFSFSR) through the reclaimed mine site would introduce curvilinear (i.e., winding) and more natural-appearing forms to the landscape; however, the modified landforms associated with the mine site would dominate the setting. The reclamation of the EFSFSR over time would soften the sharp contrasts in that area as vegetation matures. Unlike the Yellow Pine pit, which would be backfilled to accommodate reclamation of the EFSFSR, Hangar Flats and West End pits would not be backfilled and would have pit lakes that would introduce dark tones and reflectiveness from the water. Stibnite Road (CR 50-412) would not be reclaimed and a new connector with to Thunder Mountain Road (FR 50375) would be constructed over the backfilled Yellow Pine pit. The level of visual contrast associated with the road would be low, similar to existing conditions; and would not contribute substantially to permanent effects. The TSF area, angled buttress, and open-pit benches would contribute collectively to moderate-high permanent visual contrast to the characteristic landscape.

Effects by KOP

KOP 1: Meadow Creek Lookout

The strong visual contrast created by lines and colors of the mine site would be softened slightly over time as vegetation establishes around the lake and becomes more diverse. Overall with reclamation, the permanent level of visual contrast would be reduced to moderate-strong for viewers at this lookout indefinitely. Nighttime lighting would return to existing conditions.

KOP 4: Stibnite Road (CR 50-412)

At closure, Stibnite Road (CR 50-412) would be fully re-opened to the public and reclaimed close to existing conditions except for the new segment through the reclaimed Yellow Pine pit and mine site. Permanent contrast would be reduced to moderate-strong over time, as color contrasts of Yellow Pine pit would gradually diminish through reclamation, revegetation, and rock weathering. Night skies would appear as they did prior to mine development.

4.20.2.1.2 ACCESS ROADS

The viewshed analysis (**Appendix O-2**) indicates that the proposed Burntlog Route would be visible from seven KOPs, where detailed analyses were performed: KOP 1, 2, 4, 9, 10, 12, and 13. KOPs 1 and 4 are described above in Section 4.20.2.1.1. Visibility would generally extend up to around 2 to 3 miles to the east of Burntlog Route and less than 1 mile to the west. The route also could be visible from a ridgeline about 5 to 7 miles west, although due to distance, visual contrast would be weak. Upon further detailed review, the Burntlog Route would not be visible from KOP 2 because of topographic and vegetation screening as evidenced by photographs, and visual simulations; therefore, KOP 2 is not discussed further in this section. The following paragraphs describe the representative KOPs for access roads under this alternative. Visual effects of the SGP on these KOPs are summarized in the Construction, Operations, and Closure and Reclamation sections following.

KOP 9: Frank Church-River of No Return Wilderness – Pistol Lake

Pistol Lake is located about 1mile from the end of NFST 448C in the FCRNRW. KOP 9 is located approximately 3 miles east of the Burntlog Route) at its closest point. See **Figure 3.20-1**. This KOP represents what dispersed recreation users (hikers, horseback riders) might see from a location in the wilderness directly east of proposed new roadway segment for the Burntlog Route. It affords superior views across drainages and ridgelines, including a burned area of the Boise National Forest.

KOP 10: Burnt Log Road (FR 447)

KOP 10 represents foreground views from Burnt Log Road (FR 447) directed southwest. **Figure 3.20-1** shows its location. Burnt Log Road (FR 447) is currently a high-clearance vehicle route that provides access to Snowshoe Summit Trailhead at the edge of the FCRNRW and Burntlog Creek, and ends near Chilcoot Pass. This road is a sensitivity level 2 travel route and has overall moderate visual sensitivity. Burnt Log Road would be widened and graded to accommodate mine site traffic under Alternatives 1, 2, and 3.

KOP 12: Mud Lake Dispersed Camping Area

KOP 12 represents views from the Mud Lake dispersed camping area looking north-northwest (KOP 12a) and south-southeast (KOP 12b). Burnt Log Road (FR 447) is currently a high-clearance vehicle travel route with moderate visual sensitivity that provides access to Mud Lake dispersed camping area, just 2 miles east of Landmark. **Figure 3.20-1** shows its location.

KOP 13: Warm Lake Road (CR 10-579) at Landmark Maintenance Facility

KOP 13 represents views looking north from the Warm Lake Road (CR 10-579) at the proposed Landmark Maintenance Facility location. **Figure 3.20-1** shows its location. Warm Lake Road (CR 10-579) is a paved, passenger vehicle accessible, travel route that provides access to Landmark and Warm Lake. This is a sensitivity level 1 travel route used by summer and winter recreational visitors.

4.20.2.1.2.1 Access Road Construction

Effects to the Characteristic Landscape

Construction activity associated with the primary access road (Burntlog Route) would introduce short term visual contrast. Mine traffic would use existing roads (Warm Lake Road [CR 10-579], Johnson Creek Road [CR 10-413], and Stibnite Road [CR 50-412]) to access the mine year-round during construction of the Burntlog Route. Warm Lake Road (CR 10-579) does not require improvements to accommodate mine traffic during construction and would continue to be used throughout operations; therefore, short-term visual impacts associated with those roads would be limited to increased construction traffic and associated dust. It would be plowed year-round rather than seasonally groomed for snow machines. Traffic counts would increase.

Johnson Creek Road (CR 10-413) and Stibnite Road (CR 50-412) would require improvements, including ditching, culvert repair, graveling, and winter snow removal, to support the increased road use during construction. No widening or changes to the Johnson Creek Road alignment are anticipated under Alternative 1; although a groomed winter route would be added which would add movement to the winter landscape and additional winter viewer platform in this area. Additional tree clearing may be needed to support temporary winter maintenance activities along these roads until Burntlog Route is open to use, although there is no detailed engineering information at this time. Similar changes to the characteristic landscape would occur due to construction of the off-highway vehicle (OHV) connector trail. Dust and movement along the corridor from construction equipment would be visible and introduce contrast to the more natural appearing surrounding environment. Short-term visual contrast associated with maintenance activities, vegetation removal, and winter plowing would be low because the level of visual change would be similar to existing conditions.

Effects by KOP

KOP 1: Meadow Creek Lookout

Short-term, construction-related impacts visible from KOP 1 would be associated with mine traffic on FR 50479 (Juggernaut Road) and construction activities along Burnt Log Road (FR 447), which would include increased movement from construction traffic and associated dust. These impacts would appear subordinate to viewers compared with the mine site.

KOP 9: Frank Church-River of No Return Wilderness – Pistol Lake

Visibility is primarily screened by existing vegetation and intervening topography. During construction activities, weak short-term visual contrast could be experienced from KOP 9. Construction equipment would be difficult to discern at this distance; however, dust and construction activities along the route may be visible. The impacts experienced from KOP 9 would have little to no impact on the overall user experience of the wilderness.

KOP 10: Burnt Log Road (FR 447)

Short-term visual contrast from this viewpoint would result from construction activities associated with improvements along Burnt Log Road (FR 447). Construction traffic, equipment, and staff would be evident from this travel route during pre-production. The resulting level of short-term visual contrast would be moderate for receptors due to unobstructed views of construction activities in the foreground. The impacts visible from KOP 10 would alter the experience of individuals traveling on the road by transforming the surrounding setting to a more industrial-like landscape.

KOP 12: Mud Lake Dispersed Camping Area

Short-term visual contrast from this viewpoint would result from construction activities associated with improvements along Burnt Log Road (FR 447) within 100 feet of this site. Construction traffic, equipment, and staff would be evident from this area during pre-production. The resulting level of short-term visual contrast would be moderate for receptors due to views of construction activities in the foreground. The presence of heavy machinery and construction workers, and associated movement, would change the mostly natural setting viewed from KOP 12 to a more industrial-type setting, which would change the experience for viewers using the Mud Lake Dispersed Camping Area at KOP 12; campers would likely not use the site during construction due to visual and noise disruptions.

KOP 13: Warm Lake Road (CR 10-579) at Landmark Maintenance Facility

Short-term visual contrast perceptible to travelers on Warm Lake Road (CR 10-579) would result from construction of the Burntlog Route. Construction traffic, equipment, and staff would be evident from this travel route during construction. The resulting level of short-term visual contrast would be moderate for receptors due to views of construction activities in the foreground. The impacts visible from KOP 13 would alter the experience of individuals traveling on the road by transforming the surrounding setting to a more industrial-like landscape.

4.20.2.1.2.2 Access Road Operations

Effects to the Characteristic Landscape

Access road improvements along the existing portion of Burnt Log Road (FR 447) from Landmark to Trapper Flat would require grading and removal of vegetation to accommodate a travel width of 20 feet and total width of up to 26 feet (but less in some locations), including shoulders. Road modifications such as side-ditching, culverts, guardrails, and bridges may be upgraded and added to accommodate the expanded road width and stream crossing considerations. Grading improvements and vegetation removal would result in similar form, line, color, and texture of the existing road and disturbed areas associated with dispersed recreation activities. Similar to the existing portion of Burnt Log Road (FR 447), upgrades required along the portion of Thunder Mountain Road (FR 50375) between the worker housing facility and the mine entrance gate would require upgrades to existing access, including grading, vegetation removal, and upgrade of road structures.

Vegetation along portions of Burnt Log Road (FR 447) has been affected by historic fires resulting in dead or felled pine trees across the landscape. Long-term visual contrast to the characteristic landscape in these conditions is anticipated to be low-moderate in areas historically affected by fire. Removal of felled trees and smaller understory vegetation would have a low-moderate level of visual change to the characteristic landscape. Portions of Burnt Log Road (FR 447) near Burntlog Creek and East Fork Burntlog Creek are occupied by dense pine trees and living vegetation that is more characteristic of the landscape. Moderate visual contrast would occur in these areas due to the removal of dense green vegetation. The new access road segment between the end of Burnt Log Road (FR 447) to Thunder Mountain Road

(FR 50375) (approximately 15 miles) would likely result in a moderate-strong level of visual change to form, line, color, and texture associated with grading and vegetation removal in steep, rugged terrain.

Portions of the Burntlog Route that require retaining walls or bridges, which would introduce new structural elements into the setting, would increase visual contrast to strong. Approximately 1.5 miles of soil nail walls would be constructed, with the longest section being approximately 2,100 linear feet. These walls would appear darker in color than the surroundings and would appear steeper (more vertical) than surrounding topography. Their shape and line would have a more geometrical, engineered appearance compared with the native soil and topography of their surroundings. Where new access is needed, long-term visual contrast to the characteristic landscape would be moderate-high because of linear landform modifications, changes in vegetation, and introduction of new structures in a landscape that is unmodified.

During operation of the mine, the Burntlog Route would be routinely maintained, including grading (as needed), spot graveling, dust control, and snow removal in the winter. Mine operation would create traffic to the mine site from buses, vans, trucks, and personal vehicles throughout mining operations. It is estimated that the annual average daily traffic along Burntlog Route would be 68 total vehicles; 49 of those would be classified as a heavy vehicle, and 19 would be classified as a light vehicle. The presence of up to 68 vehicles per day on this route would introduce movement into the characteristic landscape, which—for the new portion of the Burntlog Route—is primarily roadless. In addition, the presence of vehicles on the road at night would introduce new lighting into the landscape.

Similar changes to the characteristic landscape would occur along the OHV connector trail that would provide recreational user access to Meadow Creek Lookout Road (FR 51290). This recreation travel route would be 15 feet wide to accommodate smaller OHVs and motorcycles between the new transmission line route and Meadow Creek Lookout Road. Overall, long-term visual contrast would be moderate for portions of these access roads requiring upgrades, and moderate-strong to strong for new improvements.

New segments of the Burntlog Route would introduce approximately 15 miles of new road that would be a viewing platform for areas of the forest, providing views to portions of the forest that are not afforded any viewing opportunity by an existing road or trail. Approximately 2 miles of new road would be situated within the viewshed of the mine site in the middle-ground distance zone, thereby increasing viewer exposure to mine-related visual impacts.

New construction associated with the Burntlog Route would cross areas managed as Retention, Partial Retention, and Modification VQOs. Except for the soil nail walls, access roads would generally conform to the Partial Retention and Modification VQO. Although new and upgraded portions of the Burntlog Route and Meadow Creek OHV Connector Trail could introduce strong visual contrast in some areas, it typically would be limited to the immediate foreground as viewed from the road/trail introducing the contrast, although it also may be visible from some trails and by individuals participating in dispersed recreation not associated with a viewer platform, such as hunting. New access facilities would not be consistent with the Retention VQO as they would introduce new lines, colors, and textures that would be evident.

Effects by KOP

KOP 1: Meadow Creek Lookout

Portions of Burntlog Route would be visible from KOP 1 when looking south. The light-tan color and straight horizontal line introduced by the new roadway portion of the Burntlog Route would introduce strong visual contrast against the darker surrounding colors, undulating ridgelines, and variable textures of the vegetation covered terrain. **Appendix O-1** provides a visual simulation looking south from KOP 1 (KOP 1b) of the proposed Burntlog Route.

KOP 9: Frank Church-River of No Return Wilderness – Pistol Lake

Visibility is primarily screened by existing vegetation and intervening topography. The increased width of the existing road would increase visual contrast, primarily associated with the expanded width of light-colored ground exposed as a result of the road widening. Visual contrast would appear weak from KOP 9 as the landscape already appears lighter in color than other surrounding areas due to the effects of historic fires in the area. The improvements to Burnt Log Road (FR 447) would appear subordinate to the large-scale surrounding landscape that would absorb the visibility of these changes to the landscape. The new roadway would not be visible from KOP 9.

KOP 10: Burnt Log Road (FR 447)

Access road improvements along the existing portion of Burnt Log Road (FR 447) from Landmark to Trapper Flat would require grading and removal of vegetation to accommodate a total travel width of 20 feet and total width of up to 26 feet (but less in some locations), including shoulders. In some locations, vegetation is densely wooded with thick understory vegetation. Removal would result in moderate color and line contrasts at the road edges. These contrasts would be less strong for portions of Burnt Log Road (FR 447) that are affected by historic fires. Dead or felled trees would be removed, along with low-lying vegetation, resulting in a low to low-moderate level of visual contrast. Landform changes and color contrast associated with new disturbance where widening or cut/fill is necessary would contribute to a moderate level of visual change.

Introduction of structural components such as culverts, guardrails, and bridges that may be upgraded or added to accommodate the expanded road width. Improved access would introduce a moderate level of visual change to existing form, line, and color; however, Burnt Log Road improvements would remain visually co-dominant to sensitive viewers on the road. During operation of the mine, Burntlog Route would be routinely maintained, including grading (as needed), spot graveling, dust control, and snow removal in the winter. Mine operations would generate traffic to the mine site from buses, vans, trucks, and personal vehicles throughout mining operations. When traveling on the road at night, these vehicles would introduce new lighting into the landscape. The impacts visible from KOP 10 would alter the experience of individuals traveling on the forest road by transforming the surrounding setting to a more industrial-like landscape. A simulation from KOP 10 showing these potential effects is included in **Appendix O-1**.

KOP 12: Mud Lake Dispersed Camping Area

Access road improvements along Burnt Log Road (FR 447) near Mud Lake would require grading and removal of vegetation to accommodate a total travel width of 20 feet and total width of up to 26 feet (but less in some locations), including shoulders. Grading improvements and vegetation removal would result in similar form, line, color, and texture as the existing road. Landform changes and color contrast associated with new disturbance where widening or cut/fill is necessary would contribute to a low-moderate level of visual change, because the site is relatively flat. Noticeable contrast would result from vegetation removal along the road. At this location, vegetation is densely wooded with thick understory vegetation. Removal would result in moderate color and line contrasts at the road edges.

Structural components such as culverts or guardrails may be upgraded or added to accommodate the expanded road width. Improved access would introduce a moderate level of visual contrast to existing form, line, and color; however, Burnt Log Road (FR 447) improvements would remain visually co-dominant to sensitive viewers at this dispersed camping area. During operation of the mine, Burntlog Route would be routinely maintained, including grading (as needed), spot graveling, dust control, and snow removal in the winter. Mine operation would create traffic to the mine site from buses, vans, trucks, and personal vehicles throughout mining operations. The presence of vehicles on this road at night would introduce new lighting into an area that has no permanent lighting sources. These impacts could result in some campers choosing to camp in other dispersed camping areas that have not been visually impacted, particularly night sky impacts.

KOP 13: Warm Lake Road (CR 10-579) at Landmark Maintenance Facility

Access road maintenance and use along the existing Burnt Log Road (FR 447) near KOP 13 would be similar to those described above for KOP 12; therefore, visual impacts also would be similar. However; visual contrast introduced by improvements to Burnt Log Road (FR 447) would be weak as viewed from KOP 13 and associated visual changes would appear subordinate in the landscape. The impacts visible from KOP 13 would alter the experience of individuals traveling on the road by transforming the surrounding setting to a more industrial-like landscape.

4.20.2.1.2.3 Access Road Closure and Reclamation

Effects to the Characteristic Landscape

Upon closure and reclamation of the SGP, upgraded portions of Burnt Log Road (FR 447) would be reclaimed to existing conditions, and new portions of the Burntlog Route would be removed from use and reclaimed. However; soil nail walls are proposed to remain in place after decommissioning and their appearance would continue to introduce strong contrast with the surrounding landscape as described above. Post-mine closure, traffic would likely return to a pre-mining level of use. Permanent visual contrast to the characteristic landscape generally would be minimal to moderate, because the road would be returned to previous width although the flatter grades and smoother curves would be retained. Changes to the landscape from removal of mature vegetation would remain evident for several years after reclamation activities. The 1.5 miles of remaining soil nail walls would be an exception; these areas would introduce strong visual contrast; however, the geographic extent of these changes would be localized.

Effects by KOP

KOP 1: Meadow Creek Lookout

Permanent visual contrast would be non-visible to weakly visible as viewed from KOP 9, because the portion of Burntlog Route visible from the KOP would be reclaimed to existing conditions

KOP 9: Frank Church-River of No Return Wilderness

Permanent visual contrast would be non-visible to weakly visible as viewed from KOP 9 because the portion of improved Burnt Log Road (FR 447) visible from the KOP would be reclaimed to existing conditions. Due to screening from vegetation and intervening topography and location within a previously burned area, changes to the landscape from removal of mature vegetation would likely not be evident.

KOP 10: Burnt Log Road (FR 447)

Upon closure and reclamation of the mine site, upgraded portions (except segments abandoned at the beginning of construction, which would have been currently reclaimed with construction activities) of Burnt Log Road (FR 447) would be reclaimed to existing conditions. At mine closure, traffic would likely return to a pre- mining level of use. Permanent visual contrast would be minimal to low-moderate, because the road would be returned to existing conditions with an assumed low-traffic volume. Changes to the landscape from removal of mature vegetation would remain evident for several years after reclamation activities.

KOP 12: Mud Lake Dispersed Camping Area

Upon closure and reclamation of the mine site, upgraded portions of Burnt Log Road (FR 447) would be reclaimed to existing conditions (except segments abandoned at the beginning of construction, which would have been currently reclaimed with construction activities). At mine closure, traffic would likely return to a pre- mining level of use. Permanent visual contrast to the characteristic landscape would be minimal to low-moderate, because the road would be returned to existing conditions with an assumed low-traffic volume. Upon closure and reclamation of the mine site, upgraded portions of Burnt Log Road (FR 447) would eventually be reclaimed similar to existing conditions; although removal of mature vegetation would remain visually noticeable for many years after closure and reclamation activities are complete.

KOP 13: Warm Lake Road (CR 10-579) at Landmark Maintenance Facility

Due to limited visibility of Burnt Log Road (FR 447) from Warm Lake Road (CR 10-579), visual changes from access road improvements would not be evident from KOP 13 after mine closure and reclamation.

4.20.2.1.3 UTILITIES

The viewshed analysis (**Appendix O-2**) indicates that utilities would be visible from 12 KOPs, where detailed analyses were performed: KOP 1, 2, 3, 5, 6, 7, 8, 9, 14, 15, 16, and 17. KOP 1 and 9 are described in Sections 4.20.1.1 and 4.20.1.2. Visibility is generally limited to a couple of miles on either side of the transmission line but does extend to some ridgelines 5 miles or more to the west. Potential visibility of the transmission line in the valley extends to about 5 miles on either side, although visual contrast would be weak due to less vegetation removal required in these areas. Communications towers are not expected to be visible from the KOPs.

KOP 2: Frank Church-River of No Return Wilderness – Summit Trail (NFST 088)

Summit Trail offers panoramic views of the Salmon River Mountains and wilderness area for the entire length of the trail between Snowshoe Summit up to Meadow Ridge. This KOP represents what moderate sensitivity recreation users (hikers, horseback riders) would see from a non-motorized trail at the edge of the wilderness. Similar to Meadow Creek Lookout, this area is not frequented by many visitors because of its remoteness; and is associated with a moderate level of sensitivity which is consistent for similar trails in this area. This trail crosses areas designated as roadless and existing views of the characteristic landscape are typically limited to dispersed recreation such as hiking or horseback riding.

KOP 3: Frank Church-River of No Return Wilderness – Mule Hill Trail (NFST 219)

Mule Hill Trail is accessible from Meadow Creek Lookout Road (FR 51290) and provides access to the Indian Creek Trail. This viewpoint represents what high sensitivity recreation users (hikers, horseback riders) might see from a trail within the wilderness.

KOP 5: Hennessey Meadow Trailhead

KOP 5 represents views from Hennessey Meadow Trailhead looking east toward the proposed transmission line corridor. Hennessey Meadow Trailhead is at the end of Horse Heaven Road (FR 416W), which is a high-clearance vehicle travel route that follows Riordan Creek. This trailhead provides access to NFST 097 which leads to Riordan Lake, a popular fishing location in the area; and NFST 233, along the historic transmission route to the mine site. At this location, NFST 233 traverses extremely steep terrain that is primarily accessible by experienced OHV users and may receive limited use due this factor. This trailhead is associated with moderate sensitivity and is a typical viewpoint for motorized vehicle recreational users in the area. The past transmission line ROW corridor is evident, although structures are not present. A new transmission line corridor would parallel FR 416W (Horse Heaven Road) and NFST 233 to the mine site.

KOP 6: Twin Bridges Dispersed Camping Area

KOP 6 represents views from Twin Bridges dispersed camping area looking south toward the proposed upgraded transmission line. Twin Bridges dispersed camping area is between Johnson Creek and the existing transmission line corridor, with Johnson Creek Road (CR 10-413) immediately west of the transmission line. This dispersed camping area is associated with moderate visual sensitivity. This viewing location is representative of dispersed recreational viewers in the area, with views of the existing transmission line. Screening is limited, and the modifications associated with the existing ROW are co-dominant in the landscape due to the enclosed landscape setting. Human development is limited to existing roads and the transmission line ROW, which would be upgraded.

KOP 7: Idaho Centennial Trail at Johnson Creek Road (CR 10-413) and Burntlog Creek Trail (NFST 075)

KOP 7 represents views from the Idaho Centennial Trail (ICT) directed west toward Burnt Log Road (FR 447). The ICT follows the Burntlog Creek Trail (NFST 075) heading north to the junction of Johnson Creek Road (CR 10-413). This trail is identified as a sensitive level 1 use area and is associated with high visual sensitivity. This KOP represents a typical ICT trail user in the analysis area with views of the transmission line upgrade. Recreational viewers associated with this viewpoint currently have unobstructed views of the transmission line, primarily due to ROW vegetation clearing. Modifications near the trail are limited to existing roads and the transmission line ROW.

KOP 8: Trout Creek Campground

KOP 8 represents the view from Trout Creek Campground looking west toward the upgraded transmission line. Trout Creek Campground is off Johnson Creek Road (CR 10-413) just southeast of the existing transmission line corridor. This campground is a sensitive level 1 use area, with developed amenities including fire pits, picnic benches, and restrooms. This viewing location is representative of campers in the analysis area that would have existing views of the transmission line corridor. The transmission line corridor is immediately adjacent to the campsite, and screening is limited to a few rows of trees at this site. Although the transmission line structures and conductors are visually subordinate from the campground due to vegetation screening, the ROW clearing is visible from many locations where understory vegetation has been thinned.

KOP 14: Cabin Creek Road (FR 467)

KOP 14 represents views from Cabin Creek Road (FR 467) looking north-northeast (KOP 14a) and south-southwest (KOP 14b) toward the upgraded transmission line. Cabin Creek Road (FR 467) is north of the Warm Lake area, and cuts across the Thunderbolt Mountains, terminating at Johnson Creek Road (CR 10-413) near Trout Creek Campground. This travel route is a sensitive level 2 use area and is used frequently for OHV recreation. Recreational users have views of existing transmission line corridor vegetation clearing and pole structures. Based on the results of the viewshed analysis, visibility of the transmission line corridor along Cabin Creek Road (FR 467) would be localized due to steep terrain.

KOP 15: South Fork Salmon River Road (FR 474) and Warm Lake Road

KOP 15 represents views from South Fork Salmon River Road (FR 474) looking southwest (KOP 15a) and northeast (KOP 15b) toward the upgraded transmission line. South Fork Salmon River Road (FR 474) is a sensitive level 1 travel route near the Warm Lake recreation area. This viewpoint represents views that travelers would see from the South Fork Salmon River Road (FR 474) from Rice Creek coming into Warm Lake. The existing transmission line corridor is currently visible from this KOP; views of the existing switchgear, which would be upgraded to a substation, are in the foreground, which would be unobstructed. The existing conditions around the switchgear site appear to be previously disturbed, graded, and vegetation removed or thinned. This area has been historically altered by fires, and several dead and burned trees occupy the landscape, with isolated areas of mature trees and understory vegetation.

KOP 16: Stibnite Gold Logistics Facility

KOP 16 represents views from Warm Lake Road (CR 10-579) looking northeast (KOP 16a) and southwest (KOP 16b) toward the proposed SGLF. Warm Lake Road (CR 10-579) is a paved, passenger vehicle–accessible travel route that provides access to Warm Lake. This is a high-sensitivity travel route that provides access to Warm Lake from Cascade. The SGLF would be constructed in Scott Valley on an area of private land that is primarily undisturbed, in a landscape with minimal structures.

KOP 17: Lake Cascade Residence

KOP 17 represents views of residents along State Highway 55 near Lake Cascade looking north toward the proposed upgraded transmission line. Residential viewers near the transmission line upgrade in Cascade are limited to a few locations near Lake Cascade and along State Highway 55. Views would be primarily unobstructed, because the upgraded transmission line corridor would be immediately adjacent to these residences or visible in the foreground. Existing modifications in this rural setting are associated with neighboring residences, agricultural or ranching facilities, distribution lines, and local roads.

4.20.2.1.3.1 Utilities Construction

Effects to the Characteristic Landscape

Visual contrast associated with short-term activities includes construction of the new transmission line and upgrading the existing transmission line during the pre-production phase. Construction vehicles, equipment, and staff would be present along this corridor. Short-term visual contrast during construction is anticipated to be low-moderate, because these activities would occur intermittently along the ROW over a short duration.

KOP 1: Meadow Creek Lookout

The new transmission line would be built approximately 2 miles north of KOP 1. Short-term effects to the landscape associated with the new transmission line, such as vehicle movement and dust, would not be evident to viewers from KOP 1.

KOP 2: Frank Church-River of No Return Wilderness – Summit Trail (NFST 088)

The new transmission line would be built approximately 5 miles north of KOP 2. Visibility would be limited due to distance and intervening topography. Distinct shapes and features are difficult to distinguish at distances of 5 miles and the scale of the landscape also would absorb modifications introduced by the construction of the transmission line. Short-term effects to the landscape associated with the new transmission line, such as vehicle movement and dust, would not be evident to viewers from KOP 2.

KOP 3: Frank Church-River of No Return Wilderness – Mule Hill Trail (NFST 219)

The new transmission line would be built approximately 5 miles northwest of KOP 3. Visibility would be limited due to distance and intervening topography. Distinct shapes and features are difficult to distinguish at distances of 5 miles and the scale of the landscape also would absorb modifications introduced by the construction of the transmission lines. Short-term effects to the landscape associated with the new transmission line, such as vehicle movement and dust, would not be evident to viewers from KOP 3.

KOP 5: Hennessey Meadow Trailhead

Construction vehicles, equipment, and staff associated with construction of the new transmission line would be visible to trailhead viewers in the foreground. Short-term visual contrast during construction is anticipated to be low-moderate, because these activities would occur intermittently along the ROW over a short duration. However, while they are occurring, these activities would disrupt the natural setting of the landscape, making it appear and feel more industrial due to construction equipment and activity in the foreground.

KOP 6: Twin Bridges Dispersed Camping Area

Short-term visual contrast from this viewpoint would result from construction activities for the transmission line upgrade. Construction traffic, equipment, and staff would be evident from this site during construction, resulting in short-term low-moderate visual contrast due to unobstructed views of construction activities in the foreground as viewed from KOP 6. It is likely that construction activities would discourage use of the camping area at least in the short term.

KOP 7: Idaho Centennial Trail at Johnson Creek Road (CR 10-413) and Burntlog Creek Trail (NFST 075)

Visual contrast associated with short-term activities includes construction of the transmission line during the construction phase. Construction vehicles, equipment, and staff would be present along this corridor, which would be visible to viewers in the foreground. Short-term visual contrast during construction is anticipated to be low-moderate, because these activities would occur intermittently over a short duration. The presence of heavy machinery and construction workers, and associated movement, would change the rural setting viewed from KOP 7 to a more industrial-type setting, which would change the experience for viewers using the ICT at KOP 7.

KOP 8: Trout Creek Campground

Short-term visual contrast from this viewpoint would result from construction activities for the transmission line upgrade. Construction traffic, equipment, and staff would be evident from this site during construction, resulting in short-term low-moderate visual contrast due to unobstructed views of construction activities in the foreground, as viewed from KOP 8. While construction activities are occurring, they would disrupt the natural setting of the landscape at the campground, appearing industrial due to construction equipment and activity in the foreground. It is likely that construction activities would discourage use of the campground at least in the short term.

KOP 9: Frank Church-River of No Return Wilderness – Pistol Lake

Viewshed modeling indicates that short-term visual contrast from this viewpoint could result from construction activities for the transmission line upgrade. However, due to distance and intervening terrain, visual contrast would be weak to none. Existing vegetation also would limit visibility as long as it is present.

KOP 14: Cabin Creek Road (FR 467)

Short-term visual contrast from this viewpoint would result from construction activities for the transmission line upgrade. Construction traffic, equipment, and staff would be evident from this site during construction, resulting in short-term low-moderate visual contrast due to unobstructed views of construction activities in the foreground, as viewed from KOP 14. While construction activities are occurring, they would disrupt the natural setting of the landscape by adding movement, dust, and construction equipment to the views.

KOP 15: South Fork Salmon River Road (FR 474) and Warm Lake Road (CR 10-579)

Short-term visual contrast would include construction activities at Warm Lake substation facilities and upgrades to the transmission line, including construction vehicles, equipment, and staff. These activities would result in short-term low-moderate visual contrast due to unobstructed views of construction activities in the foreground, as viewed from KOP 15. While construction activities are occurring, they would add movement, dust, and additional equipment to the views from South Fork Salmon River Road (FR 474), which would make the setting appear more industrial compared to the existing rural setting.

KOP 16: Stibnite Gold Logistics Facility

Short-term visual contrast would include construction of the transmission line upgrade (and logistics facility described below), including construction vehicles, equipment, and staff. These activities would result in short-term low-moderate visual contrast due to unobstructed views of construction activities in the foreground, as viewed from KOP 16.

KOP 17: Lake Cascade Residence

Short-term visual contrast from this viewpoint would result from construction activities for the transmission line upgrade. Construction traffic, equipment, and staff would be evident from this site during pre-production, resulting in short-term low-moderate visual contrast due to unobstructed views of construction activities in the foreground, as viewed from KOP 14. Residents would experience these changes to the landscape as they come and go from their homes.

4.20.2.1.3.2 Utilities Operations

Effects to the Characteristic Landscape

The transmission line upgrade would traverse steep, rugged terrain and dense stands of tall pine trees in an existing corridor. Upgrading the transmission line to a 138-kV facility would require widening the existing ROW from 70 feet to a total width of 100 feet. The new upgraded structures would be approximately 30 feet taller, with an estimated maximum height of 80 feet and spans ranging between approximately 300 to 600 feet, depending on the type of structure. Long-term visual contrast would primarily result from line and color where the ROW would be expanded. Visual changes associated with widening the ROW would reinforce the existing linear form of the ROW edge, resulting in a bolder, geometric, man-made element in this rugged natural landscape. The level of visual change would be moderate to high where tree clearing would occur in densely wooded areas with steep terrain due to grading or exposing lighter-colored rock. The taller replacement structures would result in moderate structural contrast for the existing transmission line, and moderate-high when introducing new structures into an existing ROW. Access for construction and maintenance of the transmission line would occur in the existing ROW, including conductor-stringing vehicles, construction trucks, and equipment. Long-term visual contrast would range from low-moderate when replacing existing structures in less steep terrain with minimal vegetation removal, to moderate-high where a new transmission line would be introduced in steep terrain with dense vegetation.

The new 8.5-mile-long 138-kV transmission line, beginning at Johnson Creek substation to the west, crosses steep, rugged terrain including Antimony Ridge. The new transmission line and associated 100-foot-wide ROW would introduce a light-colored line clear of vegetation across the landscape. This linear feature would contrast with the surrounding rugged landscape composed of irregular lines and vegetated, mounded and triangular landforms carpeted with dark colored mature evergreens and lighter understory. The consistent form, line, and color of the ROW would introduce strong long-term contrast with the variable natural surrounding landscape.

Substation facilities that would be upgraded or introduced into the characteristic landscape would result in long-term visual contrast. For most substations, upgrades would require grading or improvement of land, and clearing vegetation to accommodate switchers, transformers, circuit breakers, and maintenance vehicles in the site. A new switching station in Cascade would be required on flat terrain occupied by low- lying vegetation, including grasses and shrubs. The level of visual change at this site would primarily be associated with the structural features of the facility, as well as a small area of grading and vegetation removal. Grading activities and vegetation removal would create minimal color and form contrasts with the existing landscape. Long-term visual contrast to the characteristic landscape in Cascade would be low-moderate, primarily due to structural contrast.

A new substation, the Scott Valley substation, would be required to support the SGLF in Scott Valley, which is characterized by flat to slightly rolling terrain and low-lying vegetation. The Warm Lake substation would require an upgrade of switchgear facilities, but no additional ground disturbance or vegetation clearing would occur at this site. The existing location has already been modified by local access roads, vegetation clearing, or thinning near the facility; therefore, long-term visual contrast would be low due to additional structural contrasts associated with the upgrade. An upgrade to the existing tap site (Thunderbolt Tap) along Cabin Creek Road (FR 447) also would be necessary, although the extent of the modifications is not known at this time. This road currently serves as the access road for the existing transmission line corridor and has been modified by vegetation removal and grading at pole locations. Additional grading and vegetation clearing would likely occur, resulting in moderate visual contrast where lighter colored rocks and soil may be exposed, and dense vegetation removed. A new substation would be required along Johnson Creek Road (CR 10-413) near the new transmission line corridor that heads east to the mine site. Similar to Cabin Creek Road (FR 447), the terrain is rough, and occupied by dense vegetation. Grading and vegetation clearing would result in moderate visual contrast. The introduction of structures in this landscape setting would result in moderate long-term visual contrast due to existing modifications associated with the transmission line corridor.

New transmission lines would cross areas managed as Retention and Partial Retention and upgraded transmission lines would cross areas managed as Preservation, Retention, and Partial Retention. Generally, new and upgraded transmission lines would not meet the Preservation, Retention, or Partial Retention VQO but would meet the Modification VQO. The line, color, form, and texture of the ROW would visually dominate the landscape but would not be out of scale with the natural surroundings. These effects would be visible from the following viewer platforms in the foreground and middleground distance zones: Johnson Creek Road (CR 10-413), Burntlog Route (new roadway), and the Meadow Creek Lookout.

KOP 1: Meadow Creek Lookout

The cleared ROW for the new transmission line would appear as a light-colored, thin band following the ridgeline. The light-colored line would create a strong level of contrast against the rugged, vegetation-covered hillside. Although visually evident, it would appear subordinate to the TSF that would dominate the landscape in the valley floor, as discussed in Section 4.20.2.1. The proposed communication tower located at the mine site also would be visible from this location.

KOP 2: Frank Church-River of No Return Wilderness – Summit Trail (NFST 088)

The new transmission line would be built approximately 5 miles north of KOP 2. Visibility would be limited due to distance and intervening topography. Distinct shapes and features are difficult to distinguish at distances of 5 miles and the scale of the landscape also would absorb landscape modifications introduced by transmission line and associated ROW. Long-term visual effects from the linear, light-colored cleared ROW and transmission structures associated with the new transmission line would not be evident from KOP 2 and would not affect user experience of Summit Trail (NFST 088) in the FCRNRW. The viewshed indicates that the upgraded communication tower located at the mine site also would be visible from this location; however, due to distance it would likely not be visually evident.

KOP 3: Frank Church-River of No Return Wilderness – Mule Hill Trail (NFST 219)

The new transmission line would be built approximately 5 miles northwest of KOP 3. Visibility would be limited due to distance and intervening topography. Distinct shapes and features are difficult to distinguish at distances of 5 miles and the scale of the landscape would absorb landscape modifications introduced by transmission line and associated ROW. Long-term visual effects from the linear, light-colored cleared ROW and transmission towers associated with the new transmission line would not be evident from KOP 3 and would not affect user experience of Mule Hill Trail (NFST 219) in the FCRNRW. The viewshed indicates that the upgraded communication tower located at the mine site also would be visible from this location; however, due to distance it would likely not be visually evident.

KOP 4: Stibnite Road (CR 50-412)

KOP 4 is located outside of the transmission line viewshed and therefore views of the new or existing transmission line would not be visible from KOP 4. The viewshed indicates that the upgraded communication tower located at the mine site would be visible from this location; however, due to distance it would likely not be visually evident.

KOP 5: Hennessey Meadow Trailhead

The results of the viewshed analysis show that due to surrounding terrain, visibility of the new transmission line route would be limited locally. The characteristic landscape is highly constrained by steep mountainous terrain that creates an enclosed setting in which long-term visual contrast would be visible. Long-term contrast would primarily result from line and color changes where the ROW would be expanded. Vegetation growth in the previous ROW would be removed, and additional vegetation would be cleared to a total width of 100 feet. Grading would be necessary at structure locations, as well as the ROW access road. Moderate-strong structure contrast would result from strong vertical lines, dark brown colors, and smooth texture of new transmission line structures. New structural contrast, landform grading, and vegetation removal would result in moderate-strong visual contrast due to steep terrain and dense vegetation. Visual changes associated with widening the ROW would reinforce the existing linear form of the ROW edge, resulting in a bolder, geometric, man-made element in this rugged natural landscape. Resulting long-term visual contrast is anticipated to be moderate-high, which would be minimally screened, and viewed in the immediate foreground. The transmission line and associated ROW would affect the naturalness of the landscape at the trailhead; however, because it would primarily only be visible locally at the trailhead, it is not expected to have a major effect to users' experience of the trail.

KOP 6: Twin Bridges Dispersed Camping Area

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures. The results of the viewshed analysis show that due to surrounding terrain, visibility of the new transmission line route would be limited locally.

Expansion of the transmission line ROW at this location would be highly constrained due to the proximity of the dispersed camping area to Johnson Creek and Johnson Creek Road (CR 10-413). The widened ROW would appear co-dominant for viewers at this moderate-sensitivity dispersed camping area due to scale dominance. Similar form and line would be replicated along the existing transmission line corridor, resulting in a moderate level of visual change that would be evident to viewers in the foreground. Terrain in this area is relatively flat; therefore, landform changes associated with grading and creating improved access at the campsite would result in a moderate level of visual contrast. Visual contrast would primarily result from removal of tall vegetation; and for viewers at the camping area, may completely eliminate existing trees that partially screen the existing transmission line. Overall, the long-term level of visual change would be moderate as a result of the wider corridor and would affect user experience at the dispersed camping area.

KOP 7: Idaho Centennial Trail (NFST 075) at Johnson Creek Road (CR 10-413)

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures. Expansion of the transmission line ROW at this location would cross very steep terrain above Johnson Creek Road (CR 10-413) at the junction of NFST 075 (ICT). The widened ROW would appear co-dominant for viewers due to scale dominance. Similar form and line would be replicated along the existing transmission line corridor, resulting in a moderate level of visual change that would be evident to viewers in the foreground. Visual contrast would primarily result from landform grading at the structure pad sites, additional removal of tall vegetation, and introduction of larger structures. The widened corridor ROW would enhance the existing linear form of the ROW edge, resulting in a bolder, geometric, man-made element in this rugged natural landscape. Long-term contrast would be moderate for recreational users due to unobstructed inferior (viewed from below) views in the foreground. Despite these visual changes, user experience would be similar to existing conditions, because a transmission line is currently visible from KOP 7. A simulation from this KOP is provided in **Appendix O-1**.

KOP 8: Trout Creek Campground

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures. The widened ROW would appear co-dominant for viewers at this high-sensitivity campground due to scale dominance. Similar form and line would be replicated along the existing transmission line corridor, resulting in a moderate level of visual change that would be evident to viewers in the foreground. Terrain in this area is moderate to steep, and upgrades along the ROW may include changes to landform due to grading and exposure of lighter-colored rock. The potential expansion of the ROW at this location could partially or completely eliminate existing trees that screen the current transmission line for sensitive viewers. The widened ROW would enhance the existing linear form of the ROW edge, resulting in a bolder, geometric, man-made element in this rugged natural landscape. Overall, the level of visual change would be moderate due to form and line created by the wider corridor. ROW clearing would remove vegetation screening, resulting in moderate long-term visual contrast to campground viewers in the immediate foreground. These long-term changes would affect user experience at the campground and may deter some recreationists from using it.

KOP 9: Frank Church-River of No Return Wilderness – Pistol Lake

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures. The widened ROW and new transmission structures would appear subordinate in the background due to distance as well as partial screening from intervening topography and vegetation. User experience is expected to be similar to existing conditions, since visual change would be low.

KOP 14: Cabin Creek Road (FR 467)

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures. The widened ROW would appear co-dominant for viewers along this travel route due to scale dominance. Similar form and line would be replicated along the existing transmission line corridor, although color contrast may be more evident where rocky outcrops are disturbed, introducing lighter colors. Recreational users would have immediate foreground views of the upgraded transmission line with minimal screening. Removal of existing vegetation and additional clearing along the ROW edge would introduce a moderate level of contrast with existing vegetation. In addition, grading would be necessary at new structure locations and where access improvements are needed for construction and operation equipment. The widened corridor ROW would enhance the existing linear form of the ROW edge, resulting in a bolder, geometric, man-made element in this rugged natural landscape. Structural contrast would be reduced by adjacent terrain, which would backdrop the structures for viewers traveling along this road while parallel to the transmission line. These conditions would result in an overall long-term moderate level of visual contrast that would be visible to travel route viewers in the foreground. Despite these visual changes, user experience is expected to be similar to existing conditions, because transmission lines already exist and are visible from KOP 14.

KOP 15: South Fork Salmon River Road (FR 474) and Warm Lake Road (CR 10-579)

Long-term visual contrast would result from landform modifications such as grading and vegetation clearing. The substation upgrade at this site would require no landform modifications or vegetation removal to accommodate additional equipment. The substation would introduce new structures similar in form, line, and color to the existing transmission line and switchgear but would be larger in size. Facilities would be primarily geometric in form and complex and introduce colors that are more industrial in appearance over a large area. These facilities would contrast with the surrounding landscape, which is primarily rural; however, industrial modifications are evident, resulting in a low-moderate level of structural contrast. Contrast would be minimized by implementing mitigation measures requiring design features that mimic characteristics of the existing landscape, such as the color palette. The site would be large enough to accommodate maintenance vehicles, and these may be visible to sensitive viewers during operation. The perimeter of the substation would be fenced, and nighttime lighting would be required for maintenance activities, introducing sky glow that would impact the integrity of the night sky. Impacts to night sky would be reduced by implementation of mitigation measures such as using minimal lighting, directing lights downward, and shielding lights where appropriate.

KOP 16: Stibnite Gold Logistics Facility

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures and a substation. The widened ROW would appear co-dominant for viewers along Warm Lake Road due to scale dominance. Removal of existing vegetation and additional clearing along the transmission line ROW edge would introduce a moderate level of contrast with existing vegetation. Visual contrast from the building would be minimized by implementing mitigation measures requiring design features that mimic characteristics of the existing landscape, as the color palette. The new SGLF (discussed in more detail in Section 4.20.2.1.4) would result in greater changes to the characteristic landscape; therefore, the changes introduced by the upgraded transmission line and new substation would appear less noticeable to viewers.

KOP 17: Lake Cascade Residence

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures. Expansion of the transmission line ROW at this location would be highly constrained due to the proximity of the residences to the existing structures. Terrain in this area is very flat; therefore, landform changes associated with grading and creating improved access along the ROW would result in a low level of visual contrast. Visual contrast would result from removal of some vegetation; and for residential viewers, may completely eliminate existing trees that currently screen transmission line structures. Vegetation is less dense at the bottom of flat valleys, which is characteristic of the Cascade area. Vegetation clearing along the expanded ROW would not result in strong line or form contrasts, as seen in densely wooded areas. The introduction of taller structures would increase structural contrast; however, the footprint location may change to accommodate a wider span. Visibility of the facility to residences would depend on the locations of the new transmission line structures. However; residents would likely see the transmission line as they come and go from their homes. A simulation was performed from KOP 17, provided in **Appendix O-1**.

4.20.2.1.3.3 Utilities Closure and Reclamation

The upgraded transmission line would remain in service after mine closure; all new and upgraded substation sites with the exception of the new substation constructed within the mine site would remain indefinitely. Therefore; long-term effects described above would remain until Idaho Power Company decommissions the line. The new 8.5-mile transmission line to the mine site and substation constructed within the mine site would be reclaimed. The ROW associated with the new 8.5-mile transmission line would continue to be visible and appear discordant with the surrounding landscape. Over time, as vegetation matures, the contrasting linear form of the ROW footprint would blend and fade into the surrounding landscape. The mine site substation would be removed and reclaimed and would generally blend in with the surroundings.

4.20.2.1.4 OFF-SITE FACILITIES

Based on the viewshed analysis (**Appendix O-2**), off-site facilities would be visible from two KOPs where detailed analyses were performed: KOP 13 and 16, which are described in the sections above.

4.20.2.1.4.1 Off-site Facilities Construction

<u>KOP 13: Landmark Maintenance Facility</u>

Short-term visual contrast perceptible to travelers on Warm Lake Road (CR 10-579) would result from construction of the maintenance facility, including grading, new buildings, and other facilities. Construction traffic, equipment, and staff would be evident from this travel route during pre-production, resulting in moderate short-term visual contrast perceived by receptors due to views of construction activities in the foreground.

<u>KOP 16: Stibnite Gold Logistics Facility</u>

The SGLF in Scott Valley would be constructed on an area of private land that is primarily undisturbed in a landscape with minimal structures. The 25-acre site footprint would extend along Warm Lake Road (CR 10-579) in flat to slightly rolling terrain with low-lying vegetation. Short-term visual contrast perceptible to travelers on Warm Lake Road (CR 10-579) would result from construction of the facility, including grading and introduction of buildings and other facilities. Construction traffic, equipment, and staff would be evident from this travel route during pre-production. The resulting level of short-term visual contrast would be moderate for receptors due to views of construction activities in the foreground.

4.20.2.1.4.2 Off-site Facilities Operations

KOP 13: Landmark Maintenance Facility

The maintenance facility at Landmark would result in moderate visual contrast where grading, vegetation removal, and construction of facilities would occur. The site is immediately adjacent to the historic Landmark ranger station, where there are existing cabins, picnic areas, and other structures currently managed by the PNF. Terrain at Landmark is primarily flat, with patchy clusters of trees and other low-lying vegetation. Existing disturbances are evident in the proposed maintenance facility footprint, and storage facilities would be co-located in these areas, which would help minimize visual contrast. Vegetation removal and some grading would be necessary to accommodate parking, outdoor storage areas, and covered structures for storage. The maintenance facility would be visually co-dominant to receptors when viewed in the context of adjacent facilities at Landmark. The proposed layout of the maintenance facility would preserve existing tall vegetation along Warm Lake Road (CR 10-579), which would help screen the maintenance facility from sensitive viewers. Long-term visual contrast is anticipated to be moderate, and the facility would be viewed in the foreground with vegetation partially screening the site. Additional nighttime lighting would be introduced at this facility, which would contribute to sky glow in an area where existing night lighting is minimal.

The Landmark Maintenance Facility would be located in an area managed as Partial Retention. It would meet the Partial Retention VQO as buildings would be constructed using materials and colors that appear in the characteristic landscape. Additionally, due to surrounding vegetation, these facilities would typically not be visible past the foreground distance zone.

KOP 16: Stibnite Gold Logistics Facility

Long-term visual contrast would primarily result from size and scale of the structural facilities at this site. Slight modifications to landform may be evident, and vegetation would be cleared in the majority of the site footprint. The SGLF would require approximately 25 acres of disturbance to accommodate employee parking, an assay laboratory building, a core sampling logging storage facility, warehouses, laydown yards, equipment inspection areas, a truck scale, and an administration building for Midas Gold personnel. The majority of the site would be improved to accommodate vehicle parking (approximately 250 light vehicles) for employees and laydown yard areas for materials. In addition, a 199-foot communications tower would be constructed at or near the facility to provide telephone, internet, and radio communications. It would introduce strong visual contrast due to its tall, vertical, linear form and smooth texture. However, impacts would be limited to within approximately 1 mile as surrounding topography would block it from view any distance further than 1 mile.

Collectively, these structural contrasts would introduce a moderate-high level of visual change that would appear dominant to viewers on Warm Lake Road. Trucks, buses, and cars related to operations at this facility also would be evident to Warm Lake Road viewers, which would contribute to the dominance of this facility. Views of the facility would not be screened by vegetation and would be viewed in the immediate foreground for high-sensitivity travel route viewers on Warm Lake Road. Long-term visual contrast would be moderate-high. Additional nighttime lighting would be introduced at this facility, which would contribute to sky glow in an area where existing nighttime lighting is minimal; limited to the few residences in Scott Valley.

The SGLF is not within the PNF or BNF and therefore there is no VQO associated with the facility.

4.20.2.1.4.3 Off-site Facilities Closure and Reclamation

KOP 13: Landmark Maintenance Facility

After reclamation activities have concluded at the mine site, the maintenance facility would be decommissioned and reclaimed to existing conditions. Buildings would be removed, and parking areas would be ripped, recontoured, and reclaimed. Over time, color contrast would be reduced to a low level of visual contrast once native vegetation becomes established. Permanent visual contrast would be low, and nighttime lighting would return to existing conditions, resulting in minimal permanent visual contrast.

KOP 16: Stibnite Gold Logistics Facility

The Stibnite Gold Logistics Facility (approximately 25 acres) would be located on private land outside of NFS lands, and therefore it does not have a VQO. After closure of the mine the Logistics Facility would not be reclaimed (a permanent commitment of land) and it would be made available for other light industrial uses. Permanent visual contrast would be high, and nighttime lighting would likely remain, resulting in permanent visual impacts.

4.20.2.2 Alternative 2

Consistency with Scenery Management Designations

Elements of Alternative 2 may be inconsistent with current VQOs as designated by the PNF and BNF. More specific detail on acreages associated with these potential inconsistencies are provided in **Appendix O-6**.

4.20.2.2.1 MINE SITE

Under Alternative 2, infrastructure and operations at the mine site would be the same as Alternative 1, except:

West End DRSF – The West End DRSF and associated haul roads would not be present under Alternative 2.

Midnight DRSF – The Midnight DRSF would be present under Alternative 2.

Water Treatment Plant – The water treatment plant and transmission line necessary for it to operate would remain in perpetuity.

Limestone Processing – Lime and crushed limestone would be produced on site from mining in the West End pit under Alternative 2. Alternative 2 also would include a haul road from the West End pit to the limestone processing facilities.

This would result in minor differences to the characteristic landscape as viewed from KOP 4. Under Alternative 2, views from KOP 1 would appear the same as described under Alternative 1 (see Section 4.20.1.1.1). **Appendix O-3**, Alternatives Viewshed Analyses and Key Observation Points, Alternative 2, shows the viewshed of the Mine Site under Alternative 2.

4.20.2.2.1.1 Mine Site Construction

Effects to the Characteristic Landscape

Short-term visual effects associated with construction activities under Alternative 2 would appear similar to those described above under Alternative 1. Construction of the limestone crushing plant would generate additional construction traffic, requiring the delivery and construction of large equipment to the plant such as crushers and conveyers, kilns, large propane storage tanks, and large storage bins. Construction of the limestone crushing plant would generate additional dust and introduce additional industrial equipment to the landscape that would appear geometrical and smooth and introduce colors different than those of the natural surrounding landscape. Overall short-term visual contrast introduced to the characteristic landscape would be moderate, primarily due to the expansion of mining activities and introduction of nighttime lighting.

Effects by KOP

KOP 1: Meadow Creek Lookout

The limestone crushing plant would not be visible from KOP 1; therefore, short-term visual effects from mine site construction activities would appear the same as under Alternative 1.

KOP 4: Stibnite Road (CR 50-412)

The limestone crushing plant could be visible from KOP 4 in the middleground once vegetation present in the foreground is cleared. Construction activity associated with the Yellow Pine pit and DRSF would be present in the foreground between KOP 4 and the limestone crushing plant; therefore, construction activities associated with Yellow Pine pit and DRSF would dominate the views from KOP 4 so that activity and short-term effects associated with the limestone-crushing plant would be subordinate; and overall short-term effects would appear similar to those described above for Alternative 1 from KOP 4.

4.20.2.2.1.2 Mine Site Operations

Effects to the Characteristic Landscape

Long-term visual effects associated with mine operations under Alternative 2 would appear similar to those described above under Alternative 1. Under Alternative 2, the West End DRSF would not be present. The limestone crushing plant would introduce additional industrial infrastructure to the landscape and could introduce additional dust into the air. There would be no permanent Midnight Pit Lake. Overall the disturbances in the entire mine site would introduce strong contrast as a whole, and the general appearance of the mine site would be the same as described for Alternative 1 (Section 4.20.2.1.1.2).

Under Alternative 2, the mine site would be within areas managed as a VQO of Retention or Partial Retention. Where visible from viewing platforms, the mine site would not meet either of these VQOs as the mine site components would introduce form, line, color, and texture found infrequently or not at all in the characteristic landscape, and to a degree that would dominate the characteristic landscape. These effects could be visible from the Stibnite Road (CR 50-412) and the Meadow Creek Lookout viewing platforms.

Effects by KOP

KOP 1: Meadow Creek Lookout

Views from KOP 1 would continue to be dominated by the TSF, as described in Section 4.20.2.1.1.2. The West End DRSF would not be present and, therefore, not visible in the middle-ground distance zone from KOP 1. The absence of the West End DRSF from Alternative 2 and addition of the limestone crushing plant (in the West End pit) would not affect views from KOP 1.

KOP 4: Stibnite Road (CR 50-412)

The limestone crushing plant could be visible from KOP 4 in the middleground once vegetation present in the foreground is cleared. Mine activity associated with the Yellow Pine pit and DRSF would be present in the foreground between KOP 4 and the limestone crushing plant; therefore, activities associated with Yellow Pine pit and DRSF would dominate the views from KOP 4 so that activity and long-term effects associated with the limestone crushing plant would be subordinate; and overall long-term effects would appear similar to those described for Alternative 1.

4.20.2.2.1.3 Mine Site Closure and Reclamation

Effects to the Characteristic Landscape

Permanent effects to the characteristic landscape from the mine site after closure and reclamation under Alternative 2 would appear similar to Alternative 1, except the characteristic landscape would remain the same as existing conditions in the area of the West End DRSF, and the water treatment plant and transmission line necessary for it to operate would remain after closure and reclamation.

Effects by KOP

KOP 1: Meadow Creek Lookout

Permanent effects to the characteristic landscape from the mine site after closure and reclamation under Alternative 2 would appear similar Alternative 1, with the following exceptions. The characteristic landscape would remain the same as existing conditions in the area of the West End DRSF. While views of the permanent water treatment plant would be blocked by a ridge from KOP 1, the new section of transmission line would remain under this alternative and would be visible in the middleground from the lookout.

KOP 4: Stibnite Road (CR 50-412)

Under Alternative 2, permanent visual effects from the mine site as viewed from KOP 4 would appear the same as described for as Alternative 1.

4.20.2.2.2 ACCESS ROADS

The primary features relevant to scenic resources for access road infrastructure and operations specific to Alternative 2 include:

Burntlog Route, Riordan Creek Segment – An approximately 5.3-mile segment of the Burntlog Route would be re-routed to the south, higher up in the Riordan Creek drainage, where it would cross Riordan Creek north of Black Lake.

Public Access via Stibnite Road to Thunder Mountain Road Link – Public access through the mine site from Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) during mining operations would be provided by constructing a 12-foot-wide gravel road to connect Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375). The route would be open to all vehicles year-round.

Soil Nail Walls – There would be approximately 0.66 mile of soil nail walls constructed.

Alternative 2 components described above would result in very similar visual changes to the characteristic landscape as viewed from KOP 4 as described above for Alternative 1. These components would not be visible from KOPs 1, 2, 9, 10, 12, and 13; and effects would appear the same as described for Alternative 1 (see Section 4.20.1.1.1). **Appendix O-3** shows the viewshed of the access roads under Alternative 2.

4.20.2.2.2.1 Access Roads Construction

Effects to the Characteristic Landscape

Short-term visual effects associated with construction activities under Alternative 2 would appear similar to those described above for Alternative 1. Mine traffic would use existing roads (Warm Lake Road [CR-10-579], Johnson Creek Road [CR 10-413], and Stibnite Road [CR 50-412]) to access the mine all year long until construction of the Burntlog Route and the linkage between Stibnite Road (FR 50412) and Thunder Mountain Road (FR 50375) are complete. Construction activity on the Riordan Creek segment of the Burntlog Route and the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 502375) link would have the same type of impacts to the landscape as described under Alternative 1; and would include increased construction traffic, dust, grading, ditching, and vegetation removal.

Effects by KOP

KOP 4: Stibnite Road (CR 50-412)

Under Alternative 2, the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would begin at KOP 4. From KOP 4, construction activity associated with road construction would be visible in the foreground, including construction traffic, equipment, dust, and movement of equipment and construction workers.

4.20.2.2.2.2 Access Roads Operations

Effects to the Characteristic Landscape

Long-term visual effects associated with operations under Alternative 2 would be similar to those described above under Alternative 1. Improvements to Burnt Log Road (FR 447) would still occur from Landmark to Trapper Flat, and impacts would be the same as Alternative 1 (Section 4.20.2.1.2.2). The Riordan Creek segment of Burntlog Route and the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would result in changes to the characteristic landscape similar to the other upgraded section of Burnt Log Road, and appear as flat to sloping, smooth, light-brown linear forms through the landscape; and appear consistent with other existing roads in the area and visible from KOP 4. The presence of vehicles on these routes would introduce movement to the landscape, and also provide access in an area with no current road access.

The Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would provide access to and through the mine site and provide a viewer platform from which the mine site can be viewed. Viewers traveling along the public access road through the mine site would experience close-up, transient, head-on, and peripheral views of large machinery, movement, exposed soil and rock, and other mine-related equipment and infrastructure that would appear as an industrial landscape within the greater forested setting of the PNF and BNF. Soil nail walls would result in strong visual contrast. A 140-foot-tall road cut near the mine site would introduce a large, smooth light-colored surface above the road that would sharply contrast with the natural, variable lines and forms of the surrounding landscape.

New segments of the Burntlog Route would introduce approximately 15 miles of new road that would be a viewing platform for areas of the forest, providing views to portions of the forest that are not currently afforded any viewing opportunity by a road or trail. Approximately 2 miles of new road would be situated within the viewshed of the mine site in the middleground distance zone.

New construction associated with the Burntlog Route would cross areas managed as Retention, Partial Retention, and Modification VQOs. With the exception of the soil nail walls, access roads would generally conform to the Partial Retention and Modification VQO. Although new and upgraded portions of the access roads could introduce strong visual contrast in some areas, it typically would be limited to the immediate foreground as viewed from the road introducing the contrast and would appear subordinate from other viewing platforms. New access roads would not be consistent with the Retention VQO as they would introduce new lines, colors, and textures that would be evident.

Effects by KOP

KOP 4: Stibnite Road (CR 50-412)

From KOP 4, the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would travel north through the mine site and appear as a flat to sloping, smooth, light brown linear form traversing the landscape. Although the linear form and light color would contrast with the natural surroundings, it would appear consistent with other existing roads in the area that are visible from KOP 4.

4.20.2.2.2.3 Access Roads Closure and Reclamation

Effects to the Characteristic Landscape

Permanent visual effects associated with closure and reclamation activities under Alternative 2 would be similar to those described above under Alternative 1. Soil nail walls and the 140-foot-tall road cut near the mine site are proposed to remain in place and would continue to introduce strong visual contrast during and after closure and reclamation. The Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would be reclaimed, and those areas would appear similar to the reclaimed areas of Burnt Log Road (FR 447) as described under Alternative 1.

4.20.2.2.3 UTILITIES

Under Alternative 2, new construction and upgrades to transmission lines and substations would be similar to those described above for Alternative 1. The primary differences between utilities infrastructure and operations under Alternative 2 include:

Transmission line Re-route around Thunder Mountain Estates – Approximately 5.4 miles of upgraded transmission line would be routed to avoid the Thunder Mountain Estates Subdivision.

Transmission line Re-route to use an old railroad grade – Approximately 0.9 mile of upgraded transmission line would be routed to use an old railroad grade.

Cascade switching station – As a result of the transmission line route around Thunder Mountain Estates, the Cascade switching station would be located on Warm Lake Road (CR 10-579).

The differences described above would result in minor differences to the characteristic landscape but would not be visible from any KOPs. Visual changes associated with utilities experienced from KOPs 1, 2, 3, 5, 6, 7, 8, 9, 14, 15, 16, and 17 would be the same as described for Alternative 1. **Appendix O-3** shows the viewshed of the utilities under Alternative 2.

4.20.2.2.3.1 Utilities Construction

Effects to the Characteristic Landscape

Visual impacts associated with short-term activities include increased contrast during construction of the transmission line. Construction vehicles, equipment, and staff would be present along this corridor, which would be visible to viewers in the foreground. Short-term visual contrast during construction is anticipated to be low-moderate, because these activities would occur intermittently along the ROW over a short duration of time. Construction-related changes to the landscape would not be visible from the Thunder Mountain Estates subdivision under Alternative 2.

4.20.2.2.3.2 Utilities Operations

Effects to the Characteristic Landscape

Under Alternative 2, long-term visual changes associated with utilities would be similar to those described under Alternative 1. Changes to the landscape and introduced visual contrast associated with the transmission line upgrade would be the same except that residents of the Thunder Mountain Estates subdivision would not have foreground views of the upgraded transmission line. New transmission line construction effects would be the same as Alternative 1. Visual change associated with the Cascade switching station would be similar to Alternative 1 and involve grading and removal of vegetation in similar terrain, but approximately 1 mile farther south. The visual contrast introduced by the switching station would not be visible from the Thunder Mountain Estates subdivision.

A new transmission line would cross areas managed as Retention and Partial Retention and upgraded transmission lines would cross areas managed as Preservation, Retention, and Partial Retention. Generally, new and upgraded transmission lines would not meet the Preservation, Retention, or Partial Retention VQO but would meet the Modification VQO. The line, color, form, and texture of the ROW would visually dominate the landscape but would not be out of scale with the natural surroundings. These effects would be visible from the following viewer platforms in the foreground and middleground distance zones: Johnson Creek Road (CR 10-413), Burntlog Route (new segment), and the Meadow Creek Lookout.

4.20.2.2.3.3 Utilities Closure and Reclamation

The upgraded transmission line would remain in service after mine closure; all new and upgraded substation sites would remain indefinitely. Therefore, long-term effects described above in Section 4.20.2.2.3.2 would remain until Idaho Power Company decommissions the line. In addition, the new transmission line would remain in service after mine closure in order to provide power to the permanent water treatment plant located at the mine site. The new section of transmission line would be visible from KOP 1 and would introduce a linear feature that would present contrast against an otherwise natural appearing wooded hillside. **Appendix O** includes a simulation of this view from KOP 1.

4.20.2.2.4 OFF-SITE FACILITIES

Under Alternative 2, off-site facilities would be similar to those described for Alternative 1 and would include a maintenance facility and logistics facility (SGLF). The primary difference is that the maintenance facility would be located along Burnt Log Road (FR 447), 4.4 miles east of the junction of the Johnson Creek Road (CR 10-413) and Warm Lake Road (CR 10-579) along the proposed Burntlog Route. The buildings and parking areas would be the same as proposed for the Landmark Maintenance Facility under Alternative 1 and resulting visual effects would be similar, although visual contrast and change to landscape character would be less, because the maintenance facility would be constructed in an existing borrow source area. Although the viewshed indicates the proposed maintenance facility would be visible from KOP 12, a closer look at site photographs from KOP 12A indicates that existing vegetation would entirely screen the proposed Burntlog Maintenance Facility from view. **Appendix O-3** shows the viewshed of the off-site facilities under Alternative 2 and includes site specific photographs from KOP 12.

4.20.2.2.4.1 Off-site Facilities Construction

Effects to the Characteristic Landscape

Short-term visual contrast perceptible to travelers on Burnt Log Road (FR 447) would result from construction of the maintenance facility, including grading, new buildings, and other facilities. As the maintenance facility would be constructed within an existing borrow source area, new ground disturbance would be limited. Construction traffic, equipment, and staff would be evident from this travel route during pre-production, resulting in moderate short-term visual contrast perceived by receptors due to views of construction activities associated with the maintenance facility.

4.20.2.2.4.2 Off-site Facilities Operations

Effects to the Characteristic Landscape

The maintenance facility would result in low to moderate visual contrast where grading, vegetation removal, and construction of facilities would occur. Contrast would be low- moderate, because the facility would be at a borrow source location, so that disturbances from road construction would already be present. Grading and vegetation removal would be minimal, and consistent with the changes to the landscape that occurred as a result of Burntlog Route construction. The night sky would be impacted by lighting associated with the maintenance facility, which would contribute to sky glow. Visual impacts to the Landmark Ranger Station would be avoided under Alternative 2 as the maintenance facility would not be located near the Landmark Ranger Station (also see Section 4.17.2.2.1.3).

The maintenance facility would be located in an area managed as Partial Retention. It would meet the Partial Retention VQO as buildings would be constructed using materials and colors that appear in the characteristic landscape. Additionally, due to surrounding vegetation these facilities would typically not be visible past the foreground distance zone.

The SGLF is not within the PNF or BNF, and, therefore, there is no VQO associated with the facility.

4.20.2.2.4.3 Off-Site Facilities Closure and Reclamation

Effects to the Characteristic Landscape

After reclamation activities have concluded at the mine site, the maintenance facility would be decommissioned and reclaimed to existing conditions. Buildings would be removed, and parking areas would be ripped, recontoured, and reclaimed. Over time, color contrast would be reduced to a low level of visual contrast once native vegetation becomes established. Permanent visual contrast would be low, and nighttime lighting would return to existing conditions, resulting in minimal permanent visual contrast.

4.20.2.3 Alternative 3

4.20.2.3.1 MINE SITE

Under Alternative 3, infrastructure and operations at the mine site would be similar to those described above under Alternative 1. However, the Meadow Creek TSF and Hangar Flats DRSF would be constructed in the EFSFSR drainage, and the worker housing facility would be in the Blowout Creek drainage. The overall changes to the characteristic landscape would be the same as described under Alternative 1; however, views from KOP 1 would differ. The Hangar Flats area is not visible from KOP 4; therefore, views experienced from KOP 4 would be the same for Alternative 1 and Alternative 3. Views of the mine site would be visible from KOP 3, which would not be the case for Alternatives 1 and 2. **Appendix O-4**, Alternatives Viewshed Analyses and Key Observation Points, shows the viewshed of the mine site under

Alternative 3. The effects from a visible plume originating from the mine site would be the same as described for Alternative 1.

4.20.2.3.1.1 Mine Site Construction

Effects to the Characteristic Landscape

Short-term effects to the characteristic landscape from mine site construction would be the same as described for Alternative 1.

<u>KOP 1: Meadow Creek Lookout</u>

The worker housing facility would be visible from KOP 1 in the middleground; therefore, construction traffic and activity, including dust generation, would result in weak to moderate visual contrast from KOP 1. Other visual impacts associated with mine construction activity would be the same as described for Alternative 1 (see Section 4.20.2.1.1.1).

<u>KOP 3: Frank Church-River of No Return Wilderness –Mule Hill Trail (NFST 219)</u>

Construction activity associated with preparation of the EFSFSR TSF would be visible from KOP 3. Some movement and dust from construction vehicles may be visible, but the level of visual contrast would be weak.

4.20.2.3.1.2 Mine Site Operations

Effects to the Characteristic Landscape

Overall, the long-term effects to the characteristic landscape from mine site operations would be the same as described for Alternative 1. The Meadow Creek TSF and the worker housing facility would introduce the same contrast and visual changes to the landscape, although the changes would occur in different drainages, as discussed in more detail under effects seen from KOP 1.

Under Alternative 3, the mine site would be within areas managed as a VQO of Retention or Partial Retention. Where visible from viewing platforms, the mine site would not meet either of these VQOs, as the mine site components would introduce form, line, color, and texture found infrequently or not at all in the characteristic landscape, and to a degree that would dominate the characteristic landscape. These effects could be visible from the Stibnite Road (CR 50-412) and the Meadow Creek Lookout viewing platforms.

Effects by KOP

<u>KOP 1: Meadow Creek Lookout</u>

Under Alternative 3, the TSF would not be in the Meadow Creek drainage and would not be visible from KOP 1. The valley floor would appear curved and concave, with moderately coarse texture and variable vegetation appearing dark green, gray, and brown. The Hangar Flats pit would appear the same as described for Alternative 1, although it would dominate the view more under Alternative 3, because the Meadow Creek TSF and Hangar Flats DRSF would not dominate the foreground to middleground views. The worker housing facility would introduce geometric shapes, linear forms, and smooth textures; and introduce sky glow from nighttime lighting. The graded area and access to the worker housing facility would expose light-colored soil, which would introduce some contrast to the landscape.

KOP 3: Frank Church-River of No Return Wilderness –Mule Hill Trail (NFST 219)

Under Alternative 3, the EFSFSR TSF and DRSF would be visible in the middleground from KOP 3. Other components of the mine site and support facilities would not be evident from KOP 3. The EFSFSR TSF would appear as large, flat, smooth, and uniform at the bottom of the valley, which would result in strong visual contrast against the sloping, uneven texture of the surrounding mountains and valley. The flat top and monolithic form of the TSF would introduce strong contrast against the more complex, rough, rugged surrounding topography. Strong color contrast would result from unweathered tailings, which would appear as a lighter, more uniform color than the surrounding undisturbed landscape, with varied colors and textures. From this viewpoint, the TSF at full build-out would consume most of the EFSFSR valley, creating a wider basin between the mountain ranges, which is not typical for this landscape. The TSF would appear to be an artificially smooth, regular, and continuous form, contributing to a strong level of long-term visual contrast. Existing modifications from past mining activity are not visible from KOP 3, so the visual changes introduced by the mine site would appear new and inconsistent with the existing landscape and reduce the scenic integrity of the landscape as viewed from KOP 3. User experience of Mule Hill Trail (NFST 219) would be affected by the mine site, because the surrounding visible landscape, particularly from KOP 3 would change from a natural, wilderness-type setting to a more industrial setting. However; these effects would be screened by vegetation and topography in many locations along the trail and would not be consistently visible to trail users.

4.20.2.3.1.3 Mine Site Closure and Reclamation

Effects to the Characteristic Landscape

Overall, the permanent effects to the characteristic landscape from mine operations would be the same as described for Alternative 1. Permanent changes from the TSF and Hangar Flats DRSF would occur in a different drainage, as discussed in more detail under effects seen from KOP 1 and 3.

Effects by KOP

KOP 1: Meadow Creek Lookout

Under Alternative 3, the TSF would not be in the Meadow Creek drainage and would not be visible from KOP 1. The valley floor would appear curved and concave, with moderately coarse texture and variable vegetation appearing dark green, gray, and brown; and would not have permanent modifications from the TSF. The worker housing facility area would be regraded and revegetated so that permanent visual changes would not be evident from KOP 1. Nighttime lighting would return to existing conditions.

KOP 3: Frank Church-River of No Return Wilderness –Mule Hill Trail (NFST 219)

The EFSFSR TSF and DRSF would have rounded crests and variably shaped angles to more closely resemble natural landforms, which would help to reduce visual contrast. As mature vegetation establishes on reclaimed DRSFs and TSF landforms over time, visual contrast associated with lighter-colored soils would diminish for a large portion of these disturbed areas as viewed from KOP 3. Although reclamation and revegetation efforts may reduce color contrast over time, the TSF would require a substantial buttress to ensure long-term stability, which would introduce strong geometric lines and unnatural form into the landscape permanently. Overall, permanent visual contrast viewed from KOP 3 would be moderate to high.

4.20.2.3.2 ACCESS ROADS

Under Alternative 3, access to and around the mine site would be similar to that described for Alternative 1. The primary differences for access road infrastructure and operations include:

Burntlog Route near EFSFSR TSF – Burntlog Route in the vicinity of the EFSFSR TSF would be rerouted, entering the site on a new road adjacent to Blowout Creek.

Public Access to the Mine Site – There would be no public access to the mine site during operations. On closure and reclamation, public access would either be provided by converting the temporary TSF access road along the TSF pipeline to a permanent access road connecting to the existing road at both ends or retaining the mine access route for public access.

OHV Trail from Horse Heaven/Transmission line Route to Meadow Creek Lookout Road – This OHV trail would not exist.

These differences would not be visible from KOPs 1, 2, 9, 10, 12, and 13; and effects would be the same as those described above for Alternative 1 (see Section 4.20.1.1.1) from those KOPs and are not discussed in the following subsections. **Appendix O-4** shows the viewshed of the access roads under Alternative 3.

4.20.2.3.2.1 Access Roads Construction

Effects to the Characteristic Landscape

Short-term visual effects associated with construction activities under Alternative 3 would be similar to those described for Alternative 1. Mine traffic would use existing roads (Warm Lake Road [CR 10-579], Johnson Creek Road [CR 10412], and Stibnite Road [CR 50-412]) to access the mine year-round until construction of the Burntlog Route is complete. Constructing the

Burntlog Route would include short-term visual impacts such as increased construction traffic, dust, grading, ditching, and vegetation removal.

4.20.2.3.2.2 Access Roads Operations

Effects to the Characteristic Landscape

Improvements to Burnt Log Road (FR 447) would occur from Landmark to Trapper Flat, and impacts would be the same as described for Alternative 1 (Section 4.20.2.1.2.2). The new portion of the Burntlog Route in the vicinity of the EFSFSR would result in similar changes to the characteristic landscape as the other new sections of Burntlog Route; and appear as a flat to sloping, smooth, light-brown linear form through the landscape, and appear consistent with other existing roads in the area. The presence of vehicles on these routes would introduce movement to the landscape, and also provide access in a previously primarily roadless area. The OHV Trail from Horse Heaven/Transmission line Route to Meadow Creek Lookout Road (FR 51290) would not be constructed, so the landscape in that area would remain the same as existing conditions.

New segments of the Burntlog Route would introduce approximately 15 miles of new road that would be a viewing platform for areas of the forest, providing views to portions of the forest that are not currently afforded any viewing opportunity by a road or trail. Approximately 2 miles of new road would be situated within the viewshed of the mine site in the middleground distance zone.

New roads associated with the Burntlog Route would cross areas managed as Retention, Partial Retention, and Modification VQOs. With the exception of the soil nail walls, access roads would generally conform to the Partial Retention and Modification VQO. Although new and upgraded portions of the access roads could introduce strong visual contrast in some areas, it typically would be limited to the immediate foreground as viewed from the road and would appear subordinate from other viewing areas. New access roads would not be consistent with the Retention VQO as they introduce new lines, colors, and textures that are evident to viewers.

4.20.2.3.2.3 Access Roads Closure and Reclamation

Effects to the Characteristic Landscape

Permanent visual effects associated with access roads under Alternative 3 would be similar to those described above under Alternative 1. Because there would be no public access to the mine site during operations, new public access to the area would be created during closure and reclamation; either by converting the temporary TSF access road along the TSF pipeline to a permanent access road connecting to the existing road at both ends, or retaining a portion of the mine access route for public access through and beyond the mine site. Either road would appear as a flat to sloping, smooth, light-brown linear form through the landscape, and provide a viewer platform from which to view the reclaimed mine area, as described above in Section 4.20.2.3.2.1.

4.20.2.3.3 UTILITIES

Under Alternative 3, new construction and upgrades to transmission lines and substations would be similar to that described above under Alternative 1. The primary differences include:

New Transmission line Re-route – Approximately 2.5 miles of the new transmission line would be aligned to coincide with a minimally developed access road in the Meadow Creek drainage.

Re-route of 24.9-kV lines – The new 24.9-kV lines in the mine site would be realigned to accommodate the TSF and DRSF locations in the EFSFSR drainage, and the worker housing facility.

The utilities components described above would result in minor differences to the characteristic landscape that would be visible from KOP 1. Visual changes associated with utilities experienced from KOPs 2, 5, 6, 7, 8, 9, 10, 14, 15, 16, and 17 would be the same as described above for Alternative 1. **Appendix O-4** shows the viewshed of the utilities under Alternative 3.

4.20.2.3.3.1 Utilities Construction

Effects to the Characteristic Landscape

Short-term visual impacts associated with construction of the transmission line would generally be the same as described for Alternative 1 (see Section 4.20.2.1.3.1). Construction vehicles, equipment, and staff would be present along this corridor, which would be visible to viewers in the foreground. Short-term visual contrast during construction is anticipated to be low-moderate, because these activities would occur intermittently along the ROW and over a short duration.

Effects by KOP

<u>KOP 1: Meadow Creek Lookout</u>

The new transmission line would be built approximately 1 mile north of KOP 1. Short-term effects to the viewshed, such as vehicle movement and dust, would be less evident from KOP 1 under this alternative. Construction of the transmission line along an existing access road in the Meadow Creek drainage would introduce a moderate level of contrast, because clearing and grading would be minimized by following an existing road. Additionally, some construction activity would be screened from KOP 1 by vegetation and topography by siting the new activity in the Meadow Creek drainage.

4.20.2.3.3.2 Utilities Operations

Effects to the Characteristic Landscape

Long-term visual contrast associated with utilities would generally be the same as described for Alternative 1 (see Section 4.20.2.1.3.1). The primary difference would be that 2.5 miles of new transmission line would be located on an existing road in the Meadow Creek drainage, which would result in moderate long-term visual contrast and overall change in visual character.

Because the stretch of transmission line would be located in the valley rather than prominently on a ridgeline, it would be partially screened by vegetation and topography.

Under Alternative 3, new transmission lines would cross areas managed as Retention and Partial Retention and upgraded transmission lines would cross areas managed as Preservation, Retention, and Partial Retention. Generally, new and upgraded transmission lines would not meet the Preservation, Retention, or Partial Retention VQO but would meet the Modification VQO. The line, color, form, and texture of the ROW would visually dominate the landscape but would not be out of scale with the natural surroundings. These effects would be visible from the following viewer platforms in the foreground and middleground distance zones: Johnson Creek Road [CR 10-413], Burntlog Route (new segment), and the Meadow Creek Lookout.

Effects by KOP

KOP 1: Meadow Creek Lookout

Meadow Creek Lookout (KOP 1) provides a superior vantage point of the new transmission line. As discussed above, the new transmission line would introduce a low level of long-term visual contrast and overall change in visual character, as viewed from KOP 1, because 2.5 miles of the line would be located in a partially screened valley rather than along a ridge top.

4.20.2.3.3.3 Utilities Closure and Reclamation

The upgraded transmission line would remain in service after mine closure; all new and upgraded substation sites would remain indefinitely; therefore, permanent effects would be the same as long-term.

4.20.2.3.4 OFF-SITE FACILITIES

Under Alternative 3, off-site facilities would be the same as described for Alternative 1; therefore, associated visual effects from construction, operation, and closure and reclamation would be the same (see Section 4.20.2.1.4). **Appendix O-4** shows the viewshed of the off-site facilities under Alternative 3.

4.20.2.4 Alternative 4

4.20.2.4.1 MINE SITE

At the mine site, Alternative 4 components are substantially similar to those described for Alternative 1. There are no differences in the mine site that would result in perceivable differences to the characteristic landscape or views from identified KOPs. Therefore, under Alternative 4, impacts to scenic resources would be the same as described for Alternative 1 (see Section 4.20.2.1.1) for construction, operations, and closure and reclamation. **Appendix O-5** shows the viewshed of the mine site under Alternative 4.

Under Alternative 4, the mine site would be within areas managed as a VQO of Retention or Partial Retention. Where visible from viewing platforms, the mine site would not meet either of these VQOs as the mine site components would introduce form, line, color, and texture found infrequently or not at all in the characteristic landscape, and to a degree that would dominate the characteristic landscape. These effects could be visible from the Stibnite Road (CR 50-412) the Meadow Creek Lookout viewing platforms. The effects from a visible plume originating from the mine site would be the same as Alternative 1.

4.20.2.4.2 ACCESS ROADS

Under Alternative 4, the Burntlog Route would not be used for mine access; therefore, no road upgrades or new road segments would be constructed for that route. Therefore, the visual impacts associated with Burntlog Route would not occur under Alternative 4. However, visual impacts would occur as a result of the upgrades to, and year-round mine use of, Yellow Pine Route.

A new road linking Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375), providing public access through the mine site, would occur under Alternative 4. The location of impacts would vary, as described under the KOP-specific analysis below. The visual impacts would be the same as those described for Alternative 2 (see Section 4.20.2.2.2).

4.20.2.4.2.1 Access Roads Construction

Effects to the Characteristic Landscape

Short-term visual effects associated with construction activities under Alternative 4 would occur as a result of upgrades to the Yellow Pine Route. No major road widening or straightening of curves would be required for the Johnson Creek Road (CR 10-413) portion of the Yellow Pine Route; therefore, there would be no visual impacts from such activities. Traffic along the road from construction vehicles and equipment for widening the Stibnite Road portion of the route would introduce additional movement and dust from vehicle traffic along this portion of the route compared to existing conditions.

Short-term impacts associated with the road linking Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) would be similar to those described for Alternative 2 (see Section 4.20.2.2.2.1). The Stibnite Road portion of the route would be improved by widening curves to accommodate 55-foot semi-truck trailers. Construction of retaining walls and culverts would require vegetation removal and would expose large areas of native soil and rock that would contrast with surrounding vegetation and rugged, varied topography. During road construction and improvement activities, there would be an increase in construction traffic, equipment, and associated movement, and generation of dust.

Effects by KOP

<u>KOP 1: Meadow Creek Lookout</u>

Construction activity and traffic associated with the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would be visible from KOP 1 but would largely be absorbed by the larger, more visually evident activity associated with the mine site that would appear dominant.

KOP 4: Stibnite Road (CR 50-412)

Under Alternative 4, the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would begin at KOP 4. From KOP 4, this construction activity would be visible in the foreground to the south, and construction activity associated with the Stibnite Road improvements for Yellow Pine Route would be visible to the north. Short-term visual changes evident from KOP 4 would include construction traffic, equipment, dust, and movement of equipment and construction workers.

KOP 7: Idaho Centennial Trail at Johnson Creek Road (CR 10-413) and NFST 075

KOP 7 represents views from the ICT directed west. This trail is identified as a sensitive level 1 use area and is associated with high visual sensitivity. Short term construction activity may include road grading and vegetation clearing on Yellow Pine Route near the trailhead to accommodate heavy vehicle mine traffic. Grading and construction equipment used for these activities would generate dust during dry weather that would be visible during the daytime.

KOP 8: Trout Creek Campground

This campground is a sensitive level 1 use area, with developed amenities including fire pits, picnic benches, and restrooms. It is located immediately west of Johnson Creek Road (CR 10-413). Construction activity associated with road improvements for Yellow Pine Route would be visible, particularly when entering and exiting the campground. Construction traffic, equipment, dust, and movement of equipment and construction workers would contrast against the natural, and rustic environment of the campground.

4.20.2.4.2.2 Access Roads Operations

Effects to the Characteristic Landscape

There would low magnitude long-term visual impacts to the characteristic landscape associated with access roads from Alternative 4, because construction of the Burntlog Route would not occur. New access road construction through the mine site would be limited to the road connecting Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375). This new road would appear as flat to sloping, smooth, light-brown linear forms through the landscape, and appear consistent with other existing roads in the area and would be visible from KOP 4. The presence of vehicles on these routes would introduce movement to the landscape, and also provide access in a previously primarily roadless area.

The Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would provide a new viewer platform from which the mine site can be viewed (see Section 4.20.2.2.2.2). The Yellow Pine Route would consist of all existing roads; therefore, the level of visual change introduced to the landscape would be lower than that experienced as a result of the Burntlog Route under Alternatives 1, 2, or 3. Upgrades to the Stibnite Road portion of Yellow Pine Route would increase the level of visual contrast from the road due to road widening, as well as 9-foot-high retaining walls that would transform the existing line and form along the road from a natural, vegetated slope to smooth, lighter-colored man-made walls.

The new road would cross an area managed as Partial Retention and road upgrades would cross areas managed as Retention and Partial Retention. With the exception of the retaining walls, access roads would generally conform to the Partial Retention VQO. Although new and upgraded portions of the access roads could introduce strong visual contrast in some areas, it typically would be limited to the immediate foreground as viewed from the road and would appear subordinate from other viewing platforms.

KOP 1: Meadow Creek Lookout

The Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would be visible from KOP 1 but would largely be absorbed by the larger, more visually evident mine site operations.

KOP 4: Stibnite Road (CR 50-412)

Under Alternative 4, the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would begin at KOP 4. Looking south from KOP 4, the Stibnite Road to Thunder Mountain Road (FR 50375) link would travel through the mine site, and appear as a flat to sloping, smooth, light-brown linear form traversing the landscape. Although the linear form and light color would contrast with the natural surroundings, it would appear consistent with other existing roads in the area that are visible from KOP 4. Looking north from KOP 4, the upgraded Stibnite Road would be visible. The road improvements would slightly alter landscape character, because the road would transform from a low-traffic, narrow forest road to a wider, well-maintained and -graded access road with frequent mine traffic. This portion of the Yellow Pine Route would exhibit strong contrast with the surrounding terrain compared to existing conditions.

KOP 7: Idaho Centennial Trail at Johnson Creek Road (CR 10-413) and NFST 075

Johnson Creek Road (CR 10-413) would be plowed for year-round use under Alternative 4, and vegetation clearance along the road may increase in order to accommodate heavy vehicle mine traffic. These activities would increase the visual contrast of the road compared to existing conditions. Increased road use would generate dust during dry weather that would be visible during the daytime and headlights from mine traffic would be visible at night. Plowing the road during the winter would introduce a smooth, linear feature to the winter landscape that, under existing winter conditions appears similar to the surrounding natural, winter forest landscape. Additionally, large vehicles traveling the road during winter months would introduce movement and audible disruptions to the winter forest environment.

KOP 8: Trout Creek Campground

During operation of the mine, Johnson Creek Road (CR 10-413) would be routinely maintained, including grading (as needed), spot graveling, dust control, and snow removal in the winter. Due to road widening and frequent maintenance, the road would introduce a higher level of visual contrast to its surroundings due to its wider, smoother, and straighter appearance. Mine operation would create traffic to the mine site from buses, vans, trucks, and personal vehicles throughout mining operations. Nighttime traffic on this road would introduce new lighting into an area that has no permanent lighting sources. These impacts would primarily be experienced as individuals enter and exit the campground, although nighttime lighting could be visible from inside the interior of the campground.

4.20.2.4.2.3 Access Roads Closure and Reclamation

Effects to the Characteristic Landscape

The types of permanent visual effects associated with access roads under Alternative 4 would appear similar to those described under Alternative 1, although these effects would be in different locations. However, the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would not be reclaimed, and those areas would have permanent increased visual contrast on the landscape due to the presence of the new road link. This also would provide a permanent viewing platform along the route.

Stibnite Road would not be returned to the pre-mine width, and the 9-foot-high retaining walls, approximately 182 18-inch culverts, and two 60-inch culverts would remain after mine closure and reclamation activities have ceased. Therefore, the long-term impacts associated with Stibnite Road would remain as permanent impacts.

4.20.2.4.3 UTILITIES

Under Alternative 4, the proposed new and upgraded transmission lines would be the same as those described under Alternative 1.

Under Alternative 4, helicopters would be used during construction of communications sites, and would periodically enter into view from the majority of the KOPs during construction and maintenance activities. Because the activity would be periodic and only for a short duration, visual changes would be low during all phases: construction, operations, and closure and reclamation. **Appendix O-5** shows the viewshed of utilities under Alternative 4.

New transmission lines would cross areas managed as Retention and Partial Retention and upgraded transmission lines would cross areas managed as Preservation, Retention, and Partial Retention. Generally, new and upgraded transmission lines would not meet the Preservation, Retention, or Partial Retention VQO but would meet the Modification VQO. The line, color, form, and texture of the ROW would visually dominate the landscape but would not be out of scale with the natural surroundings. These effects would be visible in the foreground or middleground from the following viewer platforms: Johnson Creek Road (CR 10-413), the

Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link, and the Meadow Creek Lookout.

4.20.2.4.4 OFF-SITE FACILITIES

Under Alternative 4, proposed off-site facilities would be the same as described for Alternative 1, except the Landmark Maintenance Facility would be on the southern side of Warm Lake Road (CR 10-579). Associated visual change from construction, operations, and closure and reclamation of off-site facilities would be the same as described for Alternative 1 (see Section 4.20.2.1.4). **Appendix O-5** shows the viewshed of the off-site facilities under Alternative 4.

4.20.2.5 Alternative 5

Under Alternative 5, none of the action alternatives would be implemented, and no development of the mine site or supporting facilities would occur or be introduced. The landscape environment described in Section 3.20 would remain as it currently exists in the analysis area. Existing disturbances associated with historic mining activities at the mine site would still be visible to sensitive use areas, but there would be no changes to PNF and BNF characteristic landscape. Unlike Alternatives 1 through 4, reclamation activities would not be performed and permanent changes to the landscape in the area of the historic mine activities would dominate the landscape. Existing VQO classifications would remain the same under this alternative. Therefore, there would be no direct or indirect effects to scenic resources as a result of the No Action Alternative although the permanent scenic integrity of the area would be less than under any of the action alternatives. Additionally, the existing disturbances associated with historic mining activities do not meet the Partial Retention VQO. This would continue under Alternative 5.

4.20.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.20.4 Cumulative Effects

Past, present, and reasonably foreseeable future actions include activities, developments, or events that have the potential to change the physical, social, economic, and/or biological nature of a specified area. Existing and projected activities directly associated with an alternative, and other reasonably foreseeable future actions, provide the basis for defining and analyzing cumulative impacts. A cumulative effect must overlap in space and time with the direct and indirect effects of the action. For scenic resources, the analysis area for cumulative effects is broader than the analysis area for direct and indirect effects; and in this case, includes areas on National Forest System lands in Valley and Adams counties, including several projects in the PNF and BNF.

Several of the present and reasonably foreseeable future actions summarized in Section 4.1.5, including mineral development, wildfire management, access road maintenance, reclamation and rehabilitation plans, recreation, and infrastructure development, contribute to cumulative effects on scenic resources (see **Table 4.1-2** for brief descriptions of reasonably foreseeable future actions).

4.20.4.1 Alternatives 1 through 3

Historically, mining activities have impacted visual resources, including surface disturbances along roads, mining pits, and facilities; however, due to rugged terrain, visual impacts of these activities are highly localized. Activities associated with mineral exploration would locally increase the amount of vegetation removed to accommodate drill pad sites and improvement of access roads. Timber harvest activities also would contribute incrementally to landscape modification through the removal of vegetation over time. Forest management–related plans for noxious weed management, rehabilitation, and reclamation would result in a positive cumulative effect for the landscape by enhancing the natural, rugged setting that is characteristic of this area. There would be no new major utility corridors introduced through infrastructure development projects. Some mineral development projects have been put on hold in the cumulative analysis area; but overall, mining activity has not significantly modified these backcountry landscapes. The characteristic backcountry landscape setting would continue to be modified locally by these activities, but collectively, they would not trend toward a more highly developed or industrial-type setting. Disturbance associated with the SGP components would be reclaimed. Most disturbance areas would be reclaimed concurrently or at mine closure, and the visual effects of the disturbance would gradually decrease as vegetation matures and color contrasts are reduced by rock weathering. Permanent visual contrast would range from low to moderate-strong, and would contribute to the cumulative effects from past, present, and reasonably foreseeable actions.

4.20.4.2 Alternative 4

The contribution to cumulative effects under Alternative 4 would be similar to but slightly less than Alternative 1. This is because the new road for Burntlog Route would not be constructed under Alternative 4, and the associated long-term and permanent effects to the scenic character and integrity of the forest would not occur.

4.20.4.3 Alternative 5

Under Alternative 5, none of the action alternatives would be implemented, and no development of the mine site or supporting facilities would occur or be introduced. However; unlike Alternatives 1 through 4, mine site reclamation activities would not be performed and the changes to the landscape in the area of the historic mine activities would persist and continue to contribute to the cumulative visual changes to the landscape in the forest.

4.20.5 Irreversible and Irretrievable Commitments of Public Resources

4.20.5.1 Alternatives 1 through 4

All action alternatives would result in an irreversible loss of the characteristic landscape caused by the high walls of the open pits, where cut-slope color contrasts would persist until permanent rock weathering would reduce these contrasts. Due to the size and extent of the DRSFs and the TSF, an irreversible loss of the characteristic landscape would persist for a long period of time, until rock weathering and slope revegetation reduce visual contrast for color, form, line, and texture. Viewsheds for sensitive use areas near the mine site would be irretrievably changed due to the scale of topographic changes associated with the pits, DRSF, and TSF. Even with reclamation and revegetation, the viewshed would be dominated by these unnatural landforms.

4.20.5.2 Alternative 5

Under Alternative 5, the proposed mine activities and construction and operation of associated infrastructure would not occur. Consequently, there would be no irretrievable and irreversible commitment of scenic resources.

4.20.6 Short-term Uses versus Long-term Productivity

4.20.6.1 Alternatives 1 through 4

Short-term refers to uses with a duration of a few years or less. There would be no short-term uses that would affect long term-productivity of scenic resources.

4.20.6.2 Alternative 5

Under Alternative 5, the proposed mine activities and construction and operation of associated infrastructure would not occur, and there would be no additional short-term uses of the SGP area.

4.20.7 Summary

4.20.7.1 Change in Landscape Character and Scenic Quality of the Analysis Area

At the mine site, all action alternatives would cause similar changes to local landscape character scenic qualities over the construction, operation, and closure and reclamation timeframes. Alternative 5 would result in no change to landscape character and scenic quality. Of the action alternatives, Alternatives 1 and 3 would result in the greatest change in landscape character and scenic quality, primarily due to construction of approximately 15 miles of new roadway for the Burntlog Route, and the associated year-round vehicle movement and headlight activities during construction and operation phases. Alternative 2 would entail slightly less change as only approximately 13.5 miles of new roadway would be constructed. Of the action alternatives, Alternative 4 would entail the least change to landscape character and scenic quality of the analysis, as the mine access route would not require construction of the Burntlog Route, although it would require improvements to Yellow Pine Route, which would result in some changes to scenic quality, but to a lesser magnitude than a new road. After operations new portions of the Burntlog Route would be decommissioned and visual impacts would lessen over time.

4.20.7.2 Change in Distance Zone

Alternative 1, 2, and 3 would result in the greatest change to distance zones, because they would require construction of a new roadway in the forest. Individuals traveling through the forest on the new roadway would be able to see areas of the forest either not seen from viewing platforms under existing conditions or see them from a closer distance. Alternatives 1 and 3 would add the largest amount of new access roads (approximately 13.5 miles), with Alternative 2 providing slightly less mileage of new roads. Under Alternatives 1, 2, and 3, the mine site would be in the middleground distance zone of the new roadway for approximately 2 miles. Alternative 4 would involve construction of the new Thunder Mountain Road link that would traverse through the mine site providing immediate foreground views of the mine site. Alternative 5 would not involve construction of new access roadways and so would not provide new distance zones in the SGP area.

4.20.7.3 Change in Nighttime Lighting

Nighttime lighting at the mine site would be similar among all action alternatives. Similarly, there would be nighttime lighting effects from vehicles traveling on roads (new or improved) under all action alternatives. Alternatives 1 and 3 would include the greatest mileage of new roadway (approximately 15 miles) where this change would occur. Alternative 2 would include fewer new roadway miles (13.5), but some of these would occur at higher elevations, potentially increasing distant visibility. Alternative 4 would not include construction of Burntlog Route, but nighttime lighting effects would increase along the Yellow Pine Route, which potentially has more viewers to experience them as there are residences in the village of Yellow Pine and ranches along

Johnson Creek Road (CR 10-413). Alternative 5 would involve no change in nighttime lighting at the mine site or due to access road traffic.

4.20.7.4 Context of Impacts per Forest Guideline Visual Quality Objectives

Under all action alternatives, the mine site, access routes, new and upgraded transmission lines, and off-site facilities would introduce moderate to strong levels of visual contrast to areas with local and regional scenic importance as indicated by Preservation, Retention, and Partial Retention VQOs. Alternative 5 would not involve scenery impacts in accord with or conflicting with established forest VQOs.

4.20.7.5 Changes to Scenic Integrity

The analysis area generally has moderate scenic integrity, because the landscape is slightly altered by existing roads and transmission lines. Scenic integrity is very low where existing disturbances are present from historic mining activities, such as the mine site, because the landscape is heavily altered. Alternative 5 would result in no change to area scenic integrity. Under all action alternatives, additional alternations would occur to the already impacted mine site during construction and operations. After closure and reclamation, the scenic integrity at the mine site would likely slowly improve under all action alternatives. Access roads under Alternatives 1, 2, and 3 would cause similar degradations to scenic integrity caused by the construction of and activities on the Burntlog Route. Under Alternative 4, the change to scenic integrity would be less evident, because existing roadways would be improved rather than new roadway segments built. However, as there are residences along the existing Yellow Pine Route, there may be more viewers to experience these changes.

Table 4.20-1 provides a summary comparison of scenic resource impacts by issue and indicators for each alternative.

This page intentionally left blank

Table 4.20-1 Comparison of Scenic Resource Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may cause changes to scenic resources.	Visual contrast.	Landscape is characterized by valley floors surrounded by mountains with steep terrain broken up by narrow gorges and streams. Vegetation includes grass and evergreens. Existing modifications include the existing mine site, forest roads, transmission lines, and residences in the western portion of the analysis area.	New disturbances within the footprint of existing modifications would appear similar to existing modifications but at a larger scale. Visual contrast would increase due to larger road width, more vegetation removal, and new retaining walls. New ROW for a new transmission line and wider ROW of the upgraded transmission line would introduce high visual contrast. SGP components would result in a high level of change to the characteristic landscape during operations; permanent changes, although less than during operations, would result.	Similar to Alternative 1, except there would be slightly less visual contrast from the mine site due to absence of West End DRSF, and residents of the Thunder Mountain Estates development would experience fewer changes due to location of the transmission line away from the development.	Similar to Alternative 1 except visibility of changes from the mine site would differ as the Hangar Flats TSF would be located in the EFSFSR drainage and not visible from the Meadow Creek Lookout. There would be no public access through the mine site and, therefore, no new viewing platform providing foreground views of the mine site. The new transmission line would result in a lower level of visual change than Alternative 1 where it would follow an existing access road.	Changes associated with the mine site would be the same as Alternative 1. There would be no visual changes from Burntlog Route, because that would not be constructed. Landscape changes would result from the upgrades to Yellow Pine Route. Visual change from utilities would be the same except for additional periodic impacts from helicopters during construction and maintenance activity for communications sites.	The landscape character would not be changed by mine site activity or new or improved access roads, transmission lines, or offsite facilities associated with the mine.
	SGP component visibility.	Nighttime lighting in the analysis area is minimal and generally limited to residential areas in the western portion of the analysis area.	Nighttime lighting would increase substantially in the mine site. Additional nighttime light sources would include the maintenance facilities and vehicle headlights as they travel on mine access roads.	Similar to Alternative 1, except lighting from vehicles would occur to a slightly different area as a result of the 5.3-mile re-route of Burntlog Route. Lighting from the maintenance facility would be further east due to the different location of the maintenance facility.	Similar to Alternative 1, except lighting from worker housing would be located further west in the East Fork Meadow Creek drainage. Effects to skyglow would be the same.	Similar to Alternative 1, except SGP vehicle lights from vehicles traveling to and from the mine site would occur along the Yellow Pine Route, north and west of the Burntlog Route.	Nighttime lighting in the analysis area would not change as a result of the mine site or associated traffic or maintenance buildings.

This page intentionally left blank

4.21 SOCIAL AND ECONOMIC CONDITIONS

4.21.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to social and economic conditions includes the following issue and indicators:

Issue: The Stibnite Gold Project (SGP) may impact the socioeconomics of Valley and Adams counties and the State of Idaho.

Indicators:

- Contributions to employment levels (total, State of Idaho, and Valley and Adams counties).
- Estimated value of local income contributions.
- Estimated value of goods and services procured in Valley and Adams counties.
- Change in populations of Valley and Adams counties.
- Impacts to housing demand in Valley and Adams counties.
- Estimated tax revenue contributions.
- Changes in tourism and recreational based businesses.
- Changes in transportation and infrastructure.

Social and economic conditions were analyzed using the Economic Impact Analysis of the SGP (Highland Economics 2018), Populations at Risk profiles (Headwaters Economics 2019a,b,c), Midas Gold Idaho, Inc. (Midas Gold) Socioeconomics Baseline Study (Drage and Richins 2017), state and local tax and revenue data, U.S. Census Bureau (Census) data, geographic information system spatial analyses, scientific literature reviews, and other information and analysis documented in reports prepared for the SGP. Additional analysis also was performed when necessary to assess the validity of the data and analyses provided by Midas Gold to confirm their findings.

Assumptions used for this analysis include:

- The SGP is expected to employ both local and non-local area residents that commute in and out of the area on a bi-weekly basis. The nature and magnitude of the SGP's socioeconomic effects on the local analysis area economy are associated with the SGP-related employment impacts and potential population growth.
- There is uncertainty regarding the type and extent of local employment and in-migration resulting from the SGP. Due to the mine site's remote location and bi-weekly shift

staffing, it is difficult to project the actual extent and location of SGP-related in-migration to the local area. Because most workers would be housed on-site during their bi-weekly shifts, there is limited need or incentive for relocation to the local area. Idaho residents (particularly those living in rural areas) regularly commute or travel long distances, as do many workers in the mining industry. In the absence of benefits inducing workers to live locally, Midas Gold employees can choose from a wide variety of housing locations and base their housing decisions on factors including housing availability/affordability, local amenities, and social conditions, among others. As a result, most Midas Gold employees are expected to continue living in their current locations or choose to relocate to other larger non-local communities outside of the analysis area.

- Results from Economic Impact Analysis of the SGP (Highland Economics 2018) analysis of economic impacts are presented for each alternative and each phase of the SGP. The impact analysis presented in this environmental impact statement uses the Highland Economics' projected mid-range values of the local employment effects to discuss and evaluate the expected socioeconomic impacts to the local area.
- Valley County's labor force availability is limited, as current county unemployment levels are comparable with the state average. As a result, a high percentage of non-local employees would be expected due to local labor market constraints.

There is limited available information on use of the analysis area both by recreational visitors and Native American tribal members. As a result, the type, frequency, magnitude, and location of these users' activities are largely unknown, making it difficult to quantify their SGP-related socioeconomic impacts. Although adequate for the purposes of the socioeconomic impact analysis, limited fiscal information on Adams County's government services and revenues was available. Neither Midas Gold nor this socioeconomic analysis has been able to quantify direct revenue transfers to Valley and Adams counties resulting from the SGP's expected future mineral license fee payments to the state of Idaho.

4.21.2 Direct and Indirect Effects

The SGP would result in direct and indirect socioeconomic effects on residents, workers, and communities within the local analysis area (i.e., Valley and Adams counties and associated communities of Cascade, Council, Donnelly, McCall, New Meadows and Yellow Pine). For the purposes of the socioeconomic analysis, the indirect impacts also include induced socioeconomic effects that are attributable to the SGP activities.

Direct impacts are defined as those that would occur directly from the SGP activities in the same time and place. For example, direct employment includes not only Midas Gold employees but also other on-site construction workers that are employees of contractors hired for on-site construction or operational tasks. Indirect and induced impacts are defined as those that would be caused by an action but would occur later in time or would be farther removed in distance from the SGP activities. For example, indirect employment includes people who work for businesses that provide goods and services in support of the SGP. Induced effects are items that result from the direct and indirect effects. For example, induced employment includes people who would be employed by businesses that obtain their revenues as a result of spending by direct and indirect employees and businesses.

The following analysis of effects associated with social and economic conditions is considered within the overall context of the local analysis area and economy consisting of Valley and Adams counties and associated communities. Given the remote locations of the SGP area and rural surrounding environment, most of the direct socioeconomics impacts are likely to occur within Valley County and the New Meadows area in Adams County. In addition, analysis of statewide socioeconomic impacts from the SGP also are provided when appropriate.

Evaluation of the potential effect generally includes four components of impact: magnitude or intensity, duration, geographic extent, and context. These impacts are quantitatively analyzed when sufficient information is available, otherwise they are evaluated qualitatively.

The magnitude or intensity of an impact refers to its severity (e.g., the level of impact compared to established metrics, thresholds, etc.). The duration and geographic extent assess the impact's temporal and physical span respectively. Context refers to the implication of an action within a setting, such as society as a whole (human, national), the affected region, the affected interests, and the locality.

4.21.2.1 Alternative 1

4.21.2.1.1 CONSTRUCTION

4.21.2.1.1.1 Employment Direct

Table 4.21-1 shows the projected average annual employment and work residency for all three SGP phases (construction, operations, and closure and reclamation). An average of approximately 640 total workers are expected to be employed annually (including subcontracted employees) over the initial 3-year construction period for Alternative 1 (Highland Economics 2018).

An important factor in determining the economic benefits to the local and state economy under Alternative 1 would be the home residency of the SGP workforce. The proportion of SGP jobs filled by local workers would determine the level of SGP wages that would benefit local residents and the amount of new income that would be re-spent in the local economy benefitting other local businesses (induced impacts). Highland Economics (2018) projected low, mid, and high values of local employee residency for each SGP phase; the range of low to high values is provided in **Table 4.21-1**. The mid-value employment projection is shown below and is used in the environmental impact statement analysis to represent the expected future economic impacts.

As shown in **Table 4.21-1**, most construction workers (ranging from 50 to 85 percent) are expected to be Idaho residents. Under the mid-value scenario, it is expected that SGP construction would provide employment for 640 employees of which 420 would be Idaho residents. It is further expected that 190 of SGP's construction positions would be filled by individuals who would live in Valley or Adams counties. These local jobs would contribute to the local economy and could improve the standard of living for the employees and their families if wage rates are raised relative to current jobs. The number of SGP jobs for local residents are equivalent to 3.3 percent of the 2019 total employment for the local area of 5,777 (Idaho Department of Labor 2019).

Table 4.21-1 Projected Direct Annual Employment by Worker Residency and SGP Phase

	Total	Local Residents (Valley/Adams)	Other Idaho Residents	Out of State Residents
Construction (3 Years)				
Value Range (Low to High)	-	20% to 40%	30% to 45%	50% to 15%
Employment (Mid-Value)	640	190	230	220
Operations (12 to 15 Years)				
Value Range (Low to High)	-	20% to 50%	50% to 40%	30% to 10%
Employment (Mid-Value)	583	200	270	113
Closure and Reclamation (5 Years)				
Value Range (Low to High)	-	40% to 70%	30% to 20%	30% to 10%
Employment (Mid-Value)	160	90	40 / 20	30
Post-Closure (15 Years)				
Value Range (Low to High)	-	40% to 70%	30% to 20%	30% to 10%
Employment (Mid-Value)	40	20	20	0

Table Source: Highland Economics 2018

As discussed in the Employment Conclusion section below, current local unemployment rates and unemployed individuals in the labor force in Valley and Adams counties indicate while some of these positions could be filled by currently unemployed or under-employed local residents, it also is expected that many of the SGP construction jobs may be filled by non-local area residents that would choose to relocate to Valley or Adams County.

Indirect and Induced

Alternative 1 would result in indirect and induced economic effects on the local analysis area's economy as a result of direct employment and income from SGP construction activities.

Indirect jobs are created in the supply chain for materials and equipment used for construction. Indirect economic impacts include changes in sales, income, or jobs within the area's economy associated with the businesses that supply goods and services. For example, increased sales for local suppliers providing construction materials and equipment represent an indirect effect of Alternative 1's construction activity and spending. Induced effects represent increased economic activity from household spending of labor income by both the SGP construction and supporting businesses' workers.

Highland Economics (2018) estimated the indirect and induced economic impacts from Alternative 1 for both the State of Idaho and Valley and Adams counties' combined local economy using an input-output economic model (IMPLAN). The IMPLAN modeling software estimates the impacts of changes in final demand (spending) on other sectors of an economy by measuring the relationship between the final demand and the local inputs required to satisfy that demand.

Under the mid-value scenario, the IMPLAN analysis estimated that up to 830 full and part-time indirect jobs would be supported within Idaho's economy during the 3-year construction period for Alternative 1. Similarly, up to 570 full and part-time induced jobs also would be supported within the Idaho economy over the same period. As a result, it is projected that a total of 1,400 indirect and induced jobs would be supported annually by the SGP during the 3-year construction phase. Most of this employment would occur outside the local economy, as a total of 300 Valley and Adams counties jobs (180 indirect and 120 induced) of the 1,400 total are projected to be supported by Alternative 1 during the 3-year construction period (Highland Economics 2018).

The total local, state, and national indirect and induced full and part-time jobs supported by the SGP would be approximately 4,050 (Highland Economics 2018). It is important to note that these are jobs and income supported by the SGP, but that, at the national level, these are not necessarily additional jobs and income in the United States (U.S.) compared to the No Action Alternative. If the capital and labor resources used for SGP's development were instead invested in mining or other economic activities elsewhere within the U.S., there would be employment and income benefits generated from these alternative activities (Highland Economics 2018).

The indirect and induced job projections are based on national data on the relationship between employment and output for each affected economic sector. Depending on the specific state and local economic conditions, businesses operating at under capacity or facing limited increased demand may increase their utilization of their existing employees rather than hire new workers.

Employment Summary

Based on the direct, indirect, and induced employment impacts analyzed above, under the mid-value scenario, the overall statewide employment impact for Alternative 1 is estimated to support 1,820 full and part-time jobs for Idaho residents annually during the 3-year construction period. The overall local employment impact of Alternative 1 during the 3-year construction phase is expected to provide approximately 500 full and part-time jobs for the residents of Valley and Adams counties (i.e., 190 direct and 310 indirect/induced jobs). This local job impact would correspond to 8.7 percent of the local area 2019 total employment of 5,777 (Idaho Department of Labor 2020a,b).

The number of unemployed residents in the labor force in 2019 in Valley and Adams counties was approximately 327 (Idaho Department of Labor 2020a,b). Therefore, the SGP could provide jobs to unemployed or under-employed residents in the labor force in those counties. The SGP also is expected to attract worker in-migration to the local area.

Overall, the SGP is estimated to support 4,690 direct, indirect, and induced jobs for residents nationwide (i.e., Idaho and elsewhere in the U.S.) (Highlands Economics 2018).

4.21.2.1.1.2 Income

Direct

Table 4.21-2 shows the average annual construction spending on labor, materials, equipment and services. Expenditures for Alternative 1 also are broken out by their sourcing location.

During the construction phase, it is projected that approximately $66.7 million (in 2017 dollars) in salaries and wages would be paid annually to the 640 construction workers on average over the 3-year construction period. Under the mid-value scenario, $42.4 million in salaries and wages are projected to be paid to Idaho residents working for SGP. Of that total, Valley County and Adams County residents are projected to receive $17.4 million per year in salary and wage income from the SGP (Highland Economics 2018). Salaries and wages paid to out-of-state residents are projected to total $24.3 million.

Table 4.21-2 Projected Direct Construction Spending Per Year (in millions) (2017 Dollars)

Direct Spending	Total	Local	State Non-Local	State - Total	Out of State
Salaries & Wages [1]	$66.7	$17.4	$25.0	$42.4	$24.3
Vendor On-Site Operations	$17.7	$17.7	$0	$17.7	$0
Material, Equipment & Services	$260.1	$27.2	$179.6	$206.8	$53.3
Total	**$344.5**	**$62.3**	**$204.6**	**$266.9**	**$77.6**

Table Source: Highland Economics 2018

Table Notes:

1 Does not include direct labor expenses/income for vendor on-site workers and business proprietors.

Based on the projected total annual direct labor cost of $66.7 million, the average salary of all SGP employees (i.e., including management staff) is calculated to be $108,000 (in 2017 dollars) (Highland Economics 2018). This fully burdened wage accounts for overtime compensation, as well as employee health and other benefits. The average wage for local residents is projected to be approximately $96,600 per year (in 2017 dollars) and also is fully burdened to account for employee health and other benefits. The corresponding unburdened salary is estimated to be

$67,700, which is comparable to the area's prevailing Davis-Bacon rates of $20 to $30 per hour depending on the position (Highland Economics 2018).[1]

The projected construction worker salaries and wages are considerably higher than the prevailing wages in the local area and in the Boise area, which average approximately $18 per hour (unburdened) for the construction and extraction sector and $16 per hour across all occupations (Idaho Department of Labor 2020a, b). The average covered wage (i.e., for non-self-employed workers) statewide within Idaho is $43,480 and is $36,134 within Valley County and $37,468 within Adams County (see **Table 3.21-5**). This high compensation rate for construction workers would partly reflect the specific work conditions and labor skill needs. Nonetheless, employment opportunities under Alternative 1 would represent well-paying and attractive job opportunities for both local and non-local residents, as the average unburdened wage for employees ($67,700) would be 55 and 53 percent and higher than the average 2018 wage in Adams County ($37,468) and Valley County ($36,134), respectively (see **Table 3.21-5**).

The contribution of relatively well-paying local area employment and labor income from the SGP would result in an improved standard of living, increased spending, and increased economic activity within the local economy during the 3-year construction period.

SGP employees and contractors are expected to spend almost all of their earnings in their community of residence, given their bi-weekly shift schedules and employee housing at the mine site's remote location. As a result, the economic contributions to Valley and Adams counties' economies would be limited to the income earned by construction workers that live within the local area.

Alternative 1 would provide estimated annual income of $17.4 million for local area residents during the 3-year construction period. Alternative 1-related local area growth in well-paying jobs and increased earnings would improve the standard of living for the employees and their families. The local income also would result in increased local spending and economic activity within the local economy, which in turn also would further support local employment and income earnings.

Indirect and Induced

As discussed above for the indirect and induced employment impact analysis, SGP-related impacts from construction activities would result in indirect and induced income contributions to the statewide and local analysis area's economies. Indirect income earnings would result from the increased sales and employment for the businesses that supply goods and services for construction of Alternative 1. Induced income effects represent the local workers' earnings resulting from increased household spending by both construction and support businesses' workers.

[1] The Davis-Bacon wage rate is based on the listing of wage rates and fringe benefit rates for each job classification determined by the Administrator of the Wage and Hour Division of the U.S. Department of Labor to be prevailing for a particular type of construction (e.g., building, heavy, highway, or residential) and location.

Under the mid-value scenario, the IMPLAN analysis estimated that $44.3 million in indirect and $21.2 million (in 2017 dollars) in induced income, for a total of $65.5 million, would be supported within Idaho economy's during the 3-year construction phase for Alternative 1. Most of this income would occur outside the local economy. Construction activities are projected to support a total of $7.4 million indirect and $3.3 million per year (in 2017 dollars) in induced income within Valley and Adams counties' economies during the 3-year construction period (Highland Economics 2018). Outside of Idaho, the SGP is projected to support a total of $191.8 million in indirect and induced income, resulting in a nationwide total of $257.3 million in indirect and induced income (i.e., combined total of Idaho and elsewhere in the U.S.) (Highland Economics 2018).

Based on an assumed full-time equivalent employment rate of 80 percent for projected indirect and induced full-time and part-time local jobs, the average salary for these workers (including benefits) is estimated to range from $34,400 (induced) to $51,400 (indirect) per year.

Income Summary

Based on the direct, indirect, and induced income effects analyzed above, under the mid-value scenario, Alternative 1's overall statewide income impact is estimated to contribute a total of $110.9 million per year during the 3-year construction phase (in 2017 dollars). Of this total, the overall local income impact is projected to total $28.1 million per year for Valley and Adams County residents. Outside of Idaho, the SGP is projected to support a total of $215.5 million in direct, indirect, and induced income resulting in a nationwide total of $326.4 million in direct, indirect, and induced income (i.e., combined total of Idaho and elsewhere in the U.S.) (Highland Economics 2018).

4.21.2.1.1.3 Population and Housing

Construction of Alternative 1 could affect the surrounding communities through local employment and income effects, which in turn could cause changes in population and housing needs of communities within the local analysis area. Any such population changes also could affect the level of community public services needed. The extent of induced population growth under Alternative 1 would be a primary factor determining potential economic and social impacts (e.g., increased housing and public services demand) for Alternative 1. Under the unlikely event that existing residents filled all total local employment positions (i.e., direct, indirect, and induced), then no population or housing impacts would be expected, because there would be no change in local population levels and housing demand.

As discussed in Section 4.21.2.1.1.1, Employment, it is projected that up to 500 total local jobs (i.e., direct and indirect/induced) would be supported by SGP construction activities (Highland Economics 2018).

Commuter and In-Migration Rates

SGP proposes to operate bus/vanpool pickup sites in Cascade, McCall, and Donnelly to transport construction workers to the mine site for their bi-weekly shifts (Highland Economics

2018). Most of these commuting employees are expected to come from communities outside the local analysis area. It was assumed that most workers would reside in the Boise metropolitan area (which is located approximately 75 miles and a 1.5-hour drive south from Cascade) or communities along Idaho State Highway 55 and U.S. Route 95 travel corridors that connect easily to the bus/vanpool pickup sites. In addition to the City of Boise's population of more than 220,000 residents (2018), a similar sized population lives within approximately a 2-hour drive from Cascade in the cities of Meridian, Nampa, and Caldwell.

It is difficult to predict the actual extent and location of SGP-related in-migration to the local area, especially due to the mine site's remote location and two-week shift staffing. The need or incentive for employee relocation to the local area is limited, because most of workers would be housed on-site during their bi-weekly shifts. Idaho residents (particularly those living in rural areas) commute or travel long distances on a regular basis, as do many workers in the mining industry. In the absence of benefits inducing workers to live locally, SGP employees can choose from a wide variety of housing locations and base their housing decisions on factors including housing availability/affordability, local amenities, and social conditions, among others. As a result, many SGP employees might be expected to continue living in their current locations or choose to relocate to other larger non-local communities closer to Boise with greater housing options, amenities, and public services options.

In-migration by SGP construction employees and contractors could be limited for several reasons. First, existing local residents may be expected to fill a portion of the construction jobs. Second, during their 2-week work-shift, most employees would be housed on-site and, consequently, there would be no benefit from living within the local analysis area. Thirdly, as discussed above, non-local communities closer to Boise would offer greater housing options, amenities, and public services options within a relatively close travel distance (i.e., less than 2 hours) from the proposed employee bus/van pool pick-up locations in Cascade, McCall, and Donnelly (Highland Economics 2018).

In-migration effects on indirect and induced employment can be expected to be weaker than direct employment effects. The wage rates for the indirect and induced jobs would be far lower and more comparable to prevailing wage rates within the local area and elsewhere in the state. Generally, indirect and induced employment opportunities under Alternative 1 also would be less specialized and less skilled. As a result, there would be a larger labor pool of potential employees for any new positions. Finally, given the relatively short-term nature (3 years) of the new jobs from SGP construction activities, many businesses can be expected to meet increased business demands through more interim measures (e.g., overtime and increased facility/equipment utilization) rather than business expansion (e.g., new hires or facility expansion). Consequently, projected indirect and induced employment impacts may be expected to result in comparatively less attraction and incentives for in-migration to occur than that from the SGP's higher paid and more secure job opportunities.

However, the local area's current relatively low unemployment rate increases the potential for future in-migration from Alternative 1's indirect and induced job demand. Currently, there is only a limited labor pool of unemployed and under-employed local residents available to fill the projected new job positions.

As a result, this socioeconomic analysis identifies and evaluates the potential impacts assuming moderate in-migration rates under Highland Economics (2018) mid-value local worker residency scenario. **Table 4.21-3** shows the existing resident and new in-migrant worker populations expected under the mid-value local worker residency scenario for each of the phases of the SGP (construction, operations, and closure/reclamation). As shown in the table, new in-migrants relocating to the local analysis area could account for up to half of projected local direct employment and a third of the projected indirect and induced local employment for Alternative 1. As a result, Alternative 1 construction activities are projected to potentially result in total in-migration of approximately 198 workers.

Population Demographics

Based on Idaho statewide averages, it would be expected that 57 percent of the in-migrating workers would be married with an average of 0.64 child per capita (Census 2018). As a result, the 198 workers projected to relocate to the local analysis area during Alternative 1 construction phase would be expected to result in a total population increase of up to 438 new residents, which would consist of 240 dependents (113 spouses and 127 children).

This in-migration worker population could increase new local housing demand by up to approximately 200 homes. Although, the actual total housing demand would be less if relocating workers opt to share housing (either with existing residents or other in-migrating workers) or if in-migrating spouses also work on the SGP.

The potential for any such new housing demand to have an adverse impact on the local area's affordable housing supply is a commonly held and understandable concern for many local residents (AECOM 2018). These concerns are likely more commonplace and acutely perceived by current local residents, of which many have lived in their current residence for more than 20 years (see **Table 3.21-3**). In addition, the local analysis area's past population growth and in-migration rates also likely contribute to concerns of SGP-related adverse impacts on local affordable housing availability.

Table 4.21-3 Projected Employment by Worker Residency and SGP Phase

	Total Local Employees	Existing Local Residents	In-Migrant
Construction Employment			
Direct	190	95 (50%)	95 (50%)
Indirect and Induced [1]	310	207 (66.7%)	103 (33.3%)
Total – Construction [2]	**500**	**302**	**198**

	Total Local Employees	Existing Local Residents	In-Migrant
Operations Employment			
Direct	200	100 (50%)	100 (50%)
Indirect and Induced	270	180 (66.7%)	90 (33.3%)
Total – Operations	**470**	**280**	**190**
Closure and Reclamation Employment			
Direct	90 / 20	90 / 20 (100%)	0
Indirect and Induced	40 / 10	40 / 10 (100%)	0
Total – Reclamation / Closure	130 / 30	130 / 30 (100%)	0
Total – Annual Average [3]	**52**	**52 (100%)**	**0**

Table Source: Highland Economics 2018

Table Notes:

1 Estimated increased employment includes both full and part-time positions.

2 Totals may not sum exactly due to rounding.

3 Based on 5-year closure and reclamation phase and 15-year post-closure phase durations.

Housing Availability and Affordability

As described in Section 3.21, Affected Environment, overall there were a total 91 homes for rent,138 homes for sale, and 92 “other vacant” home in the Valley and Adams counties area available for in-migrating workers in 2018 (**Table 3.21-3)**. The data suggests that most of the local housing has been sold to second home buyers, thereby increasing the number of occasional housing units and decreasing the availability of housing to local residents (Highland Economics 2018).

Most of the “occasional use” housing within Valley and Adams counties generally consists of more expensive second homes that may be unavailable or unsuitable for workers to rent or purchase, as these custom and/or newer homes are typically less affordable. However, Census data on housing prices does not show an increase in price resulting from the relatively low availability of housing.

However, the percentage of Valley County households paying more than 30 percent of their household income on rent grew from 33.5 percent to 59.1 percent between 2010 and 2018 (Census 2010, 2018). This increase indicates that the local housing market is becoming less affordable and that local demand for affordable housing already currently exceeds the available supply in Valley County. During the same period, the portion of Adams County residents that were paying more than 30 percent of their household income on rent each month decreased from approximately 50 percent to 39.9 percent, suggesting that the local housing market has become more affordable (Census 2010, 2018).

A future influx of new SGP employees and contractors into the local communities could increase local housing demand. In-migrating employees may live in dispersed areas of the two counties, limiting the effects on housing in any one location within the two-county area (Highland Economics 2018). Given their higher paying salaries, these in-migrating workers should be able to afford to rent or buy homes with values closer to the area's median and market values. Although the 2018 quantities of homes for sale or rent is limited (321 homes), this supply exceeds the projected 95 new SGP construction workers expected to in-migrate to the local area.

As a result, potential adverse housing availability impacts under Alternative 1 would likely predominantly result from the approximately 103 workers that may migrate into the local area for the indirect and induced jobs supported by SGP's construction activities. Given the lower typical salaries for the indirect and induced jobs supported by Alternative 1 construction activities, the workers in-migrating to the local area for these jobs could increase competition for lower-priced housing, which could in turn contribute to greater scarcity of affordable housing and increased housing price appreciation within the local area.

The number of currently available homes for sale or rent is limited (321 homes), and it is expected that the projected 95 new SGP construction workers relocating to the analysis area should be able to afford to buy or rent these available homes. In which case, 226 unoccupied homes would be expected to remain available for the approximately 103 in-migrant non-SGP workers (i.e., indirect or induced workers) that are projected to relocate to Valley or Adams counties. Adverse affordable housing availability impacts could result from Alternative 1 construction activities if there is an insufficient existing inventory of suitable housing within the affected communities. In which case, Alternative 1 construction activities could result in adverse impacts to housing availability and affordability within the local area. In addition, this impact would be expected to occur primarily during the start of Alternative 1 construction and/or operations phases and then subsequently stabilize in the absence of any further increase in local employment. As described under the Relocation discussion below, many factors affect the actual housing demand from in-migrating workers. These include the extent that SGP-related indirect and induced jobs might be filled by existing residents or SGP employee spouses, the extent that in-migrating workers would cohabitate and where they would reside within local communities, which would in turn affect local housing demand and affordability for the local analysis area's existing residential population.

Relocation

Factors affecting relocation include housing availability and schools, as well as other amenities such as parks, restaurants, and recreation. Relocation is a personal decision based on interest, commute preferences, family make-up, and background. As a result, it is inherently difficult to reliably predict the future geographic distribution of the expected population growth. However, several factors may be anticipated to contribute to future relocation outcomes. Some in-migrants may be former local residents who may reside with current residents when they return. Between 2010 and 2016, an estimated 540 working age individuals out-migrated from the local area, possibly for employment reasons. Coupled with an increased prevalence of multi-generational households, a sizeable number of the in-migrating population may take up residence with friends or relatives that are existing residents and thereby have a lesser impact on local housing demand (Highland Economics 2018).

It also is possible that in-migrating SGP employees may live in dispersed areas within the two counties due to their bi-weekly work schedule and higher income levels, which would give them more housing opportunities – potentially including rental/purchase of more expensive “occasional use” second homes (Highland Economics 2018).

In-migrating workers attracted by the SGP-related indirect and induced labor demand would generally be expected to be less dispersed within the two counties. Instead these individuals may be expected to be more concentrated across the local area’s larger communities where there would likely be greater availability of affordable housing, access to public services and better proximity to local businesses with job opportunities.

As a result, given the existing distribution of population and housing within the McCall and Cascade areas, it might be expected those communities would attract a major share of in-migrating non-SGP workers. A lesser portion of employees might be expected to relocate to Council or New Meadows, while few, if any, new employees and their families would be expected to relocate to the small communities of Yellow Pine or Donnelly, or elsewhere within the unincorporated and more rural areas of the two counties.

Housing impacts under Alternative 1 may be adverse from the overall local area perspective, and it is possible that concentrated new in-migrant population increases could result in greater impacts within specific communities – especially if those communities are not well equipped to absorb the new residents. For example, while McCall has 4,259 housing units, only 1,440 are occupied year-round by residents (Census 2018). If half of the projected new in-migrant workers selected McCall for their place of residence, that would represent an approximate 3 percent increase in the community’s population (3,226 people), which would likely represent and could be perceived by current residents as a noticeable and possibly adverse population effect. As discussed under the Housing Availability and Affordability Section, the potential for affordable housing impacts would depend on the number of lower-paid in-migrants relocating to the specific community. As a result, if there is an insufficient existing inventory of suitable housing within the affected communities, it is possible that adverse affordable housing availability impacts could result from Alternative 1 construction activities.

Social Impacts

The nature of social impacts from the in-migrant work population would depend on numerous factors, including the existing population’s social character and context, the in-migrating population composition, and terms of their residency. A key factor would be the in-migrating populations’ social compatibility with the existing population’s demographic composition and social values/attitudes. The extent and duration of social disruption from new in-migrants would typically be reduced if the in-coming new residents have similar demographic characteristics, common social values, shared attitudes, and/or compatible lifestyles.

As discussed in Section 3.21.3.1, Population and Housing, there have been historically low rates of population growth and new residents moving into the local analysis area. Furthermore, the two-county area population has a high proportion (approximately 25 percent) of residents 65 years or older compared to the Idaho average of 15 percent. The two-county area also has a corresponding smaller proportion of residents under the age of 18 than the statewide average. The median age of the local population in Valley County is approximately 49 years old. The median age of Adams County residents is approximately 54 years old. The communities within Valley and Adams counties are well-established and very stable; most of the residents own their homes, and a large share of whom have lived in their current place of residence for 20 years or more. More than a quarter of Valley County residents and approximately a third of Adams County residents have lived in their current home more than 20 years. As a result, most existing residents likely have a strong connection and sense of ownership with their local community. These residents also may tend to value continuity and have some aversion to change. These factors may be reflected in their “sense of place” and “quality of life” that they perceive and attribute to their communities and relationships with their surroundings.

During SGP scoping, public comments ranged from support of the SGP to specific issues of concern about future SGP impacts. Commenter support for the SGP mentioned its benefits for the local, regional, and state economy by providing jobs. They also stated that year-round employment (as opposed to seasonal tourism-related jobs) would bring financial security to an economically depressed region from both the direct and indirect contributions to the local economy. Commenters not in support of the SGP expressed concerns about adverse effects on the environment, other industries, potential “boom and bust” impacts, and the influx of worker demand on public services like road maintenance and schools. Commenters also expressed social concerns of future property theft and vandalism (AECOM 2018).

The composition and residency of the future in-migrating population is unknown and difficult to predict. However, it is expected that a large share of the workers relocating to the area would likely be from elsewhere in Idaho or residents from adjoining states. In which case, while these in-migrating workers would likely be younger than most of the current population, it may be expected that most of the in-migrants would have a similar cultural, racial, and social backgrounds as existing residents.

The extent that the in-migrating population would have or would be perceived to have adverse impacts on the existing communities’ social character also would be dependent on other factors. The location and concentration of the incoming new resident population may affect the nature and extent of their interactions and relationships with existing residents. Given the well-paying positions, in-migrating SGP employees and contractors would have more housing choices and might be expected to be more dispersed within the local area. Non-SGP workers might be more likely to live within the area’s larger communities and closer to employment opportunities. In which case, non-SGP worker household’s presence would be more noticeable and more widely observed by existing residents. These in-migrants would have more frequent interactions with existing residents and may be perceived to be adding competition for affordable housing and jobs. Consequently, there may be more potential for adverse social effects from their relocation to local area.

Another factor would be the extent that the new in-migrant population seeks and is able to successfully integrate into the existing communities. The opportunities of relatively secure mine operations jobs might be expected to attract in-migrating SGP construction workers that would have a high likelihood of long-term residency and seek to integrate into their new community.

Typically, most substantial and serious social impact concerns of existing residents are focused on the potential disruptive actions by the in-migrating population (e.g., in the form of interpersonal conflicts, social disturbances, and incidents of crimes). For many of the reasons discussed above, the likelihood of such adverse social impacts occurring from the SGP's construction phase may be considered limited given the relative size and expected composition of the in-migrating populations.

Public Services

Direct

Alternative 1 construction activities could attract a projected 438 new residents (workers and families) that could relocate to the local analysis area (see Section 4.21.2.1.1.3, Population and Housing). This population growth would likely result in increased public services demand and use. The type and extent of the public service increases would depend on the demographics of the new residents. For example, the number and age of children relocating with in-migrating workers would determine increased enrollment impacts on the local public school system.

The population growth also would result in increased sales tax revenue (state and in some cases local), utility payments, and possibly property tax revenues (if existing property values appreciate or home development expands) (see Section 4.21.2.1.1.4, Government Revenues). Potential adverse impacts to public services may occur if the new residents' service demands exceed their revenue contribution and/or the specific public service/program's capabilities.

The local analysis area's public water utilities and school systems have the most potential to be impacted by the expected population increases. The communities of McCall, Cascade, New Meadows, and Donnelly all provide water and sewer services for their residents, and addition of new permanent residents may, in some cases, increase stress on their systems. Community members have expressed concern about these impacts (AECOM 2018).

The public school system within the local area consists of several independent school districts located in McCall, Donnelly, Cascade, New Meadows, and Council. Under the mid-value worker residency scenario for Alternative 1, it is projected that up to 121 children may relocate to the local analysis area. In which case, the potential increase in school enrollment demand would be approximately 80 students (Census 2015; Highland Economics 2018). If these new students are evenly distributed across grades, then the average enrollment increase per grade would be approximately six additional students in each grade.

As shown in **Table 3.21-8**, McCall school district's recent (2018) enrollment is higher than past 2000 and 2010 levels, while the Cascade school district's enrollment has decreased by approximately 38 percent over the last 20 years. Cascade and New Meadows are both under enrolled, while McCall and Donnelly currently do not have capacity for additional students (Idaho Department of Education 2019). As a result, the SGP-related influx of new students would correspond to an approximately 6 percent increase in enrollment. Furthermore, if the in-migrating student population consists of more similarly aged children, then the increase for their corresponding grades would be higher and more likely to be difficult for the local school systems to accommodate. If this occurs, the adverse impact on the public school system could be very substantial if the current programs and facilities have insufficient capacity to absorb that additional student enrollment.

The population increase under Alternative 1 would likely result in limited effects to local police and fire protection services. Adams and Valley counties' telecommunications and internet infrastructure operate at near capacity and, therefore, may have difficulty in maintaining service levels from increased service demand in some locations.

Public service impacts under Alternative 1 would depend on both the location of any SGP-related population growth and the specific circumstances of the affected public services. It is possible that adverse public service impacts could occur to the local analysis area's water and public school system, particularly if in-migrants are more highly concentrated in individual communities such as McCall (though this is hard to predict). In which case, there could be substantial adverse impacts to those public services.

However, if the relatively limited projected population growth is not highly concentrated, then construction could have only minor or negligible adverse impact on most of the local area's public services.

Indirect

Valley County's 2019 unemployment rate was relatively low (3.9 percent). Adams County's unemployment rate was higher at 6.6 percent in 2019 (Idaho Department of Labor 2020a,b). While vacancies in these sectors might be more readily filled by Adams County's unemployed or under-employed residents, it is likely that Valley County communities would provide a larger share of Alternative 1 local area employees and, therefore, receive greater benefit of higher wage jobs in construction and mining. Consequently, Valley County's public agencies and service sectors also would have greater potential of possible adverse impacts from wage-inflation and/or understaffing. These jobs are important for the functioning of the local economies. A lack of employees able to fill these positions could negatively affect the local government service sectors, assuming new workers do not move into the area and government agencies have limited flexibility to adjust wages and/or increase funding to pay contractors.

Labor cost increases could adversely affect the capacity for public agencies that rely on lower paid, skilled workers for their operations (i.e., school bus drivers, garbage haulers, etc.) to continue providing their services. In addition to increasing their operating costs, in more serious cases the labor shortages could result in business contractions and reduced public services if their work positions remain unstaffed. Contraction also could occur for private businesses relying on lower-wage or competing wage workers; however, businesses may have greater flexibility to react to increases in disposable income, adjust their wage rates, attract new workers, and benefit from the influx of higher wage jobs.

It also is possible that any adverse wage-inflation or staffing impacts would result in relatively short-term effects as the affected public agencies, private businesses, and local economy adjust their operations to the changes in labor force availability. These adjustments may occur during the both the mine construction and operation phases.

4.21.2.1.1.4 Government Revenues

Valley County and Adams County residents and businesses pay federal and state income taxes, and their purchases are subject to state sales taxes. In addition, the buildings within the local area owned by individuals and businesses are subject to local and state property taxes.

Table 4.21-4 shows the estimated projected annual tax revenues resulting from Alternative 1's construction activities.

Table 4.21-4 Projected Annual Taxes Generated and Supported by Alternative 1 - Construction ($M/year, 2017 Dollars)

Impact Type	Midas Gold	Other	Total - Annual	Total – All Years [4]
State Sales Tax [1]	$4.9	$0.7	$5.6	$16.8
State Personal Income Tax [2]		$3.4	$3.4	$10.2
State Corporate Income Tax		$0.3	$0.3	$0.9
State and Local Subtotal	$4.9	$4.4	$9.3	$27.9
Federal Personal Income Tax [2]		$21.2	$21.2	$63.6
Federal Payroll Taxes [2, 3]	$7.1	$27.9	$35.0	$105.0
Federal Corporate Tax		$5.3	$5.3	$15.9
Federal Subtotal	$7.1	$54.4	$61.5	$184.5
Total (Local, State, Federal)	$12.0	$58.8	$70.8	$212.4

Table Source: Highland Economics 2018

Table Notes:

1 Does not include local sales taxes.

2 Tax payments for these items also are included in the employee compensation estimates.

3 Includes social security and Medicare payments by both employee and employer paid payroll taxes.

4 Based on a 3-year construction period.

M = million

The total annual government tax revenue benefits from Alternative 1 construction activities are estimated to be $70.8 million per year and $212.4 million over the 3-year construction period. Midas Gold is projected to pay $12.0 million of these taxes annually or $36.0 million over the construction period. The other $58.8 million per year in total taxes would be obtained from businesses and employees supporting the SGP. Over the entire 3-year construction period, the total taxes paid by SGP support businesses and employees are projected to total $176.4 million.

The federal government is expected to receive most of total tax revenues resulting from Alternative 1 construction activities. The state and local tax revenues generated by Alternative 1 are projected to total $9.3 million per year, of which the majority would be received by the State of Idaho. No property taxes are expected to be paid by Midas Gold until after the SGP facilities are completed and the mining operations begin. As a result, Alternative 1 construction activities are expected to result in negligible tax revenue benefits for the local area's economy.

4.21.2.1.1.5 Transportation and Infrastructure

Transportation

Changes in the local network of access roads and traffic use could potentially have socioeconomic impacts on the surrounding communities and their residents and businesses if it results in substantial changes in roadway use and/or user spending within those communities.

Alternative 1 construction phase impacts on the local analysis area's transportation system from both use and network changes are analyzed in detail in Section 4.16, Access and Transportation. The socioeconomic impact analysis evaluates the nature and extent of projected travel redistribution and changes in traffic conditions to assess if they would result in corresponding economic changes for local area residents, businesses, and the local area's economy.

During the 3-year construction phase, a total annual average daily traffic (AADT) increase of 65 vehicle trips is projected to occur, which would be distributed across several routes within the local roadway network. No measurable socioeconomic effects on the local area economy is expected due to the affected roadway system's remote location, very low use levels, and the limited traffic growth from Alternative 1's construction activities.

Some existing roads would be upgraded and maintained to support SGP-related traffic or to offset impacts to recreational use under Alternative 1. As noted in Section 4.16, Access and Transportation, Midas Gold would be responsible for roadway maintenance measures under a cooperative agreement with the U.S. Forest Service (Forest Service) and Valley County. The Burntlog Route would be constructed specifically to provide access to the mine site for construction and operational transportation needs. In addition, an off-highway vehicle (OHV) Connector trail (from a new transmission line access road to Meadow Creek Lookout Road [National Forest System Road (FR) 51290) in an area that does not have existing motorized use trails. The Stibnite Road portion of the McCall-Stibnite Road (County Road [CR] 50-412) also would be closed at Sugar Creek.

These roadway system changes have the potential to divert some recreational travel and spending from the village of Yellow Pine to other locations with access to the Payette National Forest and Boise National Forest. Traffic data on the number of annual recreationists travelling through Yellow Pine via this route is limited but is approximately 29 vehicles per day. This traffic likely includes current SGP employees and contractors accessing the mine site area as part of ongoing exploration activities. As a result, there is the potential for reduced economic activity in Yellow Pine from May through November from Alternative 1 roadway system changes. However, it also may be expected that any of the spending from diverted recreationists would be spent locally elsewhere and recaptured by the local area economy.

While the roadway improvements may redirect some traffic within the local area, the improvements are not expected to induce significant new visitation. As a result, Alternative 1 changes to the local area's roadway system and use are not anticipated to result in any major new economic activity or economic development. Consequently, the transportation impacts under Alternative 1 are expected to have negligible socioeconomic effects on the local analysis area's economy during the construction phase.

Infrastructure

Other infrastructure changes, such as utility system upgrades, also could have socioeconomic impacts on surrounding communities depending on nature of the effects on local area residents and businesses.

All the transmission lines and electrical substations that would be upgraded or built are located within remote and underdeveloped areas with no current operating businesses or other economic activities. Concerns have been noted that the service capacity increase from Alternative 1 upgrade to the local area utility infrastructure could attract and result in other new development within the local study area that would result in additional socioeconomic impacts. However, it is considered highly unlikely that any such induced development would occur, because utility service capacity is not considered a primary limiting factor to current economic development within the vicinity of the upgraded or new utilities. Consequently, no utility service capacity related impacts are expected to occur from Alternative 1 utility service changes.

4.21.2.1.1.6 Tourism

Recreation and tourism are important sectors of the local area economy. Recreation and tourism businesses are Valley County's largest source of employment and provide more than 29 percent of county jobs (see **Table 3.21-5**).

There are several ways that SGP activities at the mine site and related infrastructure (including surrounding areas where SGP-related physical impacts may occur) could potentially affect recreation use. SGP-related physical impacts to the local analysis area's resources (e.g., noise/visual impacts and wildlife habitat conditions) could reduce the quality of the recreational resources (i.e., user opportunities and experiences) within the vicinity of the mine site and off-site facilities. The type and degree that such resource changes would affect recreational and tourism use also would depend on the relationship and extent that visitor use decisions would be influenced.

SGP-related changes in recreation access or opportunities (i.e., recreation and wildlife conditions) could affect the local area's economy through visitor spending changes at local tourism businesses. The nature and extent of the impacts to the local area's tourism economy would depend on the type and magnitude of SGP-related changes in local visitation and use. Non-local visitor use changes would generally have greater potential to impact local tourism businesses due to their higher spending on goods and services than local residents.

Recreation use impacts are analyzed in detail separately in Section 4.19, Recreation. This section evaluates the potential impacts on tourism-related businesses and the region's economy from expected changes to recreation due to construction activities.

SGP-related changes in recreation access (and consequently use) may result from both restrictions on the areas open to public use and/or changes in the local transportation system that affect users' ability to travel to the local area's recreational destinations.

SGP construction and operations would require imposition of an Operations Area Boundary primarily surrounding the mine site. Public use would not be allowed within the 13,446 acres of public lands within the Operations Area Boundary. Existing dispersed recreational use and opportunities that occur in this area would be displaced to other locations in or adjacent to the analysis area.

However, once the Burntlog Route is constructed, access to recreation areas beyond the SGP area, such as Monumental Summit and Thunder Mountain would be available when other routes through the mine site are not open to the public. As a result, there could be short-term decrease in recreational use and tourism-related business revenues during the 3-year construction phase to these areas.

Impacts on recreation opportunities at and around the mine site would begin during construction and continue until the mine was closed, the site reclaimed and the area is reopened for dispersed recreation use. Some displaced visitors may choose to continue recreating at their current locations in other National Forest areas, such as the South Fork area, rather than return to the mine site area due to permanent changes in the recreation setting within the Operations Area Boundary. Nonetheless, there would be no net loss in recreation use and visitation for the local analysis area, and the socioeconomic impacts to the local analysis area's tourism sector and overall economy would be negligible.

However, it also is possible that SGP-related displacement of some recreational use and visitation from area's near local communities, such as Yellow Pine or Warm Lake, could reduce tourism spending at their businesses. Depending on the type and magnitude of any such lost spending, it is possible that adverse economic impacts on individual businesses and community economies could occur.

More specifically, SGP construction would affect access to the operating areas of three outfitters and guides as a result of the development of Burntlog Route and the OHV Trail, as well as the closure of Stibnite Road (CR 50-412) and the mine site Operations Area Boundary. In addition, the SGP also could degrade recreation experiences for customers participating in guided activities near construction of these components due to construction noise and activity. This could negatively affect their ability to provide their licensed activities and may degrade their customer's recreation experiences. However, all outfitters would continue to be able to access and use major portions of their operating areas that would not be impacted by the SGP. It is likely that any of their permitted uses displaced by the SGP could be served elsewhere within their existing operating areas. As such, adverse impacts to their operations and customers would be very limited.

4.21.2.1.2 OPERATIONS

4.21.2.1.2.1 Employment

Direct

Table 4.21-1 shows the projected average annual employment and work residency for SGP operations. An average of 583 workers are expected to be employed annually (including subcontracted employees) over the expected 12- to 15-year operating period (Highland Economics 2018).

As shown in **Table 4.21-1**, the majority of SGP operations workers (ranging from 70 to 90 percent) are expected to be Idaho residents. Under the mid-value scenario, SGP operations would provide employment for 470 Idaho residents, of which 200 would live in Valley County or Adams County. As shown in **Table 4.21-3,** it is expected that about 100 of these jobs could be filled by workers relocating to the local two-county area.

It is expected that most of the local construction workers would be adequately qualified and/or trainable for mine operations work and that many construction workers living locally or elsewhere within Idaho would likely accept mine operations jobs. These, and other local residents, would be adequately qualified for the general, administrative, and maintenance positions. These job categories account for approximately one-half of the SGP's operations phase workforce needs (Highland Economics 2018).

This local area employment increase would improve the standard of living for the employees and their families and it can be expected to last for the duration of the mining operations phase. The estimated direct local job impact of 200 local resident employees from Alternative 1's operations would correspond to 3.5 percent of the local area's 2019 total employment of 5,777 (Idaho Department of Labor 2020a,b).

Indirect and Induced

As with the construction phase, operation's spending and employment also would result in indirect and induced employment effects on the state and local analysis area's economy.

Under the mid-value scenario, IMPLAN analysis estimates that up to 310 full- and part-time indirect jobs within the State of Idaho would be supported by Alternative 1 during the 12- to 15-year period of operations. Similarly, up to 370 full- and part-time induced jobs within Idaho also would be supported over the same period. As a result, it is projected that a total of

680 indirect and induced jobs would be supported annually by the SGP during the operations phase. Most of this employment would occur outside the local economy, as a total of 270 Valley and Adams County jobs (150 indirect and 120 induced) out of the 680 total are projected to be supported by Alternative 1 operations (Highland Economics 2018). Outside of Idaho, the total indirect and induced full and part-time jobs supported by the SGP would be approximately 1,430 (Highland Economics 2018).

Employment Summary

Based on the direct, indirect, and induced employment impacts described above, under the mid-value scenario, Alternative 1's overall statewide employment impact is estimated to support a total of 1,150 full- and part-time jobs for Idaho residents annually during the 12- to 15-year period of operations. The overall local employment impact of Alternative 1 during operations is expected to total 470 full- and part-time jobs. This local job impact would correspond to 8.1 percent of the local area's 2019 total employment of 5,777 (Idaho Department of Labor 2020a,b).

The number of unemployed residents in the labor force in 2019 in Valley and Adams counties was approximately 327 (Idaho Department of Labor 2020a,b). Therefore, the SGP could provide jobs to unemployed or under-employed residents in the labor force in those counties and also may be expected to attract some worker in-migration to the local area.

Overall, the SGP is estimated to support 2,690 direct, indirect, and induced jobs for residents nationwide (i.e., Idaho and elsewhere in the U.S.) (Highlands Economics 2018).

4.21.2.1.2.2 Income

Direct

Under Alternative 1, a total of approximately 436 million tons of ore and development rock would be mined from the Yellow Pine, Hangar Flats, and West End pits. As discussed in Section 2.3, Alternative 1 – Action Identified in Midas Gold's Plan, SGP operations would recover 4 to 5 million ounces of gold, 2 to 3 million ounces of silver, and 100 to 200 million pounds of antimony. Based on the 2014 to 2018 average mineral prices (in 2017 dollars) for gold ($1,216 per ounce), silver ($16.50 per ounce), and antimony ($3.67 per pound), the total future value of mineral production (after refining) would be estimated to range from approximately $5.3 billion to $6.9 billion (U.S. Geological Survey 2019). The annual value of extracted minerals would be between approximately $439 million and $572 million per year over the operations phase (U.S. Geological Survey 2019).

Table 4.21-5 shows the average annual spending on labor, materials, equipment, and services for SGP operations. Operations expenditures under Alternative 1 also are broken out by their sourcing location.

Table 4.21-5 Annual Operations Spending ($M/year, 2017 Dollars)

Direct Spending	Total	Local	State Non-Local	State - Total	Out of State
Salaries & Wages	$53.4	$18.7	$24.0	$42.7	$10.7
Vendor On-Site Labor	$2.3	$0.8	$0.8	$1.6	$0.7
Vendor On-Site Operations	$13.7	$13.7	$0.0	$13.7	$0.0
Material, Equipment & Services	$165.3	$26.8	$48.1	$74.9	$90.4
Total	**$234.7**	**$60.0**	**$72.9**	**$132.9**	**$101.8**

Table Source: Highland Economics 2018

During operations, it is projected that an average of approximately $53.4 million (in 2017 dollars) in salaries and wages would be paid to its 583 operations workers. Under the mid-value local residency scenario, $42.7 million in salaries and wages would be paid to Idaho residents working for SGP. Of this, Valley County and Adams County residents are projected to receive $18.7 million in annual salary and wage income (Highland Economics 2018). Salaries and wages paid to out-of-state residents are projected to total $10.7 million.

Based on the projected total annual direct labor cost of $53.4 million, the average salary of all SGP employees (i.e., including management staff) is calculated to be $90,600 (in 2017 dollars) (Highland Economics 2018). This fully burdened wage accounts for overtime compensation, as well as employee health and other benefits. The average wage for local residents is projected to be approximately $92,500 per year (in 2017 dollars) and also is fully burdened to account for employee health and other benefits. The corresponding unburdened salary is estimated to be $64,800, which is comparable to the area’s prevailing Davis-Bacon rates of $20 to $30 per hour depending on the position (Highland Economics 2018).

SGP employees are expected to spend all their earnings in their community of residence, given their bi-weekly shift schedules and employee housing at the mine site’s remote location. As a result, the direct economic impact to the Valley County and Adams County economies would be limited to the income earned by the 200 operations staff that live within the local area.

Indirect and Induced

As with the construction phase, SGP operational spending and employment would result in indirect and induced income changes to the state and local analysis area’s economy.

Under the mid-value scenario, IMPLAN analysis estimates SGP operations would result in $15.7 million in indirect and $13.7 million in induced income annually in Idaho. Most of this income would be earned outside the local economy, as Alternative 1 operations are projected to result in $7.6 million in indirect and $3.3 million in induced income within the two-county economy (Highland Economics 2018). Based on an assumed full-time equivalent employment rate of 80 percent for projected indirect and induced full-time and part-time local jobs, the average salary for these workers (including benefits) is estimated to range from $33,700 (induced) to $63,300 (indirect) per year.

Income Summary

Based on the direct, indirect, and induced income effects analyzed above, under the mid-value scenario, Alternative 1 operations statewide total income impact during the 12- to 15-year period of operations is estimated to be $71.6 million per year. Of this statewide total, the overall local income impact is expected to total $29.3 million per year for Valley County and Adams County residents. Outside of Idaho, the SGP is projected to support a total of $114.8 million in direct, indirect, and induced income resulting in a nationwide total of $186.4 million in indirect and induced income (i.e., combined total of Idaho and elsewhere in the U.S.) (Highland Economics 2018).

4.21.2.1.2.3 Population and Housing

As shown in **Table 4.21-1**, Alternative 1 local employment levels during operations are expected to be comparable to the levels during construction. Furthermore, operations are projected to result in a similar level of in-migration with a total of 190 workers expected to relocate to the local analysis area as a result of Alternative's 1 operations labor needs. Of this total, 100 would be expected to be employed by SGP's operations and up to another 90 workers would be supported by the operations either indirectly (i.e., through support business) or induced (i.e., by increased spending by SGP or indirect workers).

A portion of Alternative 1 operations labor needs is expected to be staffed by existing local residents (either pre-construction or construction in-migrants). It is expected that most of Alternative 1's local construction workers would be adequately qualified and/or trainable for the operations positions. As a result, many of those workers would accept positions to work at the mine during operations. Both these and many other local residents would be adequately qualified for general, administrative, and maintenance positions. These job categories account for approximately one-half of the operations phase work force needs (Highland Economics 2018).

The population growth or housing demand impacts from operations would likely be very similar to those resulting from construction activities. The 190 workers projected to relocate to the local area during operations phase would be expected to result in a total population increase of up to 420 new residents, which would consist of 82 single individuals, 108 couples, and 122 children. This potential in-migration could add new local housing demand for up to 190 homes.

The approximately 90 workers that may migrate into the local area due to the increased labor demand for indirect and induced jobs may impact affordable housing availability. However, this is a relatively small number, and Alternative 1's operations are expected to result in relatively minor adverse impacts to housing availability and affordability within the local area. In addition, this impact would be expected to occur primarily during the start of construction and operations phases and then subsequently stabilize in the absence of any additional local employment growth.

As discussed previously for Alternative 1 construction activity impacts, the potential for affordable housing impacts would depend on the number of lower-paid in-migrants relocating to the specific community (see subsection 4.21.1.1.3). It is possible that major adverse affordable housing availability impacts could result from Alternative 1 operations if there is an insufficient existing inventory of suitable housing within the affected communities.

Similarly, public service impacts from Alternative 1 operations would depend on both the location of any SGP-related population growth and the specific circumstances of the affected public services. It is possible that major adverse public service impacts could occur in the local area's water and public school system especially if its facilities have inadequate capacity to meet the increased service demands. However, provided the population growth from Alternative 1 operations is not highly concentrated, Alternative 1 operations would at most have only minor or negligible adverse impacts on most of the local area's public services.

The potential social impacts during SGP operations would be expected to be similar to those from SGP construction given that the expected SGP-related in-migration would be comparable between the phases. In addition, many local construction workers might subsequently be employed by the mine operations. The businesses and jobs supported by SGP operations also would be largely similar to those supported by SGP construction. As a result, the in-migrating worker population for SGP construction would be expected to continue to work and reside locally during the 12- to 15-year period of operations. Given the general continuity in SGP-related employment between the construction and operations phases, very limited net or new changes to the local area's social environment and character would be expected to be experienced or perceived by the existing residents. Furthermore, most of any social impacts from the in-migrating population would likely dissipate as the new residents integrate into their local communities and are accepted by the existing residents. As a result, the SGP operations phase may be expected to result in limited adverse social impacts over the 12- to 15-year period of operations.

4.21.2.1.2.4 Government Revenues

Table 4.21-6 shows projected annual tax revenues from SGP operations under Alternative 1. Annual government tax revenue benefits from SGP operations under Alternative 1 are estimated to total $61.7 million. Midas Gold is projected to pay $29.4 million in taxes annually. The other $32.3 million would be paid by SGP support businesses and employees.

The federal government is expected to receive most of the total tax revenues resulting from Alternative 1 operations. Federal tax receipts during the SGP operations phase are projected to be $51.6 million annually and total $619 million over the entire operations period (based on a 12-year operations period). The state and local tax revenues generated under Alternative 1 are projected to be $10.1 million per year and total $121.4 million over the entire operations period.

Most of these taxes would be received by the State of Idaho. Local tax revenues paid by Midas Gold are projected to average $0.3 million per year and total $4.5 million over the entire assumed 12-year period of operations. In 2018, Valley County's property tax totaled $7.5 million; therefore, the SGP's projected annual property tax would account for approximately 4 percent of Valley County's current total property tax. As a result, operations under Alternative 1 are expected to result in a relatively limited tax revenue increase for the local area's economy.

Table 4.21-6 Projected Annual Taxes Generated and Supported by Alternative 1 - Operations ($M/year, 2017 Dollars)

Impact Type	Midas Gold	Other	Total - Annual	Total – All Years[2]
Property Tax	$0.3	–	$0.3	$3.8
State Mine License	$0.1	–	$0.1	$1.2
State Sales Tax	–	$0.8	$0.8	$9.6
State Personal Income Tax	–	$2.3	$2.3	$27.6
State Corporate Income Tax	$6.4	$0.2	$6.6	$79.2
State and Local Subtotal	$6.8	$3.3	$10.1	$121.4
Federal Personal Income Tax	–	$10.7	$10.7	$128.4
Federal Payroll Taxes [1]	$5.7	$14.3	$20.0	$240.0
Federal Corporate Tax	$16.9	$4.0	$20.9	$250.8
Federal Subtotal	$22.6	$29.0	$51.6	$619.2
Total (Local, State, Federal)	$29.4	$32.3	$61.7	$740.6

Table Source: Highland Economics 2018

Table Notes:

1 Includes social security and Medicare payments by both employee and employer paid payroll taxes.

2 Based on a 12-year operations period.

"–" This cell is blank.

Local property taxes may be used to fund local schools, local governments, local law enforcement, fire protection, local roads, and other public services. The extent that the SGP-related increase in local tax revenues would result in a net benefit to Valley County's public services would depend on the extent that they offset increases in costs to provide public services.

It is expected that SGP's reliance on public services would be limited, as it would generally self-administer on-site security and fire protection services. As noted in Section 4.16, Access and Transportation, Midas Gold would be responsible for roadway maintenance measures under a cooperative agreement with Forest Service and Valley County. As such, there would be no increased cost to Valley County and its taxpayers as a result of any SGP-related roadway repair costs.

As discussed previously (see Public Services subsection in Section 4.21.2.1.1.3), public services demand impact would predominantly result from SGP-related local population increases (i.e., worker in-migration). In addition, Alternative 1 operations could result in adverse impacts on government provision of services and staffing from wage inflation and local worker shortages for lower paying jobs within the local area, contingent on the ability of agencies and contractors to backfill staff losses over the longer period of operations, compared to the 3-year construction phase.

4.21.2.1.2.5 Transportation and Infrastructure

Operations phase impacts under Alternative 1 on the local analysis area's transportation system from both use and network changes are analyzed in detail in Section 4.16, Access and Transportation. The socioeconomic impact analysis evaluates the nature and extent of projected travel redistribution and changes in traffic conditions to assess if they would result in corresponding economic changes for local area residents, businesses, and the local area's economy.

During operations, a total AADT increase of 68 vehicle trips is projected to occur, which would be mainly along Warm Lake Road and the Burntlog Route. This traffic growth is approximately the same as that projected during the construction phase. In addition, the roadway network would be generally the same under both the construction and operations phases, but the Burntlog Route would be the only route use to access the mine site. Therefore, Alternative 1 socioeconomic impacts from transportation during operations would be the same as those during the construction phase. Furthermore, as noted in Section 4.16.2.1.4, Access and Transportation, Midas Gold would be responsible for roadway maintenance measures under a cooperative agreement with Forest Service and Valley County. As such, there would be no increased cost to Valley County and its taxpayers as a result of SGP-related roadway repair costs. Consequently, Alternative 1 transportation impacts are expected to have negligible socioeconomic effects on the local analysis area's economy during the operations phase.

4.21.2.1.2.6 Tourism

The Operations Area Boundary established during SGP construction would remain in place during operations. SGP-related changes in recreation access and opportunities (i.e., recreation and wildlife conditions) during operations would be similar to construction, with the main difference being that mine access would be via Burntlog Route exclusively.

These SGP-related changes could result in increased or decreased recreation visitation (either in numbers of visitors and/or their recreation use). For example, new access could provide new recreation opportunities and increased access to the wilderness, but there also would be negative impacts and reduced opportunities for non-motorized uses and potential impacts to wilderness visitors.

Generally, it is expected that any impacted or displaced recreation would likely relocate to other National Forest areas within the local analysis area. This outcome may be expected due to both the limited recreation use levels of the affected areas and the existing availability of alternate and comparable recreational areas and resources. As a result, the corresponding change in recreation use under Alternative 1 operations would have negligible socioeconomic impacts to the local area's tourism sector and overall economy.

However, it also is possible that SGP-related displacement of some recreational use and visitation from area's near local communities, such as Yellow Pine or Warm Lake, could reduce tourism spending at their businesses. Depending on the type and magnitude of any such lost spending, it is possible that adverse economic impacts on individual businesses and those community economies could occur.

Furthermore, as discussed in Section 4.21.2.1.1.6, Tourism, three of the outfitter businesses currently within the analysis area could have access to portions of their operating areas and their customer experiences impaired by the SGP facilities and operations. This could negatively affect their ability to provide their licensed activities and may degrade their customer's recreation experiences. However, all outfitters would continue to be able to access and use major portions of their operating areas that would be unimpacted by the SGP. It is likely that any of their permitted use displaced by the SGP could be served elsewhere within their existing operating areas. In which case, adverse impacts to their operations and customers would be very limited.

4.21.2.1.3 CLOSURE AND RECLAMATION

4.21.2.1.3.1 Employment

Direct

SGP employment under the post-operations phases would decline sharply from construction and operations phase levels. **Table 4.21-1** shows SGP's projected average annual employment and work residency for the closure and reclamation phase. During the 5-year closure and reclamation phase, the SGP would expect to employ a total of 160 workers, which would decrease to 40 workers for the subsequent monitoring (Highland Economics 2018).

As shown in **Table 4.21-1**, the majority of SGP closure and reclamation workers (ranging from 70 to 90 percent) are expected to be Idaho residents. SGP employment during the much of the closure and reclamation phase would total 160 positions, which would be a net decrease of 423 positions from the prior operations employment levels. The decrease in employment for Idaho residents is estimated to be 340 jobs, of which 110 are expected to be local resident jobs. As discussed in the Scoping and Issues Summary Report, Midas Gold has indicated that they could ramp up and ramp down employment in a measured way to result in a more gradual transition for local area residents and the economy (AECOM 2018).

After the major closure and reclamation tasks are complete, employment would decrease to 40 positions and would correspondingly result in a decrease of 120 jobs from the prior employment levels at the beginning of this phase. The decrease in employment for Idaho residents is estimated to be 90 jobs, of which 70 are estimated to be Valley County and Adams County residents (Highland Economics 2018).

As discussed further below, the post-closure decrease in employment and other related economic activity could result in adverse economic impacts on the local area's economy from the "bust" following the prior "boom" from the SGP's construction and operations employment and spending. When mine operations cease, local communities and economies may experience a contraction in demand for private and public goods and services and a corresponding reduction in demand for labor. Investment and capacity expansion that occurred during mine operations may become under-utilized unless new economic productivity and business opportunities develop in the region. Post-closure economic expansion and investment may happen if tax revenue or fees from mining can be effectively re-invested in community services and infrastructure, creating an environment conducive for long-term economic growth.

However, the SGP closure and reclamation phase would result in net increases in local employment compared to the No Action conditions (Alternative 5). SGP reclamation's direct employment of 90 local workers during the first 5-years of closure and reclamation would correspond to 1.6 percent of the local area's 2019 total employment of 5,777 (Idaho Department of Labor 2020a,b).

SGP direct employment of 20 local workers during the final part of closure and reclamation would correspond to 0.3 percent of the local area's 2019 total employment of 5,777 (Idaho Department of Labor 2020a,b).

Indirect and Induced

As with the construction and operations phases, Alternative 1's closure and reclamation spending and employment would result in indirect and induced employment effects on the state and local analysis area's economy.

Under the mid-value scenario, IMPLAN analysis estimated that, on average, approximately 20 full- and part-time indirect jobs within Idaho would be supported annually by Alternative 1's reclamation activities during the first 5 years of this phase. Similarly, approximately 40 full- and part-time induced jobs within Idaho also would be supported over the same period. Most of these jobs would occur within the local economy. A total of 10 indirect and 30 induced local jobs are projected to be supported within the Valley and Adams counties' economy by Alternative 1's closure and reclamation phase during the first 5 years (Highland Economics 2018).

In addition, SGP closure and reclamation activities after the first 5 years is expected to support approximately 20 full- and part-time indirect and induced jobs for Idaho residents per year during the 15-year duration. Ten of these jobs are projected to be filled by local residents (Highland Economics 2018). The total local, state, and national indirect and induced full and part-time jobs supported by the SGP would be approximately 170 (Highland Economics 2018).

Employment Summary

Based on the direct, indirect, and induced employment impacts analyzed above, under the mid-value scenario, Alternative 1 overall statewide employment impact is estimated to total 190 full and part-time jobs during the first 5 years of the closure and reclamation phase. The overall local employment impact of Alternative 1 during this period is expected to total 130 full- and part-time jobs, resulting in a corresponding decrease in total employment of 340 full- and part-time jobs from prior employment levels during operations. This local employment corresponds to 2.2 percent of the local area's 2019 total employment of 5,777 (Idaho Department of Labor 2020a,b).

Under the mid-value scenario, Alternative 1 overall statewide employment impact is estimated to total 40 full- and part-time jobs during the additional 15-year period. The overall local employment impact of Alternative 1 during this phase is expected to total 30 full- and part-time jobs. This local employment corresponds to 0.5 percent of the local area's 2019 total employment of 5,777 (Idaho Department of Labor 2020a,b).

Alternative 1 is expected to support a total of 130 full- and part-time jobs (including direct, indirect and induced jobs) for local area residents during the 5-year closure and reclamation phase. Over the subsequent 15-year post-closure period Alternative 1 is expected to support 30 full- and part-time jobs for local area residents (see **Table 4.21-3**). Overall, the SGP is estimated to support 330 direct, indirect, and induced jobs during closure and reclamation for residents nationwide (i.e., Idaho and elsewhere in the U.S.) (Highlands Economics 2018).

Such potential "boom and bust" effects from a mine's closure are commonly recognized as potential source of adverse socioeconomic impacts on the local area economy. The impacts on the local area's economy depend on employees' responses after their mine employment ends, as well as their other employment opportunities. If the local area's economy is strong and there are sufficient job opportunities with adequate earning potential for the unemployed mine workers, then the adverse economic impacts on the local economy could be limited if the unemployed mine operations workers are re-employed locally elsewhere. While it may be difficult for the displaced mine workers to find equally high-paying replacement jobs, some individuals may be willing to accept less wages for job positions with more traditional work schedules, working conditions, and duties. As discussed in the Scoping and Issues Summary Report, Midas Gold also has indicated that they could ramp up and ramp down employment in a measured way to reduce the "bust" effects on the local area residents and economy (AECOM 2018).

In addition, economic development planning, job-retraining, and other mechanisms can be used to facilitate the transition after the mine's closure. However, in the absence of established funding and implementation commitments (either by Midas Gold or state/local public agencies), potential adverse "boom and bust" impacts could occur.

When mine operations cease, local communities and economies may experience a contraction in demand for private and public goods and services and a corresponding reduction in demand for labor. Investment and capacity expansion that occurred during mine operations may become under-utilized unless new economic productivity and business opportunities develop in the region. Post-mining economic expansion and investment may happen if tax revenue or fees from mining can be effectively re-invested in community services and infrastructure – creating an environment conducive for economic growth long-term.

These potential “boom and bust” effects after mine operations cease could result from both SGP’s projected 110-person reduction in the direct employment of local residents and the net 230 job decrease in local induced and indirect employment previously supported by the mining operations phase levels. Given the local analysis area’s largely rural and small economy, in the absence of adequate economic transition mitigation, the mine-closure related decrease in local employment and income could have an adverse impact on the local area’s residents, businesses, and overall economy.

4.21.2.1.3.2 Income

Direct

Table 4.21-7 shows the average annual spending on labor, materials, equipment, and services during closure and reclamation and post-closure activities. Closure and reclamation and post-closure expenditures also are broken out by their sourcing location.

Table 4.21-7 Annual Closure and Reclamation Spending (2017 Dollars)

Direct Spending ($M/year)	Total	Local	State Non-Local	State - Total	Out of State
Closure and Reclamation					
Salaries & Wages	$6.6	$3.6	$1.7	$5.3	$1.3
Material, Equipment & Services	$11.9	$1.2	$6.4	$7.5	$4.4
Total - Reclamation	$18.6	$4.8	$8.1	$12.9	$5.7
Post-Closure					
Salaries & Wages	$1.6	$0.9	$0.4	$1.3	$0.3
Material, Equipment & Services	$4.3	$0.5	$1.6	$2.0	$2.2
Total - Closure	$5.9	$1.4	$2.0	$3.3	$2.6

Table Source: Highland Economics 2018

It is projected that an approximately $6.6 million (2017 dollars) in salaries and wages would be paid annually to the 160 workers during closure and reclamation. Under the mid-value local residency scenario, $5.3 million in salaries and wages would be paid to Idaho residents working for the SGP. Of this, Valley County and Adams County residents are projected to receive

$3.6 million in annual salary and wage income (Highland Economics 2018). Salaries and wages paid to out-of-state residents are projected to total $1.3 million.

SGP employees are expected to spend all their earnings within their community of residence, given their bi-weekly shift schedules and employee housing at the mine site's remote location. As a result, the economic benefits to the Valley County and Adams County economies would be limited to the income earned by SGP operations staff that live within the local area.

Alternative 1-related local jobs and earnings also would result in spending and economic activity within the local economy that would in turn support further local employment and income growth. The projected direct income impact from Alternative 1 reclamation activities is $3.6 million annually. Alternative 1 is projected to support $18.5 million (including direct, indirect and induced jobs) for local area residents during operations (see Section 4.21.2.1.2.1). Therefore, there would be a corresponding decrease in total local income of $14.9 million from the prior employment levels during the operations phase.

During the subsequent post-closure phase, it is projected that approximately $1.3 million (2017 dollars) in salaries and wages would be paid to the 40 workers (all of whom are expected to be Idaho residents). Valley County and Adams County residents are projected to account for 20 of these employees and to receive $0.9 million in annual salary and wage income (Highland Economics 2018).

Indirect and Induced

Alternative 1 closure and reclamation spending and employment would result in indirect and induced income changes to the state and local analysis area's economy.

Under the mid-value scenario, IMPLAN analysis estimated that Alternative 1's closure and reclamation activities would support $4.5 million in indirect and $5.3 million in total induced income. The majority of this induced income would occur outside the Idaho economy, as Alternative 1 closure and reclamation activities are projected to support $1.1 million in indirect and $1.6 million in induced income out of the $4.5 million and $5.3 million totals. Of the statewide totals, Valley County and Adams Counties residents are projected to receive $0.4 million in indirect and $1.1 million in induced income. Based on an assumed full-time equivalent employment rate of 80 percent for projected indirect and induced full-time and part-time local job increase, the average salary for these workers (including benefits) is estimated to range from $41,700 (induced) to $50,000 (indirect) per year.

During the subsequent post-closure phase, it is projected that approximately $3.0 million ($2017) in salaries and wages for indirect and induced workers would be supported by the SGP's closure activities, of which approximately $0.5 million would be expected to be received by Valley and Adams County residents (Highland Economics 2018).

Income Summary

Based on the direct, indirect, and induced income effects analyzed above, Alternative 1 closure and reclamation phase is estimated to support a total of $7.8 million in annual income statewide under the mid-value scenario. The total local income supported by the SGP's closure and reclamation phase is expected to be $5.0 million. In total, the SGP is estimated to contribute $16.4 million direct, indirect, and induced income per year nationwide (i.e., $7.8 million in Idaho and $8.6 million elsewhere in the U.S.) (Highlands Economics 2018) during SGP's closure and reclamation phase.

As discussed under the closure and reclamation employment impact analysis, adverse economic disruption and dislocation impacts could occur as result of the decrease in activity from the prior levels during Alternative 1's construction and operations phases.

These potential "boom and bust" effects after mine operations cease could result from reduction in 110 local jobs and corresponding decrease in local residents' labor income by $14.9 million. In addition, the projected reduction in 230 indirect and induced local jobs could result in a corresponding decrease in local residents' labor income by $9.5 million from the prior levels during mine operations. In which case, there would be a total local labor income decrease of approximately $24.3 million from the prior operations phase. Given the local analysis area's largely rural and small economy, in the absence of adequate economic transition mitigation, the mine-closure related decrease in local employment income could have an adverse impact on the local area's residents, businesses, and overall economy. The duration of this impact would depend on the affected workers and local area economy's ability to adapt in response to the economic dislocation.

4.21.2.1.3.3 Population and Housing

As shown in **Table 4.21-1**, a portion of the closure and reclamation labor under Alternative 1 would be staffed by local residents. Furthermore, Alternative 1 total local employment during closure and reclamation would be reduced from construction and operations levels. As a result, compared to the No Action Alternative (Alternative 5), no population or housing demand growth impacts would be expected during Alternative 1 closure and reclamation phase.

However, as discussed above, in the absence of interim measures, there would be potential for substantial "bust" impacts following the cessation of the SGP's mining operations from the subsequent local job and income losses. If there are insufficient replacement job opportunities for the local residents no longer employed (directly or indirectly), then the local area economy could experience increased unemployment and reduced economic activity. Depending on the severity and duration of the economic dislocation and recovery, many of the local residents formerly employed (direct or indirectly) by the SGP's mining operations may choose to relocate out of the local area to find employment. There could be some adverse housing supply impacts from worker out-migration in the form of increased home sales and decreased tenancy/demand for rental properties, which might reduce property values if there is not adequate demand for their vacated homes.

However, given the current shortage of affordable housing and high level of demand for occasional housing units, it is might be expected that there would be sufficient housing demand (either as a primary or secondary residence) for the local area's housing market to absorb vacated homes and recover within a relatively short period of time. However, if future housing demand and supply conditions change, it may be possible that there could be adverse housing impacts to the local economy if any vacated properties remain unoccupied for an extended period of time.

In the absence of any population or housing demand growth impacts, no related adverse impacts from increased demand for public services would be expected. Nonetheless, out-migration following cessation of SGP operations may have the potential for adverse impacts to public services if it results in underuse and/or underfunding for any facility expansion that occurred to serve SGP-related population growth (e.g., development of new utility connections or school buildings). However, the potential type and extent for both operational and post-operational impacts to public services would be dependent on the location of any SGP-related population growth and the capabilities of the specific public systems serving the new residents.

4.21.2.1.3.4 Government Revenues

Table 4.21-8 shows estimated annual tax revenues resulting from Alternative 1 closure and reclamation activities and the percent change in tax revenue compared to the operations phase.

Table 4.21-8 Percent Change in Annual Taxes Generated and Supported by Alternative 1 – Operations Compared to Closure and Reclamation ($M/year, 2017 Dollars)

Impact Type	Operations	Closure and Reclamation	Change from Operations
Property Tax	$0.3	--	-100%
State Mine License	$0.1	--	-100%
State Sales Tax	$2.3	$0.3	-87.0%
State Personal Income Tax	$6.6	$0.1	-98.4%
State and Local Subtotal	$10.1	$0.4	-96.0%
Federal Personal Income Tax	$10.7	$0.3	-97.2%
Federal Payroll Taxes [1]	$20.0	$0.7	-97.0%
Federal Corporate Tax	$20.9	$0.1	-99.5%
Federal Subtotal	$51.6	$1.1	-97.9%
Total (Local, State, Federal)	$61.7	$1.5	-97.6%

Table Source: Highland Economics 2018

Table Notes:

1 Includes social security and Medicare payments by both employee and employer paid payroll taxes.

The total annual government tax revenue benefits from Alternative 1closure and reclamation activities are estimated to be $1.5 million per year, of which the federal government is expected to receive the majority ($1.1 million per year). State and local taxes revenues generated by Alternative 1 are projected to total $0.4 million per year, of which the majority would be received by the State of Idaho. As a result, Alternative 1closure and reclamation operations are expected to result in negligible tax revenue benefits for the local area's economy.

4.21.2.1.3.5 Transportation and Infrastructure

Alternative 1 closure and reclamation phase impacts on the local analysis area's transportation system from both use and network changes are analyzed in detail in Section 4.16, Access and Transportation. The socioeconomic impact analysis evaluates the nature and extent of projected travel redistribution and changes in traffic conditions to assess if they would result in corresponding economic changes for local area residents, businesses, and the local area's economy.

During Alternative 1 closure and reclamation phase, total SGP-related AADT of 25 vehicle trips is projected to occur, which would be distributed across several routes within the local roadway network. This traffic growth is less than that projected during Alternative 1construction and operations phases. Alternative 1 socioeconomic impacts from transportation during closure and reclamation would be similar in nature but lesser in magnitude as those during the operations phase. Consequently, Alternative 1 transportation impacts are expected to have negligible socioeconomic effects on the local analysis area's economy during the closure and reclamation phase.

4.21.2.1.3.6 Tourism

The Operations Area Boundary established under the operations phase would continue to be enforced during the Alternative 1 closure and reclamation phase. During this phase, both the mine site and Burntlog Route would be reclaimed, and other SGP facilities also would be similarly decommissioned. However, it would take many years (20 or more) for major revegetation to occur and many physical features would remain. Closure and reclamation noise could be audible up to 1.2 miles, therefore reducing recreation opportunities in these areas for activities that depend on a quiet, natural environment, such as wilderness activities. As a result, many of the SGP's former facility sites would likely appear disturbed for a long time. Consequently, the recreational setting for these locations are likely to be permanently altered and some recreational use may remain permanently displaced to other more natural locations within the local area. Detailed analysis of the recreation impacts is provided in Section 4.19.2.1.1.3, Closure and Reclamation.

The closure and reclamations phase recreation and tourism impacts are expected to be unchanged from the operations phase. Accordingly, the recreation use changes from Alternative 1 operations would be negligible and would have negligible socioeconomic impacts to the local area's tourism sector and overall economy.

However, it also is possible that SGP-related displacement of recreational use and visitation from areas near local communities, such as Yellow Pine or Warm Lake, could reduce tourism spending at their businesses. Depending on the type and magnitude of any such lost spending, it is possible that adverse economic impacts on individual businesses and those community economies could occur.

Furthermore, three of the outfitter businesses currently within the analysis area could have access to portions of their operating areas and their customer's experiences impaired during closure and reclamation activities. This could negatively affect their ability to provide their licensed activities and may degrade their customer's recreation experiences. However, all outfitters would continue to be able access and use major portions of their operating areas that would be unimpacted by the SGP. It is likely that any of their permitted use displaced by the SGP could be served elsewhere within their existing operating areas. As such, adverse impacts to their operations and customers would be very limited.

4.21.2.2 Alternative 2

Alternative 2 includes design and operations modifications to Alternative 1 to reduce the SGP impacts on water resources (streamflow, water temperature, and water quality), wildlife habitat and traffic. The Alternative 2 modifications potentially relevant to the socioeconomic analysis consist of:

- Relocation of the Landmark maintenance facility;
- Re-routing of a 5.3-mile segment of the Burntlog Route
- Producing lime on-site, reducing AADT to the mine site;
- Addition of a 3- or 4-mile public access road connecting Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) allowing public access through the mine site during operations; and
- Addition of a Centralized Water Treatment Plant.

Actions under Alternative 2 are very similar to those under Alternative 1 and, therefore, are expected to impact the local area residents, businesses and economy in predominantly the same way as identified under Alternative 1. The overall schedule of mining phases and activities under Alternative 2 also would be very similar to Alternative 1. Similarly, the quantities of ore extraction and mineral recovery under Alternative 2 are expected to be to the same as those under Alternative 1. The future construction and operating expenditures under Alternative 2 are not expected to be materially different from those estimated for Alternative 1. Consequently, their employment, income, population, housing, public services, and government revenue impacts would be the same as identified for Alternative 1. The water quality and aquatic habitat improvements under Alternative 2 may result in intrinsic, non-monetary benefits to recreational users or tribal members, if it results in actual or perceived improvements in the quality of recreational experiences, subsistence resources, and/or traditional use areas' conditions. Detailed evaluation of SGP-related impacts to water quality, fish and aquatic habitat, recreation, and tribal interests are provided in Section 4.9, Surface Water and Groundwater Quality;

Section 4.12, Fish Resources and Fish Habitat; Section 4.19, Recreation; and Section 4.24, Tribal Rights and Interests, respectively.

Socioeconomic impacts under Alternative 2 would be the same as those identified under Alternative 1, except for potential differences in the visitor use impacts from the roadway changes and maintenance facility relocation. Detailed evaluation of SGP-related impacts to recreation is provided in Section 4.19.2, Direct and Indirect Impacts to Recreation. The potential for these components of Alternative 2 to result in net socioeconomic impacts to the local area's tourism sector and overall economy are evaluated below on a phase by phase basis.

4.21.2.2.1 CONSTRUCTION

The majority of the construction impacts would be the same or very similar to those identified under Alternative 1. However, there also would be some relocation of construction impacts under Alternative 2 based on the Burntlog Route alignment and facility siting changes. As a result, there would be temporary increase or relocation of construction-related impacts in the vicinity of Alternative 2roadway improvements and maintenance facility development (and a corresponding elimination of similar impacts from other locations that would otherwise be affected under Alternative 1).

The construction activities located under Alternative 2 could reduce recreational opportunities for noise-sensitive recreation activities, which could result in recreational displacement until the construction is completed. Completion of the roadway changes would be expected to occur during the construction with potential incidental public use beginning during the operations phase. As a result, the roadway improvements would not be expected to result in improved recreation access and use during Alternative 23-year construction phase. Consequently, Alternative 2 construction activities would be expected to have a negligible overall impact on the local area's tourism sector and local economy.

4.21.2.2.2 OPERATIONS

Completion of the Burntlog Route re-route and the Stibnite Road (CR 50-412) connection through the mine site to Thunder Mountain Road (FR 50375) could potentially improve recreation access and possibly increase visitor use of areas served by these new roadways. These roadway changes might result in some redistribution of recreational and other traffic but the increase in traffic to local recreation locations would be very limited given the roadways low traffic volumes.

Under Alternative 2, public access between where the Stibnite Road enters the mine site and Thunder Mountain Road would allow three outfitters access to their operating areas. The location of the Landmark Maintenance Facility could impact one outfitter due to the location within their operating area. Similarly, partial re-routing of Burntlog Route could impact two outfitter operations as a result of increased recreation use within their operating areas and potential impacts on wilderness activities. As a result, there could be varied and, in some cases, possibly substantial impacts to individual outfitters under Alternative 2.

However, overall the net change in local area's overall visitation and visitor spending would be expected to negligible. As a result, the tourism impact findings for the Alternative 2 operations would be expected to be the same as those determined for the Alternative 1 12-year operations phase. Consequently, Alternative 2 operations would be expected to have a negligible overall impact on the local area's tourism sector and local economy.

Under Alternative 2, the Centralized Water Treatment Plant operations would employ 2 to 4 workers.

4.21.2.2.3 Closure And Reclamation

Impacts of Alternative 2 during closure and reclamation would be the same as those described under Alternative 1, except for the Centralized Water Treatment Plant, which would remain in perpetuity. After closure, the analysis area would be reclaimed for potential subsequent public recreational use (such as dispersed camping). The recreational visitation and use impacts of this action would be very marginal and likely comparable to those that would otherwise occur at the Landmark site under Alternative 1. As a result, it would have a negligible net impact on the local area's tourism sector and local economy. Consequently, Alternative 2 closure and reclamation would have a negligible overall impact on the local area's tourism sector and local economy.

Under Alternative 2, the Centralized Water Treatment Plant would continue to operate and employ 2 to 4 workers in perpetuity.

4.21.2.2.4 Other Benefits And Costs

Alternative 2 includes design and operations modifications to potentially reduce the SGP impacts on water resources (streamflow, water temperature, and water quality) and aquatic habitat. These potential resource impacts are determined not to have quantifiable and/or monetizable impacts that can be incorporated as socioeconomic impacts. This is generally due to lack of discernable direct changes in human use that can be attributed to the resource changes.

The Alternative 2 design and operations modifications would result in both incremental costs to the owner/operator (e.g., increased water treatment facility capital and operations and management [O&M] costs) and benefits (e.g., improved water quality or probability of meeting water quality standards) due to their intrinsic, non-market value. More specifically, the expected water resource benefits under Alternative 2 are evaluated in Section 4.9.2.2, Surface Water and Groundwater Quality, while the impacts to aquatic habitat are evaluated in Section 4.12.2.4, Fish Resources and Fish Habitat.

While changes in these resources may nonetheless have non-monetary value, when these resource changes are not expected to result in any human use changes (e.g., by recreational or by tribal member users) that can be quantified. Consequently, for the purposes of this socioeconomic impact analysis, the non-monetary benefits of such water quality and wildlife habitat would not have any socioeconomic effects. Similarly, the related fisheries and ecological/resiliency also are not recognized to have any socioeconomic effects for the purposes of this socioeconomic impact analysis.

In addition to the incremental non-monetary resource benefits discussed above, the owner/operator would incur some incremental capital and future O&M costs under Alternative 2. Costs associated with Alternative 2 would be primarily associated with the proposed centralized water treatment facility and its 2 to 4 employees, partial re-routing of Burntlog Route, construction and operation of the lime kiln on-site, and the addition of the road improvements for public access through the mine site. Overall, the capital costs for the design and operations modifications under Alternative 2 would be a relatively limited additional incremental cost, especially given the expected total future mineral production value of $5.3 billion to $6.9 billion over the SGP operating life (see subsection 4.21.2.1.2.2, Income).

The O&M costs for the design and operations modifications under Alternative 2 also are expected to be limited and predominantly associated with the lime generation equipment, the roadway O&M for the roadway miles requiring annual maintenance, and 2 to 4 employees required for operation of the Centralized Water Treatment Plant. The operational costs for the owner/operator resulting from these facility changes are expected to be relatively minor especially given the future value of the extracted minerals of $5.3 billion to $6.9 billion over the SGP operating life (see subsection 4.21.2.1.2.2, Income). As a result, the other benefits and costs under Alternative 2 would be very similar as those identified for Alternative 1.

4.21.2.3 Alternative 3

Alternative 3 includes SGP design modifications (i.e., relocation of the TSF and Hangar Flats DRSF to the East Fork South Fork Salmon River drainage) to reduce impacts on water resources (streamflow, water temperature, and water quality), aquatic and wildlife habitat, and recreation. Actions under Alternative 3 are very similar to those under Alternative 1 and, therefore, are expected to impact the local area residents, businesses, and economy in predominantly the same way as described under Alternative 1. The overall schedule of mining phases and activities under Alternative 3 also would be very similar to Alternative 1. Similarly, the quantities of ore extraction and mineral recovery under Alternative 3 are expected to be the same as those under Alternative 1. The future construction and operating expenditures under Alternative 3 are not expected to be materially different from those estimated for Alternative 1. Consequently, the employment, income, population, housing, public services, and government revenue impacts would be the same as those described for Alternative 1.

The modifications in design to potentially reduce impacts to water quality and aquatic and wildlife habitat under Alternative 3 may result in intrinsic, non-monetary benefits to recreational users or tribal members, if it results in actual or perceived improvements in the quality of recreational experiences, subsistence resources, and/or traditional use area conditions. Detailed evaluation of SGP-related impacts to water quality, fish and aquatic habitat, recreation, and tribal interests are provided in Section 4.9, Surface Water and Groundwater Quality; Section 4.12, Fish Resources and Fish Habitat; Section 4.19, Recreation; and Section 4.24, Tribal Rights and Interests, respectively.

The potential changes in socioeconomic impacts under Alternative 3 analyzed are limited to those physical changes that individually (or collectively) could result in overall net changes in future visitor use and spending to the local area's tourism sector and overall economy (e.g., changes in roadway access). However, no socioeconomic impacts are attributed to other physical resources when their improvement or impairment are not expected to result in any discernable direct changes in human use and/or activity. Although changes in these resources may nonetheless have intrinsic, existence, non-use, or other broader non-market value, it is beyond the scope of this socioeconomic analysis. As an example, the potential reduced impacts to federally-listed fish species; wetlands and riparian areas; and surface water and groundwater under Alternative 3 may result in incremental improvement in those resource conditions, but their magnitude is not expected to result in any human use changes (e.g., by recreational or by tribal member users). Consequently, for the purposes of this socioeconomic impact analysis, the non-monetary benefits of such water quality and wildlife habitat changes are not recognized to have any socioeconomic effects.

Under Alternative 3, public access would be restricted on 17,034 acres of public lands within the Operations Area Boundary. The size of the Operations Area Boundary could potentially result in impacts to recreation opportunities due to the larger area removed from recreational use.

However, as analyzed in more detail in Section 4.19, Recreation, due to the low level of wilderness recreation visitation, the recreation use impacts from the SGP are predominantly associated with SGP facility changes.

Socioeconomic changes under Alternative 3 would be limited to no construction of the OHV Trail. Detailed evaluation of SGP-related impacts to recreation is provided in Section 4.19.2.3, Direct and Indirection Impacts to Recreation. The potential for this SGP component to result in net socioeconomic impacts to the local area's tourism sector and overall economy is evaluated below on a phase by phase basis.

4.21.2.3.1 CONSTRUCTION

The Alternative 3 impacts would be similar to those identified under Alternative 1, except the temporary traffic delays on Meadow Creek Lookout Road (FR 51290) would not occur and the construction activity and impacts within two of the outfitters' operating areas would be reduced. Consequently, Alternative 3 construction activities would be expected to have a negligible overall impact on the local area's tourism sector and local economy.

4.21.2.3.2 OPERATIONS

Impacts would be similar to those described under Alternative 1; however, access to the mine site would be via a 3.2-mile road segment through Blowout Creek valley, rather than continuing on Meadow Creek Lookout Road (FR 51290) to Thunder Mountain Road (FR 50375). As a result, there would be no mine operations-related traffic on Meadow Creek Lookout Road (FR 51290) east of the new Blowout Creek valley road. This would result in fewer impacts to the area's recreation setting and recreation experiences for visitors using these roads and the sites/areas accessed from these roads.

The OHV Trail would not be built under Alternative 3 and, therefore, would not contribute any growth in the area's recreation use. Without this new trail, visitors would have limited access options to recreation sites off Thunder Mountain Road and would have to use the entire Burntlog Route to reach these sites.

In the absence of the OHV Trail's development, there would be reduced potential for impact to two outfitters who otherwise would face potential access and recreation experience impacts for their customers.

The magnitude of potential recreation use increases from these components of Alternative 3 are expected to be marginal. As a result, the overall recreational impact anticipated under Alternative 3, and, therefore, no net change in local area's overall visitation and visitor spending would be expected from that identified for Alternative 1. As a result, the tourism impact findings for the Alternative 3 operations would be expected to be the same as those identified for the Alternative 1 12-year operations phase. Consequently, Alternative 3 operations would be expected to have a negligible overall impact on the local area's tourism sector and local economy

4.21.2.3.3 Closure And Reclamation

Impacts under Alternative 3 during closure and reclamation would be the same as those identified for Alternative 1, except for those associated with no construction of the OHV Trail and addition of a new transmission line to the mine site.

As part of closure/reclamation, there would be less decommissioning activity and delays on Meadow Creek Lookout Road (FR 51290). The recreational visitation and use impacts under Alternative 3 may be expected to be marginal and have a negligible impact on the local area's tourism sector and local economy. As a result, the tourism impact findings for the Alternative 3 closure and reclamation phase would be expected to be the same as those correspondingly determined for the Alternative 1 closure and reclamation phase. Consequently, Alternative 3 would be expected to have a negligible overall impact on the local area's tourism sector and local economy.

4.21.2.3.4 Other Benefits And Costs

Alternative 3 includes design and operations modifications to potentially reduce the SGP's impacts on water resources (streamflow, water temperature, and water quality) and aquatic and wildlife habitat. As discussed above in Section 4.21.2.23, these resource changes related to the Alternative 3 modifications are determined not to have quantifiable and/or monetizable impacts that can be incorporated as socioeconomic impacts. This is generally due to lack of discernable direct changes in human use that can be attributed to the resource changes.

These modifications could result in both incremental changes in costs to the owner/operator (e.g., increased costs associated with water treatment facility capital and O&M costs) and potentially different impacts (e.g., improved water quality or probability of meeting water quality standards) due to their intrinsic, non-market value. More specifically, the expected water resource benefits under Alternative 3 are evaluated in Section 4.9.2.3, Surface Water and Groundwater Quality, while the impacts to aquatic habitat are evaluated in Section 4.12.2.5, Fish Resources and Fish Habitat.

While changes in these resources may nonetheless have non-monetary value, when these resource changes are not expected to result in any human use changes (e.g., by recreational or by tribal member users) that can be quantified. Consequently, for the purposes of this socioeconomic impact analysis, the non-monetary benefits of such water quality and wildlife habitat would not have any socioeconomic effects. Similarly, the related fisheries and ecological resiliency also are not recognized to have any socioeconomic effects for the purposes of this socioeconomic impact analysis.

In addition to the incremental non-monetary resource benefits discussed above, the owner/operator may be expected to incur some incremental capital and O&M cost savings under Alternative 3, as compared to Alternative 1. These savings would be primarily from not constructing the OHV Trail. Under Alternative 3, 17,034 acres of public lands within the Operations Area Boundary would be restricted from public access. However, given the additional area's rural and undeveloped nature, the capital and future O&M cost impacts of the area is not expected to offset the OHV Trail savings. Overall, the net operational savings for the SGP resulting from these facility changes are expected to be comparatively minor, especially given the future value of the extracted minerals of $5.3 billion to $6.9 billion over the SGP operating life (see subsection 4.21.2.1.2.2, Income). As a result, the other benefits and costs' overall impacts under Alternative 3 would be the very similar as those identified for Alternative 1.

4.21.2.4 Alternative 4

The Alternative 4 design and operations modifications consist of use of the Yellow Pine Route as the only mine access route, and other on-site and off-site facilities modifications to potentially alter impacts to water quality, aquatic resources, wildlife habitat, public access and safety, wilderness, and other natural areas from those described under Alternative 1. The Alternative 4 modifications potentially relevant to the socioeconomic analysis consist of:

- Use of the Yellow Pine Route for access to the mine for all phases (and therefore, no construction or use of the Burntlog Route);
- Minor change in the location of the Landmark Maintenance Facility;
- Public road access through the mine during operations (similar to Alternative 2); and
- Use of helicopters for construction and maintenance of cell towers and repeater sites in inventoried roadless areas.

Actions under Alternative 4 are similar to those under Alternative 1 and, therefore, are expected to impact most local area residents, businesses, and economy in predominantly the same way as identified under Alternative 1. The SGP construction period under Alternative 4 is 5 years and consequently would be 2 years longer than that under the other build alternatives. The overall schedule of mining post-construction phases and activities under Alternative 4 also would be very similar to Alternative 1. Similarly, the quantities of ore extraction and mineral recovery under Alternative 4 are expected to be to the same as those under Alternative 1. Future construction and operating expenditures under Alternative 4 are expected to be higher than those estimated for Alternative 1. The net additional construction cost of the Yellow Pine Route is estimated to total $62.5 million. Midas Gold estimates that the overall net cost effect could reduce the SGP’s value by up to $174 million due to the combined capital, operating (i.e., longer haul routes and increased roadway O&M) and financial costs (i.e., resulting from the extended construction period and delayed operations) (Midas Gold 2019). However, the related employment, income, population, housing, public services, and government revenue impacts (which would be predominately related to the increase construction and operations spending) would be marginally higher than those identified under Alternative 1.

The design changes to potentially reduce impacts to water quality and aquatic and wildlife habitat under Alternative 4 may result in intrinsic, non-monetary benefits to recreational users or tribal members, if it results in actual or perceived improvements in the quality of recreational experiences, subsistence resources, and/or traditional use area conditions. Detailed evaluation of SGP-related impacts to water quality, fish and aquatic habitat, recreation, and tribal interests are provided in Section 4.9, Surface Water and Groundwater Quality; Section 4.12, Fish Resources and Fish Habitat; Section 4.19, Recreation; and Section 4.24, Tribal Rights and Interests, respectively.

The potential changes in socioeconomic impacts under Alternative 4 analyzed for the socioeconomic analysis are limited to those physical changes that individually (or collectively) could ultimately result in overall net changes in future visitor use and spending to the local area’s tourism sector and overall economy (e.g., changes in roadway access). However, no socioeconomic impacts are attributed to other physical resources when their improvement or impairment are not expected to result in any discernable direct changes in human use and/or activity. Although changes in these resources may nonetheless have intrinsic, existence, non-use or other broader non-market value, it is beyond the scope of this socioeconomic analysis to incorporate in this socioeconomic analysis. The potential reduced impacts to water quality and quantity, wetlands, fish resources, and cultural resources under Alternative 4 may result in incremental changes in those resource conditions. For example, upgrade and use of the Yellow Pine Route for the project’s future operations would reduce roadway-related surface disturbance, stream diversions and wetland impacts. But the Yellow Pine Route’s greater proximity to Johnson Creek and the East Fork South Fork Salmon River may be expected to increase the roadway development and use within both avalanche-prone areas and riparian conservation areas and thereby could result in increased public safety and environmental risks and impacts. However, the combined and overall magnitude of these impacts is not expected to result in any human use changes (e.g., by recreational or by tribal member users). Consequently, for the purposes of this socioeconomic impact analysis, the non-monetary benefits of these design changes are not recognized to have any socioeconomic effects.

Impacts on public access within the Operations Area Boundary under Alternative 4 would generally be the same as those identified under Alternative 1 except for potential differences in the visitor use impacts from the roadway changes, maintenance facility relocation, and helicopter usage. Alternative 4's roadway changes are expected to include potential increased adverse impacts on public access and safety. Detailed evaluation of SGP-related impacts to recreation is provided in Section 4.19.2.4, Recreation. The potential for these components of Alternative 4 to result in net socioeconomic impacts to the local area's tourism sector and general economy are evaluated below on a phase by phase basis.

4.21.2.4.1 CONSTRUCTION

Under Alternative 4, the access route to the mine would be via the Yellow Pine Route. The Yellow Pine Route starts at the intersections of Warm Lake Road (CR 10-579) and Johnson Creek Road (CR 10-413) and includes Johnson Creek Road (CR 10-413) and the Stibnite Road section of the McCall-Stibnite Road (CR 50-412). The Yellow Pine Route would be used as the primary route to the mine site during construction, operations, and reclamation/closure would result in increased traffic on Johnson Creek and Stibnite roads. During the 5-year construction phase, AADT on Johnson Creek Road would increase from 57 to 122 and from 39 to 104 on Stibnite Road. This traffic growth would increase the noise and activity near campgrounds, dispersed camping areas, trailheads, and recreational residences adjacent to these roads which could change their recreation setting and reduce visitor recreation experiences. The Village of Yellow Pine would experience an increase in truck traffic from SGP vehicles use of the Yellow Pine Route to the mine site throughout all phases. Truck traffic increases along the Yellow Pine Route also could have some effects on other roadway users travelling along the roadway to and from Yellow Pine.

Road closures on Stibnite Road would occur on a daily basis for three years during construction and more periodically on Johnson Creek Road. These road closures would result in reduced access to recreation sites/areas, decreases in recreational opportunities/settings, and decreased recreation experiences. As a result of these impacts, visitors may be displaced from these areas during Alternative 4 construction.

The minor relocation of Landmark Maintenance Facility would be expected to solely result in reduced noise impacts to the historic Landmark cabins.

Under Alternative 4, public road access through the mine during construction would be permitted and would be similar to that under Alternative 2. As result, the impacts during construction would be expected to be the same as those identified for Alternative 2 but would occur over a two-year longer construction period.

Noise and disruption from the use of helicopters during construction of some communication and utility facilities (rather than building an access road) may affect the recreation setting for users within visual and audible distance of the helicopters. The resulting temporary changes to the recreation setting of these locations could lead to displacement of dispersed recreational use, particularly related to non-motorized activities, wilderness activities, and wildlife-related activities (due to wildlife displacement).

The magnitude of the recreation use changes from these components of Alternative 4 are expected to be marginal and localized. As a result, overall recreational impact is anticipated to be minimal and, therefore, no net change in local area's overall visitation and visitor spending would be expected. As a result, the tourism impact findings during Alternative 4 construction phase would be expected to be the same as those determined for the Alternative 1 construction phase. Consequently, Alternative 4's construction activities would be expected to have a negligible overall impact on the local area's tourism sector and local economy.

4.21.2.4.2 OPERATIONS

The village of Yellow Pine would experience an increase in future truck traffic from SGP vehicle use of the Yellow Pine Route to the mine site during SGP operations. Truck traffic increases along the Yellow Pine Route (estimated to average 60 vehicles daily) also could have some effects on other roadway users travelling along the roadway to and from Yellow Pine. Roadway changes under Alternative 4 might also result in some redistribution of recreational and other traffic. Given the very low use levels of these roadways the increase in traffic to local recreation locations would be very limited. The additional SGP-related traffic along the Yellow Pine Route may displace some recreation use to other less noisy locations. Under Alternative 4 outfitters would not experience the adverse changes in their ability to access their operating areas.

Overall, no net or very limited change in local area's overall visitation and visitor spending would be expected compared to that under Alternative 1 operation. Recreational traffic along the Yellow Pine Route would have to share the road with mine traffic (est. 60 vehicles/day) during operations which may be expected to increase travel times. However, the public access would be maintained and traffic impacts to recreation users may be expected to result in relatively limited user displacement. As a result, the overall tourism impact findings for Alternative 4 operations would be expected to be the same as those determined for the Alternative 1 operations phase.

The minor change in location of the Landmark Maintenance Facility would result in negligible operational impact changes from Alternative 1.

Under Alternative 4, public road access through the mine during operations would be permitted and be similar to Alternative 2. As a result, the impacts during operations would be expected to be the same as those determined for Alternative 2.

Noise and disruption from the use of helicopters for maintenance activities may affect the recreation setting for users within visual and audible distance of the helicopters. These occasional changes to the recreation setting of these locations could lead to displacement of dispersed recreational use, particularly related to wilderness and wildlife-related activities (due to wildlife displacement).

The magnitude of the recreation use changes from these components of Alternative 4 are expected to be marginal and localized. As a result, there overall recreational impact is anticipated to be minimal and therefore no net change in local area's overall visitation and visitor spending would be expected. As a result, the tourism impact findings for the Alternative 4 operations would be expected to be the same as those determined for the Alternative 1 operations phase. Consequently, Alternative 4's operations would be expected to have a negligible overall impact on the local area's tourism sector and local economy.

4.21.2.4.3 Closure And Reclamation

Impacts of Alternative 4 during closure and reclamation would be similar to those described under Alternative 1, except roadway improvements along the Yellow Pine Route would remain. Traffic volumes and road closures would be reduced from construction and operational phases. In addition, because both Burntlog Route and OHV Trail would not be constructed under Alternative 4, the reclamation activity and long-term recreational resource impacts for those facilities also would be avoided.

The net recreational visitation and use impacts resulting from Alternative 4's reduced recreational and decommissioning impacts may be expected to be limited. Consequently, Alternative 4 would be expected to have a negligible overall impact on the local area's tourism sector and local economy.

4.21.2.4.4 Other Benefits And Costs

Alternative 4 includes design and operations modifications to potentially reduce the SGP's impacts on water resources (streamflow, water temperature, and water quality); cultural resources (moving the Landmark Maintenance Facility and no construction of Burntlog Route); and wildlife habitat. These resource changes related to the Alternative 4 modifications are determined not to have quantifiable and/or monetizable impacts that can be incorporated as socioeconomic impacts. This is generally due to lack of discernable direct changes in human use that can be attributed to the resource changes.

These modifications would result in both incremental costs to the owner/operator (e.g., surface water treatment and O&M costs) and benefits (e.g., improved water quality or probability of meeting water quality standards) due to their intrinsic, non-market value. More specifically, the water resource impacts under Alternative 4 are evaluated in Section 4.9.2.4, Surface Water and Groundwater Quality, impacts to aquatic habitat are evaluated in Section 4.12.2.6, Fish Resources and Fish Habitat, and cultural resources are evaluated in Section 4.17.2.4, Cultural Resources.

While changes in these resources may nonetheless have non-monetary value, when these resource changes are not expected to result in any human use changes (e.g., by recreational or by tribal member users) that can be quantified. Consequently, for the purposes of this socioeconomic impact analysis, the non-monetary benefits of such water quality and wildlife habitat changes are not attributed to have any socioeconomic effects. Similarly, the related fisheries and ecological/resiliency also are not recognized to have any socioeconomic effects for the purposes of the socioeconomic impact analysis.

The relocation of the Landmark Maintenance facility is expected to have negligible incremental cost effect. However, there would be a substantial net capital and O&M cost increase under Alternative 4 would result from the upgrade of the existing Yellow Pine Route instead of construction of new roadway segments for the Burntlog Route. As discussed above, the net additional cost for construction of the Yellow Pine Route is estimated to total $62.5 million. Midas Gold estimates that the overall net cost effect could reduce the SGP's value by up to $174 million due to the combined capital, operating (i.e., longer haul routes and increased roadway O&M) and financial costs (i.e., resulting from the extended construction period and delayed operations) (Midas Gold 2019). Overall, the SGP cost increase under Alternative 4 would correspond to 3.3 to 2.5 percent of the project's expected total mineral production value of $5.3 billion to $6.9 billion over the SGP overall operating life (see subsection 4.21.2.1.2.2 Income) and result in a major decrease in the project's expecting operating profits. Besides that, the other benefits and costs under Alternative 4 would be the very similar as those identified for Alternative 1.

4.21.2.5 Alternative 5

Under Alternative 5, there would be no large-scale mining operations. As a result, no new mine site and off-site facilities, access roads, or utility infrastructure changes would occur.

Under Alternative 5, current uses by other users on patented mine/millsite claims and on the Payette National Forest and Boise National Forest would continue in compliance with all existing applicable codes and regulations. These uses of National Forest System (NFS) lands include mineral exploration, dispersed and developed recreation, such as pleasure driving, hunting, off-highway-vehicle use, camping, hiking, snowmobiling, bird watching, target shooting, firewood cutting, and other forms of recreation. Private businesses, such as outfitter and guide services, also operate on NFS lands through special use permits. Traditional cultural uses of the area would continue, including the collection of plants, hunting, and fishing. Access to public land in the area would continue as governed by law, regulation, policy, and existing and future landownership constraints.

Midas Gold would continue to implement surface exploration and associated activities that have been previously approved on NFS lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project Environmental Assessment (Forest Service 2015). These approved activities include construction of several temporary roads to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads) and drilling on both NFS and private lands at and in the vicinity of the mine site. The continuation of approved exploration activities at the mine site would result in the continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip.

Any impacts on recreation, infrastructure development, revenues, population, housing, and transportation impacts would be temporary and short term and no long-term changes to socioeconomic resources would occur (Forest Service 2015).

4.21.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.21.4 Cumulative Effects

The cumulative effects analysis area for socioeconomics is the same area as the analysis area as described for direct and indirect socioeconomic effects. Other past, present, and reasonably foreseeable actions occurring on federal and non-federal lands, with similar effects that overlap in time and space include forest management, mining and mine reclamation, roadway changes, campground upgrades, and winter motorized use of forest roads.

Past and present mining and mining-related activities have occurred around the Stibnite Mining District for over 100 years. These activities have contributed to the local analysis area's present socioeconomic conditions.

4.21.4.1 Common to All Action Alternatives

The SGP activities under Alternatives 1 through 4 would have a socioeconomic impact on the local area's economy. The action alternatives other resource effects (e.g., recreation or access and transportation changes to the tourism sector economy), combined with impacts from other past, present, and reasonably foreseeable actions, would be very minor or marginal.

4.21.4.2 Alternative 5

Under Alternative 5, no action alternative would be approved by the Forest Service. There would be no open-pit mining or ore processing in the SGP area, no new or upgraded access roads, no changes to utilities, and no construction of off-site facilities. Although none of the Reasonably Foreseeable Future Actions identified in **Table 4.1-2** would physically overlap with action alternative disturbance footprints, forest management, motorized use of road systems, fire suppression, prescribed fire and wildfire, dispersed camping, fishing, and hunting activities would continue in the cumulative effects area and vicinity, which would remain and continue to contribute to the cumulative socioeconomic effects on the local area's residents, businesses or economy. Under Alternative 5, the Golden Meadows Exploration Project would have negligible direct and indirect effects to socioeconomic conditions on the local area's residents, businesses, and economy. Therefore, Alternative 5 would result in negligible cumulative effects on the local area's residents, businesses, and economy.

4.21.5 Irreversible and Irretrievable Commitments of Public Resources

4.21.5.1 Common to All Action Alternatives

Implementation of all action alternatives would result in the commitment of natural and human-made resources for new infrastructure, mine operations, closure and reclamation, and other post-mining activities. The predominant commitment of resources would result from the mining, which would deplete the valuable mineral assets in the targeted ore bodies. Extraction and use of the non-renewable mineral resources would constitute an irreversible commitment. However, the SGP is proposed in a legacy mining area, where substantial habitat reclamation is needed. The SGP may mitigate some existing environmental impacts, which would improve their resource conditions.

Substantial labor and materials needs are anticipated throughout the life of the SGP – these are irretrievable. Utility upgrades and new infrastructure are required to facilitate mine operations and reclamation of historically damaged areas. Legacy mined waste rock would be incorporated into new construction to the extent feasible. Contaminated areas would be remediated during new construction as required.

Implementation of the action alternatives would remove the land from other uses while it is in operation, but the use would eventually be reversed through reclamation. The temporal loss of the land's availability for other uses during that period would be irretrievable.

4.21.5.2 Alternative 5

No irretrievable or irreversible commitments of public resources are anticipated under Alternative 5.

4.21.6 Short-term Uses versus Long-term Productivity

4.21.6.1 Common to All Action Alternatives

All action alternatives would result in short-term use of the mine site area, and construction of new roadways in the SGP area. After closure, the mine site and new roads would be reclaimed/decommissioned.

Short-term uses of both the mineral resources and other natural and human-made resources (i.e., for construction, operations and closure/reclamation) would represent a lucrative use of these resources. The socioeconomic value of the short-term use of the resources is represented by both the extracted minerals market value and the monetary cost of the resources used to mine them.

As a non-renewable resource, the mineral extraction activities by the action alternatives would permanently reduce the site's future productivity for mineral production and economic development potential. However, the activities under the action alternatives would result in reclamation and environmental improvements that would be expected to enhance other future use potential.

Use of the mine site and other facility locations on NFS lands also would result in a short-term decrease in the acreage available for recreation. The mining activities and Operations Area Boundary would result in short-term displacement of recreational use as well as changes in recreation opportunities and setting within sections of the local area. These changes to local outfitter businesses and their customers' and other visitors' recreation experiences changes would have the potential to result in short-term socioeconomic impacts on the local area's tourism sector and economy.

After reclamation is completed, the Operations Area Boundary would be re-opened to recreation. As a result, there would not be recreation access impacts to long-term use of the mine site, access roads, and other facility locations for recreation after mine closure. However, it possible that long-term impacts to the recreation setting and recreation experiences (e.g., reduced wildlife populations) that could adversely affect local outfitter businesses and their customers' and other visitors' recreation experiences. In which case, if these changes result in adverse socioeconomic impacts on the local area's tourism sector and economy, there could be a long-term reduction in the area's economic productivity for future tourism use.

4.21.6.2 Alternative 5

Under Alternative 5, No Action would be undertaken. Consequently, there would be no short-term use that would affect recreation resources, and no effect on long-term productivity.

4.21.7 Summary

Construction and operation of the SGP would provide jobs and income for both individuals directly employed for the SGP, as well as for other individuals whose employment and incomes would be indirectly or induced by SGP's activities. Most of these employment and income impacts would support Idaho residents, of which a portion are expected to be local area (Valley and Adams counties) residents. Given the local area's population and current low unemployment conditions, it is expected that the SGP would result in in-migration of up to 200 individuals and another 230 dependents for SGP-related employment opportunities.

The potential for socioeconomic impacts to the local area's economy and social conditions would primarily result from the new in-migrant population. The potential influx of new residents (especially those that would be non-SGP employees) may increase the demand and supply of affordable housing within the local area. It also is expected that there could be potential for "boom and bust" impacts on the local area economy if there are insufficient alternative employment opportunities when SGP operations end.

Although there are some construction and operational differences between the action alternatives, overall socioeconomic impacts would be very comparable between Alternatives 1, 2, and 3. As a result, while some locational or distributional differences between socioeconomic effects would occur, they would be relatively marginal. Alternative 4 would have substantial increased construction and O&M costs from use of the Yellow Pine Route. However, due to its longer construction period (5 years instead of 3 years) and the operating phase's extended duration, Alternative 4's resulting socioeconomic impacts (i.e., employment, income, population, housing, public services, and government revenue impacts) would be expected to be marginally higher than those identified under Alternative 1, 2, and 3.

The potential for other adverse impacts to the local area's economy is expected to be relatively limited. This is due to both the relatively limited extent and remote location of SGP's expected resource impacts. In addition, the availability of alternate recreational opportunities for public use displaced by SGP's activities would likely be relocated elsewhere within the local area. As a result, overall these other SGP-related impacts generally are not expected to result in future visitation changes or other impacts to the local area's overall economy.

Table 4.21-9 provides a summary comparison of socioeconomic impacts by issue and indicators for each alternative.

The SGP action alternatives also would result in other benefits and costs besides those identified above. The primary purpose and benefit of all the SGP action alternatives for the owner/operator would be mineral extraction. Although there are some construction and operational differences between the action alternatives, their total future revenues are expected to be approximately the same. As shown below in **Table 4.21-9**, several types of resources would be differently impacted under the various action alternatives. Generally Alternative 3 is expected to have the largest total adverse resource impacts while Alternative 2 would generally result in the least resource impacts. Alternative 4 has differences in SGP costs (both for construction and operations) and transportation impacts to the community of Yellow Pine due to the proposed upgrade of the existing Yellow Pine Route instead of construction of a new and more direct roadway to the mine site (i.e., the Burntlog Route) as proposed under Alternatives 1, 2, and 3. Alternative 4 also will potentially have both increased environmental benefits (e.g., less roadway-related surface disturbance, stream diversions and wetland impacts) and adverse impacts (increase public safety risks). Otherwise, Alternative 4 is expected to have overall resource impacts generally comparable to those under Alternative 1.

As discussed in the comparative analysis of Alternative 2, 3, and 4 (see subsections 4.21.2.2, 4.21.2.3, and 4.21.2.4, respectively), no socioeconomic impacts are attributed to other physical resource changes when their improvement or impairment are not expected to result in any discernable direct changes in human use and/or activity. Although changes in these resources may nonetheless have intrinsic, existence, non-use or other broader non-market value, it is beyond the scope of this socioeconomic analysis to incorporate in this environmental impact statement. Nonetheless, the summary of other benefits and costs are provided below to clearly disclose key issues and differences for additional consideration and evaluation between the action alternatives.

This page intentionally left blank

Table 4.21-9 Comparison of Socioeconomic Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may impact the socioeconomics of Valley and Adams counties and the State of Idaho.	Total contributions to employment levels.	No change in recent employment trends.	**Employment – Total (annual)** Construction • Direct: 640 • Total[1]: 4,690 Operations • Direct: 583 • Total[1]: 2,690 Closure and Reclamation • Direct: 160 / 40 • Total[1]: 330 / 90	Same as Alternative 1, except there would be an additional 2 to 4 employees for operation of the Centralized Water Treatment Plant during operations and continuing post-closure.	Same as Alternative 1.	Marginally higher than Alternative 1 due to increased construction and operations spending from use of Yellow Pine Route. However, construction impacts spread over longer 5-year period of construction.	No change from baseline conditions.
	Contributions to employment levels in Idaho.	No change in recent employment trends.	**Employment – Idaho (annual)** Construction • Direct: 420 • Total[1]: 1,820 Operations • Direct: 470 • Total[1]: 1,150 Closure and Reclamation • Direct: 130 / 40 • Total[1]: 190 / 60	Same as Alternative 1, except there would be an additional 2 to 4 employees for operation of the Centralized Water Treatment Plant during operations and continuing post-closure.	Same as Alternative 1.	Marginally higher than Alternative 1 due to increased construction and operations spending from use of Yellow Pine Route. However, construction impacts spread over longer 5-year period of construction.	No change from baseline conditions.
	Contributions to employment levels in Valley and Adams counties.	No change in recent employment trends.	**Employment – Valley and Adams counties (annual)** Construction • Direct: 190 • Total[1]: 500 Operations • Direct: 200 • Total[1]: 470 Closure and Reclamation • Direct: 90 / 20 • Total[1]: 130 / 30	Same as Alternative 1, except there would be an additional 2 to 4 employees for operation of the Centralized Water Treatment Plant during operations and continuing post-closure.	Same as Alternative 1.	Marginally higher than Alternative 1 due to increased construction and operations spending from use of Yellow Pine Route. However, construction impacts spread over longer 5-year period of construction.	No change from baseline conditions.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Estimated value of local income contributions.	No change in recent employment trends.	**Income – Valley and Adams counties (annual)** Construction • Direct: $18.1 million/year • Total[1]: $28.1 million/year Operations • Direct: $18.5 million/year • Total[1]: $29.3 million/year Closure and Reclamation • Direct: $3.6 million/year Total[1]: $5.0M/year Post-Closure • Direct: $0.9 million/year • Total[1]: $1.3 million/year	Same as Alternative 1.	Same as Alternative 1.	Marginally higher than Alternative 1 due to increased construction and operations spending from use of Yellow Pine Route. However, construction impacts spread over longer 5-year period of construction.	No change from baseline conditions.
	Estimated value of goods and services procured in Valley and Adams counties.	No additional procured goods or services.	**Direct Spending in Valley and Adams Counties (annual)** Construction • Total: $62.3 million/year Operations • Total: $60.0 million/year Closure and Reclamation • Total: $4.8 million/year Post-Closure • Total: $1.4 million/year	Same as Alternative 1.	Same as Alternative 1.	Marginally higher than Alternative 1 due to increased construction and operations spending from use of Yellow Pine Route. However, construction impacts spread over longer 5-year period of construction.	No change from baseline conditions.
	Change in populations of Valley and Adams counties.	No change in recent population growth trends. • Valley County: 0.4%/year (35 people) • Adams County: 0%/year (0 people)	**In-migration by workers to Valley and Adams counties** Construction • SGP: 95 • Total[1]: 198 Operations Net construction change limited by local workers job transfers: • SGP: 100 • Total[1]: 190 Closure and Reclamation • No in-migration	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No change from baseline conditions.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Impacts to housing demand in Valley and Adams counties.	No increase in housing demand or population from current conditions.	Construction • Housing demand increase up to 198 units • Total[1]: 438 new residents (85 single, 113 married, 127 children). Operations • Negligible net change from construction – many workers transfer • Housing demand increase up to 190 units • Total[1]: 420 new residents (82 single, 108 married, 122 children) Closure and Reclamation • No new residents	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No change from baseline conditions.
	Estimated tax revenue contributions.	No tax revenue increase from current conditions.	**Total Tax Revenues (annual)[2]** Construction • State/Local: $9.3M • Federal: $61.5M Operations • State/Local: $10.1M • Federal: $51.6M Closure and Reclamation • State/Local: $0.4M • Federal: $1.1M	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No change from baseline conditions.
	Changes in tourism and recreational based businesses.	No increase in tourism sector from current conditions and trends.	Limited displaced recreation due to low use levels and likely local area relocation. Negligible adverse impact to local area tourism economy expected. Potential for adverse impacts to specific individual recreation businesses and/or communities.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No change from baseline conditions.
	Changes in transportation and infrastructure.	No major changes expected that would result in economic activity or development changes that would substantially impact the local area's current economic conditions.	Local area infrastructure and/or roadway use changes are not expected to result in any major changes in economic activity or development that would result in substantial impacts on the local area's economy.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No change from baseline conditions.

Table Notes:

1 Consists of direct, indirect and induced employment (and includes both full and part-time positions).

2 Estimated annual tax revenues generated from action alternatives related direct, indirect and induced economic activity.

Table 4.21-10 Comparison of SGP Other Benefits and Costs by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
SGP mineral extraction revenue.	Market values of extracted minerals.	No mineral extraction.	SGP mineral production projected value (after refining) = $5.3 to $6.5 billion over the SGP operating life	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1. SGP value reduced by up to $174 million due to increased construction, O&M and financial costs from use of Yellow Pine Route.	No change from baseline conditions.
Water quality impacts from SGP construction and operations	Removal of legacy mine tailings and waste rock. Volume and disposition of mineralized waste from mining operations.	Legacy waste in Meadow Creek valley from historical mining. No new mining waste production.	Removal of legacy mine waste materials in Meadow Creek Valley. New mineralized waste generated by operations will result in water quality impacts.	Least water quality impacts due to Centralized Water Treatment Plant and other mitigation to reduce water quality impacts The Centralized Water Treatment Plant will add O&M costs during operations and continuing post-closure.	Greatest decrease in water quality as no removal of legacy mine waste materials in Meadow Creek Valley.	Same as Alternative 1.	No change from baseline conditions.
Fish resources and fish habitat resource impacts from SGP construction and operations.	Fish population and fish habitat conditions.	Mine site and area streams currently provide important habitat for Chinook salmon, bull and steelhead trout populations.	Changes in fish habitat during construction and operations. Habitat decreases at mine site and Meadow Creek. Restored fish passage would increase habitat available upstream of Yellow Pine Pit. Overall short-term habitat loss adversely impact fish populations during construction and operations.	Least adverse fish population impacts from changes in habitat, streamflow and temperatures	Largest adverse fish population impacts from habitat, streamflow and temperature changes.	Similar to Alternative 1 with reduced fish passage that reduces available habitat but avoids fish mortality at mine site streams.	No change from baseline conditions.
Wildlife impacts from SGP construction and operations	Wildlife population and habitat conditions	Mine site and area streams currently provide important habitat for other wildlife populations.	Short-time adverse impacts on wildlife from SGP-related development (both at mine site and other areas within the analysis area), loss of habitat, and increased human activity within those areas.	Although some construction and operational differences, overall impact would be same as Alternative 1.	Largest adverse impact on wildlife habitat due to largest mine site footprint.	Decrease in adverse impacts on wildlife habitat due to smaller mine site footprint and no construction of Burntlog Route.	No change from baseline conditions.
Incremental costs to the SGP as a result of proposed facility and operation modifications.	Changes in the SGP's construction costs and/or future operating expenses.	The SGP is not built and no mining operations occurs.	Construction of SGP estimated to cost approximately $334 million. Annual operations estimated to cost approximately $234 million / year	Limited increase in future construction costs and annual O&M expenses compared to Alternative 1 from Centralized Water Treatment Plant and roadway changes (Burntlog Route and Stibnite-Thunder Mtn Rd).	Very limited decrease in future construction costs and O&M expenses compared to Alternative1 from elimination of OHV Trail.	Additional construction costs compared to Alternative 1 from upgrade of Yellow Pine Route instead of Burntlog Route construction. Net increase in future annual O&M cost due to longer haul distances.	No costs for SGP construction or future O&M expenses.

4.22 ENVIRONMENTAL JUSTICE

4.22.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to environmental justice populations includes one issue and the following indicators:

Issue: The Stibnite Gold Project (SGP) may disproportionately impact minority or low-income populations.

Indicators:

- Number and size of minority populations affected.
- Number and size of low-income populations affected.
- Location of SGP facilities, including roads and transmission lines in relation to minority or low-income residents.
- Differences in access to public lands.
- Change in traditional Tribal practices and/or access to Tribal resources.

Impacts to environmental justice populations were analyzed using information from the U.S. Census Bureau's (Census) 2013-2017 American Community Survey demographic data (the most recent data year available for this environmental impact statement) (Census 2017), Tribally sponsored research on Native American fish consumption (U.S. Environmental Protection Agency 2016), and information and analysis documented in Section 4.17, Cultural Resources, Section 4.21, Social and Economic Conditions, and Section 4.24, Tribal Rights and Interests.

For each identified environmental justice community, the analysis assesses if any SGP-related impacts would result in disproportionately high and adverse human health or environmental effects on minority populations and/or low-income populations.

Effects are discussed in terms of magnitude or intensity, duration, geographic extent, and context. The magnitude or intensity of impact is discussed in terms of the communities impacted. The duration of impacts would be short-term—lasting only though the construction phase (approximately 3 years); or long-term—lasting throughout the life of the SGP (approximately 12 years) and closure and reclamation (approximately 5 years). The geographic extent of an impact depends on the location and proximity to the affected community. Context is discussed relative to the significance of an action in an environmental justice community.

As discussed in Section 4.17, Cultural Resources, the Nez Perce Tribe and the Shoshone-Paiute Tribes have completed ethnographies that address traditional practices, tribal world view, traditional cultural properties, sacred sites, and traditional resource collection areas in the analysis area. The Shoshone-Bannock Tribes have begun their ethnographic work, but it is not yet complete. Specific spatial data are not currently available from the ethnographies. Data from ethnographies prepared by the tribes with interest in the analysis area (Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes) will be included prior to the Record of Decision.

4.22.2 Direct and Indirect Effects

The following analysis of effects associated with environmental justice is considered in the overall context of communities and populations that might potentially be disproportionately adversely affected by the SGP. As discussed in Section 3.22, Environmental Justice Affected Environment, the following environmental justice communities were identified:

- Nez Perce Census County Subdivision;
- Fort Hall Reservation (reservation of the Shoshone-Bannock Tribes); and
- Duck Valley Reservation (reservation of the Shoshone-Paiute Tribes).

Tribal access and uses of the region (including hunting, fishing, ceremonial and spiritual, medicinal, and intrinsic values) have long-standing and on-going subsistence and cultural importance for Tribal members.

4.22.2.1 Alternative 1

As noted in Section 3.22, Environmental Justice Affected Environment, no environmental justice communities are in the SGP area. There are no environmental justice communities in Valley and Adams counties that meet the definition of an environmental justice community. In addition, none of the proposed mine site, access roads, utilities, or off-site facilities are on reservation lands. Furthermore, no significant adverse biological impacts (e.g., wildlife and vegetation resources), public health impacts (e.g., contamination of fish in local streams), or other physical impacts (e.g., air quality and noise) are identified that would directly impact reservation lands and their Tribal environmental justice communities that are located outside of the SGP area. However, these impacts from the SGP could affect Tribal members' access to subsistence or traditional use of the lands within the SGP area. Currently, there is no restricted access on National Forest System (NFS) lands in the SGP area. Some restrictions are in place on private lands. As a result, the potential for any adverse and disproportionate SGP-related impacts to the Tribal environmental justice communities are expected to be limited to changes in access for Tribal members, and subsistence or traditional use of the lands.

As discussed in Section 4.24.2, Tribal Rights and Interests, Direct and Indirect Effects, limited information received from the Nez Perce Tribe and Shoshone-Paiute Tribes' ethnographies indicate that areas, resources, and off-reservation rights of concern and importance include disruption of traditional practices, tribal world view, fishing rights in the South Fork Salmon River watershed, including the East Fork South Fork Salmon River (EFSFSR), Meadow Creek, Fiddle Creek, West End Creek, and Sugar Creek. Tribally significant travel corridors and waterways are known: Old Thunder Mountain Road (National Forest System Road 440); the EFSFSR system, which includes several streams; and the Riordan Lake shore. Traditional plant gathering locations or collection areas within the analysis area also were cited as important to the Nez Perce Tribe, but exact locations of these collection areas have not been shared. Specific species of plants and animals identified in the ethnographies are listed in Section 3.22. Other landscape features of importance include Riordan Lake and high points in the landscape (e.g., mountain tops and ridgelines) that have religious significance, and traditional plant gathering locations or collection areas.

As discussed in Section 4.12.2.3, Fish Resources and Fish Habitat, Direct and Indirect Effects, Alternative 1, entrainment by in-stream activities or manmade features, flow reductions, temperature changes, changes in habitat structure, water quality changes, and reduced access to suitable habitat may affect the distribution and relative abundance of fish populations in affected streams in the SGP area. The potential for the SGP to cause changes in surface water quality from increased erosion and sedimentation, changes in temperature, and changes in general water chemistry (i.e., pH, temperature, major ions, total dissolved solids and dissolved metals, and organic carbon) are discussed in Section 4.9, Surface Water and Groundwater Quality. And, Section 4.19.2.1, Recreation, Direct and Indirect Effects, Alternative 1 discusses effects on public, including Tribal member, access to the SGP area for recreational opportunities, including fishing.

4.22.2.1.1 CONSTRUCTION

Construction of the SGP would impact access to traditional use areas and subsistence resources. Public and Tribal member use would generally not be allowed in the mine site footprint, areas adjacent to the mine site (i.e., the Operations Area Boundary), the upgraded transmission line right-of-way (ROW), and the new transmission line ROW from Johnson Creek Substation to the mine site (**Figure 2.3-1**). Approximately 13,446 acres of public lands within the Operations Area Boundary, as shown on **Figure 2.3-1**, would become inaccessible to the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes once construction begins. Impacts would begin during construction and would continue through closure and reclamation. Restricted access does not keep with tribal rights and trust responsibilities, because it does not allow Native Americans to hunt, fish, or gather plants in the areas of restricted public and Tribal member access during construction (3 years in duration), operations (approximately 12 years), and closure and reclamation (5 years) (see Section 4.24, Tribal Rights and Interests for further detail).

Construction of the new Burntlog Route, off-highway vehicle (OHV) connector trail, over- snow vehicle (OSV) routes, and off-site support facilities (i.e., Stibnite Gold Logistics Facility on Warm Lake Road [County Road {CR} 10-579], Landmark Maintenance Facility on Burnt Log Road [National Forest System Road 50447]) could impact access to traditional use areas and subsistence resources through habitat loss; behavioral disturbance to wildlife from increased noise and human activity; concerns about contamination of resources; and avoidance by Tribal members of traditional use areas. Furthermore, safety considerations, equipment use, presence of workers, construction-related traffic, and road closures may discourage and restrict subsistence use by Tribal members in the proximity of construction activity. In general, the construction impacts to subsistence resource availability on Tribal minority and low-income communities could potentially be adverse and would continue through construction, operations, and closure and reclamation.

4.22.2.1.2 OPERATIONS

Under Alternative 1, the SGP would occupy approximately 3,533 acres, with the mine site occupying approximately 1,970 acres of this total, not including exploration areas. Portions of the mine site are patented (private) lands and have been subject to mining activity for more than a century. The mine site and its immediate surroundings are highly disturbed and show evidence of long-term mining operations as the dominant land use. Public lands in the SGP area continue to be used by the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes as traditional use areas or areas used for subsistence resources (Battaglia 2018; Walker 2019).The SGP would encroach into previously undisturbed areas (e.g. the new construction along the Burntlog Route). Public and Tribal member access to the mine site and surrounding areas for traditional uses and subsistence resources is currently allowed. Midas Gold Idaho, Inc. (Midas Gold) has established an Operations Area Boundary identifying the area where public and Tribal member access would be restricted. Public and Tribal member access inside the Operations Area Boundary would be restricted during the mine's approximately 12-year period of operations. Restricted access to traditional use areas on public lands would occur in the 13,446-acre Operations Area Boundary (see **Figure 2.3-1**). Consequently, this previously accessible lands would become inaccessible for a generation, thus potentially disrupting the transfer of place-based traditional knowledge from generation to generation. This could impact Tribal rights and interests by reducing access of Tribal members to traditional use areas and subsistence resources within the operations area boundary. Noise and vibrations would increase during operation of the mine and related activities and would be constant during working or daylight hours. This could cause changes in natural conditions and distractions for Tribal member use of these areas. If sacred sites are located within the affected area, Native American religious practices and use at those sites could be adversely impacted by noise and vibration impacts from the mine operations.

However, the Operations Area Boundary represents a small portion of the total area within the Payette National Forest and Boise National Forest (2.3 million and 2.6 million acres, respectively) available to the Tribes to conduct their traditional use and access subsistence resources. All other existing areas outside of the Operations Area Boundary would remain fully accessible for hunting, fishing, gathering, and other traditional land uses. Nonetheless, there could potentially be adverse and long-term impacts on Tribal minority and low-income communities for the duration of the operations (approximately 12 years) and beyond.

The proposed Burntlog Route, a new OHV connector, and new OSV groomed trails would provide new and/or improved access to the SGP area and vicinity, which could have a positive impact on Tribal minority and low-income communities by providing for motorized access to cultural sites and subsistence resources in the SGP area.

Alternative 1 also may facilitate increased public and Tribal member access and use of NFS lands, particularly for recreational users, as a result of SGP-related road improvements. However, these access and use increases also could result in potential indirect adverse impacts to Tribal members due to increased human activity that results in actual or perceived decreases in Tribal member access to, availability, and/or quality of subsistence resources and/or traditional use areas' conditions.

4.22.2.1.3 CLOSURE AND RECLAMATION

Impacts during closure and reclamation would be similar to those described for construction, with similar effects on access to traditional use areas and subsistence resources. After reclamation, the mine site would have a less natural looking setting compared to the existing setting, as topography would be permanently altered and more man-made development would be present (e.g., a tailings storage facility [TSF] in Meadow Creek valley). The mine site would take a long time to fully revegetate. Wildlife may not re-populate the mine site after reclamation for a long period of time, and there would be a reduction in wildlife-related opportunities during that time. Fish species composition and/or relative populations within the creeks in the mine site area may change after reclamation, as anticipated habitat may favor steelhead over Chinook salmon, and there would be a decrease in habitat for bull trout, westslope cutthroat trout, and Chinook salmon. Therefore, fishing opportunities and the types of fish available may be altered after reclamation. This in turn could have an adverse effect on tribal members.

After closure and reclamation, the Stibnite Road portion of McCall - Stibnite Road (CR 50-412) that was closed at the boundary of the mine site, would be reopened and public and Tribal member access through the mine site would be permitted. The newly constructed portions of Burntlog Route would be decommissioned and reclaimed, and the currently existing and upgraded portions would be returned to their prior use. SGP-related beneficial impacts provided by the Burntlog Route, the OHV connector, and the OSV groomed trails would no longer exist after reclamation, resulting in some areas made accessible by the SGP, becoming more difficult to access after decommissioning. Therefore, the positive impact on Tribal minority and low-income communities provided by access to previously more difficult to access cultural sites and subsistence resources in the SGP area would no longer occur. Therefore, after closure and reclamation, there could potentially be adverse effects on Tribal minority and low-income communities in areas no longer accessible. However, there would be beneficial impacts of improved SGP area access in areas that were closed during construction and operation.

4.22.2.1.4 ENVIRONMENTAL JUSTICE DETERMINATION

Due to their unique tribal rights, cultural relationships, and uses of the lands within the local area, the Tribes could potentially be impacted more specifically and widely by changes in access, use, and resource conditions. Most other users and stakeholders have more limited or singular interests (e.g., wilderness recreationalist or OHV users). However, the Tribes have multiple and inter-related interests and associations with the local area resources (e.g., religious, traditional, and subsistence uses). Many of these interests also are inherently incompatible with any resource changes, including increased presence or alternate use of the local area by non-tribal individuals or entities. Unlike displaced recreational use, there are no substitute resources or replacement opportunities for most of the Tribal interests and use of the local area.

As a result, Tribal members are more likely to be impacted by local area resource changes. Due to the long-standing cultural significance and importance of these resources for the Tribes, many of the resource impacts would likely be perceived by Tribal members to have a greater and more long-term adverse impact than that for non-tribal users. Due to the wider range of their affected interests and use, Tribal members would likely be more broadly impacted. For these reasons, Tribal members have a greater potential to be disproportionately impacted than the general population. However, specific information from the Tribes regarding the exact nature, duration, and location of impacts on Tribal populations resulting from the excluded areas for the SGP and/or resource impacts is not available in the public domain. Based on the restricted information provided to the Forest Service by the Tribes, it is expected that the SGP-related impacts would be of a type and/or magnitude to represent an adverse environmental justice impact to the Tribal environmental justice communities. Section 5.1.2, Tribal Consultation and Government-to-Government Consultation, describes the efforts the Forest Service has made to involve local Tribal governments and to solicit their input regarding the SGP. Consultation is ongoing, and the Forest Service will continue to engage with the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes to develop ways to avoid, minimize, and mitigate effects to tribal rights that would be impacted by the SGP.

4.22.2.2 Alternative 2

Under Alternative 2, the potential for adverse and disproportionate SGP-related impacts to the Tribal environmental justice communities are expected to be limited to changes in Tribal members’ access and subsistence or traditional use of the lands.

Actions during construction and operations phases under Alternative 2 in the mine site are similar to those under Alternative 1, and those actions would similarly impact Tribal environmental justice communities. However, there are differences under Alternative 2 during the construction and operations phases that would impact Tribal environmental justice communities related to re-routing of a segment of the Burntlog Route, and construction of a new road that connects the Stibnite Road portion of McCall - Stibnite Road (CR 50-412) to Thunder Mountain Road (National Forest System Road 50375) to allow public and Tribal member access through the mine site during operations Under Alternative 2, re-routing the Riordan Creek section of Burntlog Road to avoid two un-named creeks (tributaries to Riordan Creek) would avoid potential impacts to fish in those drainages (see Section 4.12, Fish Resources and Fish Habitat).

4.22.2.2.1 CONSTRUCTION

Under Alternative 2, construction of the SGP would impact access to traditional use areas and subsistence resources. The types of impacts associated with the SGP footprint and Operations Area Boundary, as shown on **Figure 2.4-1**, would be the same as those described under Alternative 1. Approximately 13,446 acres of public lands within the Operations Area Boundary would be inaccessible to the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes once construction begins.

Other impacts related to construction of the new Burntlog Route, OHV connector trail, OSV routes, and off-site support facilities, as well as construction of the new public access road that connects Stibnite Road (CR 50-412) to Thunder Mountain Road (CR 50375) under Alternative 2, would be the same as those described for Alternative 1. Therefore, similar to Alternative 1, the construction impacts to subsistence resource availability and access to traditional use areas on Tribal minority and low-income communities would potentially be adverse but short-term, lasting only though the construction phase (approximately 3 years) under Alternative 2.

4.22.2.2.2 OPERATIONS

. Impacts would be similar as those described under Alternative 1; however, under Alternative 2, the SGP would occupy approximately 3,423 acres, with the mine site occupying approximately 1,879 acres. The Operations Area Boundary would include 13,446 acres of public lands. Impacts on Tribal rights and interests resulting from reducing Tribal members access to traditional use areas and subsistence resources would be similar to those described for Alternative 1.

Positive impacts associated with new and/or improved access to the SGP mine site via incidental use of Burntlog Route, a new OHV connector, and new OSV groomed trails would be the same as Alternative 1, except for the realigned 5.3-mile segment of Burntlog Route. In addition, public and Tribal member access also would be allowed through the mine site under Alternative 2 via a road that would connect Stibnite Road (CR 50-412) to Thunder Mountain Road (CR 50375). The public access road would be within the Operations Area Boundary, and there would be no use allowed off of the road within this boundary. The road would only be available for public and Tribal member access through the mine site to access Thunder Mountain Road (CR 50375). Therefore, the new road would return access to areas that were closed temporarily during construction, and allow faster, more direct access to areas east and south of the mine site.

Under Alternative 2, the re-routed section of Burntlog Route near Riordan Creek could induce increased recreational use in the Black Lake area compared with all other alternatives,, because the roadway would be closer to this lake. The rerouted segment also would be closer to the Frank Church-River of No Return Wilderness and may result in increased use of the wilderness area by recreational users, and potentially result in unauthorized motorized use due to the proximity of the roadway to the wilderness boundary. This potential public and Tribal member access and use increase in the Black Lake area and Frank Church-River of No Return Wilderness could result in potential indirect adverse impacts to Tribal members due to increased human activity if it results in actual or perceived decreases in their access to, availability, and/or quality of subsistence resources and/or traditional use areas' conditions.

4.22.2.2.3 CLOSURE AND RECLAMATION

Impacts due to closure and reclamation activities associated with the mine site would be the same as those described under Alternative 1. Therefore, there could be adverse effects on Tribal minority and low-income communities, and SGP-related beneficial impacts from the improved access via Burntlog Route, a new OHV connector, and new OSV groomed trails would no longer exist as they would be closed and reclaimed to current conditions.

4.22.2.2.4 ENVIRONMENTAL JUSTICE DETERMINATION

For the same reasons described for Alternative 1, Tribal members are more susceptible and likely to be impacted by local area resource changes and many of the resource impacts would likely be perceived by Tribal members to have a greater and more long-term adverse impact than for non-tribal users. In addition, due to the wider range of their affected interests and use, Tribal members would likely be more generally impacted. As a result, Tribal members have a greater potential to be disproportionately impacted than the general population. However, specific information from the Tribes regarding the exact nature, duration, and location of impacts on Tribal populations resulting from the excluded areas for the SGP and/or resource impacts is not available in the public domain. Based on the restricted information provided to the Forest Service by the Tribes, it is expected that the SGP-related impacts would be of a type and/or magnitude to represent an adverse environmental justice impact to the Tribal environmental justice communities.

Section 5.1.2, Tribal Consultation and Government-to-Government Consultation, describes the efforts the Forest Service has made to involve local Tribal governments and to solicit their input regarding the SGP. Consultation is ongoing, and the Forest Service will continue to engage with the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes to develop ways to avoid, minimize, and mitigate effects to tribal rights that would be impacted by the SGP.

4.22.2.3 Alternative 3

Under Alternative 3, the potential for any adverse and disproportionate impacts to the Tribal environmental justice communities are expected to be limited to changes in Tribal member access and subsistence or traditional use of the lands. Modifications under Alternative 3, that would impact Tribal environmental justice communities include a larger overall SGP footprint and Operations Area Boundary, no construction of the OHV trail, and re-routing of a segment of Burntlog Route through Blowout Creek Valley. The EFSFSR system would be much more heavily impacted under Alternative 3 compared with all other alternatives,, resulting in impacts to fish, which are considered a traditional resource and currently an important tribal resource. Impacts to fish under Alternative 3 are discussed in detail in Section 4.12, Fish Resources and Fish Habitat.

4.22.2.3.1 CONSTRUCTION

Construction of the SGP would impact access to traditional use areas and subsistence resources. Approximately 17,034acres of public lands within the Operations Area Boundary, as shown on **Figure 2.5-1**, would become inaccessible to the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes once construction begins.

The types of impacts associated with construction would be the same as those described under Alternative 1. Impacts related to construction of the Burntlog Route, including the re-routed segment through the Blowout Creek Valley, OSV routes, and off-site support facilities, would be similar to Alternative 1. Therefore, similar to Alternative 1, the construction impacts to subsistence resource availability and access to traditional use areas on Tribal minority and low-income communities would likely be adverse, but short-term, lasting only though the construction phase (approximately 3 years) under Alternative 3.

4.22.2.3.2 OPERATIONS

Impacts would be similar to those described under Alternative 1. Under Alternative 3, the SGP would occupy approximately 3,610 acres, with the mine site occupying approximately 2,071 acres. The Operations Area Boundary under Alternative 3 would include approximately 17,034 acres of public lands, which is greater than all other alternatives. Impacts on Tribal rights and interests resulting from reducing Tribal member access to traditional use areas and subsistence resources would occur within this larger area.

Potentially beneficial impacts associated with new and/or improved access to the area via Burntlog Route and new OSV groomed trails would be the same as those described under Alternative 1. However, the OHV Connector Trail would not be built under Alternative 3 and, therefore, would not contribute to potential new motorized access to cultural sites and subsistence resources in that corridor.

The SGP could increase public and Tribal member access to NFS lands and the impacts would be similar to those described under Alternative 1. However, the OHV Connector Trail would not be built under Alternative 3, and therefore would not contribute to an increase in use in that area.

4.22.2.3.3 CLOSURE AND RECLAMATION

The types of impacts associated with closure and reclamation activities at the mine site would be similar to those described under Alternative 1. Therefore, there may be adverse effects on Tribal minority and low-income communities. In addition, the SGP-related beneficial impacts of improved access to the general area via Burntlog Route and new OSV groomed trails would no longer exist as they would be closed and reclaimed.

Following closure, the public and Tribal member access under this alternative would be provided around the East Fork South Fork Salmon River TSF location; either by retaining the mine access road from Stibnite Road (CR 50-412) through the mine site and up Blowout Creek for public and Tribal member access, or by converting the operational TSF access road along the TSF pipeline into a permanent public road connecting Stibnite Road (CR 50-412) through the mine site and past the TSF to the existing road on the east. Therefore, new and/or improved access to the SGP area and vicinity would occur and would have a beneficial impact on Tribal minority and low-income communities by providing for motorized access to cultural sites and subsistence resources.

4.22.2.3.4 Environmental Justice Determination

For the same reasons described for Alternative 1, Tribal members are more susceptible and likely to be impacted by local area resource changes and many of the resource impacts may be perceived by Tribal members to have a greater and more long-term adverse impact than that for non-tribal users. In addition, due to the wider range of their affected interests and use, Tribal members would likely be more broadly impacted. As a result, Tribal members have a greater potential to be disproportionately impacted than the general population. However, specific information from the Tribes regarding the exact nature, duration, and location of impacts on Tribal populations resulting from the excluded areas for the SGP and/or resource impacts is not available in the public domain. Based on the restricted information provided to the Forest Service by the Tribes, it is expected that the SGP-related impacts would be of a type and/or magnitude to represent an adverse environmental justice impact to the Tribal environmental justice communities.

Section 5.1.2, Tribal Consultation and Government-to-Government Consultation, describes the efforts the Forest Service has made to involve local Tribal governments and to solicit their input regarding the SGP. Consultation is ongoing, and the Forest Service will continue to engage with the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes to develop ways to avoid, minimize, and mitigate effects to tribal rights that would be impacted by the SGP.

4.22.2.4 Alternative 4

Similar to Alternative 1, the potential for any adverse and disproportionate SGP-related impacts to the Tribal environmental justice communities are expected to be limited to changes in Tribal member access and subsistence or traditional use of the lands.

Under Alternative 4, modifications with the potential to impact Tribal environmental justice communities include a smaller overall footprint because the Yellow Pine Route would be the only access route to the mine for all phases. The Burntlog Route would not be constructed or used under Alternative 4. Public and Tribal member access through the mine during operations would be similar to Alternative 2. These changes would result in different impacts than Alternative 1, particularly the use of the Yellow Pine Route during mine construction, operations, closure and reclamation.

4.22.2.4.1 Construction

Under Alternative 4, construction of the SGP would impact access to traditional use areas and subsistence resources. The types of impacts associated with the overall footprint and operations area boundary would be the same as those described under Alternative 1;. However, the construction phase under Alternative 4 would be up to 5 years. Approximately 13,446 acres of public lands within the Operations Area Boundary, as shown on **Figure 2.6-1**,would be inaccessible to the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes once construction begins.

Burntlog Route and the OHV connector trail would not be constructed under Alternative 4; therefore, there would be no construction impacts from these routes. Access impacts related to upgrading Yellow Pine Route and construction of the new OSV routes and off-site support facilities would be similar to Alternative 1, except for the location of the maintenance facility.

Upgrades to Yellow Pine Route and its use as the access route to the mine site during construction would result in greater impacts to Tribal environmental justice communities along this route due to increased noise, traffic, and safety-related issues from mine-related construction traffic. Traffic on Johnson Creek (CR 10-413), Warm Lake (CR 10-579), and McCall – Stibnite (CR 50-412) roads would substantially increase, thereby increasing the noise and activity near these roads.

Therefore, Tribal members may avoid these areas because of noise associated with activities and traffic along Warm Lake, McCall - Stibnite, and Johnson Creek roads. These impacts would begin during construction and would continue through operations and closure and reclamation, because Johnson Creek, McCall - Stibnite, and Warm Lake roads would be used during mine operations as well; therefore, traffic and traffic noise would continue through operation, and closure and reclamation. Therefore, impacts to subsistence resource availability and access to traditional use areas under Alternative 4 on Tribal minority and low-income communities would likely be adverse from the beginning of construction and through closure and reclamation.

4.22.2.4.2 OPERATIONS

Types of impacts would be similar to those described under Alternative 1. Under Alternative 4, the SGP would occupy approximately 3,219 acres, with the mine site occupying approximately 1,989 acres. The Operations Area Boundary under Alternative 4 would include approximately 13,446 acres of public lands.

Burntlog Route and the OHV connector trail would not be constructed under Alternative 4; therefore, there would be no beneficial impact on Tribal minority and low-income communities from new and/or improved access to within the SGP area and vicinity, as described for Alternative 1.

Under Alternative 4, access to the mine site would be via the Yellow Pine Route, which would be upgraded and improved along its route. Public and Tribal member access through the mine site would be via a new shared (public and mine site) access road to link Stibnite Road (CR 50-412) with Thunder Mountain Road (CR 50375), which is similar to one of the options under Alternative 2 that goes around the Yellow Pine Pit. Therefore, the impacts would be similar to those described above for Alternative 2.

During operations, Yellow Pine Route would be used as the main access route into the mine site. Impacts associated with the continued use of these roads would be the same as those described for construction.

4.22.2.4.3 Closure and Reclamation

Impacts associated with closure and reclamation at the mine site would be similar to those described under Alternative 1; however, there would not be a Burntlog Route to reclaim under Alternative 4. For the same reasons described under Alternative 1, wildlife and fish populations may be altered after reclamation. After closure and reclamation, there could be adverse effects on Tribal minority and low-income communities associated with post-mining land uses at the mine site.

Under Alternative 4, the Yellow Pine Route (specifically Stibnite Road [CR 50-412]) would not be returned to its pre-SGP width, and traffic on the road would be greatly reduced as operations cease. This could encourage the return of traditional use sites and areas used for subsistence resources east of the mine site off Thunder Mountain Road (CR 50375) that were displaced during mining operations due to road closures and increased road traffic. Therefore, Alternative 4 closure and reclamation could have a positive impact on Tribal minority and low-income communities by returning pre-SGP access to traditional use sites and areas used for subsistence resources east of the mine site after closure and reclamation.

4.22.2.4.4 Environmental Justice Determination

For the same reasons described for Alternative 1, Tribal members are more susceptible and likely to be impacted by local area resource changes, and many of the resource impacts would likely be perceived by Tribal members to have a greater and more long-term adverse impact than that for non-tribal users. In addition, due to the wider range of their affected interests and use, Tribal members would likely be more broadly impacted. As a result, Tribal members have a potential to be disproportionately impacted than the general population. However, specific information from the Tribes regarding the exact nature, duration, and location of impacts on Tribal populations resulting from the excluded areas for the SGP and/or resource impacts is not available in the public domain. Based on the restricted information provided to the Forest Service by the Tribes, it is expected that the SGP-related impacts would be of a type and/or magnitude to represent an adverse environmental justice impact to the Tribal environmental justice communities.

Section 5.1.2, Tribal Consultation and Government-to-Government Consultation, describes the efforts the Forest Service has made to involve local Tribal governments and to solicit their input regarding the SGP. Consultation is ongoing, and the Forest Service will continue to engage with the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes to develop ways to avoid, minimize, and mitigate effects to tribal rights that would be impacted by the SGP.

4.22.2.5 Alternative 5

Under Alternative 5, no action would be implemented, and there would be no mining operations associated with the SGP. There would be no new or upgraded access roads; no changes in location or upgrades to the existing transmission lines or substations; and no construction of the Stibnite Gold Logistics Facility and Landmark Maintenance Facility. Conversely, there would be no negative impact to the cultural values of the area, no negative impacts to the fisheries population, and the Tribal members would maintain access to the area as they currently hold. Alternative 5 would not result in adverse impacts to environmental justice communities or Tribal members.

The Midas Gold Golden Meadows Exploration Project was issued a Decision Notice and Finding of No Significant Impact in January 2016 and would be expected to continue under Alternative 5. The proposed Golden Meadows Project would continue in and near the vicinity of the SGP area and would include exploration activities.

Except for areas affected by the Golden Meadows Exploration Project, future access to subsistence resources and uses in the existing area would remain unchanged. As a result, no adverse and disproportionate impacts to minority or low-income populations are expected to occur under Alternative 5.

4.22.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.22.4 Cumulative Effects

Past, present, and reasonably foreseeable future actions (RFFA) include activities, developments, or events that have the potential to change the physical, social, economic, and/or biological nature of a specified area. This includes approved activities, such as continued mining and reclamation work on private or federal land. Existing and known future activities, and other RFFAs provide the basis for defining and analyzing cumulative impacts. A cumulative effect must overlap in space and time with the direct and indirect effects of the action. For environmental justice, the cumulative effects analysis consists of the environmental justice communities and populations that might be affected (either directly or indirectly) by the action alternatives and RFFAs. This includes the Native American Tribes whose traditional subsistence range includes the SGP area including the mine site (i.e., the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes).

Descriptions of existing and RFFAs considered as part of the cumulative effects analysis for all resources are included in Section 4.1.5, Cumulative Effects. Past, Present, and RFFAs that have impacted subsistence resources and traditional use areas include mining projects and their related activities and non-mining related projects, such as timber harvest; recreation; transportation; and urban development in Valley County.

4.22.4.1 Action Alternatives

Cumulative impacts resulting from constructing the SGP and other simultaneous construction projects and RFFAs could alter access to Tribal traditional use areas and subsistence resources; cause habitat loss, behavioral disturbance to resources from increased noise and human activity, concerns about contamination of resources, and avoidance by Tribal members of traditional use areas; and discourage and restrict subsistence use by Tribal members in proximity to construction activity sites. In general, the SGP construction when combined with other RFFAs and their potential construction impacts to subsistence resource availability on Tribal minority and low-income communities would potentially be cumulatively adverse, but impacts would likely be short-term, lasting only though the duration of the construction phase.

Additional mining development in the cumulative effects area, including mining near Big Creek and at Yellow Pine, could cumulatively impact Tribal rights and interests by reducing Tribal member access to traditional use areas and subsistence resources. The presence and usage of Native American sacred sites within the cumulative effects area have been identified. However, specific locations have not been disclosed for the public domain. If sacred sites are located within the affected area, Native American religious practice and use at those sites could be adversely impacted from the mine operations, such as from noise and vibration. Therefore, there could potentially be cumulatively adverse and long-term impacts on Tribal minority and low-income communities for the duration of the SGP operations.

The SGP action alternatives and RFFAs may facilitate increased public and Tribal member access, particularly for recreational users. The South Fork Restoration and Access Management Plan and East Fork Salmon River Restoration and Access Management Plan include numerous actions relating to motorized and non-motorized access and improvements of recreation facilities within the South Fork Salmon River watershed. Other RFFAs, such as development in the Big Creek area, may result in displacement of recreation to other areas, possibly increasing recreation and permitted use within the analysis area, which may already see an increase in recreation use from the action alternatives. This increased access and use could result in potential indirect adverse cumulative impacts to Tribal members due to increased human activity if it results in actual or perceived decreases in their access to, availability, and/or quality of subsistence resources and/or traditional use areas’ conditions.

Overall, Tribal members are more susceptible and likely to be impacted by local area resource changes and many of the resource impacts would likely be perceived by Tribal members to have a greater and more long-term adverse impact than that for non-tribal users. The Tribes have multiple and inter-related interests and associations with the local area resources (e.g., religious, traditional, and subsistence uses), and many of these interests also are inherently incompatible with any resource changes, including increased presence or alternate use of the local area by non-tribal individuals or entities. Due to the wider range of their affected interests and use, Tribal members would likely be more broadly impacted. As a result, Tribal members have a greater potential to be disproportionately affected than the general population, and the cumulative impacts of the action alternatives in combination with on-going actions and RFFAs could potentially be adverse.

4.22.4.2 Alternative 5

Cumulative impacts under Alternative 5 would be experienced through the continuing conditions in the SGP area if none of the action alternatives were implemented. Cumulative effects associated with Alternative 5 include past and present actions, as well as RFFAs. These include ongoing and planned mining activities, exploratory drilling, reclamation and closure of mining and processing facilities, recreation and tourism, timber harvest on public lands, and transportation projects. These projects could affect Tribal minority and low-income communities by changing access to, availability, and/or quality of subsistence resources and/or traditional use areas' conditions, but this project would not add any additional impacts or restricted access. As a result, no cumulative adverse and disproportionate impacts to minority or low-income populations are expected to occur under Alternative 5.

4.22.5 Irreversible and Irretrievable Commitments of Public Resources

4.22.5.1 Action Alternatives

A commitment of resources is irreversible when the impacts of the proposed action or alternatives would limit the future options for use of the resource. This applies primarily to non-renewable resources or to processes or resources that are renewable over long periods of time. As discussed previously, the Nez Perce Tribe and Shoshone-Paiute Tribes have completed ethnographies that address traditional cultural properties, sacred sites, and traditional resource collection areas in the analysis area. Based on the restricted information provided by the Tribes, it is expected that the action alternatives would cause irreversible impacts (Battaglia 2018; Walker 2019). The Shoshone-Bannock Tribes ethnography is in progress. Destruction of those sites/areas, if any are present, would constitute an irreversible commitment.

A commitment of resources is irretrievable when the impacts of the proposed action or alternatives would result in a loss of production, harvest, or use of renewable resources; it describes the temporal loss of renewable resources. Future land use of the mine site would be altered permanently, because an area that has been historically used for mining would, after the closure of the mine and reclamation of the site, no longer be used for mining. In these areas, original land uses, including Tribal uses, would be reclaimed in the areas where specific land uses for the action alternatives would be reclaimed (e.g., Burntlog Route, access roads, transmission line ROW). However, temporal loss of the land for other uses (including hunting, fishing, gathering, and other traditional uses by Tribal members) and downstream impacts to fish species and their habitats during the previous construction and operations periods would be irretrievable. In addition, prohibiting use of a culturally important area for approximately 20 years over the life of the SGP could result in the irretrievable and irreversible loss of cultural practices and identity to a generation of Tribal members (see Section 4.17, Cultural Resources, and Section 4.24, Tribal Rights and Interests).

4.22.5.2 Alternative 5

The action alternatives would not be implemented under Alternative 5. Consequently, there would be no irreversible or irretrievable commitment of resources.

4.22.6 Short-term Uses versus Long-term Productivity

4.22.6.1 Action Alternatives

Short-term use of the mine site area and other facility locations in NFS lands would reduce Tribal member access to traditional use areas and subsistence resources; provide new and/or improved access to the SGP area and vicinity; and facilitate increased public and Tribal member access and use of NFS lands, particularly for recreational users, as a result of SGP-related road improvements.

It is expected that the original land uses, including Tribal uses, would be reclaimed in the SGP areas where specific land uses for the action alternatives would be reclaimed (e.g., Burntlog Route, access roads, transmission line ROW). Therefore, there would be no long-term disproportionate effects on Tribal minority and low-income communities.

4.22.6.2 Alternative 5

The action alternatives would not be implemented under Alternative 5. Consequently, there would be no short-term use that would affect minority or low-income populations, and no effect on long-term productivity.

4.22.7 Summary

There are no environmental justice minority or low-income communities in the SGP area. However, the SGP area is within the traditional subsistence range of Tribal minority and low-income populations from the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes. Tribal members are more susceptible and likely to be impacted by local area resource changes due to both their use of the SGP area and their long-established cultural connections and attitudes to the local area resources. As a result, many of the SGP-related resource impacts would likely be perceived by Tribal members to have a greater and more long-term adverse impact than that by non-tribal users. For these reasons, Tribal members have a greater potential to be affected than the general population under all four action alternatives.

Table 4.22-1 provides a summary comparison of environmental justice impacts by issue and indicators for each alternative.

Table 4.22-1 Comparison of Environmental Justice Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP may disproportionately affect minority or low-income populations.	Number and size of minority populations affected.	The Nez Perce Census County Subdivision, Duck Valley Reservation, and Fort Hall Reservation meet the definition of minority populations.	There are no minority communities within the SGP area. There would be no direct effect to reservation lands and their Tribal minority populations that are outside of the SGP area, but there would potentially be indirect effects.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No effect on minority populations.
	Number and size of low-income populations affected.	The Duck Valley Reservation (1,353 residents) meets the definition of a low-income population.	There are no low- income communities within the SGP area. There would be no direct effect to Duck Valley Reservation lands and their Tribal low-income populations that are outside of the SGP area, but there would potentially be indirect effects.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No effects on low- income populations.
	Location of SGP facilities, including roads and transmission lines in relation to minority or low-income residents.	There are no environmental justice communities in the SGP area.	There would be no direct effect of SGP facilities on environmental justice communities. None of the SGP facilities would be on any of the reservation lands; therefore, there would be no direct effect of SGP facilities on Tribal environmental justice communities.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No SGP facilities would be constructed.
	Differences in access to public lands.	Public and Tribal member access is available throughout the SGP area except in areas previously used for mining. There are no minority and low-income populations in the SGP area that would be affected by differences in public and Tribal member access. Tribal members use public lands within the Payette National Forest and Boise National Forest to access cultural and subsistence resource areas.	Construction could impact access to traditional use areas and subsistence resources through habitat loss; behavioral disturbance to resources from increased noise and human activity; and concerns about contamination of resources. Burntlog Route and new OSV/OHV groomed trails would provide new and/or improved access to the SGP area and vicinity, which could have a positive impact by providing motorized access to cultural sites and subsistence resources. Access and use increases could result in potential indirect adverse impacts to Tribal members due to increased human activity.	Same as Alternative 1, except for: Public and Tribal member access also would be provided through the mine site by constructing new road to link Stibnite Road to Thunder Mountain Road. Rerouting the Riordan Creek Segment of Burntlog Route could impact Tribal members by potentially increasing unauthorized motorized use, causing distractions and changing natural conditions of Native American religious practices at sacred sites.	Same as Alternative 1, except for: Closure and reclamation include a permanent roadway around the TSF that would provide the continuation of beneficial impacts of improved SGP area access.	Same as Alternative 1, except for: No new and/or improved access from construction or use of the Burntlog Route. Upgrades to Yellow Pine Route and use of Warm Lake, Johnson Creek, and Stibnite roads as the primary access route to the mine site would result in greater impacts to Tribal environmental justice communities. Stibnite Road would not be returned to its pre-mining width and traffic on Stibnite Road would be greatly reduced.	No effects on access to public lands for minority or low- income populations.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Change in traditional Tribal practices and/or access to Tribal resources.	Tribal access and use of the region have long-standing and on-going current cultural importance and subsistence value for many Tribal members.	Restricted access to traditional use areas would occur in the 3 13,446 acres of public lands within the Operations Area Boundary.	Same as Alternative 1	Same as Alternative 1, except the public lands within the Operations Area Boundary would include 17,034 acres.	Same as Alternative 1	Except for the Golden Meadows Exploration Project, future access to subsistence resources and for cultural uses in the existing SGP area would remain unchanged.
	Change in traditional Tribal practices and/or access to Tribal resources.	Based on limited information received from the Nez Perce Tribe and Shoshone-Paiute Tribes ethnographies, sacred sites do exist in the analysis area, although exact locations are not public information.	Due to the local area's long-standing cultural significance and importance of these resources for the Tribes, many of the resource impacts would likely be perceived by Tribal members to have a greater and more long-term adverse impact than that for non-tribal users.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	There would be no potential impact to sites of cultural significance.

4.23 Special Designations

4.23.1 Wilderness

4.23.1.1 Effects Analysis Indicators and Methodology of Analysis

The following issue and indicators were used to evaluate the effects of the alternatives on the five qualities of wilderness character.

Issue: The Stibnite Gold Project (SGP) could change the quality of wilderness character in designated or recommended wilderness areas.

Indicators:

- Distance of SGP facilities from designated or recommended wilderness.
- Distance of designated or recommended wilderness from sights and sounds of human activity.
- Change in opportunities for self-reliant recreation within designated or recommended wilderness.

Potential impacts on designated wilderness and recommended wilderness areas were evaluated based on the five qualities of wilderness character, as described below, which include untrammeled; natural; undeveloped; opportunities for solitude or primitive and unconfined recreation; and other features of value.

Impacts on the five qualities of wilderness character were analyzed using resource databases, including trailhead registrations, Geographic Information System (GIS) spatial analyses, scientific literature reviews, and information and analysis documented in reports prepared for the SGP. Effects on the qualities of wilderness character are quantified where possible.

4.23.1.2 Direct and Indirect Effects

The analysis of effects on recommended or designated wilderness includes a qualitative analysis of the effects on the five qualities of wilderness character from the construction, operation, and closure and reclamation of the SGP. The five qualities of wilderness character are summarized below.

Untrammeled – The area is essentially unhindered and free from the actions of modern human control or manipulation. Untrammeled wilderness areas are where the native plants, fish, and wildlife are distributed naturally across the landscape.

Natural – Natural areas are substantially free from the effects of modern civilization. The area is without non-native plants or animals. In addition, the composition of indigenous species and the structure and function of entire ecological systems in the wilderness are unaltered by activities either within or outside the wilderness.

Undeveloped – Undeveloped wilderness areas are without structures and the use of motors or mechanical transport that increases the human ability to occupy or modify the environment.

Undeveloped areas are without any administrative infrastructure or other physical development and are managed without the use of motors or mechanical transport.

Opportunities for solitude or primitive and unconfined recreation – Wilderness provides outstanding opportunities for solitude or primitive and unconfined recreation. Opportunities include self-reliance, reflection, self-discovery, exploration, personal growth, inspiration, freedom, and adventure that reinforce the connection to our ancestors and our American heritage.

Other Features of Value – Wilderness areas also may contain other features such as ecological, geological, other features of scientific, educational, scenic, or historical values that are essential to the character of a particular wilderness (Arthur Carhart National Wilderness Training Center 2014; Landres et al. 2012, 2015).

The following analysis of effects on designated wilderness (i.e., the Frank Church-River of No Return Wilderness [FCRNRW]) and recommended wilderness areas are considered in the overall context of wilderness character within the analysis area. Elements of this context include:

- There would be no changes to non-conforming uses within the FCRNRW or recommended wilderness areas.
- No structures or surface disturbing activities from the SGP would occur within a designated wilderness or recommended wilderness areas.
- The U.S. Forest Service (Forest Service) would not enact new management restrictions on visitor behavior within the wilderness analysis area.
- Opportunities for solitude within wilderness or recommended wilderness areas are available when visitation numbers are low and are affected by potential increases in visitation to the wilderness and associated sights or sounds of human activity and development.
- Other features, such as soundscapes and dark skies, are included in the evaluation of the other four qualities of wilderness character.
- Proposed SGP activities undertaken outside of the wilderness boundary are not designed with the intention of influencing populations or ecological functions within the wilderness or recommended wilderness.
- No additional facilities would be constructed within the FCRNRW or recommended wilderness areas. There would be no changes to the numbers of structures or

developments within the FCRNRW or recommended wilderness areas or changes to the number of inholdings.

- The levels of administrative and non-emergency use of motor vehicles, motorized equipment, or mechanical transport within wilderness or recommended wilderness areas would continue along present trends.

Potential effects on the five qualities of wilderness character could occur during all phases (construction, operations, closure and reclamation) of the SGP. The duration of effects on wilderness character considered includes temporary, short-term, or long-term. Temporary effects are those lasting a few hours to a few months, such as encountering others in the wilderness. Short-term effects are those that are expected to last more than a few months and up to 15 years. The duration of long-term effects on four wilderness qualities of untrammeled, natural, undeveloped, and opportunities for solitude or primitive and unconfined recreation would be 15 or more years. Other features of value, the fifth wilderness character, is included within the discussions for the other four wilderness qualities of untrammeled, natural, undeveloped, and opportunities for solitude or primitive and unconfined recreation.

4.23.1.2.1 Alternative 1

The following activities could affect the wilderness character qualities of untrammeled, natural, undeveloped, and solitude or a primitive unconfined type of recreation:

- Mine site facilities;
- Access roads; and
- New transmission line.

4.23.1.2.1.1 Untrammeled

While no structures or facilities would be developed inside the FCRNRW, the untrammeled quality of wilderness character could be impacted by the SGP facilities and access roads. Construction, operation, and closure and reclamation could change soundscapes or natural dark sky conditions in the FCRNRW. The extent where the SGP facilities and access roads could change soundscapes or natural dark sky conditions is influenced by topography and weather.

Noise from SGP activities, an increase in human activity, or additional traffic on roads could change wildlife species natural distribution within the FCRNRW. The disturbance to wildlife species along or near the Yellow Pine Route would be short-term. Once construction of Burntlog Route is complete, traffic on the Stibnite Road portion of McCall-Stibnite Road (County Road [CR] 50-412) (Stibnite Road) could return to existing annual average daily traffic (AADT) of 39 vehicles. Sound from mechanical equipment at the mine site and daily Burntlog Route maintenance could change natural wildlife species distribution in the Big Chief drainage within the FCRNRW. During the 3 years of construction and 12 years of operation, the natural distribution of wildlife species in the FCRNRW in habitats adjacent to the Yellow Pine Route (during construction) and Burntlog Route could change (Idaho Department of Fish and

Game 2019). Noise from blasting at the mine site could be audible up to 4.5 miles from the mine during the 12 years of mine operation, and Burntlog Route daily maintenance activities could be audible up to approximately 2.9 miles from the road, including within portions of the FCRNRW (AECOM 2017, 2019). Topography between the FCRNRW and blasting in the open pits and mine operation would reduce the distance noise from these activities are audible (Brüel and Kjaer 2000). See Section 4.6, Noise, for more detailed information regarding noise levels at varying distances from the mine site and Burntlog Route.

Lights used during mine construction, operation, and closure could result in skyglow, changing natural dark sky conditions. There could be temporary impacts on night sky conditions from construction lights at the mine site and vehicle headlights. Once construction in an area is completed, mine lights in localized areas would no longer be needed. Lights from vehicles on Burntlog Route would be visible within the upper elevations of Big Chief Creek within the FCRNRW. Topography and vegetation could block or filter lights, reducing the area where lights are visible (Larkin 1996). The extent of change to natural dark skies from lights during mine operation and vehicle headlights on Burntlog Route is unknown. Mitigation measures to shield lights would reduce the area where mine operation lights change natural dark skies.

Human activity at the mine site would increase to accommodate the mine’s year-round 24-hour a day operation schedule. Increasing human activity at the mine site and from the potential public use of Burntlog Route could alter wildlife species migration into habitats in the FCRNRW. The use of Burntlog Route could increase the number of people recreating and hunting in wildlife habitats adjacent to or in the FCRNRW. Increased human activity could change wildlife distribution. The extent wildlife distribution would change is influenced by the type of activity, vegetation, and species (Taylor and Knight 2003; Wisdom et al. 2018).

The untrammeled quality of wilderness character would be impacted when noise and lights change wildlife species distribution and behaviors. Noise from mine activities, vehicles on Burntlog Route, and changes to natural dark skies during proposed construction, operation, and closure and reclamation activities could result in a long-term change in wildlife species natural distribution. The duration could be short-term as some individuals of wildlife populations become habituated to noise, lights, and human activity.

Noise from recontouring slopes during the decommissioning of Burntlog Route and returning Meadow Creek Lookout Road (National Forest System Road [FR] 51290) to the existing width could be audible within Big Chief Creek drainage. Noise from recontouring slopes, removing buildings at the mine site, and Burntlog Route decommissioning could be audible for approximately 3 miles (AECOM 2017, 2019). Noise from recontouring slopes or decommissioning Burntlog Route would be temporary. These activities would be completed within a few days or weeks in a specific area, and, as activities ended, wildlife species distribution could return to pre-disturbance conditions. The duration of changes to wildlife species distribution after closure and reclamation activities cease would depend on species sensitivity to disturbance.

4.23.1.2.1.2 Natural

Plants

During construction, the 65 mine-related vehicles per day using Yellow Pine Route could transport non-native plant species. Non-native plant species transported on vehicles could become established and spread into the FCRNRW. Removing vegetation and disturbance during the construction of Burntlog Route also could spread non-native plant species (Forest Service 2019). Vegetation established during the interim reclamation of disturbed areas could reduce opportunities for invasive species to establish (Foltz 2012; Gornish et al. 2016; Romme et al. 2003).

During the 12 years of mine operation, approximately 68 mine vehicles per day, on average, would use Burntlog Route. This traffic and daily maintenance activities also could disperse non-native plant species or remove vegetation along the roadside. During the decommissioning of Burntlog Route, surface disturbance and removal of vegetation established during interim reclamation could provide opportunities for non-native plant species to become established and spread. In addition, equipment used during decommissioning could disperse non-native plant species. Reclamation could impact the “natural” quality of wilderness character if the non-native annual plant species included in the seed mix spread into the FCRNRW (Morris and Schupp 2009). Reclamation of disturbed areas, which involve revegetation on National Forest System (NFS) lands, would be done according to Payette or Boise Forest Plan Standards and in coordination with a Forest botanist.

During Burntlog Route construction, operation, and closure and reclamation, dust and sediment could be deposited on vegetation within the FCRNRW. Dust and sediment deposition in areas of the FCRNRW adjacent to Burntlog Route could change vegetation community composition within the FCRNRW. The amount of dust and sediment deposited would be influenced by weather conditions, road maintenance, vehicle speed, and road surface. Limiting mine traffic to a 25-mile per hour speed limit, as proposed, could reduce the amount of dust generated. However, recreation traffic may not follow posted speed limits and speeds could be higher, which is associated with a higher amount of fugitive dust generated. The extent of dust and sediment deposition is unknown; however, the changes in vegetation would result in a long-term impact on the natural quality of wilderness character within the FCRNRW. Impacts on vegetation are discussed in Section 4.10, Vegetation.

Burntlog Route would be open to public use during the 12 years of mine operation and 5 years of mine closure and reclamation (Rew et al. 2018) when other routes through the mine site are not open to the public. Recreation use could increase in areas of the FCRNRW accessed from trailheads along Burntlog Route. Due to mine construction and operation, recreation use could increase in recommended wilderness areas if forest visitors avoid areas of FCRNRW. Recreation equipment and vehicles could disperse non-native plant species seeds (Pickering et al. 2010; Taylor et al. 2012; Rew et al. 2018). Indirectly, the natural quality of wilderness character in the FCRNRW and recommended wilderness areas could be impacted if recreation use spreads non-native plant species.

Mitigation measures of inspecting vehicles at the Stibnite Gold Logistics Facility prior to use and conducting monitoring surveys for 3 years after a disturbed area is seeded or planted would increase the potential for non-native plant species to be detected and treated. Surveys and implementing treatments decrease the potential for non-native plant species to spread into the FCRNRW. The effectiveness of the mitigation measures would vary depending on site conditions, invasive plant species characteristics, when surveys are conducted, and the size of the area needing treatment (Pearson et al. 2016).

In the long-term, the introduction of non-native plant species could change the composition of native plant communities. The potential for non-native plant species to spread depends on the specific characteristics and local site conditions (Zouhar 2003). Surveys and implementing treatments as described in the Frank Church-River of No Return Noxious Weed Prevention Plan and the Integrated Weed Management program for the Payette National Forest (PNF) and Boise National Forest (BNF) would reduce the potential for non-native plant species to spread. The extent non-native plant species could spread and the duration these species could persist in native plant communities is unknown. The natural quality of wilderness character would be impacted if non-native plant species became established within the FCRNRW or recommended wilderness areas.

Fish and Wildlife

During construction, operation, and closure and reclamation of Burntlog Route, vegetation removal and excavation of soil and rock could increase sediment load into Big Chief Creek tributaries and affect fish and aquatic habitat. Erosion control measures, such as sediment fencing, ditch checks, and other measures, would reduce erosion from the road into the tributaries. There could be a long-term risk to fish and aquatic habitats from the accidental spill of material, such as fuel or mine processing chemicals, where Burntlog Route crosses a Big Chief drainage tributary. The extent of impacts to aquatic habitat would be from the site of the spill downstream to the point of dilution. The measures included in the Spill Prevention, Control, and Countermeasure Plan would reduce the potential for a spill to reach downstream waters. Section 4.12.2.3.2.2, Fish Resources and Fish Habitat - Access Roads, Utilities, and Off-site Facilities, provides additional information.

In the short-term, the SGP would result in an estimated 104 AADT, including 65 mine-related vehicles, on Yellow Pine Route during the first 2 years of construction. The average distance where noise from mine vehicles would drop to 40 decibels on the A-weighted scale (dBA) is 190 feet. The average distance where noise would be 20 dBA is 0.8 mile. Noise from traffic on Yellow Pine Route could change wildlife migration in Tamarack Creek drainage during the first 2 years of mine site construction. Noise from an individual vehicle would be temporary; however, between 5:00 am and 7:00 pm, when most vehicles would use Yellow Pine Route, there would be approximately five mine-related vehicles per hour. Once constructed, mine-related traffic from the 68 AADT on Burntlog Route during the 12 years of mine operations could be audible for the same distance as vehicles on Yellow Pine Route. Noise and the number of vehicles on Burntlog Route could change wildlife distribution in Big Chief drainage. Sound from mine traffic during the mine closure and reclamation also would be audible within the FCRNRW;

however, with fewer mine vehicles using Burntlog Route, the daily duration of traffic sound could be less than during operation. Topography, weather, and natural sounds influence the distance noise can be heard. Noise impacts are discussed in Section 4.6, Noise.

Noise from the daily Burntlog Route maintenance could disturb wildlife and change their natural distribution. The extent of wildlife distribution changes is influenced by wildlife species sensitivity to noise, number of vehicles, and duration of human activity. Burntlog Route, which would be open to public use when other routes into the area are not available, could increase disturbance to wildlife species as the public could use the road at any time of day. Individuals in wildlife populations could become habituated to Burntlog Route noise and traffic during the 12 years of operation and 5 years of mine closure and reclamation. In the long-term, vehicles on Burntlog Route would likely change the distribution of species in the FCRNRW.

During the 2 years of Burntlog Route decommissioning and reclamation after mine closure, noise and human activity could disturb big game and sensitive wildlife species within the FCRNRW. Noise from these activities could be audible up to 2 miles from Burntlog Route, depending upon topography and weather (AECOM 2017, 2019). Recontouring slopes, spreading growth media, and seeding areas would be conducted in May through November. The average distance where noise from decommissioning Burntlog Route would drop to 40 dBA is approximately 1.2 miles, and the average distance where noise would be 20 dBA is 3 miles. Noise impacts from decommissioning Burntlog Route would last for a few weeks while decommissioning activities are conducted in a specific location. Once human activity and noise from decommissioning cease, habitat use in the FCRNRW by big game and disturbance-sensitive wildlife would return over time to natural distributions. Noise impacts are discussed in Section 4.6, Noise.

The extent within the FCRNRW where wildlife could be disturbed or areas where wildlife would avoid is unknown. Lights from mine operation and vehicle lights on Burntlog Route could be visible within the upper elevations of Big Chief Creek within the FCRNRW. Noise and lights could disturb sensitive wildlife species. However, over time, some individuals could become habituated to noise, lights, and human activity. The natural quality of wilderness character would be impacted where wildlife distribution changes within the FCRNRW.

A new transmission line would be constructed from the new Johnson Creek substation to the mine site under all action alternatives. Raptors could use the new transmission line and mine site distribution line structures as perches, which can expose them to electrocution risks (Eccleston and Harness 2018). Raptor species with home ranges that include portions of the FCRNRW, or recommended wilderness areas could perch and forage from transmission line structures. There could be raptor mortality from electrocution or collisions with transmission line structures, indirectly reducing the number of raptors in the FCRNRW or recommended wilderness areas. The transmission line structures would be designed and constructed to meet the Avian Power Line Interaction Committee recommended raptor-protection recommendations to avoid raptor perching. Power structures with the Avian Power Line Interaction Committee recommended raptor-protection would reduce the risk of raptor mortality. The natural quality of wilderness character would be impacted if there was a decline in raptor populations from mortality caused by the transmission line.

Air and Water

The SGP would result in emissions listed in **Table 4.23-1** that could affect air quality in the FCRNRW. The predicted emissions of pollutants from within the Operations Area Boundary into the FCRNRW, as discussed in Section 4.3, Air Quality, including ozone precursors (e.g., nitrogen oxides and volatile organic compounds) would be below the National Ambient Air Quality Standards (NAAQS) thresholds. The potential deposition of nitrogen, mercury, and sulfur in the FCRNRW also were predicted to be below analysis thresholds outside the Operations Area Boundary. **Figure 2.3-1**, Alternative 1 Overview of Proposed Action, shows the Operations Area Boundary and the boundary of the FCRNRW.

Table 4.23-1 Air Quality Analysis Modeled Pollutants Outside the Operations Area Boundary

Pollutant	Below NAAQS
Hg (mercury)	Yes
CO (carbon monoxide)	Yes
NO_X (Nitrogen oxides)	Yes
NO_2 (Nitrogen dioxide)	Yes
SO_X (Sulfur oxides)	Yes
SO_2 (Sulfur dioxide)	Yes
PM_{10} (particulate matter less than 10-micron diameter)	Yes
$PM_{2.5}$ (particulate matter less than 2.5-micron diameter)	Yes
TSP (Total suspended particulate)	Yes
HAP (hazardous air pollutant)	Yes
VOC (volatile organic compounds)	Yes

Table Source: Air Sciences 2018

Table Notes:

NAAQS = National Ambient Air Quality Standards

The predicted regional haze from operations outside the Operations Area Boundary to 31 miles, which is within the FCRNRW, would be less than a 5 percent change in current conditions. Visibility of the landscape within the FCRNRW within 31 miles from the Operations Area Boundary would not be impaired.

Plumes from emissions sources during mine operation could be visible within the FCRNRW; however, when and where the plume is visible depends on topography, weather conditions, and time of day. The mine site emission sources are in a valley, and the intervening topography influences the plume’s visibility within the FCRNRW. In the long-term, the natural quality of wilderness character within the FCRNRW would be impacted where and when plumes from emissions are visible.

The potential exists for increased runoff, erosion, and sedimentation from vegetation removal and surface disturbance, which could result in increased sediment load in streams. Proposed mine site facilities would be constructed and operated in watersheds that do not contain tributaries that enter the FCRNRW. Widening approximately 1.3 miles of Meadow Creek Lookout Road (FR 51290) for construction of the Burntlog Route would remove vegetation and disturb soils from areas located 170 to 300 feet from the FCRNRW boundary. Where vegetation would be removed, and surface disturbance is upgradient to the FCRNRW boundary, sediment could be deposited into headwater tributaries to Big Chief Creek. Sediment deposition in streams within 300 feet of Burntlog Route could increase relative to existing conditions (Watson 2000). The amount of sediment that could be deposited is influenced by slopes, soil, surface roughness, and vegetation. Stormwater pollution protection measures and interim reclamation would reduce the potential for sediment deposition into Big Chief Creek tributaries within the FCRNRW. Interim reclamation would establish vegetation cover indirectly reducing erosion. In the short-term, the natural quality of wilderness character within the FCRNRW could be impacted if SGP activities along Burntlog Route resulted in increased sediment deposition in the headwater tributaries.

Ecological Processes

Under Alternative 1, widening approximately 21 miles of existing roads (Meadow Creek Lookout Road [FR 51290], Thunder Mountain Road (FR 50375), and Burnt Log Road [FR 447]) could indirectly increase recreation use within the FCRNRW as a result of improved access. The connection of Burntlog Route to Meadow Creek Lookout Road (FR 51290) could indirectly increase recreation use and duration of recreation activities within areas of the FCRNRW accessed from these roads. If recreation use increased, people and pack animals could compact soils, indirectly increasing erosion potential on portions of trails within the FCRNRW. The intensity of the effect on ecological processes from increased recreation use within the FCRNRW is influenced by site conditions, vegetation, and the duration of use at a specific site.

The number and size of vehicles using Burntlog Route for mine operation and closure and reclamation could result in wilderness visitors avoiding areas of the FCRNRW. Wilderness visitor’s avoidance could indirectly increase recreation use in recommended wilderness areas or other areas of the FCRNRW, such as Big Creek. The increase in recreation use could result in areas where human influence impedes the free play of natural forces or interferes with natural processes in localized areas of the FCRNRW and recommended wilderness areas. Depending upon the magnitude, there could be long-term local changes in ecological processes within the FCRNRW and recommended wilderness areas. The natural quality of wilderness character could be impacted where there are changes in ecological processes.

4.23.1.2.1.3 Undeveloped

Under Alternative 1, no additional structures would be constructed, or SGP-related mechanical transport used, within the FCRNRW or recommended wilderness areas. Changes in Valley

County road maintenance or groomed over-snow vehicle routes would not include roads or routes within or adjacent to recommended wilderness areas. The construction, operation, closure and reclamation of proposed facilities would not change infrastructure within the FCRNRW or recommended wilderness areas. The undeveloped quality of wilderness character would remain unchanged relative to existing conditions within the FCRNRW and the recommended wilderness areas.

4.23.1.2.1.4 Solitude, Remoteness, and Primitive Recreation Opportunities

The opportunities for solitude, remoteness, and primitive recreation within the FCRNRW and recommended wilderness areas could be indirectly affected by mining facilities and access roads outside of the FCRNRW and changes in wilderness visitation. Weather, topography, and vegetation influence the distance sounds would be audible and lights visible within the FCRNRW.

Noise from mine related vehicles on Yellow Pine Route during construction could decrease remoteness and increase the evidence of humans in Tamarack Creek drainage adjacent to the roadBurntlog Route would decrease remoteness and increase the evidence of humans within Big Chief Creek drainage during construction, operation, and closure and reclamation. Burntlog Route cut and fill slopes, very high frequency (VHF) access roads, and mine operation lighting could be visible to wilderness visitors within Big Chief drainage, Summit trail, and at higher elevations within the FCRNRW. Sounds from the construction, operation, and daily maintenance of Burntlog Route also could be audible in these areas. As the visitor ventures further into the FCRNRW, the effects on solitude, remoteness, and primitive recreation opportunities could lessen. Where visible, cut and fill slopes and changes in vegetation structure could provide wilderness visitors a sense of their location in relation to the FCRNRW boundary.

During Burntlog Route decommissioning and reclamation, the duration of sound from recontouring slopes and seeding areas would be temporary, as activities would be completed within a few days or weeks at any given location. While the cut and fill slopes would be seeded during reclamation, the change in vegetation structure could be visible from areas within the FCRNRW for decades.

The duration would be greatest in areas where cut slopes remain after decommissioning Burntlog Route or where trees are removed during construction.

Burntlog Route would change motorized access to several trailheads/trails leading into the FCRNRW. Indirectly, Burntlog Route could increase the number of wilderness visitors and the duration of recreation in the FCRNRW. The potential for recreation use to increase is unknown; however, once constructed, the public could use Burntlog Route for approximately 18 years. Visitor encounters at trailheads/trails within the analysis area of the FCRNRW wilderness could increase due to the widening of Burnt Log Road (FR 447) and Meadow Creek Lookout Road (FR 51290) as part of Burntlog Route. Some of the 500 mine workers could visit areas of the FCRNRW adjacent to the approximately 8,000-acre Operations Area Boundary. **Figure 2.3-1**, Alternative 1 Overview of Proposed Action, shows the operations boundary and the boundary of the FCRNRW.

The number and size of vehicles transporting supplies to the mine site on Yellow Pine Route and Burntlog Route could deter some visitors from the FCRNRW. The number of vehicles and delays due to construction and maintenance activities could indirectly increase recreation use in recommended wilderness areas or other areas of the FCRNRW. During construction, operations, and closure and reclamation, wilderness visitors would need to travel further into the FCRNRW or recommended wilderness areas to attain solitude, remoteness, and primitive recreation opportunities.

4.23.1.2.2 ALTERNATIVE 2

Under Alternative 2, the construction of proposed mine facilities, access roads, the off-highway vehicle (OHV) trail, and the new transmission line would have the same effect on wilderness character as Alternative 1. Operating the water treatment plant at the mine site and the new transmission line in perpetuity would not be visible or audible from the FCRNRW. The differences between Alternatives 1 and 2 where there is a measurable effect on designated wilderness and recommended wilderness areas include:

Burntlog Route, Riordan Creek Segment – A 5.3-mile segment of the Burntlog Route would be re-routed to the south, higher up in the Riordan Creek drainage, where it would cross Riordan Creek north of Black Lake.

Public Access through the mine site – Public access through the mine site from Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) during mining operations would be provided by constructing a 12-foot-wide gravel road (one of two options) to connect Stibnite Road to Thunder Mountain Road. The route would be open to all vehicles year-round.

Limestone Processing – Lime and crushed limestone would be produced on-site from mining a limestone formation in the West End pit.

4.23.1.2.2.1 Untrammeled

Under Alternative 2, mine operation, off-site facilities, and the new transmission line would have the same impact on the untrammeled quality of wilderness character. Constructing Burntlog Route closer to the FCRNRW boundary could increase areas where noise and lights could be audible and visible within the Big Chief Creek drainage. The ridge between Burntlog Route cut and fill slopes and the FCRNRW boundary would influence noise intensity and block where headlights from vehicles on Burntlog Route could be visible within the FCRNRW. The effects on soundscapes, natural dark skies, and natural wildlife distribution within the FCRNRW would be the same as Alternative 1. Changing the location of Burntlog Route in the Riordan Creek drainage could increase the area within the Big Chief Creek drainage where noise and lights from vehicles are audible or visible.

4.23.1.2.2.2 Natural

Plants

Under Alternative 2, mine operation, off-site facilities, and the new transmission line would have the same impact on the untrammeled quality of wilderness character. Constructing Burntlog Route closer to the FCRNRW boundary could increase the potential for non-native plants to become established within the FCRNRW. Within the headwaters of Riordan Creek, Burntlog Route cut and fill slopes would be approximately 100 feet from the FCRNRW boundary. This approximately 5.3-mile-long segment of Burntlog Route is downslope of the FCRNRW boundary. This shorter distance between disturbed areas and the wilderness could increase the risk of non-native plant species spreading into the FCRNRW. The two public access roads through the mine site and the decreased number of mine vehicles on Burntlog Route under Alternative 2 could indirectly increase recreation use in the FCRNRW.

Either of the two public access road options through the mine site would be open to all vehicles year-round. Public use is expected to be seasonal, because the destination areas for the public are generally inaccessible between December and May. Forest visitors could access public lands beyond the mine site and adjacent to Monumental Summit from the village of Yellow Pine. Recreation equipment and vehicles could disperse non-native plant species. The potential increase in recreation use under Alternative 2 either on Burntlog Route or the public access road options is unknown. Where established, non-native plant species would have a long-term effect on vegetation communities within the FCRNRW. Mitigation measures to survey and implement treatments would reduce the potential for non-native plant species to spread. The natural quality of wilderness character could decrease within the Big Chief Creek drainage.

Fish and Wildlife

The production of lime at the mine site would reduce the number of mine vehicles using Burntlog Route during the approximately 12 years of operation. Fewer mine vehicles using Burntlog Route, estimated at 50 AADT under Alternative 2, could reduce the disturbance of big game and sensitive wildlife species. However, less mine-related traffic and the proximity of Burntlog Route to the FCRNRW could indirectly increase recreation use of the area. Constructing Burntlog Route closer to the ridge on the FCRNRW boundary could increase dispersed recreation use, both in areas adjacent to the FCRNRW and within Big Chief Creek drainage within the FCRNRW. If recreation use in the FCRNRW increases, the duration, and extent where wildlife distribution changes, either from vehicles or increased human activity, could increase. The extent where big game and sensitive wildlife species habitats within the FCRNRW are avoided by wildlife could increase. Traffic and plowing on Stibnite Road from Yellow Pine to the mine site, when audible, could change wildlife distribution in Tamarack Creek drainage. The extent where habitat within the FCRNRW could be avoided is unknown. The natural quality of wilderness character could decrease within the Big Chief Creek drainage.

Air and Water

The effects on air and water within the FCRNRW and recommended wilderness would be the same as Alternative 1. The mining and hauling of limestone and operation of the lime generation plant would increase air emissions in the analysis area. Emissions from the on-site generation of lime and the increased number of propane deliveries could increase sulfur dioxide emissions. However, emissions would be below NAAQS thresholds, and potential impacts on air quality as a component of the natural quality of wilderness character would be the same as Alternative 1.

The reduction in mine traffic on Burntlog Route from 68 to 50 vehicles per day on average could reduce the amount of dust generated; however, there could be an increase in vehicles from public recreation. Dust abatement mitigation measures on Burntlog Route would decrease the generation of fugitive dust from vehicles, although some dust deposition could occur on plants within the FCRNRW.

The 5.3 miles of Burntlog Route in the Riordan Creek drainage would be located within 100 feet of the FCRNRW boundary. Although this road segment would be close to the wilderness boundary, a ridge separates it from streams in the FCRNRW. Surface water flow and sediment from this section of Burntlog Route would not deposit to headwater tributaries within the FCRNRW. Air and water quality within the FCRNRW and recommended wilderness areas would be the same as Alternative 1. Potential impacts on water quality as a component of the natural quality of wilderness character would be the same as Alternative 1.

Ecological Processes

Under Alternative 2, the two public access road options through the mine site and the decreased number of mine vehicles on Burntlog Route could indirectly increase recreation use in the FCRNRW. The two public access road options would be open to all vehicles year-round. Forest visitors would have motorized access to public lands beyond the mine site and adjacent to Monumental Summit from Yellow Pine. Public access road use through the mine site is expected to be seasonal due to snow cover between December and May, or later in the year. Operation of the lime kiln at the mine site would decrease mine- related traffic on Burntlog Route. During the 12 years of operation, mine-related traffic on Burntlog Route would be 50 AADT. The decreased number of mine-related vehicles and the public access roads through the mine site could increase recreation use on Burntlog Route and adjacent trails within FCRNRW. Recreation equipment and vehicles could disperse non-native plant species. The potential increase in recreation use under Alternative 2, either on Burntlog Route or the public access road options, is unknown. If recreation use in areas of the FCRNRW adjacent to Burntlog Route increased, there could be a loss of natural ecological processes where non-native plant species become established, and wildlife is disturbed.

4.23.1.2.2.3 Undeveloped

Under Alternative 2, within the FCRNRW or recommended wilderness areas, no additional structures would be constructed, or SGP-related mechanical transport used. Changes in Valley County road maintenance or groomed over-snow vehicle routes would not include roads or routes within or adjacent to recommended wilderness areas. The undeveloped quality of wilderness character within the FCRNRW and the recommended wilderness areas would be the same as Alternative 1.

4.23.1.2.2.4 Solitude, Remoteness, and Primitive Recreation Opportunities

Under Alternative 2, the two public access road options, the change in the location of Burntlog Route, and the lime kiln operation could increase recreation use within the FCRNRW. During the 12 years of operation, the two public access road options would be open to all vehicles year-round. Usage is expected to be seasonal because the destination areas for the public are generally inaccessible between December and May due to snow cover, with some areas such as Monumental Summit not accessible until June or early July. Forest visitors would have motorized access to public lands beyond the mine site and adjacent to Monumental Summit from Yellow Pine. The public access road options could increase the number of wilderness visitors. Forest visitors seeking solitude in Monumental Creek and Big Chief Creek may need to venture further into the FCRNRW. Operation of the lime kiln would reduce the number of mine-related vehicles to 50 AADT and locating 5.3 miles of Burntlog Route closer to the FCRNRW boundary could indirectly increase recreation use. Decreasing mine-related traffic and the proximity of Burntlog Route to the FCRNRW could indirectly increase the number of wilderness visitors and the seasons of use in the FCRNRW. Decreasing the distance between Burntlog Route within the Riordan Creek drainage and the wilderness boundary could increase the areas where the sounds and lights are audible or visible within the FCRNRW. Increases in recreation use and areas where noise and lights from human activity are audible or visible would reduce the area with opportunities for solitude, remoteness, and primitive recreation. Traffic and plowing on Stibnite Road from Yellow Pine to the mine site, when audible, would reduce opportunities for solitude in Tamarack Creek drainage. During construction, operations, and closure and reclamation there would be less area within the FCRNRW or recommended wilderness areas where solitude, remoteness, and primitive recreation opportunities quality of wilderness character would be available.

4.23.1.2.3 ALTERNATIVE 3

Under Alternative 3, the construction of proposed mine facilities, access roads, and the new transmission line would have the same effect on wilderness character as Alternative 1. The differences between Alternatives 1 and 3 where there is a measurable effect on designated wilderness and recommended wilderness areas include:

Public Access through the mine site – The OHV trail would not be constructed and, during the 12 years of mine operation, there would be no public access roads through the mine site.

Public Access after mine closure – Public access options after mine closure would either consist of a new road segment in the East Fork of Meadow Creek (Blowout Creek) or converting a Tailings Storage Facility (TSF) operation road in the East Fork South Fork Salmon River (EFSFSR) drainage to a public access road.

4.23.1.2.3.1 Untrammeled

Under Alternative 3, mine operation, off-site facilities, and the new transmission line would have the same impact on the untrammeled quality of wilderness character as those described for Alternative 1. The potential changes to soundscapes, natural dark skies, and natural wildlife distribution within the FCRNRW would be the same as Alternative 1. Under Alternative 3, the untrammeled quality of wilderness character could be impacted in the same areas where there are changes to soundscapes or natural dark sky conditions in the FCRNRW. The area where there are potential impacts on the untrammeled quality of wilderness character would be the same as Alternative 1.

4.23.1.2.3.2 Natural

Plants

Motorized public access to areas of the FCRNRW adjacent to Burntlog Route would be the same as Alternative 1. Not constructing the OHV trail and no public access through the mine site for 12 years during operation could indirectly decrease recreation use within the FCRNRW. During the 12 years of operation, the 38.2 mile-long Burntlog Route would provide access to trails within Monumental Summit drainage; however, the estimated 36-mile drive from Landmark and the number and size of mine related vehicles on Burntlog Route could decrease recreation use due to the longer drive to access the FCRNRW. If recreation use in the FCRNRW decreases, the risk of non-native plant species becoming established within the FCRNRW also would be less.

Decreased recreation use could help retain the existing vegetation conditions within the FCRNRW (Rew et al. 2018). Recreation use in the Monumental Creek area and adjacent areas of the FCRNRW would still occur; however, surveys and implementing treatments as described in the Frank Church-River of No Return Noxious Weed Prevention Plan could reduce the potential for non-native plant species to spread. The natural quality of wilderness character would be impacted if non-native plant species became established within the FCRNRW or recommended wilderness areas.

Fish and Wildlife

Although a segment of Burntlog Road would be closer to the FCRNRW, the road is downslope of the boundary. Potential effects on fish habitat within the FCRNRW would be the same as Alternative 1.

Motorized public access to areas of the FCRNRW adjacent to Burntlog Route would be the same as Alternative 1. Constructing the EFSFSR TSF and DRSF would cover a segment of Thunder Mountain Road (FR 50375) during the second year of construction. Motorized public access to trailheads in the Monumental Creek drainage would not be available until the construction of Burntlog Route is completed. Not constructing the OHV trail and no public access through the mine site for 12 years could indirectly decrease motorized recreation use on Thunder Mountain Road (FR 50375) and Meadow Creek Lookout Road (FR 51290) while

Burntlog Route is constructed. The construction of Burntlog Route could indirectly decrease recreation use in portions of the FCRNRW and the disturbance of big game or sensitive wildlife species in Monumental Creek and Big Chief Creek drainages. The potential decrease in recreation use within the Monumental Creek drainage and the adjacent FCRNRW is unknown.

Air and Water

The effects on air and water within the FCRNRW and recommended wilderness from emissions during mine operations would be the same as Alternative 1. Where and when plumes from mine site emissions are visible or where sediment is deposited into headwater tributaries to Big Chief Creek would be the same as Alternative 1. Impacts on the natural quality of wilderness character within the FCRNRW would be the same as Alternative 1.

Ecological Processes

Motorized public access to areas of the FCRNRW adjacent to Burntlog Route would be the same as Alternative 1. Under Alternative 3, not constructing the OHV trail and no public access through the mine site for construction, operations, and closure and reclamation could indirectly decrease motorized recreation use on Thunder Mountain Road (FR 50375) and Meadow Creek Lookout Road (FR 51290).

Constructing the EFSFSR TSF and DRSF would cover a segment of Thunder Mountain Road during the second year of construction. Motorized public access to trailheads in the Monumental Creek drainage would not be available until the construction of Burntlog Route is completed. Indirectly, changes in public access while Burntlog Route is constructed could reduce recreation use and help retain natural ecological processes within FCRNRW Monumental and Big Chief Creek drainages.

However, during the 12 years of operation, the Operations Area Boundary closure and no public access through the mine site could displace wilderness visitors. Indirectly, displaced wilderness visitors could increase recreation use in recommended wilderness areas or other areas of the FCRNRW such as Big Creek. Increased recreation use could increase the risk of non-native plant species becoming established, disturbance of big game, and sensitive wildlife species within recommended wilderness areas. If recreation use increases, there could be a long-term change in natural ecological processes within recommended wilderness areas. The potential increase in recreation use in recommended wilderness areas or other areas of the FCRNRW is unknown. Under Alternative 3, the impacts on the natural quality of wilderness character from changes in ecological processes could be the same as Alternative 1.

4.23.1.2.3.3 Undeveloped

The effects on the undeveloped quality of wilderness character within the FCRNRW and recommended wilderness areas would be the same as those described under Alternative 1.

4.23.1.2.3.4 Solitude, Remoteness, and Primitive Recreation Opportunities

Under Alternative 3, no additional structures would be constructed, or SGP-related mechanical transport used, within the FCRNRW or recommended wilderness areas. Changes in Valley County road maintenance or groomed over-snow vehicle routes would not include roads or routes within or adjacent to recommended wilderness areas. Some of the 500 mine workers could visit areas of the FCRNRW adjacent to the Operations Area Boundary. **Figure 2.5-1** shows the Operations Area Boundary and the boundary of the FCRNRW.

4.23.1.2.4 ALTERNATIVE 4

Under Alternative 4, the construction of proposed mine facilities and the new transmission line would be the same as Alternative 1. The differences between Alternatives 1 and 4 where there is a measurable effect on designated wilderness and recommended wilderness areas include:

- **Yellow Pine Route –** Under Alternative 4, access to the mine site would be via Yellow Pine Route, and the SGP's construction phase would be 5 years. During the construction phase, the Stibnite Road section of McCall-Stibnite Road (CR 50-412) from the village of Yellow Pine to the mine site would require daily temporary road closures from 10:00 AM to 4:00 PM, and temporary closures of Yellow Pine Route during road maintenance activities also could be necessary during the 12 years of mine operation (Parametrix 2018). The Johnson Creek Road (CR 10-413) also could be closed for 1 year during construction (see Section 4.16.2.4.1, Access and Transportation - Construction).
- **Public Access through the mine site** – Public access through the mine site from Stibnite Road to Thunder Mountain Road (FR 50375) during mining operations would be provided by constructing a 12-foot-wide gravel road to connect Stibnite Road to Thunder Mountain Road. The route would be open to all vehicles year-round.
- **VHF construction** – VHF towers in inventoried roadless areas (IRAs) would be constructed using helicopters.

4.23.1.2.4.1 Untrammeled

Under Alternative 4, mine operation, off-site facilities, and the new transmission line would have the same impact on the untrammeled quality of wilderness character as those described for Alternative 1. The potential changes to soundscapes, natural dark skies, and natural wildlife distribution within the FCRNRW from the mine site operation and closure and reclamation phases would be the same as those described under Alternative 1. Sky glow visible within the FCRNRW during operation would be the same as Alternatives 1.

Using Yellow Pine Route for mine access would require improvements to Johnson Creek Road and widening/reconstructing Stibnite Road from the village of Yellow Pine to the mine site. The duration of the mine construction phase would increase to 5 years (instead of 3 years). Under Alternative 4, the number of vehicles on Stibnite Road as part of the Yellow Pine Route would increase to 104 AADT during mine construction and 107 AADT during mine operation. Traffic volumes on Stibnite Road would be approximately 2.6 times the existing AADT of 39 vehicles. Construction and road maintenance on Yellow Pine Route could reduce the number of forest and wilderness visitors in areas of the FCRNRW where access is from Stibnite Road or Thunder Mountain Road and increase recreation use in recommended wilderness areas near these roads. After mine closure, improvements to Stibnite Road could increase recreation use in Tamarack Creek drainage of the FCRNRW if road conditions influence wilderness visitors.

The disturbance of wildlife species from dispersing into or from habitats adjacent to Yellow Pine Route could be a long-term effect. The volume of traffic during mine construction and operation could change the natural distribution of wildlife within the Tamarack Creek drainage (Idaho Department of Fish and Game 2019). The extent of effects on wildlife distribution would be less because the Burntlog Route would not be constructed or used. However, the intensity of the effect on wildlife distribution within Tamarack Creek could be greater, because there would be increased traffic for 17 years during construction and operation. Under Alternative 4, the untrammeled quality of wilderness character could be impacted in the Tamarack Creek drainage of the FCRNRW.

4.23.1.2.4.2 Natural

Plants

Using Yellow Pine Route as the mine access road could reduce motorized recreation use on Thunder Mountain Road and Meadow Creek Lookout Road. Delays on the public access road option through the mine site and the increase in size and number of mine-related vehicles on Yellow Pine Route could decrease recreation use within the FCRNRW. Decreased recreation use could indirectly reduce the risk of non-native plant species becoming established within the FCRNRW. During mine closure and reclamation, surface disturbance from recontouring slopes, seeding and planting areas disturbed by mine facilities, and stream relocation would be 1 mile or more from the FCRNRW boundary. The increased distance between areas disturbed during recontouring and areas where the seed mix includes non-native annual plant species would decrease the potential for changes to vegetation communities within the FCRNRW. Reclamation of disturbed areas, which involve revegetation on NFS lands, would be done according to Payette or Boise Forest Plan Standards and in coordination with a Forest botanist. This could help retain the existing vegetation conditions within the FCRNRW. The natural quality of wilderness character within the FCRNRW could be the same as existing conditions.

However, if recreation use in recommended wilderness areas near the South Fork Salmon River increases, the spread of non- native plant species also could increase. Mine related traffic on Yellow Pine Route could result in forest visitors avoiding areas of the FCRNRW accessed from trailheads along Stibnite Road, such as Missouri Ridge. This could indirectly increase recreation use in recommended wilderness areas and other trails in the FCRNRW. Changes in recreation use could increase the potential for non-native plant species to spread into recommended wilderness areas or other areas of the FCRNRW. Surveys and implementing treatments, as described in the Integrated Weed Management program for the PNF and BNF, would reduce the potential for non-native plant species to spread. The natural quality of wilderness character within the recommended wilderness areas would be impacted if there was an increase in non-native plant species populations.

Fish and Wildlife

There could be a long-term risk to fish and aquatic habitats from the accidental spill of material, such as fuel or mine processing chemicals, where Yellow Pine Route is adjacent to or crosses streams. If a spill occurred and material entered a stream, there could be injury or mortality of fish and aquatic species, which could indirectly alter species distribution in portions of the FCRNRW Tamarack Creek drainage. The extent an accidental spill could affect aquatic species or fish habitat is unknown. The measures included in the Spill Prevention, Control, and Countermeasure Plan would reduce the extent of a spill in adjacent streams. Section 4.12.2.3.2.2, Fish Resources and Fish Habitat - Access Roads, Utilities, and Off-site Facilities, provides additional information.

Using Yellow Pine Route as the mine access road could reduce motorized recreation use on Thunder Mountain Road (FR 50375) and Meadow Creek Lookout Road (FR 51290). Delays on the public access road option through the mine site and the increase in size and number of mine-related vehicles on Yellow Pine Route could decrease recreation use within the FCRNRW. Decreased recreation use could reduce the disturbance of big game and sensitive wildlife species within the Monumental Creek and Big Chief Creek drainages within the FCRNRW. During mine closure and reclamation, surface disturbance from recontouring slopes, seeding, and planting areas disturbed at the mine site would be 1 mile or more from the FCRNRW boundary. The increased distance from the noise generated during mine closure activities and the FCRNRW boundary could reduce disturbance to big game species and sensitive wildlife within the Big Chief Creek drainage.

The increased number of vehicles on Stibnite Road during mine construction and operation could change the natural distribution of wildlife within the Tamarack Creek drainage (Idaho Department of Fish and Game 2019). The long-term effect on big game species could include reduced habitat quality and changes in the natural distribution of wildlife species within the Tamarack Creek drainage. The natural quality of wilderness character would be impacted in the areas where wildlife species change their migration patterns.

However, the volume of traffic and potential delays along Yellow Pine Route could result in forest visitors avoiding FCRNRW trailheads accessed from Stibnite Road. Indirectly, recreation use in recommended wilderness areas and other areas of the FCRNRW could increase. Changes in recreation use could increase disturbance of big game and sensitive wildlife species in recommended wilderness areas or other areas of the FCRNRW. The natural quality of wilderness character would be impacted in recommended wilderness areas where wildlife species change their migration patterns.

Air and Water

The effects on air and water within the FCRNRW and recommended wilderness from mine operation emissions would be the same as Alternative 1. The rate of sediment deposition into streams within the FCRNRW and recommended wilderness areas would be the same as existing conditions. Streams crossed by the Yellow Pine Route do not flow into the FCRNRW or the recommended wilderness areas.

Ecological Processes

Using Yellow Pine Route as the mine access road could reduce motorized recreation use on Thunder Mountain Road and Meadow Creek Lookout Road. Timing restrictions during the construction phase and road maintenance activities could deter wilderness visits to areas of the FCRNRW accessed from Monumental Creek. Decreased recreation use could reduce the potential for non-native plant species to be introduced from recreation equipment and vehicles (Rew et al. 2018). In the long-term, ecological processes within the FCRNRW would be the same as existing trends. The natural quality of wilderness character for ecological processes within the FCRNRW would be the same as existing conditions.

Indirectly, the volume and size of mine related traffic on Yellow Pine Route could indirectly increase recreation use in recommended wilderness areas. If recreation use in recommended wilderness areas increases due to forest visitors avoiding areas of the FCRNRW accessed from Yellow Pine Route, there could be an increase in the dispersal of non-native plant species. In the long-term, ecological processes would change in areas where non-native plant species become established. The number of forest visitors who might avoid areas of the FCRNRW accessed from Yellow Pine Route is unknown. The natural quality of wilderness character would be impacted in recommended wilderness areas where non-native plant species become established.

4.23.1.2.4.3 Undeveloped

Under Alternative 4, no additional structures would be constructed, or SGP-related mechanical transport used within the FCRNRW or recommended wilderness areas. The undeveloped quality of wilderness character would remain unchanged relative to existing conditions within the FCRNRW and the recommended wilderness areas.

4.23.1.2.4.4 Solitude, Remoteness, and Primitive Recreation Opportunities

The 104 to 107 AADT and potential delays on Yellow Pine Route during the construction and operation phases could decrease recreation use in the FCRNRW. Public access would be allowed through the mine site under Alternative 4 via a 12-foot gravel road that connects Stibnite Road to Thunder Mountain Road. During mine construction and operation, public access roads through the mine site would be temporarily closed during mining activities that are public safety hazards (e.g., high wall scaling, blasting). When the public access roads are closed due to mine operations, forest and wilderness visitors would not be able to use Thunder

Mountain Road to drive to Monumental or Lookout Mountain trailheads. During mine construction, public access roads and indirectly Thunder Mountain Road could be closed for 2 to 3 months.

Helicopters used to construct and maintain cell towers or VHF repeater sites located within IRAs could be audible in the FCRNRW. Helicopters would be used for a few hours during the day during construction and maintenance. Noise from helicopters could be audible in the Big Chief drainage and would temporarily reduce opportunities for solitude, sense of isolation and remoteness from sights and sounds of human activities.

During the 12 years of mine operation, public access roads could be closed for periods of five days to one month. Indirectly, this could increase recreation use in other areas of the FCRNRW and recommended wilderness areas. If recreation use increases, wilderness visitors would need to travel further into the FCRNRW or recommended wilderness areas to attain solitude, remoteness, and primitive recreation opportunities. The extent where roads adjacent to the FCRNRW boundary would be visible or audible would be the same as existing conditions.

4.23.1.2.5 Alternative 5

The use and character of the FCRNRW and recommended wilderness areas is expected to continue as projected in the Frank Church-River of No Return Wilderness Plan and the Payette and Boise Forest Plans. Under Alternative 5, none of the approved exploration activities would be conducted within the FCRNRW boundary or recommended wilderness boundaries. No measurable effects under Alternative 5 are anticipated on the untrammeled, natural, undeveloped, or solitude, remoteness, and primitive recreation opportunities qualities of wilderness character in the FCRNRW or recommended wilderness areas.

4.23.1.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold Idaho, Inc (Midas Gold) as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.23.1.4 Cumulative Effects

Past, present, and reasonably foreseeable future actions (RFFAs) include activities, developments, or events that have the potential to change the physical, social, economic, and/or biological nature of a specified area. For untrammeled, natural, undeveloped, and solitude, remoteness, and primitive recreation opportunities quality of wilderness character, the analysis area for cumulative effects includes NFS lands and projects in the Krassel and McCall Ranger Districts.

The following RFFAs have been identified that, in conjunction with the development of the SGP, could contribute to cumulative effects on the untrammeled, natural, and solitude, remoteness, and primitive recreation qualities of wilderness character.

- Morgan Ridge Exploratory Drilling[1]
- South Fork Restoration and Access Management Plan (RAMP)
- East Fork South Fork Recreation Access Management Plan
- Big Creek Hazardous Fuels Reduction Project

4.23.1.4.1 Alternatives 1, 2, and 3

Untrammeled

Under Alternative 1, 2, and 3, the increase in human activity during the implementation of the RFFAs and construction and operation of the mine-related facilities could change the natural distribution of wildlife and plants. Increased human activity from project or recreation activities could change wildlife distribution into or from the FCRNRW or recommended wilderness areas. The extent where noise from these activities could change the natural distribution of wildlife would vary depending upon the season activities were implemented, duration, topography, and weather. The potential for non-native plant species establishment could increase. Surveys and treatments for non-native invasive species are ongoing in the cumulative impact analysis area. Each project is reviewed or surveyed for protected plant species and mitigation is developed where any of these species are found.

The RFFAs would be implemented during daylight hours on weekdays, limiting the extent and duration of potential changes to wildlife distribution. Surveys and implementing treatments as described in the Frank Church-River of No Return Noxious Weed Prevention Plan and the Integrated Weed Management program for the PNF and BNF would reduce the spread of non-native plant species. As such, Alternatives 1, 2, and 3, in combination with the RFFAs, could cumulatively impact the untrammeled quality of wilderness character.

Natural

Plants

The activities from the RFFAs and Alternatives 1, 2, and 3 would result in additional land disturbance. The potential for non-native plant species establishment could increase either from project activities or from changes in recreation use. These effects have or would occur primarily

[1] Morgan Ridge Exploratory Drilling is currently on hold.

along the western boundary of the FCRNRW near the Idaho-Valley County border and Logan Creek, or the recommended wilderness areas west of the South Fork Salmon River. The potential for an increase in non-native plant species to establish with FCRNRW or recommended wilderness would be influenced by existing vegetation, site conditions, and non-native plant species characteristics. The extent where non-native plant species could become established is unknown. Surveys and implementing treatments as described in the Frank Church-River of No Return Noxious Weed Prevention Plan and the Integrated Weed Management program for the PNF and BNF would reduce the spread of non-native plant species. As such, Alternatives 1, 2, and 3 would cumulatively impact natural quality of wilderness character where non-native plant species become established.

Fish and Wildlife

Construction, operation, and decommissioning SGP facilities, including Burntlog Route and the RFFAs, would disturb sensitive wildlife species within the FCRNRW and recommended wilderness areas. These actions could increase wildlife mortality from vehicles. The extent where the natural wildlife distribution and movement could change or increase in mortality is unknown. A cumulative impact to the natural quality of wilderness character would occur where there is a decrease in wildlife habitat quality, an impact on wildlife distribution, or mortality from vehicles.

The South Fork and East Fork RAMPs in combination with Alternatives 1, 2, and 3 could reduce sediment in the South Fork Salmon River drainage and barriers to fish passage. Reducing sediment in the drainage would improve water quality and indirectly fish habitat quality.

Replacing culverts could reduce barriers to fish passage and improve aquatic species habitat connectivity within the South Fork Salmon River drainage. Long-term improvements to fish habitat quality could increase fish populations in the South Fork Salmon River drainage. The increase in fish populations in a specific stream is unknown. The natural quality of wilderness character could improve where sediment load in streams decline and barriers to fish passage are removed.

Solitude, Remoteness, and Primitive Recreation Opportunities

Under Alternatives 1, 2, and 3, the extent that wilderness visitors see or hear human activities could cumulatively increase. The extent where noise from human activity within the FCRNRW and recommended wilderness areas is influenced by topography and weather. The duration of increased noise from the RFFAs and project activities would be temporary as implementing the RFFAs would be completed in 10 days to several months in a specific area during weekdays. A temporary cumulative impact on solitude, remoteness, and primitive recreation opportunities quality of wilderness character would occur.

4.23.1.4.2 ALTERNATIVE 4

Untrammeled

Under Alternative 4, implementing the South Fork RAMP, East Fork RAMP, and Big Creek Hazardous Fuel Reduction projects could increase human activity during construction and operation of the proposed SGP. Increased human activity from project or recreation activities could change wildlife distribution into or from recommended wilderness areas and the Big Creek drainage within the FCRNRW. The extent where noise from human activity changes the natural distribution of wildlife would vary depending upon the season the activities were implemented, the duration of human activity, topography, and weather. This would result in additional disturbance and could cumulatively increase the potential for non-native plant species establishment.

The RFFAs would be implemented during daylight hours on weekdays, limiting the extent and duration of potential changes to wildlife distribution. Surveys and implementing treatments as described in the Frank Church River of No Return Noxious Weed Prevention Plan and the Integrated Weed Management program for the PNF and BNF would reduce the spread of non-native plant species. As such, Alternative 4 could cumulatively impact the untrammeled quality of wilderness character.

Natural

Plants

Alternative 4 and the RFFAs would result in additional disturbance and could increase the potential for non-native plant species establishment, either from project activities or from changes in recreation use. These effects have or would occur primarily along the western boundary of the FCRNRW near the Idaho-Valley County border and Logan Creek, or the recommended wilderness areas west of the South Fork Salmon River. The potential for an increase in non-native plant species to establish within FCRNRW or recommended wilderness would be influenced by existing vegetation, site conditions, and the non-native plant species characteristics. The extent where non-native plant species could become established is unknown. Surveys and implementing treatments as described in the Frank Church-River of No Return Noxious Weed Prevention Plan and the Integrated Weed Management program for the PNF and BNF would reduce the spread of non-native plant species. As such, Alternatives 4 and the RFFAs would cumulatively impact natural quality of wilderness character where non-native plant species become established.

Fish and Wildlife

Construction, operation, and decommissioning project facilities and the RFFAs would disturb sensitive wildlife species within the FCRNRW and recommended wilderness areas. These actions could increase wildlife mortality from vehicles. The extent where the natural wildlife distribution and movement could change or increase in mortality is unknown. The natural quality of wilderness character would have a cumulative impact where there is a decrease in wildlife habitat quality, distribution, or mortality from vehicles.

The South Fork and East Fork RAMPs and Alternative 4 could reduce sediment in the South Fork Salmon River drainage and barriers to fish. Reducing sediment in the South Fork Salmon River drainage would improve water quality and indirectly fish habitat quality. Replacing culverts could reduce barriers to fish passage and improve aquatic species habitat connectivity. Long-term improvements to fish habitat quality could increase fish populations in the South Fork Salmon River drainage. The increase in fish populations in a specific stream is unknown. The natural quality of wilderness character could improve where sediment load in streams declined, and barriers to fish passage were removed. Reductions in stream sediment load could be offset with the use of Yellow Pine Route for mine access.

Solitude, Remoteness, and Primitive Recreation Opportunities

Alternative 4, in combination with the RFFAs, could increase the extent where wilderness visitors see or hear human activities. If recreation increased in the FCRNRW and recommended wilderness areas, there could be an increase in traffic on roads also used to implement the RFFAs. Increased traffic could change the soundscape, increasing the area where noise from vehicles would be audible within the FCRNRW or recommended wilderness areas. The extent where noise from human activity within the FCRNRW and recommended wilderness areas is influenced by topography and weather. The duration of increased noise from the RFFAs and project activities would be temporary as implementing the RFFAs would be completed in 10 days to several months in a specific area during weekdays. A temporary cumulative impact on solitude, remoteness, and primitive recreation opportunities quality of wilderness character would occur.

4.23.1.4.3 ALTERNATIVE 5

Under Alternative 5, none of the action alternatives would be implemented, and no development of the mine site or supporting facilities would occur or be introduced. Topography and the distance of between the FCRNRW and human activity at the mine site and locations of the RFFAs would not measurably change the untrammeled, natural, undeveloped, or solitude, remoteness, and primitive recreation opportunities quality of wilderness character compared to existing conditions.

4.23.1.5 Irreversible and Irretrievable Commitments of Public Resources

Under Alternatives 1, 2, and 3, Burntlog Route would be used by mine related traffic and open to public use for approximately 18 years. Motor vehicles on Burntlog Route would increase the potential for non-native plant species to spread into the FCRNRW and disturb wildlife relative to existing conditions. Under these Alternatives, surveys conducted for 3 years after a disturbed area is seeded or planted, and treatment of non-native plant species could reduce the extent of spreading. If treatments of non-native plant species are successful, vegetation composition and structure could provide high-quality wildlife habitat over years or decades. The extent of and locations where non-native plant species could establish is unknown, but the most likely areas are along rights-of-way (ROWs) and access roads. Irretrievable effects on the natural quality of wilderness character within the FCRNRW or recommended wilderness areas would occur where non-native plant species become established. The spread of non-native plant species would be an irretrievable effect on the natural quality of wilderness character.

Under Alternative 2, Stibnite Road from Yellow Pine to the mine site would be plowed to support the water treatment plant operation in perpetuity. Where and when audible, plowing Stibnite Road from Yellow Pine to the mine site would be an irreversible commitment of solitude.

The increase in human activity in the FCRNRW or recommended wilderness areas would decrease opportunities for solitude, remoteness, and primitive recreation under all action alternatives. The extent of the decrease in the solitude, remoteness, and primitive recreation opportunities quality of wilderness character is unknown; however, following mine closure, recreation use could return to pre-mining levels, and there would be no long-term irreversible commitment of resources.

4.23.1.6 Short-term Uses versus Long-term Productivity

The untrammeled, natural, and solitude, remoteness, primitive recreation opportunities qualities of wilderness character would be impacted in both the short- and long-term under all action alternatives. The decrease in solitude where the duration is temporary would be considered a short-term impact. However, the establishment of non-native plant species within the FCRNRW or recommended wilderness would result in a long-term reduction in the natural quality of wilderness character.

4.23.1.7 Summary

No structures or human facilities would be developed inside the FCRNRW for the SGP. Mine site operations would affect soundscapes, natural dark skies, and natural wildlife distribution within the FCRNRW under all action alternatives, impacting the untrammeled quality of wilderness. The SGP would result in emissions that could affect air quality in the FCRNRW. However, emissions would be below NAAQS thresholds under all alternatives. Under Alternatives 1, 2, and 3, construction and use of the Burntlog Route near the FCRNRW boundary could increase noise and lights in adjacent wilderness areas. Use of the Yellow Pine Route under Alternative 4 would eliminate these impacts. However, the volume of traffic and potential delays along Yellow Pine Route could result in forest visitors avoiding FCRNRW trailheads accessed from Stibnite Road (CR 50-412). Indirectly, recreation use in recommended wilderness areas and other areas of the FCRNRW could increase.

Table 4.23-4, at the end of Section 4.23.4, provides a summary comparison of impacts to the FCRNRW and recommended wilderness areas by issue and indicators for each alternative.

4.23.2 Wild and Scenic Rivers

4.23.2.1 Effects Analysis Issues and Indicators and Methodology of Analysis

The analysis of effects to wild and scenic rivers (WSRs) includes the following issue and indicators:

Issue: The SGP may affect WSRs.

***Indicators**:*

- Free-flowing conditions for eligible and suitable WSR segments;
- Water quality for eligible and suitable WSR segments;
- Outstanding Remarkable Values (ORVs) for which eligible and suitable WSR segments are designated or nominated;
- Potential changes to classification of eligible and suitable WSR segments as Wild, Scenic, or Recreational.

WSRs were analyzed using resources including GIS spatial analyses, scientific literature reviews, and information and analysis documented in reports prepared for the proposed SGP.

4.23.2.2 Direct and Indirect Effects

The following analysis of effects associated with WSR is considered within the overall context of the Wild and Scenic Rivers Act of 1969 (the WSR Act) and Forest Service policy regarding implementation of the WSR Act. Specifically, the analysis considers direct and indirect effects to rivers identified as eligible or suitable for inclusion in the National WSR System and one designated WSR.

4.23.2.2.1 ALTERNATIVE 1

The following activities under Alternative 1 have the potential to intersect with eligible or suitable WSRs, as discussed in the sections below.

During construction, operation, and closure and reclamation, mine-related traffic would access the mine site from State Highway 55, north of the town of Cascade, via Warm Lake Road (CR 10- 579). This route crosses the South Fork Salmon River.

During construction, access to the mine site from Warm Lake Road would be via Johnson Creek Road (CR 10-413) to the village of Yellow Pine, and from Yellow Pine to the mine site via the Stibnite Road portion of McCall-Stibnite Road (CR 50-412) (i.e., the Yellow Pine Route) until Burntlog Route is complete. The Yellow Pine Route travels along and adjacent to Johnson Creek and has multiple crossings of this waterbody. During operations and closure/reclamation, mine-related traffic would use the Burntlog Route.

Burnt Log Road (FR 447) crosses the WSR-eligible Burntlog Creek and its tributaries. The road would change from a summer-only route with primarily recreational traffic to year-round use involving plowing, de-icing, and serving heavy industrial traffic. Rock, gravel, and sand required to construct and maintain the road surface would be quarried from locations along the route. During mine operations, these borrow (quarry) sites would be used to stockpile soil/cleared vegetation for use in eventual reclamation. Mine closure and reclamation traffic would continue to use the Burntlog Route during these activities, and the new road segments would be decommissioned once closure and reclamation activities are completed. Any additional access to the mine site post-closure would be via Yellow Pine Route or other existing routes.

Alternative 1 would require construction activities at existing substations, the construction of new substations, the upgrading of existing transmission lines along the WSR-eligible segment of Johnson Creek, and the construction of a new transmission line between a new Johnson Creek substation and Stibnite (mine site) substation. The transmission line ROW would be widened to 100 feet from 70 feet, and vegetation would be cleared and maintained in this area. The upgraded transmission line also would cross the eligible South Fork Salmon River at Warm Lake Road.

4.23.2.2.1.1 Construction

Alternative 1 construction activities include widening Burnt Log Road; mining gravel, sand, and rock at several borrow sources along the Burntlog Route for use in road surfacing; placing construction camps along Burntlog Route; and the construction of new segments of road from its current terminus to the mine site. Soil and cleared vegetation from road widening would be salvaged and stored within borrow sources once they have been quarried.

Construction also would entail upgrading the existing transmission line to increase capacity. The utility corridor ROW would be widened from 70 feet to 100 feet. Tall trees in this corridor would be cleared. New or widened access spur roads to the transmission line would be required in some locations.

Burntlog Creek

<u>Impacts to free-flowing conditions of eligible, suitable, and designated WSRs.</u>

Construction activities could result in short-term impacts to the free-flowing condition as a result of culvert and bridge replacement on Burnt Log Road under Alternative 1.

<u>Impacts to water quality of eligible, suitable, and designated WSRs.</u>

Alternative 1 includes widening and resurfacing Burnt Log Road through the Burntlog Creek watershed (approximately 13.75 miles of roadway). Widening would entail the excavation (or blasting) of uphill cut slopes and construction of downhill fill slopes. Three bridges would be replaced within the watershed, at Burntlog Creek, East Fork Burntlog Creek, and a tributary to East Fork Burntlog Creek. Remaining stream and drainage crossings would be via culverts. Because the roadway would be widened, existing culverts would be removed and replaced.

Up to three borrow sources in the Burntlog watershed have been identified, two for rock to be used during road construction, and one for sand to be used for road maintenance during operations. One borrow site is located uphill of the road crossing of the mainstem Burntlog Creek. Another borrow site is located uphill of the road near the crossing of the East Fork Burntlog Creek.

Traffic by heavy construction vehicles and equipment would occur throughout the road and mine site construction periods. The Motorized Mixed-Use Analysis Report (DJ&A, PC 2017) anticipates an addition of 65 vehicles per day on the Burntlog Route during construction, with 69 percent of those anticipated to be heavy vehicles.

During Burntlog Route construction, the potential also exists for increased runoff, erosion, and sedimentation as a result of localized vegetation removal and excavation of soil, rock, and sediment, which could result in increased sediment load in streams. Expected permit stipulations from the Idaho Department of Water Resources (IDWR) and Idaho Department of Environmental Quality (IDEQ) would require that:

- Streambank vegetation be protected except where its removal is necessary;
- New cut or fill slopes not protected with some form of riprap be seeded and planted with native vegetation to prevent erosion;
- Use of temporary erosion and sediment control Best Management Practices (BMPs) associated with a stormwater pollution prevention plan (SWPPP); and
- That all construction activities be conducted per Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations.

Impacts to ORVs for which eligible, suitable, and designated WSRs are recognized.

During construction, replacement of culverts at stream crossings along the Burnt Log Road has the potential to temporarily impact fish passage, increase sedimentation, and alter primary productivity. Use of typical BMPs during installation of stream crossing structures, including seasonal timing of installation based on known fish use (including overwintering of fish) and temporary bypass design during installation, could minimize the potential for temporary effects to fish passage if used during periods of the year when passage is most critical (e.g., spawning periods for salmon and juvenile outmigration).

Impacts to the preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs.

Figure 4.23-1 shows the estimated range of noise and visual impacts of Alternative 1 along the Burnt Log Road. Roadway widening would be generally consistent with the visual quality objective of Preservation (Wild segment) and Partial Retention (Recreational segment).

As discussed in Section 4.6, Noise, these impacts are likely to be most pronounced during construction of the route, as noise would be generated by quarrying, slope excavation, roadway widening, and other construction activities in addition to the noise of the trucks and equipment using the road to access the mine site. During widening of the road, noise levels would increase from 10 to 26 dBA above ambient sounds, and roadway construction noise would dominate the noise environment within about 2,000 feet of the road. Downstream of Burnt Log Road, Burntlog Creek has a preliminary classification of Wild. Noise is expected to adversely affect approximately 881 acres of the WSR corridor, and visual impacts would be noticeable from approximately 595 acres of the corridor.

The segment upstream of Burnt Log Road has a preliminary classification of Recreational. Noise impact during construction would affect approximate 721 acres in this segment, and visual impacts would affect approximately 1,142 acres. As one of the potential borrow areas is located adjacent to the road crossing of Burntlog Creek and partially within the WSR corridor, recreation access to this portion of the waterway could be adversely affected.

Approximately 28.6 acres of new utility ROW is located within the Wild segment of the Burntlog Creek WSR corridor at its confluence with Johnson Creek. However, at this location the utility corridor is not visible from Burntlog Creek itself (Forest Service 2013) and changes to it would not affect the Wild preliminary classification.

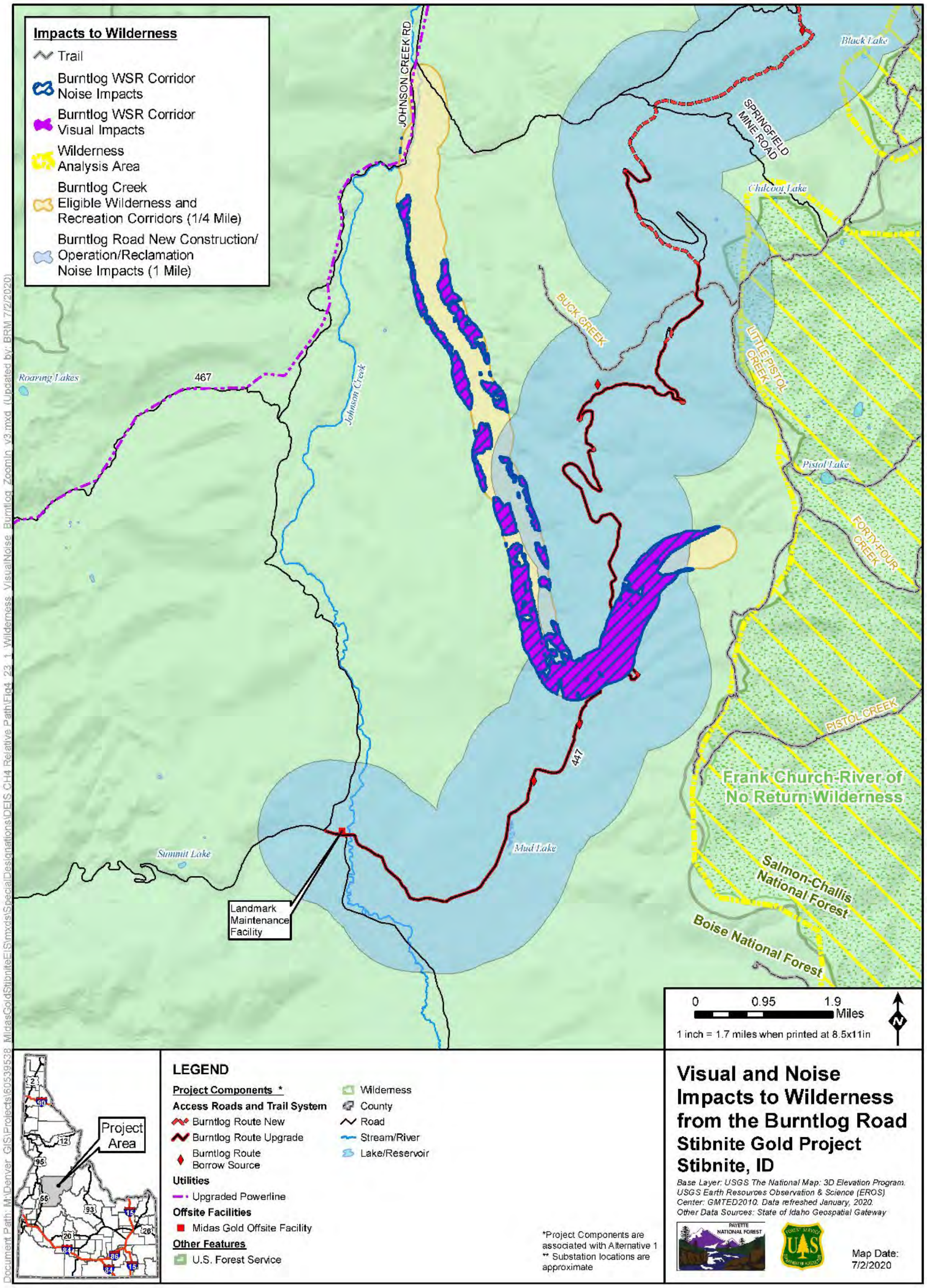


Figure Source: AECOM 2020

Figure 4.23-1 Visual and Noise Impacts to Wilderness from the Burntlog Road

Johnson Creek

Impacts to free-flowing conditions of eligible, suitable, and designated WSRs.

Construction activities would not impact the free-flowing condition of Johnson Creek, as there would be no impoundment, diversion, or other water resource projects within this waterbody as a result of Alternative 1.

Impacts to water quality of eligible, suitable, and designated WSRs.

The transmission line corridor parallels the eligible Recreational segment of Johnson Creek. The ROW would be widened from 70 to 100 feet. This increases the ROW area within the Johnson Creek eligible corridor by approximately 73.3 acres. This could result in an adverse impact to water quality from vegetation clearance. Decreased shade can increase water temperatures in the creek, and reduced vegetation cover can increase sedimentation rates. Although the transmission line footprint has not been finalized, it is likely to include new spur roads that also could increase runoff. Vehicle use could result in potential impacts from oil or gas spills. During construction, sedimentation from construction sites could increase in the short term. As discussed in Section 4.9, Surface Water and Groundwater Quality, expected permit stipulations from IDWR and IDEQ would require the use of erosion and sediment control BMPs associated with a SWPPP. All activities would be conducted in accordance with Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations. ROW clearing would be for the purpose of maintaining low height vegetation during operations and would not entail clearing and grubbing to bare dirt. Consequently, the vegetation root structure within soils would be retained, reducing erosion potential compared to bare dirt.

Impacts to ORVs for which eligible, suitable, and designated WSRs are recognized.

The transmission line parallels Johnson Creek and its ROW overlaps with the creek and WSR study corridor. Construction of the new transmission line segment would involve subsurface excavation to set poles. Accessing the existing transmission line for upgrades and maintenance would require truck traffic that could damage artifacts, features, or prehistoric sites along the transmission line upgrade route. The transmission line itself is an eligible historic property and part of the heritage ORV of this segment of river as discussed in Section 4.17, Cultural Resources.

As a contributing resource to the heritage ORV for which this segment is recognized, upgrading the transmission line would result in adverse impacts to this ORV. Consequently, a suitability study would be required for the eligible segment of Johnson Creek.

During construction, mine-related traffic would access the mine site using Johnson Creek Road (CR 10-413). No road alignment modification or widening of Johnson Creek Road is proposed under Alternative 1. Because no roadwork would occur outside of the existing ROW, no direct impacts to heritage resources (artifacts or sites) are expected to occur.

Short term indirect effects to the recreation setting could result from increased traffic related to mine construction (approximately 65 AADT during construction). These impacts would be temporary (approximately 3 years), as mine-related traffic under Alternative 1 is proposed to be diverted to the Burntlog Route during operations and closure/reclamation.

Impacts to the preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs.

During construction, traffic noise levels along Johnson Creek are anticipated to rise by 2 dBA day-night noise level as discussed in Section 4.6, Noise. On average this increase is not detectable, and so would not likely adversely impact the Recreational designation of Johnson Creek. Recreation access would not be impacted under long-term operational conditions.

South Fork Salmon River

Impacts to free-flowing conditions of, suitable, and designated WSRs.

Construction activities would not impact the free-flowing condition of the South Fork Salmon River (or the EFSFSR tributary of the South Fork Salmon River), as there would be no impoundment, diversion, or other water resource activities within this waterbody as a result of Alternative 1.

Impacts to water quality of eligible, suitable, and designated WSRs.

The transmission line corridor crosses the eligible South Fork Salmon River at Warm Lake Road. Widening the ROW from 70 to 100 feet would affect up to 17.4 acres within the South Fork Salmon River WSR study corridor. This acreage includes the waterway itself. Although some loss of shading or temporary sediment increases during vegetation clearance or line construction could occur, any effects to water quality would likely be too small to measure because of this waterway’s large watershed and large flow volume. As discussed in Section 4.9, Surface Water and Groundwater Quality, expected permit stipulations from the IDWR and IDEQ would ensure that streambank vegetation would be protected except where its removal is absolutely necessary; that new cut or fill slopes not protected with some form of riprap would be seeded and planted with native vegetation to prevent erosion; use of temporary erosion and sediment control BMPs associated with a SWPPP; and that all activities would be conducted in accordance with Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations.

Impacts to ORVs for which eligible, suitable, and designated WSRs are recognized.

Short-term construction-related actions could impact recreation ORVs for the South Fork Salmon River through:

- Temporary impacts to recreational access by construction-related access restrictions; or
- Access delay, noise, or visual impacts in the vicinity of the existing transmission line crossing.

Recreation access would be restored following transmission line construction, and, therefore, no long-term impacts to recreation ORVs are anticipated.

Short-term construction-related actions could impact scenery ORVs through temporary activities related to vegetation clearing in the transmission line ROW and replacement of conductors and support structures as discussed in Section 4.20, Scenic Resources. Long-term impacts to scenery ORVs at the crossing could result from vegetation clearing within the expanded ROW and the larger, taller utility poles. Direct impacts would be of limited geographic extent and associated with the existing disturbance of the crossing of Warm Lake Road over the South Fork Salmon River. Therefore, long-term direct impacts to scenery ORVs are expected to be minor.

No construction impacts to geological, cultural, botanical, and fisheries ORVs are expected.

Impacts to the Wild, Scenic, or Recreational classification for eligible and suitable WSRs.

Construction activities could briefly limit recreational access to the Recreational South Fork Salmon River during widening of the transmission line ROW where it crosses the river at Warm Lake Road. Impacts would be temporary and minor and would not affect the Recreational classification.

4.23.2.2.1.2 Operations

As described below, activities at the mine site during the operations phase would not directly or indirectly affect eligible or suitable WSR segments on the South Fork Salmon River, Burntlog Creek, or Johnson Creek.

Under Alternative 1, the Landmark Maintenance Facility would be located where Warm Lake Road crosses Johnson Creek (upstream from the eligible Recreational segment) and would house road maintenance and snow removal equipment. Additional features at the maintenance facility may include covered stockpiles for winter sanding activities, housing for road maintenance crews during periods of heavy snow removal or other winter maintenance activities, and communications.

Upon completion of the Burntlog Route, all mine-related operational traffic would use that route under Alternative 1. The nexus of access roads to eligible and suitable WSR segments is as follows:

- All mine access routes cross the suitable segment of the South Fork Salmon River on Warm Lake Road.
- Burnt Log Road crosses the eligible segment of Burntlog Creekand divides the upper Recreational portion from the lower Wild portion.

Burntlog Creek

Impacts to free-flowing conditions of eligible and suitable WSRs.

Impacts to free-flowing conditions of Burntlog Creek would continue due to the presence of culverts and bridge crossings along Burnt Log Road. Stream crossings would be designed to minimize potential impacts on surface water hydrology, water quality, and fish passage. The Forest Service would require stream crossings to be designed to accommodate a 100-year flood recurrence interval, unless site-specific analysis using calculated risk tools or another method determines a more appropriate recurrence interval. Additionally, Midas Gold would be required to comply with specific design requirements as part of the IDWR Stream Channel Alteration Permit, such as line of approach, minimum bridge clearance and minimum culvert size per length, and anchoring on steep slopes. These permit-related design requirements, use of BMPs, and required maintenance activities would allow natural streamflow and minimize impacts to free- flowing condition.

Impacts to water quality of eligible, suitable, and designated WSRs.

Under Alternative 1, Burnt Log Road would be widened and mine-related traffic on it would increase. Approximately 77.5 acres of the Burntlog Creek watershed would be affected by road widening cut and fill activities. Approximately 16.7 of those acres would be within the eligible WSR corridor. The road would be plowed and sanded during winter months (currently it is not plowed or sanded). The road would be re-surfaced with sub-base material topped by gravel. The culvert at the Burntlog Creek crossing would be replaced. A borrow pit (gravel extraction) is proposed within the eligible WSR corridor, on the east side of the current road crossing of Burntlog Creek. See **Figure 4.23-1** for the location of these features.

As discussed in Section 4.9, Surface Water and Groundwater Quality, traffic on Burnt Log Road would increase from approximately 27 vehicles per day (summer months only and primarily recreation-related vehicles) to an average of 95 vehicles per day, year-round, with approximately 52 percent of those being heavy vehicles or equipment.

As described above in Section 4.23.2.2.1.1, Alternative 1 - Construction, increased acreage of gravel roads and increased heavy vehicle traffic is associated with increases in sediment load delivery to streams (Reid and Dunne 1984). Forest roads can accelerate erosion and sediment delivery to streams and have been identified as the primary contributor of sediments to stream channels in managed watersheds (Trombulak and Frissell 2000). Roads are often chronic sources of sediment delivery from cut-slopes, ditch-lines, and running (i.e., driving) surfaces, and act as potential sites for accelerated mass movements (e.g., mud slides). Roads also intercept subsurface flows, concentrate flows in ditch lines and through culverts and bridges, and act as direct conduits for sediment delivery to stream channels (Beschta 1978).

For operation and use of the Burntlog Route, sedimentation mitigation would be approached using standard erosion control measures, such as silt fencing, ditch checks, and other measures, which would be installed and maintained to minimize the potential for erosion and sedimentation. Numerous small (15- to 60-inch) drainage culverts would be installed along the Burntlog Route to reduce rutting and shunt water out of ditches and off the road prism. The road would be maintained as a hardened road surface with gravel surfacing to allow for all-weather use of the road.

Impacts to ORVs for which eligible, suitable, and designated WSRs are recognized.

Burntlog Creek has an ORV for fish. If year-round heavy vehicle use and winter plowing/sanding of the Burntlog Route during mine operations increases sedimentation rates to Burntlog Creek, this could adversely affect fish spawning habitat in the creek.

Impacts to the preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs.

As discussed above in Section 4.23.2.2.1.1, Alternative 1 - Construction, heavy vehicle mine traffic would be more visible from the eligible Wild portion of Burntlog Creek than the current traffic levels on the existing Burnt Log Road.

As discussed in Section 4.6, Noise, noise levels during mine operations along the Burntlog Route from road maintenance and use would increase by about 10-12 dBA (at about 2,000 feet distance from the road) and would be particularly noticeable in winter due to plowing and winter traffic, which does not currently occur. Noise impacts could adversely impact the overall wild character of the eligible Wild segment of Burntlog Creek.

Alternative 1 includes a borrow site that is located partially within the Burntlog Creek WSR corridor, at the crossing of Burnt Log Road. Sand and gravel excavated from this and other quarries would be stockpiled at the borrow site for use during winter maintenance. This may inhibit recreational access to the Recreational portion of Burntlog Creek, as the location of the proposed quarry and stockpile site is at the only road access point to the Recreational section of the creek.

Johnson Creek

Impacts to free-flowing conditions of eligible and suitable WSRs.

No impacts to the free-flowing conditions of Johnson Creek are anticipated during operations as no impoundments or diversions are anticipated to occur.

Impacts to water quality of eligible, suitable, and designated WSRs.

As discussed in Section 4.16, Access and Transportation, traffic during operations on the native-surfaced/gravel Johnson Creek Road is anticipated to be 96 AADT along Johnson Creek, an increase of approximately 50 percent from current traffic rates. The road would not be plowed for winter use once the Burntlog Route was complete. Increases in traffic on gravel roads are associated with increased sedimentation rates (Reid and Dunne 1984).

Impacts to ORVs for which eligible, suitable, and designated WSRs are recognized.

No operations activities are anticipated to affect the Heritage ORV on the eligible segment of Johnson Creek, as the heritage ORV is primarily given for historic gold mining in the area.

Impacts to the preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs.

Although traffic along Johnson Creek Road would increase over current conditions during mine operations, this increase in traffic would not change access to the eligible corridor. Consequently, there would be no impact to the preliminary classification of Recreational for this segment of Johnson Creek.

South Fork Salmon River

Impacts to free-flowing conditions of eligible and suitable WSRs.

No impacts to the free-flowing conditions of the South Fork Salmon River are anticipated during operations as no impoundments or diversions are expected to occur.

Impacts to water quality of eligible, suitable, and designated WSRs.

Impacts to water quality in the suitable South Fork Salmon River are not expected to result from implementation of Alternative 1, as no SGP activities likely to cause such impacts would occur in this location.

Impacts to ORVs for which eligible, suitable, and designated WSRs are recognized.

Because no access road upgrades are proposed for Warm Lake Road (where it crosses the South Fork Salmon River), no impacts to ORVs (ORVs for recreation, scenery, geological, cultural, botanical, and fisheries resources) for which the South Fork Salmon River is recognized would result from this component of Alternative 1.

Impacts to the preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs.

Recreational classification is compatible with roadway access to or along Recreational WSR waterways. Alternative 1 would not alter access to the suitable segment of the South Fork Salmon River, so there would be no impacts to its preliminary classification of Recreational.

4.23.2.2.1.3 Closure and Reclamation

Closure activities at the mine site would have the same effects to the South Fork Salmon River, Johnson Creek, and Burntlog Creek as activities during operations.

During closure and reclamation of the mine site, the Burntlog Route would remain the main access route, and closure and reclamation of the new portion of the roadway would be among the last activities to take place. According to the Reclamation and Closure Plan (Tetra Tech 2019), grades on the Burnt Log Road would remain as constructed for the SGP, but roadway widths would be returned to pre-SGP widths by removing fill slopes and recontouring cut slopes. Quarries in the borrow sites built along the road would be reclaimed.

Reclamation would entail grading and scarification along the outside edges of the road, followed by seeding. Approximately 30 acres of ground adjoining existing roads would be reclaimed.

Where no indicator is listed below, no impacts from closure activities are expected for that indicator.

Burntlog Creek

Impacts to water quality of eligible, suitable, and designated WSRs.

Recontouring slopes along the roadway would entail earth-disturbing activities with the potential to increase sedimentation rates, similar to what was discussed in Section 4.23.2.2.1.1, Alternative 1 - Construction. Use of temporary erosion and sediment control BMPs associated with a SWPPP would reduce potential for erosion and sedimentation. If the slopes are successfully revegetated and stabilized, this erosion and sediment impacts to Burntlog Creek would be temporary.

Impacts to ORVs for which eligible, suitable, and designated WSRs are recognized.

Burntlog Creek has an ORV for fish. Spawning habitat is adversely affected by increased sedimentation in creek beds. Use of temporary erosion and sediment control BMPs associated with a SWPPP would reduce potential for erosion and sedimentation. If the re-contoured slopes are successfully stabilized, this effect would be temporary.

Impacts to the preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs.

As discussed in Section 4.23.2.2.1.1, Alternative 1 - Construction, earth works and slope re-contouring activities performed during decommissioning/narrowing of the Burnt Log Road would generate short-term visual and noise impacts to the eligible Burntlog Creek WSR corridor. During closure, the use of heavy equipment along the road and reclamation of borrow sites may result in short-term restrictions on access to the eligible Recreational segment of Burntlog Creek.

Johnson Creek

No impacts to the eligible Johnson Creek are anticipated from closure and reclamation activities.

South Fork Salmon River

No impacts to the suitable South Fork Salmon River are anticipated from closure and reclamation activities.

4.23.2.2.2 ALTERNATIVE 2

Alternative 2 actions related to the mine site, access roads, off-site facilities, and utility corridor would differ from Alternative 1, but would not change the effects to eligible or suitable WSR corridors.

Under Alternative 2, the Landmark Maintenance Facility would be located along Burnt Log Road (FR 447) approximately 4.4 miles east of the junction of Johnson Creek Road (CR 10-413) and Warm Lake Road (CR 10-579). This location is near Peanut Creek in the Burntlog Creek watershed. The Landmark Maintenance Facility would be located in part of a proposed new borrow site that would be excavated for gravel for SGP road improvements. Following excavation, the maintenance facility would serve as a base for equipment and materials stockpiles needed for winter plowing and sanding of the Burntlog Route. The facility would include fuel tanks and a fueling station for vehicles and heavy equipment, a building for vehicle and equipment maintenance, and space for offices and overnight accommodation for equipment operators. Approximately 2.5 acres of the 5.13-acre borrow site would be occupied by structures or storage after gravel quarry operations were complete. The facility would have an on-site generator for electricity, and would require water and septic services, presumably on-site.

As there are currently no buildings or operations in the Burntlog Creek watershed, the addition of this facility would likely have an incremental increased effect on stormwater runoff, potential leaks or spills of automotive fluids, and sedimentation of dust from on-site road sanding material storage and vehicle travel over gravel surfaces. However, the facility would change less than 0.1 percent of the watershed to industrial use from forestry use, so any effects on water quality, ORVs, or the Wild classification of Burntlog Creek are likely to be small.

With this exception, the effects to eligible and suitable WSR corridors under Alternative 2 would be the same as those described for Alternative 1.

4.23.2.2.3 ALTERNATIVE 3

With respect to WSR corridors, Alternative 3 would have the same effects as described for Alternative 1 as there would be no differences in the portions of the planned access routes and utility corridors where they intersect with WSR corridors.

4.23.2.2.4 ALTERNATIVE 4

Under Alternative 4, actions related to the mine site, utility corridor, and Landmark Maintenance Facility would have the same effects as described under Alternative 1. Effects of access roads would differ for Johnson Creek and Burntlog Creek as described below. Effects to the South Fork Salmon River would be the same as described for Alternative 1.

Burntlog Creek

Alternative 4 would have no direct impacts to the eligible Burntlog Creek WSR, as the access route to the mine would not follow Burnt Log Road. No road widening, bridge and culvert replacement, slope excavation/blasting, or quarrying of sand and gravel would occur as a result of Alternative 4 in the Burntlog Creek watershed. The existing road would not be plowed and sanded during winter and would not have dust suppressant applied during summer. Traffic on the road would remain primarily recreational and seasonal. The amount of traffic may increase over current conditions if recreationists seek alternate areas away from the mine site for their recreation activities but would likely be less than traffic projections associated with mining activity and would not include heavy industrial vehicles and equipment. Compared to current conditions, Alternative 4 would have no effects to water flow or quality, ORVs, or classification for Burntlog Creek.

Johnson Creek

Johnson Creek Road (CR 10-413) would be part of the mine access route under Alternative 4. Increased traffic would occur along this route, which parallels the eligible segment of Johnson Creek. Detailed road prism studies of this potential route have not been completed. For the purposes of this analysis, it is assumed that Johnson Creek Road (would be resurfaced but would not require slope excavations or cut/fill to widen turns, as the road is relatively straight along the eligible segment.

<u>Impacts to free-flowing characteristics of eligible and suitable WSRs.</u>

Construction activities could result in short-term impacts to the free-flowing condition of Johnson Creek as a result of culvert replacement on Johnson Creek Road under

Alternative 4. Operations-related impacts would be similar to current conditions, with free-flowing conditions modified by culverts. As described in Section 4.23.3.2.1.1, Alternative 1 - Construction, permit-related design requirements, use of BMPs, and required maintenance activities would maintain natural streamflow and minimize impacts to free-flowing condition.

Impacts to water quality of eligible, suitable, and designated WSRs.

Heavy construction vehicles and equipment traffic would occur throughout construction, operation, and closure and reclamation periods. Increases in heavy vehicle traffic are associated with increases in sediment delivery load to streams (Reid and Dunne 1984). Sedimentation could adversely affect water quality and fish spawning habitat. While numeric modeling of potential sedimentation impacts to Johnson Creek from these activities is not available, in general, increases in sedimentation are expected from:

- Travel-generated dust and sedimentation due to the change in road use from seasonal, primarily recreational or 4x4 vehicle use, to year-round use by heavy equipment.
- Application of de-icers or sand for traction during winter months.

Impacts to ORVs for which eligible, suitable, and designated WSRs are recognized.

Johnson Creek has a Heritage ORV, primarily relating to the area's history of mining. While increased mine traffic on Johnson Creek Road next to the eligible segment could have noise and visual impacts to the area, this action would not directly or indirectly affect heritage resources. Impacts to heritage resources would be the same as those described for Alternative 1 due to removing and replacing the transmission line. Consequently, a suitability study would be required for the eligible segment of Johnson Creek under Alternative 4.

Impacts to the preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs.

Although traffic along Johnson Creek Road would increase over current conditions during mine operations, this increase in traffic would not change access to the eligible corridor. Consequently, there would be no impact to the preliminary classification of Recreational for this segment of Johnson Creek.

4.23.2.2.5 ALTERNATIVE 5

Under Alternative 5, there would be no SGP-related surface mining or ore processing to extract gold, silver, and antimony, and no underground exploration or sampling or related operations and facilities on NFS lands.

Current uses by Midas Gold on patented mine/millsite claims, and on the PNF and BNF would continue. Concurrent uses of NFS lands include mineral exploration, and dispersed and developed recreation, such as pleasure driving, hunting, off-highway-vehicle use, camping, hiking, snowmobiling, bird watching, target shooting, firewood cutting, and other forms of recreation. Private businesses, such as outfitter and guide services, operate on the Forests through special use permits. Traditional cultural uses of the SGP area would continue, including the collection of plants for basket-making, food, and medicinal uses. Access to public land in the area would continue as governed by law, regulation, policy, and existing and future landownership constraints, the latter of which may include denial of access over private land.

Under Alternative 5 there would be no new or upgraded access roads. Current access to the area, via Johnson Creek Road and Stibnite Road, would remain. No additional SGP-related traffic would occur along Johnson Creek, and winter plowing of the currently-unplowed section would not occur. Existing road access to Recreational river segments would not change, and existing effects to Wild segments would continue, including ongoing noise and sediment impacts from existing summer use. Burnt Log Road would not be widened and extended, and traffic on this road near Burntlog Creek would remain largely recreational. No winter plowing of the road would occur, and snowmobiles would continue to use it.

There would be no changes to the existing transmission lines and no new segment of transmission line constructed. No additional clearing of vegetation along the existing transmission line corridor would occur. The existing transmission line along Johnson Creek, which is eligible for the National Register of Historic Places, would remain and would continue to contribute to the Heritage ORV for which this segment is recognized.

4.23.2.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.23.2.4 Cumulative Effects for All Action Alternatives

The cumulative effects analysis area for WSRs includes all federally managed land and actions in the South Fork Salmon River watershed, and includes any action that could affect other eligible, suitable, or designated WSR waterways in the watershed. In addition to the three waterways discussed above, the Secesh River is in the South Fork Salmon River watershed and is considered suitable for inclusion in the National WSR System. The upper and lower portions of the Secesh River are classified as Recreational, and the central portion, between NFS Trail (NFST) 080and the Lick Creek Road portion of McCall-Stibnite Road (CR 50-412), is classified as Wild.

Cumulative effects associated with the SGP consider the range of existing and RFFAs and their potential effects with respect to WSR. Past and present actions that have, or are currently, affecting WSR and RFFAs that could cumulatively contribute to WSR impacts in the analysis area are described in Section 4.1.5, Cumulative Effects, and have the following effects with respect to the WSR indicators:

- No cumulative impacts to the free-flowing characteristics of eligible and suitable WSRs.
- Improvements to the water quality of eligible, suitable, and designated WSRs are likely to result from watershed management; Comprehensive Environmental Response, Compensation, and Liability Act actions; and bridge/culvert improvement projects.
- Improvements to fish ORVs are likely to result from the RFFAs. Ongoing maintenance and upgrades to the existing Idaho Power Company transmission line along Johnson Creek could result in cumulatively adverse impacts to this contributing historical resource.
- No impacts to the preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs are anticipated from these projects combined with impacts from the SGP.

4.23.2.5 Irreversible and Irretrievable Commitments of Public Resources

4.23.2.5.1 ALL ACTION ALTERNATIVES

If the National Register-eligible historic transmission line along Johnson Creek is upgraded as part of the action alternatives, this would constitute an irreversible commitment of an eligible cultural resource, which would have an adverse effect on ORVs.

4.23.2.5.2 ALTERNATIVE 5

No irreversible and irretrievable commitments of Public Resources relating to WSRs are expected under Alternative 5.

4.23.2.6 Short-term Uses versus Long-term Productivity

4.23.2.6.1 ALTERNATIVES 1 THROUGH 3

Short term indirect effects to the setting along WSR-eligible Johnson Creek could result from increased traffic related to mine construction on Johnson Creek Road (CR 10-413) (approximately 65 AADT during construction). These impacts would be temporary, as traffic is proposed to be diverted from Johnson Creek Road (CR 10-413) to the Burntlog Route during operations and closure. No traffic-related direct or indirect impacts to heritage resources are expected during reclamation. Construction traffic is not expected to affect the Johnson Creek setting over the long term.

4.23.2.6.2 ALTERNATIVE 4

Under Alternative 4, Johnson Creek Road (CR 10-413) would be the main route to access the mine site over its entire construction, operation, and closure and reclamation timespan. The duration of effects described in the paragraph above would, therefore, be long-term.

4.23.2.6.3 ALTERNATIVE 5

No short-term or long-term effects are anticipated under Alternative 5.

4.23.2.7 Summary

Impacts to WSR Free-Flowing Conditions

No impacts to WSR free-flowing conditions are anticipated under any of the action alternatives.

Impacts to WSR Water Quality

Alternatives 1, 2, and 3 may impact water quality in Burntlog Creek as a result of increased sedimentation from Burntlog Route construction, winter maintenance, and increased traffic from heavy vehicles. Under Alternative 4, Burntlog Creek would not be adversely impacted as the Burntlog Route would not be built. However, increased heavy vehicle traffic could increase sedimentation rates and therefore decrease water quality in Johnson Creek due to use of Johnson Creek Road for all SGP-related traffic under Alternative 4.

Impacts to ORVs

Under all action alternatives, the Heritage ORV of Johnson Creek may be adversely affected by the upgrade of the existing transmission line, which is an eligible historic resource. Under Alternatives 1, 2, and 3, the fish ORV of Burntlog Creek may be adversely impacted by increased sedimentation into fish spawning habitat in the creek. Under the WSR Act, impacts to ORVs of eligible waterways would trigger WSR suitability studies for those waterways.

Impacts to Wild, Scenic, or Recreational Classification

Under Alternatives 1, 2, and 3, the Wild segment of Burntlog Creek would be adversely impacted by noise and visual effects from the extension, widening, and mine traffic usage of Burnt Log Road (FR 447). The Recreational segment of Burntlog Creek could be adversely impacted if a proposed gravel quarry is sited at the only road access to the Recreational segment of this creek.

Table 4.23-4, at the end of Section 4.23.4, provides a summary comparison of impacts to WSRs by issues and indicators for each alternative.

4.23.3 Inventoried Roadless Areas

4.23.3.1 Effects Analysis Issues and Indicators and Methodology of Analysis

The analysis of effects to IRAs and lands contiguous to unroaded areas includes the following issue and indicators:

Issue: The SGP may impact roadless character in IRAs and lands contiguous to unroaded areas.

Indicators:

- Miles and acres of roads in IRAs or contiguous unroaded lands.
- Number and acres of proposed SGP facilities in IRAs or contiguous unroaded lands.

Inventoried roadless areas were analyzed using resource databases, including PNF and BNF monitoring and survey information, GIS spatial analyses, scientific literature reviews, and information and analysis documented in reports prepared for the SGP. The analysis area for direct and indirect effects of the SGP on IRAs and lands contiguous to unroaded areas (the "roadless expanse") is the area within 5 miles of the locations of proposed facilities. Effects on roadless character within the roadless expanse can be temporary, short-term, or long-term. Temporary effects are less than one year, and short-term effects are expected to last three to fifteen years. Long-term effects could last beyond 15 years (Forest Service 2003, 2010). Permanent effects to IRAs and lands contiguous to unroaded areas would exist indefinitely.

The analysis of effects on roadless character focuses on the following roadless area characteristics, which are described in **Table 3.23-10**, Wilderness Attributes and Corresponding Roadless Area Characteristics, Inventoried Roadless Areas, Existing Conditions.

- Naturalness;
- Undeveloped character;
- Outstanding opportunities for solitude and primitive types of recreation;
- Special features and values; and
- Manageability.

4.23.3.2 Direct and Indirect Effects

The following analysis of effects associated with IRAs is considered within the context of undeveloped lands under Forest Service administration within Valley County.

Elements of this context include roadless area characteristics based on the Forest Service Handbook 1909.12 (72.1), which include:

- The biophysical resources in roadless areas include high quality or undisturbed soil, water, and air. Diverse plant and animal communities provide habitat for threatened, endangered, proposed, candidate, and sensitive species, which are dependent on large, undisturbed areas of land.
- The absence of structures and evidence of human occupation and activities in roadless areas provide natural appearing landscapes with high scenic quality. Roadless areas and lands contiguous to unroaded areas provide opportunities for primitive, semi-primitive non-motorized, and semi-primitive motorized Recreation Opportunity Spectrum (ROS) classes of dispersed recreation.
- Roadless areas and lands contiguous to unroaded areas provide outstanding opportunities for solitude and primitive recreation.
- Roadless areas contain traditional cultural properties, sacred sites, and other locally identified unique characteristics.
- Roadless area boundaries influence the ability of the Forest Service to meet size criteria and elements of roadless area characteristics.
- Estimated noise from SGP activities does not consider the effects of topography or weather. Therefore, the noise impacts presented in the analysis may be more extensive than what forest visitors and wildlife experience.
- Manageability is a measure of the Forest Service's ability to manage for wilderness character.

Table 4.23-2 identifies the direct impacts to IRAs that would occur under each alternative.

Table 4.23-2 Direct Effects to Inventoried Roadless Areas (Acres/Miles) Under All Action Alternatives

Roadless Area Name	SGP Component	Alternative 1 Acres/(Miles)	Alternative 2 Acres/(Miles)	Alternative 3 Acres/(Miles)	Alternative 4 Acres/(Miles)
Bernard	None	N/A	N/A	N/A	N/A
Black Lake	Access roads	75.6 / (6.4)	80.3 / (7.2)	75.6 / (6.4)	0
Burnt Log	Access roads	38.1 / (0.9)	38.1 / (0.9)	38.1 / (0.9)	0
Caton Lake	Utilities	0.8 / (0)	0.8 / (0)	0.8 / (0)	0.8 / (0)
Horse Heaven	Mine site (Acres only)	122.0	122.0	28.9	122.0
Horse Heaven	Utilities	32.6 / (2.5)	32.6 / (2.5)	2.0 / (0.4)	32.6 / (2.5)
Meadow Creek	Mine site (Acres only)	368.8	368.8	425.7 (0.7)	368.8
Meadow Creek	Access Roads	101.5 / (9.6)	85.1 / (5.0)	52.8 / (9.9)	0
Meadow Creek	Utilities	11.1 / (0.1)	11.1 / (0.1)	12.7 / (0.1)	5.4 / (0.1)

Roadless Area Name	SGP Component	Alternative 1 Acres/(Miles)	Alternative 2 Acres/(Miles)	Alternative 3 Acres/(Miles)	Alternative 4 Acres/(Miles)
Needles	None	N/A	N/A	N/A	N/A
Peace Rock	None	N/A	N/A	N/A	N/A
Reeves Creek	Access roads	0.3 / (0.1)	0.3 / (0.1)	0.3 / (0.1)	0.3 / (0)
Reeves Creek	Utilities	1.0 / (0.1)	1.0 / (0.1)	1.0 / (0.1)	1.0 / (0.1)
Secesh	None	N/A	N/A	N/A	N/A
Stony Meadows	None	N/A	N/A	N/A	N/A
Sugar Mountain	None	N/A	N/A	N/A	N/A
Whiskey	None	N/A	N/A	N/A	N/A
Total		**751.7 / (19.6)**	**740.1 / (15.8)**	**637.9 / (18.5)**	**530.9 / (2.6)**

Table Source: AECOM 2020a

Table Notes:

N/A = not applicable

4.23.3.2.1 ALTERNATIVE 1

Construction, operation, and closure and reclamation of the SGP could affect the roadless area characteristics of naturalness; undeveloped character; outstanding opportunities for solitude and primitive types of recreation; special features and values; and manageability. A detailed evaluation of the impacts of SGP activities on roadless area characteristics by phase is included in the SGP Effects on Roadless Character (AECOM 2020b) report. Following is a summary of the analysis.

4.23.3.2.1.1 Naturalness

As discussed in Section 3.23.3.3, Inventoried Roadless Areas, Existing Conditions, the 13 IRAs and lands contiguous to unroaded areas within the analysis area contain large areas of undisturbed habitat and support diverse plant communities. Air, water, and soil quality in the IRAs also are considered high quality. As shown in **Table 4.23-4**, construction and operation of the SGP under Alternative 1 would directly impact Meadow Creek, Horse Heaven, Black Lake, Burnt Log, Caton Lake, and Reeves Creek IRAs. Construction and operation of mine facilities, Burntlog Route, the OHV trail, and the new transmission line would remove vegetation, alter topography, and modify fish and wildlife habitat within IRAs.

Plants

Approximately 752 acres of vegetation would be removed within six IRAs. Vegetation removal and construction traffic could spread non-native plant species within IRAs during the 3 years of construction. Maintaining the new transmission line, mine site facilities, Burntlog Route, and

OHV trail during the 12 years of mine operation also could increase the opportunities for non-native plant species distribution. Areas within IRAs where non-native plant species become established would alter vegetation composition and change the natural ecological processes. The applicant would inspect vehicles at the Stibnite Gold Logistics Facility prior to use and survey disturbed areas and treat invasive plant species for 3 years after a disturbed area is seeded or planted. These measures could decrease the potential for non-native plant spread. Surveys and implementing treatments described in the Integrated Weed Management program for the PNF and BNF would reduce the potential for non-native plant species to spread. During the 5 years of mine closure and reclamation, recontouring slopes and seeding disturbed areas would reclaim vegetation in the impacted IRAs; however, plant communities would be less diverse relative to existing conditions. Section 4.10.2.1, Direct and Indirect Impacts to Vegetation - Alternative 1, and **Appendix H,** Vegetation**,** provide additional information on vegetation communities and botanical resources.

Construction of Burntlog Route, VHF access roads, and the new transmission line would fill approximately 73.3 acres of wetlands in Burnt Log, Black Lake, Meadow Creek, and Horse Heaven IRAs. Construction of the TSF and DRSFs at the mine site would permanently affect slope and valley wetlands in Meadow Creek and Fiddle Creek drainages, including wetlands and riparian vegetation within the Meadow Creek IRA. Section 4.11.4.1, Direct and Indirect Impacts to Wetlands and Riparian Resources - Alternative 1, contains additional information about potential impact on wetlands and riparian areas.

Fish and Wildlife

Diverting Meadow Creek into a channel and construction of a TSF embankment would reduce aquatic habitat complexity and aquatic habitat connectivity within Horse Heaven and Meadow Creek IRAs. Section 4.12.1, Fish Resources and Fish Habitat, Effects Analysis Issues and Indicators, provides additional information about potential effects on fish habitat during construction.

As discussed in Section 4.12, Fish Resources and Fish Habitats, the approximately 0.8-mile EFSFSR tunnel with fish passage could remove a barrier to fish passage and improve aquatic species habitat connectivity. Increases in fish habitat connectivity in the EFSFSR stream segments above Yellow Pine pit could improve fish species distribution in Sugar Creek drainage. The extent and intensity of the increase would vary depending on fish species and other water quality parameters. In the long-term, if aquatic habitat connectivity increased, the natural quality of roadless character could improve in Sugar Mountain IRA.

During construction, operation, and closure and reclamation of access roads, vegetation removal and excavation of soil and rock could increase sediment load in sections of streams within Sugar Creek, Burnt Log, Black Lake, Meadow Creek, and Horse Heaven IRAs. Fish habitat connectivity would be temporarily disrupted during the installation or removal of culverts on access roads within these five IRAs. Erosion control measures, such as sediment fencing, ditch checks, and other measures, would reduce erosion from the road into streams.

Vegetation including Canada lynx and wolverine habitat removed within Meadow Creek, Horse Heaven, Black Lake, and Burnt Log IRAs would alter wildlife habitat by reducing cover and changing habitat quality. The lack of vegetation cover in addition to the newly constructed retaining walls for access roads could change wildlife movement and distribution (Montgomery et al. 2012). During mine operation, vegetation would continue to be removed as the TSF facility is expanded. A 6-foot-tall wildlife fence also would surround the TSF. Converting approximately 491 acres to a TSF and DRSFs at the mine site would remove wildlife habitat and could change wildlife species distribution in Meadow Creek and Horse Heaven IRAs. Section 4.13, Wildlife and Wildlife Habitat, and **Appendix K**, Wildlife and Wildlife Habitat, provide additional information.

Construction and operations noise, lights, and human activity could displace wildlife species from habitat within IRAs and lands contiguous to unroaded areas during the three years of construction. Section 4.13, Wildlife and Wildlife Habitat, provides additional information regarding wildlife habitats. Some wildlife species could temporarily avoid habitat when noise from construction activities is greater than ambient levels (Robinson et al. 2010; Trombulak and Frissell 2000). As described in Section 4.6, Noise, SGP-related noise levels are predicted from noise generated by major SGP-related noise sources. The distance where SGP-attributed noise could be greater than outdoor ambient levels in IRAs is up to 3 miles from the mine site, access roads, and utilities (AECOM 2017, 2019). Additional information on wildlife and wildlife habitat is found in **Appendix K**.

During mine closure and reclamation activities, approximately 5 years, the wildlife security fencing around the TSF and other areas would be removed. As vegetation becomes established, and human activity decreases, wildlife distribution for some species could return to existing conditions.

Soil, Water, and Air

Construction of SGP facilities would result in approximately 752 acres of total soil resource commitments and detrimental disturbance of soil resources within IRAs. Interim reclamation and mitigation measures could reduce the potential loss of soil resource. Section 4.5.2.1, Soils and Reclamation Cover Materials, Alternative 1, provides additional information on the commitment of soil resources. Growth media from Burntlog Route construction would be stockpiled and stored in borrow source sites and in windrows at the top of fill slopes. Long-term storage of growth media also could reduce mycorrhizal activity and a loss of soil viability. During closure and reclamation, growth media would be spread and areas reseeded within the TSF and DRSFs in Meadow Creek and Horse Heaven IRAs and along Burntlog Route in Meadow Creek, Burnt Log, and Black Lake IRAs. Areas with soil nail walls would be reclaimed to the foot of the wall; however, soil nail walls would remain. Section 4.5.2.1, Soils and Reclamation Cover Materials, Alternative 1, provides additional information regarding soils and reclamation as proposed in the Reclamation and Closure Plan (Tetra Tech 2019).

During construction, approximately 3.5 miles of Meadow Creek would be conveyed in a channel around the TSF and Hangar Flats DRSF. In Meadow Creek and Horse Heaven IRAs, water temperature and chemistry in the 3.5 miles stream segment of Meadow Creek located in a channel could change and become less productive for fish and aquatic species. As described in Sections 4.9.2.1, Surface Water and Groundwater Quality – Alternative 1, and 4.12.2.3, Fish Resources and Fish Habitat – Alternative 1, changes to streamflow, groundwater-surface water interactions, and stream shading have the potential to affect stream temperatures. During operations, approximately 1.1 miles of Fiddle Creek would be diverted in a channel around Fiddle DRSF. Locating approximately 1.1 miles of Fiddle Creek into a channel could change water temperature and chemistry of the stream segment in Horse Heaven IRA. Ten years after mine operation ends, surface flows in stream segments below Hangar Flats diversion could recover to the existing conditions. The streams segments with changes to surface flow are downgradient and outside of the Meadow Creek, Horse Heaven, and Sugar Mountain IRAs boundaries.

Fugitive dust sources during construction would be from haul roads, access roads, dust from vehicle travel, and transferring material would be deposited in adjacent areas. Dust from vehicles using unpaved roads could become airborne and there could be a temporary impact on air quality in adjacent areas of IRAs. During construction, as described in Section 4.3.2.1, Alternative 1, Air Quality, the predicted particulate matter 2.5 microns or less and 10 microns or less emissions would be below NAAQS thresholds at the Operations Area Boundary shown on **Figure 2.3-1**. During operations, pollutants including ozone precursors (e.g., nitrogen oxides and volatile organic compounds) are predicted to be below NAAQS thresholds at Operations Area Boundary. The potential deposition of nitrogen, mercury, and sulfur also are predicted to be below analysis thresholds from the Operations Area Boundary outward.

Natural Appearing Landscapes with High Scenic Quality

Construction of the TSF, Hangar Flats DRSF, access roads, OHV trail, and the new transmission line would disturb approximately 751 acres within six IRAs. During the 12 years of operation, the flatter valley basins, terraces, and slopes from Hangar Flats and Fiddle DRSFs and the TSF would contrast with the surrounding unmodified landscapes within Meadow Creek and Horse Heaven IRAs. During closure and reclamation, Hangar Flats and Fiddle DRSFs and the TSF would be graded/recontoured to blend into the surrounding topography and terrain; however, they would still be apparent in the environment. The change in elevation, flatter valley basins, terraces, and sloped landforms could continue to show evidence of human modification to natural landscapes within Meadow Creek and Fiddle Creek drainages after closure and reclamation.

Areas cleared of vegetation, rock cuts, retaining walls, and human activity would be visible in Burnt Log, Black Lake, and Meadow Creek IRAs during the construction and operation of Burntlog Route. Areas cleared of vegetation, exposed soil color, and changes in terrain during the construction and operation of Burntlog Route would modify the natural landscape and reduce scenic quality. During closure and reclamation, Burntlog Route would be decommissioned, structures removed, and slopes graded to blend with adjacent slopes where possible. After decommissioning, approximately 1.5 miles of soil nail walls, some slopes, and rock cuts along local areas of Burntlog Route would remain. Soil nail walls and rock cuts would continue to be evidence of human alterations in localized areas. Section 4.20.2.1.1, Scenic Resources, and **Appendix O-2**, Alternatives Viewshed Analyses and Key Observation Points, Alternative 1, provide additional details on where the mine facilities and Burntlog Route could be visible.

4.23.3.2.1.2 Undeveloped Character

The natural appearance in the 13 IRAs and lands contiguous to unroaded areas has generally been unaffected by human development. Past mining activities, roads, and utility infrastructure are evident in the landscape on the edges of the IRA boundaries. There are NFS roads and trails that allow motorized use in the roadless expanse. The SGP would result in human development, including new structures within IRAs.

Structures

Under Alternative 1, the TSF and Hangar Flats DRSF would be permanent structures within Meadow Creek and Horse Heaven IRAs. During mine operation, tailings deposition would change the elevation of lower Meadow Creek drainage from approximately 7,120 to 7,520 feet above mean sea level. The downstream slopes of the Hangar Flats and Fiddle DRSFs would permanently alter the existing topography within Meadow Creek and Horse Heaven IRA.

New road segments, cut and fill slopes, and approximately 1.5 miles of soil nail retaining walls would be present along the 14.3 miles of the Burntlog Route that would be within Burnt Log, Black Lake, and Meadow Creek IRAs during construction, operations, and closure and reclamation. Indirectly, improvements to Burnt Log Road (FR 447) and the 14.3 miles of new road could increase the number of user-created dispersed recreation sites in IRAs. The proliferation of dispersed recreation sites along Burntlog Route could decrease the undeveloped roadless characteristic IRAs.

An approximately 2.3-mile segment of new transmission line would be present within Meadow Creek and Horse Heaven IRAs. Existing transmission line structures would be replaced, and new access roads to transmission structures would be present within Reeves Creek and Caton Lake IRAs.

As a result of facilities constructed within the IRAs, there would be a conversion of acres within IRAs managed for Backcountry Restoration meeting the semi-primitive non-motorized setting to the area meeting rural and semi-primitive motorized physical setting during both the summer and winter relative to existing conditions (AECOM 2020b).

During closure and reclamation, mining facilities on and off the mine site and mine site utilities would be removed (e.g., transmission line from Johnson Creek substation to the mine site), and new mine access roads (i.e., portions of Burntlog Route) would be decommissioned and reclaimed. After mine closure, 491 acres at the mine site, 1.5 miles of access road retaining walls, geotextile fabric, and the foundations for the transmission poles, would remain as structures within Meadow Creek, Horse Heaven, Black Lake, and Burnt Log IRAs. There would be an increase of approximately 491 acres of structures compared to the No Action Alternative.

Natural Appearance

In the long-term, Burntlog Route, transmission line structures, access roads, and VHF repeaters within IRAs would reduce the undeveloped area and natural landscape in localized areas. Noise, lighting, and human activity from constructing and operating mining facilities and access road construction and maintenance would change the natural landscape within Burnt Log, Black Lake, Meadow Creek, Horse Heaven, Secesh, and Sugar Mountain IRAs and would be evidence of modern human presence and modifications to the natural environment.

During closure and reclamation, the TSF and DRSF within Horse Heaven and Meadow Creek IRAs would be recontoured to blend with adjacent slopes. However, the elevation and change from a V-shaped valley topography to a level valley would remain noticeable and provide evidence of past human activity. The recontoured slopes, topography, and sparser vegetation would decrease the area within IRAs with a natural appearance. Recontouring slopes, reestablishing drainage, and seeding the 14.3 miles of Burntlog Route within the Black Lake, Burnt Log, and Meadow Creek IRAs could help return these areas to a natural appearance over time.

4.23.3.2.1.3 Outstanding Opportunities for Solitude and Primitive Recreation

The 13 IRAs and lands contiguous to unroaded areas are large enough to provide outstanding opportunities for solitude and primitive recreation. Outstanding opportunities for solitude or primitive recreation vary throughout the roadless expanse depending on topography, vegetation, distance to roads and trails that allow motorized use, and other human structures. Forest visitors seeking outstanding opportunities for solitude could be displaced from IRAs and adjacent unroaded areas during construction, operation, and closure and reclamation of the SGP. The Operations Area Boundary includes approximately 8,874 acres of Sugar Mountain, Horse Heaven, and Meadow Creek IRAs combined and reduces the area available for outstanding opportunities for solitude or primitive recreation. The presence of workers, vehicles, and the sound of equipment would be high during the entire life of the SGP. The presence of workers, vehicles, and the sound of equipment would decrease the areas within Meadow Creek, Black Lake, Burnt Log, and Horse Heaven IRAs and adjacent unroaded areas with outstanding opportunities for solitude and primitive types of recreation.

During operation, noise from daily road use or maintenance and blasting at the mine site could continue to reduce areas within these IRAs with outstanding opportunities for solitude. The OHV trail and Burntlog Route could lead to increase motorized public use and, thereby, indirectly increase recreation use in Meadow Creek, Horse Heaven, Black Lake, and Burnt Log IRAs. Due to increased traffic, forest visitors also may avoid IRA areas nearer to the mine site, indirectly increasing recreation use in Caton Lake, Secesh, or other IRAs. After mine closure, the Burnt Log Road (FR 447) would remain and could lead to increased recreation use and decreased opportunities for primitive recreation and solitude within IRAs. Section 4.19.2.1, Direct and Indirect Impacts to Recreation - Alternative 1, provides additional information about the potential effects on recreation.

4.23.3.2.1.4 Special Features and Values

Special features in the 13 IRAs include areas valued for their scientific qualities, scenic qualities, or other notable distinct features. Special features that could be affected by the SGP under Alternative 1 include habitat for Canada lynx, wolverine, and anadromous fish species; elk security areas (winter range) and migration paths; and vegetation communities where whitebark pine could be present. Construction of mine site facilities, access roads, and utilities could result in a loss or fragmentation of Threatened and Endangered Species and Forest Service Sensitive species habitat within Meadow Creek, Horse Heaven, Black Lake, Burnt Log, Caton Lake, and Reeves Creek IRAs. Elk use and migration within the elk security area of Horse Heaven IRA could be disturbed by noise from mine-related traffic and human activity during all SGP phases. Fish habitat would be improved if sediment loads reduce and fish passage improves in streams within Meadow Creek, Caton Lake, and Horse Heaven IRAs. The Chilcoot Peak Resource Natural Area (RNA) and eligible WSR segments of Burntlog Creek and Johnson Creek also could be indirectly affected by activities under Alternative 1 from invasive species and sediment loading changes creating changes to water quality. Section 4.23.4, Research Natural Areas, provides additional information on RNAs.

4.23.3.2.1.5 Manageability

Manageability of IRAs is the ability of the Forest Service to manage these areas to maintain roadless characteristics. The new mining facilities, access routes, and transmission line would create substantially noticeable human development and structures within IRAs and would create isolated parcels that may be difficult to manage during construction and operation of the SGP. Constructing the OHV trail would increase the miles of motorized trails within Meadow Creek IRA from 14.9 miles to 17.2 miles, a 15 percent increase. The location of Burntlog Route and the new transmission line in Black Lake, Burnt Log, and Meadow Creek IRAs would create isolated parcels that would be difficult to manage as wilderness.

4.23.3.2.2 ALTERNATIVE 2

Under Alternative 2, the construction of proposed mine facilities, access roads, OHV trail, and new transmission line would be similar to Alternative 1. **Figure 2.4-1** and **Figure 2.4-2** show the location of proposed SGP facilities. The differences between Alternatives 1 and 2 where there is a measurable effect on IRAs and land contiguous to unroaded areas include:

- **Burntlog Route, Riordan Creek Segment** – A 5.3-mile segment of the Burntlog Route would be re-routed to the south, higher up in the Riordan Creek drainage, where it would cross Riordan Creek north of Black Lake. **Figure 2.4-5** shows the revised Riordan Creek segment of Burntlog Route.
- **Public access through the mine site** – Public access through the mine site from the Stibnite portion of the McCall-Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) during mining operations would be provided by constructing a 12-foot-wide gravel road to connect Stibnite Road to Thunder Mountain Road. The route would be open to all vehicles year-round.

- **Soil nail walls** – There would be 0.5 mile of soil nail walls constructed within IRAs.
- **Limestone processing** – Lime and crushed limestone would be produced on site from mining a limestone formation in the West End pit.
- **DRSF geosynthetic layer** – A low-permeability geosynthetic layer material overlain by a layer of soil/rock and growth media would be included in the cover material on the Fiddle and Hangar Flats DRSFs.
- **New transmission line** – would remain to provide power to the water treatment plant at the mine site in perpetuity.

A detailed evaluation of the impacts of SGP activities on roadless area characteristics by phase is included in the Stibnite Gold Project Effects on Roadless Character (AECOM 2020b) report. Following is a summary of the impacts under Alternative 2. The impacts associated with the upgraded transmission line would have the same effects on the roadless expanse as described under Alternative 1.

4.23.3.2.2.1 Naturalness

As shown in **Table 4.23-3**, construction and operation of the SGP under Alternative 2 would directly impact Meadow Creek, Horse Heaven, Black Lake, Burnt Log, Caton Lake, and Reeves Creek IRAs. Impacts to these IRAs would be similar in nature to Alternative 1, with differences in total acreages and locations of disturbance. Under Alternative 2, a segment of the Burntlog Route would be re-routed to the south, higher up in the Riordan Creek drainage, where it would cross Riordan Creek north of Black Lake. This re-routed segment would result in 740 acres of IRAs directly impacted, and it would be located closer to Black Lake, where human activity and noise from construction could disturb wildlife species that use Black Lake and the associated riparian areas along Riordan Creek.

Plants

Approximately 740 acres of vegetation would be removed within the six IRAs under Alternative 2. Construction of Burntlog Route would fill approximately 26.5 acres of wetlands. Section 4.10.2.2, Vegetation - Alternative 2 and **Appendix H**, provide additional information on vegetation communities and botanical resources. **Appendix N-3**: Chapter 4 Recreation Mapbooks and Figures, Alternative 2, shows the location of proposed new roads within Burnt Log, Black Lake, and Meadow Creek IRAs. During the 12 years of operation under Alternative 2, with the limestone processing at the mine site, the number of mine vehicles on Burntlog Route would be 50 AADT. Reducing the amount of mine related traffic could reduce the transport of non-native plant species within Burnt Log, Black Lake, and the eastern part of Meadow Creek IRAs. Maintaining vegetation in the new transmission line and use of access roads would permanently change plant succession within 33 acres of Horse Heaven and Meadow Creek IRA. Vehicles used to maintain the new transmission line could transport non-native plant species.

Fish and Wildlife

A 5.3-mile segment of Burntlog Route would be near the ridge between the upper elevations of Riordan Creek and the FCRNRW. Vegetation, including Canada lynx and wolverine habitat, would be removed within Meadow Creek, Horse Heaven, Black Lake, and Burnt Log IRAs. Human activity and noise during construction and operations could disturb wildlife species near Black Lake and the associated riparian areas along Riordan Creek. Maintaining vegetation in the new transmission line and use of access roads would permanently change wildlife within 38 acres of Horse Heaven and Meadow Creek IRA. Section 4.13.2 Wildlife and Wildlife Habitat, Direct and Indirect Effects, provides additional information regarding wildlife habitats.

Soil, Water, and Air

Construction of SGP facilities would result in approximately 740 acres of total soil resource commitments and detrimental disturbance of soil resources within IRAs. Channeling approximately 3.5 miles of Meadow Creek around the TSF and Hangar Flats DRSF would have the same effects on streamflow and water quality as Alternative 1. As described in Section 4.3, Air Quality, the lime kiln operation would increase emissions of sulfur dioxide.

Natural Appearing Landscapes with High Scenic Quality

The total amount of disturbance within the IRAs would be 740 acres, and the distance through IRAs where soil nail walls are constructed to retain slopes would be 0.5 mile. Locating a 5.3-mile segment of Burntlog Route at a higher elevation within the Riordan Creek drainage could be visible in a greater area of the Black Lake and Meadow Creek IRAs, depending upon the height of cut slopes. Maintaining vegetation in the new transmission line ROW and use of access roads in perpetuity would permanently change plant succession within 33 acres of Horse Heaven and Meadow Creek IRA. The 100-foot-wide ROW would contrast with the adjacent undisturbed vegetation, reducing the quality of scenic resources. Section 4.20.2.2, Scenic Resources - Alternative 2, provides additional information about the potential effects on scenic resources under Alternative 2.

4.23.3.2.2.2 Undeveloped

The effects on the undeveloped roadless character within IRAs during construction, operations, and closure and reclamation would be the same as those described under Alternative 1 for SGP facilities at the mine site. The location of Burntlog Route under Alternative 2 would impact 118.4 acres in Burnt Log, Black Lake and Meadow Creek IRAs.

After mine closure and reclamation, the 491 acres of TSF and DRSF would be the same as Alternative 1; however, DRSF liners, new transmission line, 3.1 miles of transmission line access roads, and approximately 0.5 mile of retaining walls would remain as structures within Meadow Creek, Horse Heaven, Black Lake, and Burnt Log IRAs There would be approximately 529 additional acres of structures within IRAs compared to the No Action Alternative.

4.23.3.2.2.3 Outstanding Opportunities for Solitude and Primitive Recreation

Under Alternative 2, there would 135,827 acres within IRAs that would meet the semi-primitive non-motorized recreation setting during the summer, as detailed in **Appendix N**. During the winter, there would be 104,717 acres meeting the semi-primitive motorized recreation setting. Increasing areas within the roadless expanse meeting semi-primitive motorized physical recreation setting could reduce opportunities for solitude and primitive recreation. Maintaining the new transmission line and use of access roads would reduce the area within Horse Heaven and Meadow Creek IRA with outstanding opportunities for solitude. The construction and use of either of the two public access road options could increase recreation use and motorized access in Meadow Creek IRA. Section 4.19.2.2, Recreation – Alternative 2, provides additional information about the potential effects on recreation.

4.23.3.2.2.4 Special Features and Values

Under Alternative 2, construction of Burntlog Route would be the same distance from the Chilcoot Peak RNA and the Burnt Log eligible WSR corridor. Therefore, the effects on special features and values during construction, operations, and closure and reclamation would be the same as those described under Alternative 1.

4.23.3.2.2.5 Manageability

Under Alternative 2, relocating 5.3 miles of Burntlog Route within the Riordan Creek drainage would have the same effect on the manageability of Black Lake IRA as Alternative 1. The new transmission line and access roads would create an isolated parcel within Horse Heaven IRA in perpetuity. Burntlog Route and the OHV connector trail within the Black Lake, Burnt Log, Horse Heaven, and Meadow Creek IRAs would create isolated parcels that would be difficult to manage for wilderness during mine construction and operation.

4.23.3.2.3 ALTERNATIVE 3

Under Alternative 3, infrastructure and operations at the mine site would be similar to Alternative 1. However, under Alternative 3, the TSF would be in the EFSFSR drainage, worker housing facility would be in the East Fork Meadow Creek (Blowout Creek) drainage, the new transmission line would be located outside of Horse Heaven and Meadow Creek IRAs, and there would be no public access through the mine site during operations. **Figures 2.5-1** and **2.5-2** show the location of proposed SGP facilities.

The effect from the upgrade to the transmission line would have the same effects on the roadless expanse as Alternative 1. A detailed evaluation of the impacts of SGP activities on roadless area characteristics by SGP phase is included in the Stibnite Gold Project Effects on Roadless Character (AECOM 2020b) report. The impacts under Alternative 3 to roadless character are described in the following sections.

4.23.3.2.3.1 Naturalness

As shown in **Table 4.23-4**, construction and operation of the SGP under Alternative 3 would directly impact Meadow Creek, Horse Heaven, Black Lake, Burnt Log, Caton Lake, and Reeves Creek IRAs. Impacts to these IRAs would be similar in nature to Alternative 1, with differences in the total acres and locations of disturbance. Construction of Burntlog Route would result in a loss of naturalness in the Blowout Creek drainage of the Meadow Creek IRA.

Plants

Approximately 638 acres of vegetation would be removed within the six IRAs. Under Alternative 3, construction of Burntlog Route and VHF access roads would have the same impacts on wetlands within IRAs as Alternative 1. Section 4.10.2.3, Vegetation – Alternative 3 and **Appendix H**, provide additional information on vegetation communities and botanical resources. **Appendix N-4**: Chapter 4 Recreation Mapbooks and Figures – Alternative 3, shows the location of proposed new roads within Burnt Log, Black Lake, and Meadow Creek IRAs. Construction of the TSF and DRSF in the EFSFSR would permanently affect slope and valley wetlands in the Fern Creek and EFSFSR drainages, including wetlands and riparian vegetation within the Meadow Creek IRA. Section 4.11.3.4, Wetlands and Riparian Resources – Alternative 3, contains additional information about potential impact on wetlands and riparian areas.

Fish and Wildlife

The TSF/DRSF placement could reduce the amount and productivity of fish habitat in the EFSFSR watershed. The TSF/DRSF would form a barrier to fish passage in the EFSFSR above the confluence with Meadow Creek. Fish habitat connectivity would be temporarily disrupted during the installation or removal of culverts on access roads within four IRAs, Burnt Log, Black Lake, Horse Heaven, and Meadow Creek. Section 4.12.2.5, Fish Resources and Fish Habitat, Alternative 3, provides additional information about potential effects on fish habitat during construction.

Under Alternative 3, the predicted concentrations of arsenic, antimony, and manganese in the EFSFSR downgradient of the Meadow Creek confluence would be higher than the strictest potentially applicable surface water quality standards. Long-term, the higher concentrations of these minerals could indirectly affect aquatic species and fish habitat in tributaries downstream of the Meadow Creek and Horse Heaven IRAs. Vegetation including Canada lynx and wolverine habitat would be removed within Meadow Creek, Horse Heaven, Black Lake, and Burnt Log IRAs. Changing the location of the TSF and DRSF to the EFSFR would increase the area where large trees are removed. Construction of SGP components would reduce suitable Canada lynx and wolverine habitat. Section 4.13.2, Wildlife and Wildlife Habitat, and **Appendix K**, provide additional information.

Soil, Water, and Air

Construction of the SGP within IRAs would result in 638 acres of total soil resource commitments and detrimental disturbance of soil resources within IRAs. As discussed in Section

4.8, Surface Water and Groundwater Quantity, changes in surface water flows in the EFSFSR above the confluence with Meadow Creek are predicted to be less than changes under Alternative 1, because groundwater discharge to the EFSFSR beneath the TSF and DRSF would be less. Under Alternative 3, construction of the TSF/DRSF would not use material from the spent ore disposal area, and the predicted concentrations of arsenic, antimony, and sulfate in the EFSFSR downgradient of the Meadow Creek confluence would be higher under Alternative 3 compared to the No Action Alternative.

Natural Appearing Landscapes with High Scenic Quality

The TSF and DRSF would alter the landforms on the eastern side of Meadow Creek IRA within the EFSFSR drainage. Modifications to the landscape would convert natural landforms to structured landforms that would not blend with adjacent slopes and undisturbed areas. The lighter unoxidized color of the DRSF rocks and lack of vegetation would reduce the natural appearing landscapes and scenic quality in EFSFSR drainage within the eastern part of Meadow Creek IRA.

The effects on the natural appearing landscape and scenic quality in Burnt Log and Black Lake IRAs from Burntlog Route would be the same as Alterative 1. Section 4.20.2.3, Scenic Resources - Alternative 3, provides additional information about the potential effects on Scenic Resources.

4.23.3.2.3.2 Undeveloped Character

Under Alternative 3, constructing the worker housing and 2.2 miles of Burntlog Route in Blowout Creek would be additional structures within Meadow Creek IRA. Long-term, worker housing and Burntlog Route would affect the undeveloped roadless character in the eastern part of Meadow Creek IRA from the introduction of new structures into the natural landscape. If the Blowout Creek segment of Burntlog Route is converted to a public access road after mine closure and reclamation, there would be an additional 2.2 miles of roads within Meadow Creek IRA.

Under Alternative 3, the new transmission line would be located outside of IRAs (in the gap between Meadow Creek and Horse Heaven IRAs). The new transmission line from Johnson Creek substation to the mine site would require construction and maintenance of two poles within Meadow Creek IRA near FR 416W. These poles would be in the same location as Alternative 1.

After mine closure, 455 acres at the mine site, 1.5 miles of access road retaining walls, geotextile fabric, and the foundations for the transmission poles, would remain as structures within Meadow Creek, Horse Heaven, Black Lake, and Burnt Log IRAs. If the Forest Service selects the public access road through Blowout Creek, the length of roads within Meadow Creek IRA would increase to 5.1 miles compared to 2.9 miles under Alternative 1. There would be an increase of approximately 455 acres of structures compared to the No Action Alternative.

4.23.3.2.3.3 Outstanding Opportunities for Solitude and Primitive Recreation

Impacts on outstanding opportunities for solitude and primitive recreation would be the same as those described under Alternative 1, although the Operations Area Boundary would be approximately 10,905 acres of Sugar Mountain, Horse Heaven, and Meadow Creek IRAs. During the 12 years of mine operation there would be no public access through the mine site, as shown on **Figure 2.5-2**, Mine Site Overview. Under Alternative 3, there would be a decrease in areas meeting the roaded natural recreation setting in IRAs. During the winter, the area meeting the semi-primitive motorized recreation setting would be 102,516 acres. Section 4.19.2.3, Recreation - Alternative 3, provides additional information about the potential effects on recreation.

4.23.3.2.3.4 Special Features and Values

The effects on special features and values during construction, operations, and closure and reclamation would be the same as those described under Alternative 1

4.23.3.2.3.5 Manageability

Alternative 3 would have similar impacts on IRA manageability as Alternative 1. The new transmission line would be located between Horse Heaven and Meadow Creek IRAs, and, therefore, the ability to manage the Meadow Creek drainage area of Horse Heaven and Meadow Creek IRAs as wilderness would be the same as existing conditions. Changing the location of the TSF and DRSF to the EFSFSR on the east side of Meadow Creek IRA would make this area of the IRA more difficult to manage as wilderness.

4.23.3.2.4 ALTERNATIVE 4

Under Alternative 4, infrastructure and operations at the mine site would be the same as Alternative 1. **Figure 2.6-1** and **2.6-2** show the location of proposed SGP facilities. The differences between Alternatives 1 and 4 where there is a measurable effect on IRAs and lands contiguous to unroaded areas include:

- **Yellow Pine Route** – Access to the mine site during construction, operation, closure and reclamation would be via Johnson Creek Road (CR 10-413) and Stibnite portion of the McCall-Stibnite Road (CR 50-412). The construction phase of the SGP would increase to 5 years. During construction, public use of Stibnite Road from the village of Yellow Pine to the north mine gate would be limited to before 10:00 AM and after 4:00 PM. Also, the Johnson Creek Road would be periodically closed to public use for extended periods (up to 4 to 5 months) during construction.
- **Public access through the mine site** – Public access through the mine site from Stibnite Road to Thunder Mountain Road (FR 50375) during mining operations would be provided by constructing a 12-foot-wide gravel road to connect Stibnite Road to Thunder Mountain Road. The route would be open to all vehicles year-round.

- **VHF construction** – Construction of VHF towers sites within an IRA would be via helicopter.

The upgrade to the transmission line would have the same effects on the roadless expanse as Alternative 1. A detailed evaluation of the impacts of SGP activities on roadless area characteristics by SGP phase is included in the Stibnite Gold Project Effects on Roadless Character (AECOM 2020b) report. A summary of the impacts under Alternative 4 that would result in changes to roadless character is described in the following sections.

4.23.3.2.4.1 Naturalness

As shown in **Table 4.23-4**, construction and operation of the SGP under Alternative 4 would directly impact Meadow Creek, Horse Heaven, Caton Lake, and Reeves Creek IRAs. Impacts to these IRAs from mine facilities and utilities would be similar in nature to Alternative 1. Under Alternative 4, improvements and use of only the Yellow Pine Route for mine access would eliminate impacts within Black Lake and Burnt Log IRAs and within portions of Meadow Creek IRA associated with the Burntlog Route.

Plants

A total of 531 acres of vegetation would be removed within the Meadow Creek, Horse Heaven, Caton Lake, and Reeves Creek IRAs. Section 4.10.2.4, Vegetation – Alternative 4 and **Appendix H**, provide additional information on vegetation communities and botanical resources. Impacts on 5.5 acres of wetlands from construction of the new transmission line would be the same as Alternative 1. Section 4.11.4.4, Wetlands and Riparian Resources – Alternative 4, contains additional information about potential impact on wetlands and riparian areas

Construction of Yellow Pine Route along the boundary of Meadow Creek, Horse Heaven, and Sugar Mountain IRAs could disperse non-native invasive plant species. Construction and operations traffic along Yellow Pine Route also would increase the spread of non-native plant species into these IRAs.

Using a helicopter to construct VHF repeater sites located within IRAs would reduce the miles of temporary access roads needed and reduce the potential for non-native plant species to spread in the eastern part of Meadow Creek IRA.

Fish and Wildlife

Fish and aquatic species habitat alterations at the mine site would be the same as those described under Alternative 1, except during operations a pipeline would create a new passage barrier to all resident fish species attempting to move upstream in Meadow Creek upstream of the Hangar Flats pit.

Under Alternative 4, using Yellow Pine Route to access the mine site could disturb wildlife movement in Caton Lake, Meadow Creek, Horse Heaven, and Sugar Mountain IRAs. Vegetation including Canada lynx and wolverine habitat removed during construction of the TSF, DRSFs, and new transmission line within Meadow Creek and Horse Heaven IRAs would alter wildlife habitat. Construction of Yellow Pine Route along the boundary of Caton Lake, Meadow Creek, Horse Heaven, and Sugar Mountain IRAs would extend SGP construction to 5 years. The additional 2 years of construction and 12 years of mine operation would increase the duration when sensitive wildlife species could be displaced from habitats in IRAs adjacent to Yellow Pine Route. Section 4.13.2, Wildlife and Wildlife Habitat, and **Appendix K** provide additional information.

Soil, Water, and Air

Construction of SGP components within IRAs would result in 531 acres of total soil resource commitments and detrimental disturbance of soil resources within IRAs. Sediment deposition during the construction of Yellow Pine Route from replacing or clearing culverts would have a temporary impact on water quality. Section 4.9.2.4.2.2, Surface Water and Groundwater Quality - Access Roads, provides additional information on sediment and access roads. Construction to widen Yellow Pine Route would generate fugitive dust.

Natural Appearing Landscapes with High Scenic Quality

The effects on the natural appearing landscapes from constructing the TSF, Hangar Flats DRSF, and the new transmission line would be the same as Alternative 1. Widening Yellow Pine Route would change natural appearing landscapes in adjacent areas within Secesh, Sugar Mountain, and Horse Heaven IRAs. Section 4.20.2.4, Scenic Resources – Alternative 4, provides additional information about the potential effects on Scenic Resources.

4.23.3.2.4.2 Undeveloped Character

Under Alternative 4, within Meadow Creek and Horse Heaven IRAs, the TSF and TSF embankment structures would have same effect as those described under Alternative 1.

After mine closure, 491 acres at the mine site and the foundations for the transmission poles, would remain as structures within Meadow Creek, Horse Heaven IRAs. There would be an increase of approximately 491 acres of structures compared to the No Action Alternative.

4.23.3.2.4.3 Outstanding Opportunities for Solitude and Primitive Recreation

Under Alternative 4, using Yellow Pine Route to access the mine site during construction, operation, and closure and reclamation, would decrease opportunities for solitude in adjacent areas of Secesh, Sugar Mountain, Horse Heaven, and Meadow Creek IRAs.

Under Alternative 4, areas that meet the semi-primitive non-motorized recreation setting would be 136,077 acres during the summer, as detailed in the Stibnite Gold Project Effects on Roadless Character (AECOM 2020b) report. During the winter 154,240 acres would meet the semi-primitive non-motorized recreation setting.

Indirectly, the number and size of mine vehicles using Yellow Pine Route could change dispersed recreation use within the 13 IRAs. Some forest visitors may choose to avoid areas where SGP components would be constructed or where Yellow Pine Route would be used for access. This could increase recreation use in other areas of the 13 IRAs and lands contiguous to unroaded areas. Section 4.19.2.4, Recreation – Alternative 4, provides additional information about the potential effects on recreation.

4.23.3.2.4.4 Special Features and Values

Under Alternative 4, the construction Yellow Pine Route would have no direct effect on the eligible Burntlog Creek WSR or any of the six RNAs. Alternative 4 would disturb 525 acres of whitebark pine, Canada lynx, and wolverine habitat.

4.23.3.2.4.5 Manageability

Under Alternative 4, the manageability of Black Lake and Burnt Log IRAs as wilderness would be the same as existing conditions. The new transmission line and the TSF and DRSF locations in Horse Heaven and Meadow Creek IRAs would have the same effect on the ability for the Forest Service to manage these areas as wilderness as those described under Alternative 1.

4.23.3.2.5 ALTERNATIVE 5

Under Alternative 5, approved mineral exploration adjacent to, but not within, Meadow Creek, Horse Heaven, and Sugar Mountain IRAs would continue. As such, the roadless character within the 13 IRAs would be the same as existing conditions.

4.23.3.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.23.3.4 Cumulative Effects

Effects on IRAs and the lands contiguous to unroaded areas could overlap in space and time with the direct and indirect effects and the following RFFAs:

- Morgan Ridge Mineral Exploratory Drilling[2]
- South Fork Salmon River RAMP
- East Fork Salmon River RAMP
- Big Creek Hazardous Fuels Reduction Project

Cumulative effects from the proposed SGP components and RFFAs could affect naturalness and outstanding opportunities for solitude and primitive types of recreation.

4.23.3.4.1 ALTERNATIVES 1, 2, AND 3

Naturalness

Surface disturbance and vehicles from SGP and RFFA activities could spread non-native plant species. Depending on site conditions, and non-native plant species characteristics, non- native invasive plant species could spread into Sugar Mountain, Horse Heaven, and Meadow Creek IRAs. The extent where non-native invasive plant species could become established within these IRAs is unknown. Surveys and treatments implemented for Alternatives 1, 2, and 3 and RFFAs would reduce the potential for non-native species to spread.

Burntlog Route and the RFFAs could result in temporary to short term barriers to wildlife movement, disturbance, and increase vehicle-wildlife collisions. Wildlife mortality and distribution would be influenced by existing vegetation, site conditions, the wildlife species sensitivity to disturbance. The extent where wildlife distribution and movement could change or increase in vehicle-wildlife collisions is unknown. Changes in wildlife distribution from the activities associated with Alternatives 1, 2, and 3 and the RFFAs could decrease natural roadless character in Meadow Creek, Horse Heaven, and Sugar Mountain IRAs.

Blowout Creek rock drain, hazardous fuel reduction, and potential changes to the miles of roads could reduce sediment in streams within the cumulative impact analysis area. Reducing sediment would improve water quality and long-term fish habitat quality. The extent and locations of streams where fish habitat quality could improve is unknown; however, increases in fish habitat quality within IRAs would improve natural roadless character.

Outstanding Opportunities for Solitude and Primitive Recreation

Noise from Alternatives 1, 2, and 3 and the RFFAs would decrease outstanding opportunities for solitude within Sugar Mountain, Horse Heaven, and Meadow Creek IRAs and lands contiguous to unroaded areas. The intensity of the effect would vary depending upon the forest visitor’s sensitivity. Human activity and noise during the 20 years of mine construction, operation, and closure and reclamation and the RFFAs decrease the area with outstanding opportunities for solitude. Theextent where these effects could decrease roadless character within IRAs and

[2] The Morgan Ridge Exploratory Drilling Project is currently on hold.

lands contiguous to unroaded areas is unknown and influenced by topography, vegetation and when activities for the RFFAs are implemented.

4.23.3.4.2 ALTERNATIVE 4

Naturalness

Surface disturbance and vehicles from Alternative 4 and implementation of the RFFAs could increase the potential for non-native plant species to spreading into IRAs and lands contiguous to unroaded areas. Using Yellow Pine Route for mine access, combined with the RFFAs, could increase the vehicle traffic and increase the potential for non-native invasive plant species to spread. The extent where non-native invasive plant species could become established is unknown. Existing vegetation and site conditions would influence the spread of non-native invasive plant species. Surveys and treatments implemented for Alternative 4 and the RFFAs would cumulatively reduce the effects on the natural roadless character.

Traffic on Yellow Pine Route during mine construction and operation, combined with the RFFAs, would increase habitat fragmentation and barriers to movement, noise, and potential vehicle-wildlife collisions. These actions could increase wildlife mortality and change the distribution of wildlife within Sugar Mountain and Horse Heaven IRAs. The potential for an increase in wildlife mortality and habitat fragmentation would be influenced by existing vegetation, site conditions, and wildlife sensitivity to disturbance. The extent where wildlife distribution and movement could change is unknown; however, areas within the IRAs and lands contiguous to unroaded areas that are avoided by wildlife would have less natural roadless character.

Outstanding Opportunities for Solitude and Primitive Recreation

Forest visitors avoiding the mine site or areas of IRAs accessed from Yellow Pine Route and changes from access management plans could decrease outstanding opportunities for solitude within IRAs and lands contiguous to unroaded areas. The intensity of the effect would vary depending upon the forest visitor’s sensitivity. Human activity and noise during the SGP’s 22 years (5 years mine construction, 12 years operation, 5 years mine closure/reclamation) and the duration the RFFAs are implemented would decrease outstanding opportunities for solitude. The extent where these effects could decrease roadless character within IRAs and lands contiguous to unroaded areas is unknown and would be influenced by topography, vegetation, and timing of when RFFAs are implemented.

4.23.3.4.3 ALTERNATIVE 5

Naturalness

Under Alternative 5, surface exploration authorized as part of the RFFAs could increase the potential for non-native invasive plant species to spread. The surface exploration for the Golden Meadow project and the RFFAs could disturb soils and remove vegetation adjacent to Sugar Mountain IRA. Surface disturbing activities could increase the spread of non-native invasive plant species into the adjacent area of Sugar Mountain IRA. The extent where non-native invasive plant species could become established is unknown. Surveys and treatments implemented for the RFFAs would reduce the effects on the natural roadless character.

Outstanding Opportunities for Solitude and Primitive Recreation

Under Alternative 5, noise from surface exploration authorized for the Golden Meadow project combined with the East Fork RAMP, could decrease outstanding opportunities for solitude within the area of Sugar Mountain, Meadow Creek, and Horse IRAs. The noise extent from the Golden Meadows project mineral exploration in combination with the RFFAs is unknown. Topography and distance between surface exploration activities and the RFFAs influence the area where noise could decrease outstanding opportunities for solitude and primitive recreation.

4.23.3.5 Irreversible and Irretrievable Commitments of Public Resources

Under Alternatives 1, 2, and 3, soil nail walls would remain within Burnt Log, Black Lake, and Meadow Creek IRAs after decommissioning Burntlog Route. The areas where soil nail walls remain would be an irreversible commitment of natural roadless character. Under Alternative 1, approximately 1.5 miles of soil nail walls would be constructed and remain in place after Burntlog Route decommissioning. Under Alternatives 2 and 3, 0.5 mile of soil nail walls would remain in place after Burntlog Route decommissioning (Parametrix 2019). Starting at the end of mine year 18, Midas Gold would remove the Burntlog Route travelway and recontour slopes where practical (Tetra Tech 2019). The travelway would be removed to the toe of soil nail walls (Midas Gold 2018). Soil nail walls would not support vegetation communities or habitat for wildlife species that require large undisturbed areas. Soil nail walls would provide evidence of past human activity, resulting in an irreversible decrease in the undeveloped roadless character within the three IRAs.

Under Alternative 2, the new transmission line, access roads, and plowing Stibnite Road from the Yellow Pine to the mine site would support the water treatment plant operation in perpetuity. The 38 acres where the transmission line corridor and access roads remain would be an irreversible commitment of natural roadless character. Where and when audible, plowing Stibnite Road from Yellow Pine to the mine site would be an irreversible commitment of solitude roadless character.

Under Alternatives 1, 2, 3, and 4, non-native plant species could spread into the IRAs, and disturbance of wildlife would increase relative to existing conditions. Under all action alternatives, surveys conducted by Midas Gold for 3 years after a disturbed area is seeded or planted, and treatment of non-native plant species could reduce the extent where non-native plant species become established. Where treatments of non-native plant species are successful, vegetation composition and structure could provide high-quality wildlife habitat over years or decades. The extent of where non-native plant species could establish is unknown but would most likely be along ROWs and access roads. There could be an irretrievable loss of the natural quality of roadless character where non-native plant species become established.

The increase in human activity in the IRA and lands contiguous to unroaded areas would decrease outstanding opportunities for solitude and primitive types of recreation under all action alternatives. The extent of the decrease in associated roadless character is unknown; however, following mine closure, outstanding opportunities for solitude could return to pre-mining levels, and there would be no long-term irreversible commitment of roadless resources.

4.23.3.6 Short-term Uses versus Long-term Productivity

4.23.3.6.1 ALTERNATIVE 1

Short-term uses of areas disturbed for the new transmission line and upgraded transmission line would have a long-term effect on solitude in Horse Heaven, Meadow Creek, and Reeves Creek IRAs. The TSF, DRSFs, and 1.5 miles of retaining walls along Burntlog Route would be a long-term loss of soil productivity on 751 acres within six IRAs. In the long term, areas that were cleared of vegetation for SGP components would be visible from several key viewpoints, resulting a long-term impact on visual quality.

4.23.3.6.2 ALTERNATIVE 2

The short-term uses of Horse Heaven, Meadow Creek, and Reeves Creek IRAs would be the same as those described under Alternative 1. Under Alternative 2, there would be approximately 204 acres disturbed by Burntlog Route and 0.5 mile of retaining walls and the transmission line in Horse Haven and Meadow Creek would remain long-term.

4.23.3.6.3 ALTERNATIVE 3

The short-term uses of Meadow Creek, and Reeves Creek IRAs for the upgraded transmission line would be the same as those described under Alternative 1. Under Alternative 3, the long-term loss of soil productivity within Meadow Creek, Burnt Log, and Black Lake IRAs from the retaining walls would be the same as Alternative 1.

4.23.3.6.4 ALTERNATIVE 4

The short-term uses of Horse Heaven, Meadow Creek, and Reeves Creek IRAs for the new transmission line and upgraded transmission line would be the same as those described under Alternative 1. Under Alternative 4, the long-term loss of soil productivity within Meadow Creek, Burnt Log, and Black Lake IRAs the TSF and Hangar Flats DRSF would be the same as Alternative 1.

4.23.3.7 Summary

The analysis of effects on roadless character focuses on the roadless area characteristics of naturalness; undeveloped character; outstanding opportunities for solitude and primitive types of recreation; special features and values; and manageability.

Under all action alternatives, construction of mine site facilities, access roads, and utilities would remove vegetation, alter topography, and modify fish and wildlife habitat within IRAs.

Construction and operation of the SGP under Alternatives 1, 2, and 3 would directly impact Meadow Creek, Horse Heaven, Black Lake, Burnt Log, Caton Lake, and Reeves Creek IRAs. Impacts to these IRAs would be similar in nature under these alternatives, with differences in total acreages and locations of disturbance. Alternative 4 would have the least impact on IRAs. Under Alternative 4, improvements and use of only the Yellow Pine Route for mine access would eliminate impacts within Black Lake and Burnt Log IRAs and within portions of Meadow Creek IRA associated with Burntlog Route.

Table 4.23-4 at the end of Section 4.23.4 provides a summary comparison of IRA impacts by issue and indicators for each alternative.

4.23.4 Research Natural Areas

4.23.4.1 Effects Analysis Indicators and Methodology of Analysis

The analysis of effects to RNAs includes the following issue and indicators:

Issue: The SGP could impact research values or ecosystem conditions within RNAs.

Indicators:

- Change in vegetation community composition and structure within an RNA.
- Change in number of vehicles using roads and human activity.
- Changes to water quality (chemistry, temperature) or quantity within an RNA.

RNAs were analyzed using resource databases including invasive plant species surveys, GIS spatial analyses, scientific literature reviews, and information and analysis documented in reports prepared for the SGP. The establishment records for the RNAs and monitoring reports include a plant list, the forest types, and habitat within the RNA. However, complete botanical survey information for the six RNAs in the analysis area is unavailable.

4.23.4.2 Direct and Indirect Effects

The following analysis of effects associated with RNAs is considered within the overall context of vegetation and hydrologic conditions within the RNA analysis area. Elements of this context include:

- By definition, RNA's unique ecological communities provide opportunities to study ecological processes and long- and short-term ecological change. Within the Intermountain Region, the RNAs provide a control area for comparing the results of manipulative research and monitor the effects of resource management techniques and practices applied to similar ecosystems.
- Ecological processes within the six RNAs are related to overall ecosystem health and impacts that alter vegetation or affect hydrology could have effects that extend to the greater ecosystem of an area.
- Potential impacts to research values, ecological site conditions, and ecological processes are analyzed based on SGP phasing (e.g., construction, operations, closure and reclamation).
- Under all action alternatives, the applicant would be required to adhere to SGP design features, resource protection measures, Forest Service-required measures, and expected permit stipulations.

The purpose of the analysis is to disclose the potential effects on the research values, ecological site conditions, and processes in the six RNAs within the analysis area. **Table 4.23-3** describes the distance and direction of the nearest SGP component to each RNA.

Table 4.23-3 Research Natural Area Location and Distance to Nearest SGP Component

RNA	Location and Distance to SGP Component
Back Creek	A portion of the Back Creek RNA is within the Peace Rock IRA and is located about 7 miles south of Warm Lake Road (CR 10-579), which would be used for mine access.
Belvidere Creek	The entire Belvidere Creek RNA is within the FCRNRW and is located about 7 miles northeast of the village of Yellow Pine and approximately 7 miles north of the mine site.
Chilcoot Peak	Portions of the Chilcoot Peak RNA are within the FCRNRW and Burnt Log IRA and are located near FR 447 (Burnt Log Road).
Circle End Creek	A portion of the Circle End Creek RNA is within the Secesh IRA and is located about 18 miles north/northwest of the mine site and about 11 miles northwest of the village of Yellow Pine.
Needles	The entire Needles RNA is within the Needles IRA and is located about 7 miles north of Warm Lake Road (CR 10-579), which would be used for mine access.
Phoebe Meadows	A portion of the Phoebe Meadows RNA is within the Caton Lake IRA; about 8 miles southwest of the village of Yellow Pine, and about 15 miles west the mine site.

Table Source: AECOM 2020a

Table Notes:

CR = County Road; FCRNRW = Frank Church-River of No Return Wilderness; FR = National Forest System Road; IRA = Inventoried Roadless Area; RNA = Research Natural Area

As discussed in Section 3.23.3, Affected Environment, Research Natural Areas, the analysis area includes RNAs that are within 5 miles of the mine site, access roads, off-site facilities, and new and upgraded transmission lines. The analysis area also includes RNAs where there could be potential effects on research values, ecological site conditions, and processes from recreation use. Under all alternatives, there would be no structures or facilities located within the boundaries of the six RNAs. Under all action alternatives, the proposed SGP activities would be located downgradient of streams that flow through RNAs or would be in watersheds that do not contain streams that flow through RNAs. There are no predicted changes to water chemistry, temperature, or quality in the stream segments that flow through the six RNAs.

4.23.4.2.1 ALTERNATIVE 1

4.23.4.2.1.1 Construction

As part of Burntlog Route, reconstructing approximately three miles of Burnt Log Road (FR 447) would remove vegetation and disturb soils located within 100 to 3,100 feet of the Chilcoot Peak RNA boundary. Removing existing vegetation and disturbing soils would disperse non-native invasive plant species that could become established within the Chilcoot Peak RNA (Forest Service 2019; Jacobs et al. 2009). Non-native invasive plant species populations along Burnt Log Road, such as rush skeletonweed, spotted knapweed, and oxeye daisy, could become established in areas disturbed during Burntlog Route construction (Milan et al. 2016; Forest

Service 2019). Material from the 94.8 acres of borrow sources used to reconstruct and widen Burnt Log Road also could contain non-native invasive plant species. The potential for non-native plant species to spread into the Chilcoot Peak RNA depends upon adjacent vegetation conditions and the non-native plant species characteristics. Surveying interim reclamation areas for non-native invasive plant species and implementing treatments for 3 years after Burntlog Route construction is completed could reduce the potential for non-native invasive plant species to become established. Additionally, performing non-native plant species control measures as required in the Payette Forest Plan and Boise Forest Plan and under Forest Service Manual 2900 would reduce the potential for invasive plant species to become established. Implementing Forest Service standards NPST07, NPST08, and NPST12 could reduce the spread of non-native invasive plant species from borrow sources. Surveys and implementing treatments would not completely remove the risk of non-native invasive plants or species that are not present within Chilcoot RNA from becoming established and spreading into the Chilcoot Peak RNA.

Interim reclamation and the use of certified weed-free mulch in disturbed areas would decrease the potential for non-native invasive plant species to spread and help stabilize soils (Gornish et al. 2016; Midas Gold 2016; Tetra Tech 2019). The Forest Service approved species used in the seed mix could spread into the Chilcoot Peak RNA (Morris and Schupp 2009). The spread of plant species not currently present within the Chilcoot Peak RNA habitat types would change research values, ecological site conditions, and ecological processes within the Chilcoot Peak RNA (Forest Service 1995).

Once Burntlog Route is complete, the AADT would increase from 27 to 95 vehicles, approximately 3.5 times the existing traffic volume. Increasing the number and size of vehicles using Burnt Log Road as part of Burntlog Route could increase the amount of dust deposited on adjacent vegetation. The distance dust travels depends on a variety of factors, including wind direction and speed, dust particle size, and vehicle travel speed (Cuscino et al. 1977). Dust deposition could change ecological conditions in approximately 10 acres of the Chilcoot Peak RNA that are within 300 feet of Burntlog Route (Lewis et al. 2017; Watson 2000). Dust abatement measures during construction would reduce the amount of fugitive dust generated and deposited on vegetation within the Chilcoot Peak RNA. During the two years of Burntlog Route construction, the effects on vegetation health from dust deposition within the RNA would likely not be measurable (Squires 2016; Trombulak and Frissel 2000; Ulrichs et al. 2008).

During construction, widening Burnt Log Road would increase human activity in areas near the Chilcoot Peak RNA and could increase the potential for human-ignited fires. While lightning is the primary source of fire in northwest forests, the human-ignited fire season is longer. Human-ignited fires occurring earlier or later than lightning-ignited fires could change the natural fire regime (Nagy et al. 2018). Fires occurring more frequently or during different seasons than lightning-ignited fires could change vegetation plant species succession and ecological processes within the Chilcoot Peak RNA. The presence of road construction crews in construction camps could decrease the amount of time before a fire is detected and increase the probability of a human-caused fire.

Timber harvested at the mine site could be transported on Burntlog Route. Timber from the mine site could have conifer pathogens such as pathogenic bark beetle species (e.g., mountain pine beetle [*Dendroctonus ponderosae*]), and white pine blister rust, which is caused by the introduced pathogen *Cronartium ribicola* (Hinke et al. 2016; Keane et al. 2017). At this time, the presence of conifer pathogens at the mine site is unknown; however, if present, pathogens could be transported on timber harvested at the mine site or other areas (Brockerhoff and Liebhold 2017; Jain and Graham 2005). Conifer pathogens could be distributed during the transport of timber on Burntlog Route. The potential for conifer pathogens to be introduced into the Chilcoot Peak RNA depends upon site conditions during the transport of timber and specific characteristics of a conifer pathogen. Whitebark pine/subalpine fir habitat type is one of the distinguishing features of the Chilcoot Peak RNA, and conifer pathogens could cause mortality of whitebark pine and other conifers. Changes in the composition and structure of existing vegetation communities and ecological succession would result in a long-term loss of the Chilcoot Peak RNA research value and ecological condition. The extent where insects and pathogens could be introduced into Chilcoot Peak RNA from the transport of timber harvested in other areas is unknown.

Nine new culverts would be installed and two existing culverts would be replaced on an approximately 0.7-mile segment of Burntlog Route near Chilcoot Peak RNA (**Figure 4.23-2**). The culverts could change the movement of sediment, woody debris, and other organic material (Forest Service 2008). Culverts could change water quantity or hydrologic connection and indirectly effect ecological processes in areas adjacent to the Chilcoot Peak RNA. The extent and duration of where there could be changes to ecological processes is unknown.

The removal of vegetation, soil disturbance, and access road improvements from the upgrade to the existing Idaho Power Company transmission line could disperse non-native invasive plant species into adjacent RNAs. Vehicles and equipment could transport non-native plant species seeds that could become established and spread (Trombulak and Frissell 2000). This increase in vehicles, human activity, and the disturbance of vegetation and soils would be over 3 miles from the six RNAs listed in **Table 4.23-3**. As part of Idaho Power Company's construction activities, the Weed Management Plan outlines measures for preventing and controlling noxious weed infestations. This plan also includes protocols for noxious weed surveys and reporting. This plan does not specifically discuss non-native plants that are not noxious weeds; however, the applicable noxious weed and non-native species standards from the Payette Forest Plan (Forest Service 2003) and Boise Forest Plan (Forest Service 2010) would apply to the connected action. Constructing the upgraded transmission line would not result in measurable direct or indirect effects on the research values, ecological site conditions, and ecological processes within the six RNAs.

This page intentionally left blank

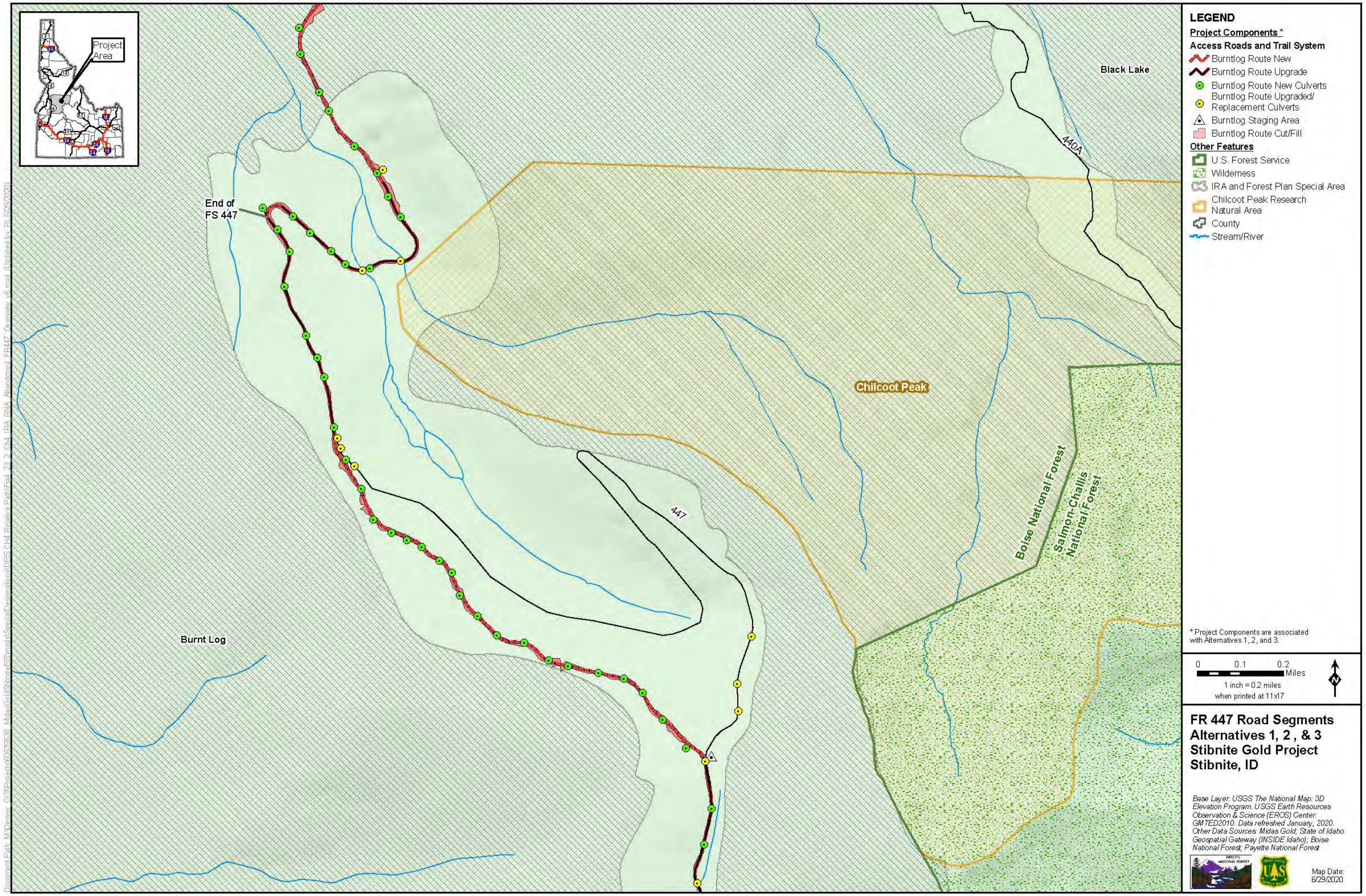


Figure Source: AECOM 2020

Figure 4.23-2 FR 447 Road Segments Alternatives 1, 2, and 3

This page intentionally left blank

4.23.4.2.1.2 Operation

During the 12 years of operation, AADT along the Burntlog route would increase from 27 to 95 vehicles, approximately 3.5 times the existing number of vehicles on Burnt Log Road. Daily road maintenance of Burntlog Route could disturb vegetation on road shoulders and distribute non-native invasive species seeds (Rew et al. 2018). The Forest Service could conduct surveys for invasive plant species and implement treatments. However, surveys and treatments would not completely remove the risk of non-native invasive plants or species spreading into the Chilcoot Peak RNA. Traffic on Burntlog Route could continue to deposit dust on approximately 10 acres of vegetation within the Chilcoot Peak RNA. Dust abatement measures during operation would reduce the amount of fugitive dust generated and the amount of dust that could be deposited on vegetation within the Chilcoot Peak RNA (Lewis et al. 2017; Ulrichs et al. 2008). Changes in vegetation community composition and structure would result in a loss of research values, ecological site conditions, and ecological processes in the Chilcoot Peak RNA.

Use of Burntlog Route would remove an approximately 2.4-mile section of Burnt Log Road that is within 700 to 800 feet of the Chilcoot Peak RNA boundary. Removing and decommissioning approximately 2.4 miles of abandoned Burnt Log Road segments during SGP operation could increase the spread of invasive plant species such as rush skeleton weed near Chilcoot Peak RNA. Widening Burnt Log Road as part of Burntlog Route could increase the recreation use of Summit Trail (NFST 088) and Springfield Mine Road (FR 440A), which cross the Chilcoot Peak RNA (Forest Service 1995; Marion et al. 2016). Recreation use and the risk of non-native invasive plant species distribution and establishment would increase (Trombulak and Frissel 2000). Vehicles, clothing, and recreation equipment could transport non-native plant and invasive plant species seeds (Ansong and Pickering 2016; Taylor et al. 2012; Trombulak and Frissel 2000). The potential for non-native plant species to spread into the Chilcoot Peak RNA depends upon adjacent vegetation conditions and the non-native plant species characteristics. Changes to existing vegetation community composition and structure would result in the long-term loss of research values, ecological site conditions, and ecological processes within the Chilcoot Peak RNAs.

Forest visitors may choose to avoid Burnt Log Road, Burntlog Route, and the mine site due to the increased traffic, increased number of large vehicles, and potential delays during daily Burntlog Route maintenance activities. Recreation use could increase in other areas, such as the South Fork Salmon River and Big Creek drainages. During the summer, if recreation use on Warren-Profile Gap Road (FR 50340), Hamilton Bar (FR 50673), South Fork Road (FR 50674), and NFST 291 increases, the risk of non-native invasive plant species distribution and establishment would increase (Trombulak and Frissel 2000). Non-native plant species could become established within the Belvidere Creek, Circle End Creek, and Phoebe Meadows RNAs.

Changes in vegetation community composition and structure within these three RNAs would occur where non-native invasive plant species become established, soils are compacted, trails widened, or there is a change in fire frequency. Changes to vegetation composition and structure would result in the long-term loss of research values, ecological site conditions, and ecological processes within these three RNAs.

The operation and maintenance of the upgraded transmission line could disperse non-native invasive plant species. Vehicles and equipment could transport non-native plant species seeds that could become established and spread (Trombulak and Frissell 2000). The increase in vehicles, human activity, and the vegetation management of the transmission line would be over 3 miles from the six RNAs listed in **Table 4.23-3**. At this distance, these activities would not result in measurable direct or indirect effects on the research values, ecological site conditions, and ecological processes within the six RNAs.

4.23.4.2.1.3 Closure and Reclamation

During mine closure and reclamation, an estimated AADT of 57 vehicles, including 25 mine vehicles, would use Burntlog Route an additional 5 to 7 years after the mine operation ceases. During mine closure, the AADT on Burntlog Route, including 25 mine vehicles, would increase from 27 to 57, approximately 1.9 times the existing traffic on Burnt Log Road. Vehicles and daily road maintenance activities could disperse non-native invasive plant species and continue to deposit dust on approximately 10 acres of vegetation within the Chilcoot Peak RNA. Dust abatement measures during closure and reclamation would reduce the amount of fugitive dust generated. The amount of dust deposited on vegetation within the Chilcoot Peak RNA is unknown (Lewis et al. 2017; Ulrichs et al. 2008).

Recontouring slopes, reducing the width of the Burnt Log Road segment of Burntlog Route, and the use of the reclamation seed mix could spread non-native invasive plant species. Seeding disturbed areas with the approved seed mix and certified weed-free mulch would stabilize soils and decrease the potential for non-native invasive plant species to become established (Gornish et al. 2016; Midas Gold 2016; Tetra Tech 2019). Native and non-native plant species used in the seed mix could spread into the Chilcoot Peak RNA (Morris and Schupp 2009). The spread of native and non-native plant species into Chilcoot Peak RNA would change vegetation community composition and structure (Forest Service 1995). Changes in vegetation community composition and structure would result in a loss of research values, ecological conditions, and ecological processes in the Chilcoot Peak RNA. Reclamation of disturbed areas, which involve revegetation on NFS lands, would be done according to Payette or Boise Forest Plan Standards and in coordination with a Forest Service botanist.

Implementing actions described in the SGP Final Reclamation Plan, South Fork Salmon River Subbasin Noxious and Invasive Weed Management Plan, and Valley County noxious weed control programs would reduce the potential for non-native plant species to become established within the RNAs. Surveys and implementing treatments would not altogether remove the risk of non-native invasive plants or species that are not present in existing habitat types from becoming established and spreading into the Chilcoot Peak RNA. Where non-native plant species become established within an RNA, there would be a permanent loss of RNA values.

4.23.4.2.2 ALTERNATIVE 2

4.23.4.2.2.1 Construction

The effects on Chilcoot Peak RNA research values, ecological site conditions, and ecological processes from Burntlog Route construction, including the reconstruction of Burnt Log Road, dust deposition, increased human activity, and the transport of timber from the mine site, would be the same as those described under Alternative 1. Once Burntlog Route is complete, the AADT would increase from 27 to 95 vehicles, approximately 3.5 times the existing traffic volume. The potential for non-native plant species and plant species used during interim reclamation to spread into adjacent undisturbed areas depends upon vegetation conditions and the non-native plant species characteristics. The extent insects and pathogens could be introduced into Chilcoot Peak RNA from the transport of timber harvested at the mine site is unknown. The spread of plant species not present within the Chilcoot Peak RNA vegetation communities, insects, and pathogens would change research values, ecological site conditions, and ecological processes within the Chilcoot Peak RNA (Forest Service 1995).

4.23.4.2.2.2 Operations

The effects on the six RNAs research values, ecological site conditions, and ecological processes from vehicles on Burntlog Route, dust deposition, recreation, and human activity, would be the same as those described under Alternative 1. During the 12 years of SGP mine operation, the AADT would increase from 27 to 77 vehicles number approximately 2.8 times the existing traffic on Burnt Log Road. Lime kiln operation would reduce the amount of mine-related traffic on Burntlog Route. Reducing the number of mine vehicles to an average of 50 vehicles per day could reduce the transport of non-native invasive plant species.

Daily maintenance of Burntlog Route, vehicles, and recreation use could increase the potential for non-native invasive plant species to spread and become established within Chilcoot Peak RNA. The spread of non-native invasive plant species would change the composition and structure of vegetation communities within the Chilcoot Peak RNA. Changes in vegetation community composition and structure would result in a loss of research values, ecological site conditions, and ecological processes in the Chilcoot Peak RNA (Forest Service 1995).

The potential for increased recreation use on Warren-Profile Gap Road (FR 50340), Hamilton Bar (FR 50673), South Fork Road (FR 50674), and NFST 291 in the South Fork Salmon River and Big Creek drainages would be the same as Alternative 1. Widening Burnt Log Road as part of Burntlog Route could increase the recreation use of Summit Trail (NFST 088), which crosses Chilcoot Peak RNA (Forest Service 1995). Increased recreation use could increase the risk of non-native invasive plant species distribution and establishment within Belvidere Creek, Chilcoot Peak, Circle End Creek, and Phoebe Meadows RNAs (Marion et al. 2016; Rew et al. 2018; Trombulak and Frissel 2000). Changes in vegetation community composition and structure within RNAs would occur where non-native invasive plant species become established, soils are compacted, or trails widened, or there is a change in fire frequency. Changes to vegetation composition and structure would result in a long-term loss of research values, ecological site conditions, and ecological processes within these four RNAs.

4.23.4.2.2.3 Closure and Reclamation

The effects on Chilcoot Peak RNA research values, ecological site conditions, and ecological processes from vehicles on Burntlog Route, dust deposition, recreation, and human activity, would be the same as those described under Alternative 1. The non-native invasive plants and plant species used in the seed mix could spread into the Chilcoot Peak RNA (Gornish et al. 2016; Midas Gold 2016; Morris, Schupp 2009; Tetra Tech 2019). The spread of native and non-native plant species that are not present Chilcoot Peak RNA would change vegetation community composition and structure. Changes in vegetation community composition and structure would result in a loss of research values, ecological site conditions, and ecological processes in the Chilcoot Peak RNA (Forest Service 1995).

Implementing actions described in the SGP Final Reclamation Plan, Forest Standards, and the Payette and Boise National Forest Noxious Weed and Poisonous Plant Control Programs would reduce the potential for non-native plant species to become established within the RNA. Surveys and implementing treatments would not completely remove the risk of non-native invasive plants or species that are not present within Chilcoot RNA from becoming established and spreading into the Chilcoot Peak RNA.

4.23.4.2.3 ALTERNATIVE 3

4.23.4.2.3.1 Construction

The effects on Chilcoot Peak RNA research values, ecological site conditions, and ecological processes from Burntlog Route construction, including the reconstruction of Burnt Log Road, dust deposition, increased human activity, and the transport of timber from the mine site, would be the same as those described under Alternative 1. Once Burntlog Route is complete, the AADT would increase from 27 to 95 vehicles, approximately 3.5 times the existing traffic volume. The potential for non-native plant species and plant species used during interim reclamation to spread into adjacent undisturbed areas depends upon vegetation conditions and the non-native plant species characteristics. The extent insects and pathogens could be introduced into Chilcoot Peak RNA from the transport of timber harvested at the mine site is unknown. The spread of plant species not present within the Chilcoot Peak RNA vegetation communities, insects, and pathogens would change research values, ecological site conditions, and ecological processes within the Chilcoot Peak RNA (Forest Service 1995).

4.23.4.2.3.2 Operations

The effects on the six RNAs research values, ecological site conditions, and ecological processes from vehicles on Burntlog Route, dust deposition, recreation, and human activity, would be the same as those described under Alternative 1. Traffic during the 12 years of operation on the Burntlog Route would be approximately 3.5 times the existing traffic. During the 12 years of mine operation, the AADT would increase from 27 to 95 vehicles. However, there would be no public access through the mine site, which could reduce the number of recreation vehicles using Burntlog Route. If recreation use on Burntlog Route decreased, the transport of non-native invasive plant species and risk of human ignited fires could decrease in areas adjacent to Chilcoot Peak RNA. The potential for a decrease in recreation use and human activity is unknown. The spread of non-native invasive plant species would change the composition and structure of vegetation communities within the Chilcoot Peak RNA. Changes in vegetation community composition and structure would result in a loss of research values, ecological site conditions, and ecological processes in the Chilcoot Peak RNA (Forest Service 1995).

The potential for increased recreation use on Warren-Profile Gap (FR 50340), Hamilton Bar (FR 50673), South Fork Road (FR 50674), and NFST 291 in the South Fork of the Salmon River and Big Creek drainages would be the same as Alternative 1. Widening Burnt Log Road as part of Burntlog Route could increase the recreation use of Summit Trail (NFST 088), which crosses Chilcoot Peak RNA (Forest Service 1995). Increased recreation use could increase the risk of non-native invasive plant species distribution and establishment within Belvidere Creek, Chilcoot Peak, Circle End Creek, and Phoebe Meadows RNAs (Marion et al. 2016; Rew et al. 2018; Trombulak and Frissel 2000;). Changes in vegetation community composition and structure within RNAs would occur where non-native invasive plant species become established, soils are compacted, or trails widened, or there is a change in fire frequency. Changes to vegetation community composition and structure would result in a long-term loss of research values, ecological site conditions, and ecological processes within these four RNAs.

4.23.4.2.3.3 Closure and Reclamation

The effects on Chilcoot Peak RNA research values, ecological site conditions, and ecological processes from vehicles on Burntlog Route, dust deposition, recreation, and human activity during closure and reclamation would be the same as those described under Alternative 1.

Implementing actions described in the SGP Final Reclamation Plan, Forest Standards, and the PNF and BNF Noxious Weed and Poisonous Plant Control Programs would reduce the potential for non-native plant species to become established within the RNA. Surveys and implementing treatments would not completely remove the risk of non-native invasive plants or species that are not present within Chilcoot RNA from becoming established and spreading into the Chilcoot Peak RNA.

4.23.4.2.4 ALTERNATIVE 4

4.23.4.2.4.1 Construction

Under Alternative 4, Burntlog Route would not be constructed, and the 65 mine construction vehicles would use Yellow Pine Route. During the 5 years of mine construction, the AADT would increase from 57 to 122 vehicles on Johnson Creek Road (CR 10-413), and from 39 to 104 on the Stibnite portion of the McCall-Stibnite Road (CR 50-412), approximately 2.1 to 2.6 times the existing traffic volumes. These activities would disperse non-native invasive plant species (Forest Service 2019; Jacobs et al. 2009). The increase in vehicles, human activity, and the disturbance of vegetation and soils would occur over 3 miles from the six RNAs listed in **Table 4.23-3**. These activities would not result in measurable direct or indirect effects on the research values, ecological site conditions, and ecological processes within the six RNAs.

Construction of mine access roads under Alternative 4 would be 1 year longer than under any other action alternative and increase the overall construction period to 5 years; which could increase the potential for recreation use in other areas. The increase in vehicles and delays during the 5 years of construction could indirectly increase recreation use in other areas such as the South Fork Salmon River. If recreation use on Phoebe Meadows trail (NFST 291) and South Fork Salmon River East trail (NFST 076) increases, the risk of non-native invasive plant species distribution and establishment would increase (Trombulak and Frissel 2000). Vehicles, clothing, and recreation equipment could transport non- native plant and invasive plant species seeds (Ansong and Pickering 2016; Taylor et al. 2012; Trombulak and Frissel 2000). Non-native plant species could become established within the Circle End Creek and Phoebe Meadows RNAs from vehicles and recreation use of Phoebe Meadows Trail (NFST 291) or South Fork Salmon River East Trail (NFST 076). The potential for non-native plant species to spread into the RNAs depends upon vegetation conditions and the non-native plant species characteristics. Changes in vegetation community composition and structure within the RNAs would occur where non-native invasive plant species become established, soils are compacted, or trails widened, or there is a change in fire frequency. Changes to vegetation composition and structure would result in the long-term loss of research values, ecological site conditions, and ecological processes within these three RNAs.

The application of Forest Plan standards and implementing treatments consistent with the PNF Noxious Weed Program and Idaho's Noxious Weed Management and Control Program would reduce the potential for non-native plant species to become established within Phoebe Creek and Circle Creek RNAs during construction. Non-native invasive plant species could become established within the RNAs. This would result in a long- term loss of research values, ecological conditions, and ecological processes.

4.23.4.2.4.2 Operations

During the 12 years of the mine operation, traffic volumes on Yellow Pine Route would increase. The AADT on Johnson Creek Road would increase from 57 to 125 vehicles, and on Stibnite Road from 39 to 107 vehicles, approximately 2.1 to 2.7 times the existing traffic volumes. Forest visitors may choose to avoid Yellow Pine Route due to the increased traffic, increased number of large vehicles, and potential delays during daily maintenance activities. Forest visitors could increase recreation use in the South Fork Salmon River and Big Creek drainages. Widening Stibnite Road could increase recreation use in the Big Creek drainage. During the summer, if recreation use on Warren-Profile Gap Road (FR 50340), Hamilton Bar (FR 50673), South Fork Road (FR 50674), and Phoebe Meadows Trail (NFST 291) increases, the risk of non-native invasive plant species distribution and establishment would increase (Trombulak and Frissel 2000). Vehicles and recreation equipment could disperse non-native invasive plant species (Forest Service 2013, 2015, 2019; Jacobs et al. 2009). Non-native plant species could become established within Belvidere, Circle End Creek, and Phoebe Meadows RNAs. The distance reduces the potential for invasive plant species to spread within the Phoebe Meadows and Circle Creek RNAs from conducting road maintenance activities. Changes in vegetation community composition and structure within the RNAs would occur where non-native invasive plant species become established, soils are compacted, or trails widened, or there is a change in fire frequency. Changes to vegetation community composition and structure would result in the long-term loss of research values, ecological site conditions, and ecological processes within these three RNAs.

4.23.4.2.4.3 Closure and Reclamation

During the 5 years of mine closure and reclamation, the AADT on Johnson Creek Road increases from existing 57 to 82 vehicles, and on Stibnite Road from 39 to 64 vehicles, approximately 1.4 to 1.6 times the existing traffic volumes. Human activity and the disturbance of vegetation and soils would be over 3 miles from the six RNAs listed in **Table 4.23-3**. Belvidere Creek, the RNA nearest to the mine site, is approximately 6 miles north. These activities would not result in measurable direct or indirect effects on the research values, ecological site conditions, and ecological processes within the six RNAs.

During the summer, if recreation use on Warren-Profile Gap Road increased, the risk of non-native invasive plant species distribution and establishment could increase (Trombulak and Frissel 2000). Vehicles and recreation equipment could disperse non-native invasive plant species (Forest Service 2013, 2015, 2019; Jacobs et al. 2009). Non-native plant species could become established within Belvidere RNA. Changes in vegetation community composition and structure within Belvidere RNA would occur where non-native invasive plant species become established, soils are compacted, or trails widened, or there is a change in fire frequency. Changes to vegetation community composition and structure would result in the long-term loss of research values, ecological site conditions, and ecological processes within Belvidere RNA.

4.23.4.2.5 Alternative 5

Under Alternative 5, Midas Gold would continue with exploration, monitoring, and reclamation commitments as described in the Golden Meadows Decision Memo and Environmental Assessment. Belvidere Creek, the RNA nearest to the mine site, is approximately 6 miles north. Fugitive dust generated from vehicles and reclamation activities would attenuate within 300 feet of unpaved roads (Watson 2000). The distance of approximately 6 miles between Belvidere Creek RNA and mine site reclamation and monitoring activities reduces the potential for fugitive dust and non-native invasive plant species establishment that could result in the loss of research values, ecological site conditions, and ecological processes within the six RNAs.

The spread of non-native invasive plant species varies based on each species characteristics. The distance from the mineral exploration and seeding of disturbed areas to any of the six RNAs listed in **Table 4.23-3** is more than 5 miles. The distance and the NFS and Valley County roads used for access reduce the potential for mine site activities to spread non-native invasive plant species into the six RNAs. Therefore, there would not be measurable direct or indirect effects on the hydrologic conditions, vegetation communities, or the research values within the six RNAs from exploration, reclamation, and monitoring activities conducted at the mine site.

Warm Lake Road, Johnson Creek Road, and Stibnite Road would be used to access the mine site for exploration and monitoring activities in the summer. Motor vehicles and personnel using these roads or conducting maintenance activities could transport non-native invasive plant species seeds and propagules. Chilcoot Peak, the RNA nearest to Johnson Creek Road, is approximately 3 miles east of Johnson Creek Road, where aggregate and road maintenance activities would be conducted. The distance reduces the potential for fugitive dust and invasive plant species to spread within the Chilcoot Peak RNA from conducting road maintenance activities. Therefore, there would not be measurable direct or indirect effects on research values or ecosystem conditions within the six RNAs listed in **Table 4.23-3** from the use of existing roads or their maintenance.

4.23.4.3 Other Suggested Mitigation Measures and Effectiveness

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service; and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

4.23.4.4 Cumulative Effects

The RFFAs that could contribute to cumulative changes in research values, ecological site conditions, or change ecological processes within the six RNAs listed in **Table 4.23-3** are:

- South Fork Salmon River RAMP
- Big Creek Hazardous Fuels Reduction Project

The SGP and these RFFAs include surface disturbing activities or changes in human activity that could indirectly affect research values and vegetation communities' conditions within an RNA.

4.23.4.4.1 Alternative 1, 2, and 3

The RFFAs would not impact the RNAs; therefore, no cumulative effects would occur in the RNAs.

4.23.4.4.2 Alternative 4

Under Alternatives 4, during mine construction and operation, recreation use could increase in other areas, such as the South Fork Salmon River and Big Creek drainages.

Improvements and maintenance of Stibnite Road as part of the Yellow Pine Route could indirectly increase recreation use in the Big Creek drainage. Recreation use in the Big Creek drainage during the 17 years of mine construction and operation, combined with the implementation of the Big Creek Hazardous Fuels Reduction Project, could increase the potential for non-native invasive plant species to spread into Belvidere RNA.

Increased recreation use from forest visitors avoiding the mine site, areas with increased traffic volumes and human activity, combined with surface disturbance associated with implementing the RFFAs, could increase the potential non-native invasive plant species to spread into Belvidere RNA. The potential for non-native plant species to spread into the RNA depends upon vegetation conditions and the non-native plant species characteristics.

Changes in vegetation community composition and structure within the Belvidere RNA would occur where non-native invasive plant species become established, soils are compacted, or trails widen. Changes to vegetation community composition and structure would result in the long-term loss of research values, ecological site conditions, and ecological processes within the Belvidere RNA.

4.23.4.4.3 ALTERNATIVE 5

Under Alternative 5, the exploration and reclamation activities at the mine site and the RFFAs are over 6 miles from the six RNAs. Belvidere Creek, the RNA nearest to the mine site, is approximately 6 miles north, reducing the potential for cumulative effects from the RFFAs and mine site reclamation and monitoring activities.

4.23.4.5 Irreversible and Irretrievable Commitments of Public Resources

4.23.4.5.1 ALTERNATIVES 1, 2, 3, AND 4

The establishment of non-native invasive plant species and human-ignited fire could indirectly change the composition and structure of vegetation communities within the six RNAs. The change in vegetation community composition and structure would be an irretrievable loss of research values within an RNA and the Intermountain Region. The extent of non-native invasive species established or within the six RNAs listed in **Table 4.23-3** or changes in fire frequency from human-ignited fires is unknown.

4.23.4.5.2 ALTERNATIVE 5

Under Alternative 5, within the six RNAs, there would be no measurable irreversible commitment of research values, ecological conditions, or change in ecological processes.

4.23.4.6 Short-term Uses versus Long-term Productivity

Under alternatives 1, 2, 3, and 4, the research values, ecological site conditions, and ecological processes within RNAs could be impacted in both the short- and long-term. The increase in risk for non-native invasive plant species to establish within the RNAs where the duration of the surface disturbance is temporary would be considered a short-term impact. However, the establishment of non-native invasive plant species would be a long-term reduction in research values, ecological site conditions, and ecological processes within any of the six RNA listed in **Table 4.23-3.**

4.23.4.7 Summary

Under all action alternatives, the proposed SGP activities would be located downgradient of streams that flow through RNAs or would be in watersheds that do not contain streams that flow through RNAs. There are no predicted changes to water chemistry, temperature, or quality in the stream segments that flow through the six RNAs.

Under Alternatives 1, 2, and 3 reconstructing approximately 3 miles of Burnt Log Road (FR 447) for the Burntlog Route would remove vegetation within 100 to 3,100 feet of the Chilcoot Peak RNA. Interim reclamation and vehicles could provide opportunities for non-native plant species to become established and spread into the RNA. There would be a long-term loss of Chilcoot Peak RNA research and ecological process values where non-native plant species become established. Forest approved species used during interim reclamation, and increased traffic and recreation use could spread non-native plant species into Chilcoot Peak RNA. Increased human activities could increase the risk of human ignited fires. Changes in the fire regime could result in a loss of research and ecological process values within the Chilcoot Peak RNA.

Under Alternatives 1, 2, and 3 nine additional culverts on a 0.7-mile segment of Burntlog Route could change the movement of sediment, woody debris, and other organic material (Forest Service 2008). Culverts could change water quantity or hydrologic connection and indirectly ecological processes in areas adjacent to the Chilcoot Peak RNA. The extent and duration of where there could be changes to ecological processes within Chilcoot Peak RNA is unknown.

The Burntlog Route would not be constructed under Alternative 4 and would retain the existing ecological process values of Chilcoot Peak RNA. If Forest visitors choose to avoid Yellow Pine Route during construction and operation, recreation use on motorized trails could increase in Circle Creek RNA. Increased recreation use could provide opportunities for non-native plant species to become established and spread in this RNA. There would be a long-term loss of Circle Creek RNA research and ecological process values where non-native plant species become established.

Under Alternative 5, Midas Gold would continue with exploration, monitoring, and reclamation commitments as described in the Golden Meadows Decision Memo and Environmental Assessment. The distance of approximately 6 miles between Belvidere Creek RNA, the nearest RNA, and reclamation and monitoring activities reduces the potential for fugitive dust and non-native plant species to spread into the RNA. Therefore, there would not be measurable direct or indirect effects on research values or ecosystem conditions within the six RNAs under Alternative 5.

Table 4.23-4 provides a summary comparison of RNA impacts by issue and indicators for each alternative.

Table 4.23-4 Comparison of SGP Impacts by Alternative

Issue	Indicator	Baseline (Existing) Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Wilderness							
The SGP could change the quality of wilderness character in designated or recommended wilderness areas.	Distance of SGP facilities from designated or recommended wilderness.	The FCRNRW and recommended wilderness areas contain diverse vegetation and wildlife species. Vegetation varies from ponderosa pine/bluebunch wheatgrass or Idaho fescue, and Douglas- fir/ninebark or snowberry at lower elevations, to near-alpine habitat in the highest elevation areas. Wildfires have continually altered the wilderness landscape, creating brush fields, large lodgepole pine stands, extensive snag patches, and variations in species and age classes of vegetation.	Surface disturbance and vehicles used during the 2 years to construct Burntlog Route would increase the potential for non- native plant species to spread into the FCRNRW. Construction and maintenance of 1.3 miles of Burntlog Route between 170 and 300 feet of the FCRNRW boundary could result in sediment deposited in headwater tributaries to Big Chief Creek. The use of Yellow Pine Route, construction of Burntlog Route and the OHV Connector Trail could disturb wildlife and change the distribution of big game within the FCRNRW. During the 3 years of construction, the increase in human activity near the western FCRNRW boundary could change ecological processes in areas where non-native plant species establish. During the 12 years of operation, mine traffic and recreation use on Burntlog Route could increase the potential for non-native plant species to spread into the FCRNRW. Where established, non- native plants could alter ecological processes. The 68 vehicles per day, Burntlog Route daily road maintenance, and recreation use of access roads adjacent to the FCRNRW western boundary could displace wildlife from areas within the FCRNRW. The OHV trail could increase motorized recreation use in areas near the FCRNRW and disturb big game, decreasing their use of habitat within the FCRNRW. Mine and forest visitor traffic using Burntlog Route during the 5 years of mine closure	Effects would be the same as Alternative 1 except: Disturbance from the cut and fill slopes on 5.3 miles of Burntlog Route in the headwaters of Riordan Creek would increase the risk of non-native plant species spreading into the FCRNRW. Decreasing mine traffic to 50 vehicles per day on Burntlog Route could decrease the potential for non- native plant species to spread into the FCRNRW. However, decreasing the number of mine vehicles could increase recreation use on Burntlog Route. During the 2 years of Burnt Log Route decommissioning, the increase in disturbed areas near the FCRNRW would increase the potential for non-native plant species to spread into the FCRNRW.	Effects would be the same as Alternative 1 except: Not allowing public access through the mine during construction and not constructing the OHV trail could decrease recreation vehicle traffic on roads adjacent to the FCRNRW. This could decrease the potential for non-native plant species to spread into the FCRNRW. If forest visitors avoid NFS lands beyond the mine site, recreation use in Big Creek area of the FCRNRW or recommended wilderness areas could increase. Indirectly increasing recreation use could increase the areas where big game is disturbed. Not allowing public access through the mine during construction and not constructing the OHV trail could decrease recreation vehicle traffic on roads adjacent to the FCRNRW. This could decrease the potential for non-native plant species to spread into the FCRNRW. During the 12 years of mine operation if forest visitors avoid NFS lands beyond the mine site, recreation use in Big Creek area of the FCRNRW or recommended wilderness areas could increase. Indirectly increasing recreation use could increase the areas where big game is disturbed.	Using Yellow Pine Route during the 5 years of mine construction would reduce the potential for non-native plant species to spread into the FCRNRW. Using Yellow Pine Route for mine access would reduce the miles of road near the FCRNRW and help retain existing wildlife distribution. Using Yellow Pine Route for mine access during the 12 years of mine operation would reduce the miles of road near the FCRNRW. Using Yellow Pine Route during the 12 years of mine operation would reduce the potential for non-native plant species to spread into the FCRNRW. Mine vehicles and recreation use would be on existing roads. The use of existing roads for mine traffic would reduce the area adjacent to the FCRNRW where vehicle traffic could disturb big game species. Surface disturbance from mineral exploration, reseeding disturbed areas, and monitoring activities would be 3 miles from the FCRNRW boundary. The natural quality of wilderness character would be the same as existing conditions.	Surface disturbance from mineral exploration, reseeding disturbed areas, and monitoring activities would be 3 miles from the FCRNRW boundary.

Issue	Indicator	Baseline (Existing) Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
			could increase the potential for non-native plant species to spread into the FCRNRW. Recontouring slopes and seeding during the 2 years of decommissioning Burntlog Route also would increase the potential for non-native plant species to spread into the FCRNRW.				
The SGP could change the quality of wilderness character in designated or recommended wilderness areas.	Distance of designated or recommended wilderness from sights and sounds of human activity from SGP activities.	The FCRNRW and recommended wilderness areas contain diverse vegetation and wildlife species. Vegetation varies from ponderosa pine/bluebunch wheatgrass or Idaho fescue, and Douglas- fir/ninebark or snowberry at lower elevations, to near-alpine habitat in the highest elevation areas. Wildfires have continually altered the wilderness landscape, creating brush fields, large lodgepole pine stands, extensive snag patches, and variations in species and age classes of vegetation.	Noise from the construction of Burntlog Route would be audible up to 3 miles within the FCRNRW. Noise from daily road maintenance activities on Burntlog Route could be heard within FCRNRW up to 4 miles depending upon topography and weather conditions. Noise from recontouring slopes during the 5 years of mine closure would be audible up to 4 miles within the FCRNRW where audible noise would reduce opportunities for solitude within the FCRNRW.	Effects would be the same as Alternative 1 except: Decreasing the distance between Burntlog Route and the FCRNRW boundary would increase the area where noise from construction activities is audible. Decreasing the distance between Burntlog Route and the FCRNRW boundary would increase the area where noise from recontouring slopes and seeding activities would be audible.	Effects would be the same as Alternative 1 except: Not allowing public access through the mine during construction and not constructing the OHV trail could increase recreation use in recommended wilderness areas	Using Yellow Pine Route during construction, operation, and closure and reclamation would eliminate impacts on wilderness associated with the Burntlog Route.	Sights and sounds of human activity from mineral exploration and monitoring activities would be three miles from the FCRNRW boundary.
	Reduced opportunities for self-reliant recreation within designated or recommended wilderness.	The FCRNRW and recommended wilderness areas provide opportunities for solitude and primitive recreation.	If wilderness visitors avoid the FCRNRW areas accessed through the mine site or adjacent to Burntlog Route, increased recreation in recommended wilderness areas could reduce opportunities for solitude within the FCRNRW. Where audible, during the 12 years of mine operation noise from road maintenance would reduce opportunities for solitude within the FCRNRW. Burntlog Route could facilitate an increase in wilderness visits in Big Chief Creek and Pistol Creek drainages of the FCRNRW. During the 17 years of mine operation and mine closure, if wilderness visitors avoid the FCRNRW areas accessed through the mine site or adjacent to Burntlog Route, recreation use in recommended wilderness	Effects would be the same as Alternative 1 except: Decreasing the distance between Burntlog Route and the FCRNRW boundary would increase the area where noise from SGP activities is audible. The extent where noise is audible would reduce opportunities for solitude within the FCRNRW. Decreasing the number of mine related vehicles using Burntlog Route to 50 vehicles per day could indirectly increase wilderness visits in the FCRNRW in Big Chief Creek and Pistol Creek drainages.	Effects would be the same as Alternative 1 except: Not allowing public access through the mine during construction and not constructing the OHV trail could increase recreation use in recommended wilderness areas. Increasing recreation use could reduce opportunities for solitude within recommended wilderness areas. During the 12 years of mine operation, not allowing public access through the mine site could indirectly increase recreation use in recommended wilderness areas. If recreation use increases, it could reduce opportunities for solitude within the recommended wilderness areas.	Using Yellow Pine Route during construction, operation, and closure and reclamation would eliminate impacts on wilderness associated with the Burntlog Route. Using Yellow Pine Route during the 12 years of mine operation could increase wilderness visits to recommended wilderness areas or other areas of the FCRNRW. If recreation use increases, it could reduce opportunities for solitude within the recommended wilderness areas.	Opportunities for solitude would be the same as existing conditions.

Issue	Indicator	Baseline (Existing) Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
			areas could increase. Increased recreation use in recommended wilderness areas could opportunities for solitude.				
Wild and Scenic Rivers							
The SGP may affect the value of eligible or suitable WSRs.	Impacts to free-flowing characteristics of eligible and suitable WSRs.	Free-flowing conditions currently not impacted.	No impacts to free-flowing conditions anticipated.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1.	No impacts to free-flowing conditions anticipated.
	Impacts to water quality of eligible, suitable, and designated WSRs.	Water quality to improve as a result of improved management, site cleanups, and watershed restoration projects.	Area-wide water quality to improve, except for Burntlog Creek where water quality may be adversely impacted. Erosion and sediment control BMPs could reduce water quality impacts.	Same as Alternative 1.	Same as Alternative 1.	Area-wide water quality to improve, except for Johnson Creek where water quality may be adversely impacted. Erosion and sediment control BMPs could reduce water quality impacts.	Water quality to improve as a result of improved management, site cleanups, and watershed restoration projects.
	Impacts to ORVs for which eligible, suitable, and designated WSRs are recognized.	Heritage ORVs likely to decline over time. Fish ORVs anticipated to remain stable or improve.	Heritage ORVs likely to decline over time and one contributing resource removed. Fish ORVs anticipated to remain stable or improve, with possible exception of Burntlog Creek.	Same as Alternative 1.	Same as Alternative 1.	Heritage ORVs same as Alternative 1. Fish ORVs anticipated to remain stable or improve, with possible exception of Johnson Creek.	Heritage ORVs likely to decline over time. Fish ORVs anticipated to remain stable or improve.
	Impacts to the preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs.	No impacts to preliminary Wild, Scenic or Recreational classifications anticipated.	Likely impacts to Wild classification of Burntlog Creek, possible impacts to recreation access to Burntlog Creek.	Same as Alternative 1.	Same as Alternative 1.	No impacts to preliminary Wild, Scenic or Recreational classifications anticipated.	No impacts to preliminary Wild, Scenic or Recreational classifications anticipated.
Inventoried Roadless Area							
The SGP may impact roadless character in IRAs and lands contiguous to unroaded areas.	Miles and acres of new roads in IRAs or contiguous unroaded lands.	Thirteen IRAs within the analysis area are managed for roadless character	During construction and mine operation a total of 17 miles (215 acres) of access roads within five IRAs (Meadow Creek, Horse Heaven, Black Lake, Burnt Log, and Reeves Creek). Within Meadow Creek, Black Lake, and Burnt Log IRAs, 1.5 miles of soil nail walls would be constructed in association with Burntlog Route. After mine closure 1.5 miles of retaining wall (soil nail wall) would remain within the IRAs.	During construction and mine operation a total of 13 miles (204 acres) of access roads within five IRAs (Meadow Creek, Horse Heaven, Black Lake, Burnt Log, and Reeves Creek). Within Meadow Creek, Black Lake, and Burnt Log IRAs, 0.5 miles of soil nail walls would be constructed in association with Burntlog Route. After mine closure, 0.5 miles of retaining walls, and 3.1 miles of access road for the new transmission line would remain within the IRAs.	Total of 17 miles (167 acres) of access roads within five IRAs (Meadow Creek, Horse Heaven, Black Lake, Burnt Log, and Reeves Creek). Within Meadow Creek, Black Lake, and Burnt Log IRAs, 1.5 miles of soil nail walls would be constructed in association with Burntlog Route. After mine closure 1.5 miles of retaining walls and 2.2 miles of Burntlog Route would remain in the IRAs.	No access roads within IRAs.	No new roads within IRAs.
	Number and acres of proposed SGP facilities in IRAs or contiguous unroaded lands.	Thirteen IRAs within the analysis area are managed for roadless character	Total of 751 acres of SGP facilities within six IRAs (Meadow Creek, Horse Heaven, Black Lake, Burnt Log, Caton Lake, and Reeves Creek). After mine closure 491 acres of TSF and DRSFs structures	Total of 740 acres of SGP facilities within six IRAs (Meadow Creek, Horse Heaven, Black Lake, Burnt Log, Caton Lake, and Reeves Creek). After mine closure 529 acres of TSF and DRSFs and transmission line structures	Total of 638 acres of SGP facilities within six IRAs (Meadow Creek, Horse Heaven, Black Lake, Burnt Log, Caton Lake, and Reeves Creek). After mine closure 455 acres of TSF and DRSFs structures	Total of 531 acres of SGP facilities within four IRAs (Meadow Creek, Horse Heaven, Caton Lake, and Reeves Creek). After mine closure 491 acres of TSF and DRSFs structures would remain in Meadow Creek and Horse Heaven IRAs.	No new facilities within IRAs.

Issue	Indicator	Baseline (Existing) Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
			would remain in Meadow Creek and Horse Heaven IRAs.	would remain in Meadow Creek and Horse Heaven IRAs.	would remain in Meadow Creek and Horse Heaven IRAs.		
Research Natural Area							
The SGP could impact research values or ecosystem conditions within RNAs.	Change in vegetation community composition and structure within an RNA. Change in number of vehicles using roads and human activity. Changes to water quality (chemistry, temperature) or quantity within an RNA.	The six RNAs within the analysis area provide opportunities to conduct research and provide a control site to evaluate ecological conditions and processes within the Intermountain West.	Areas where non-native plant species become established would reduce Chilcoot Peak RNA values in the long term. Changes to the vegetation community composition would result in a loss of research values and ecological conditions within an RNA. Dust deposited on vegetation could change vegetation conditions and ecological processes within Chilcoot Peak RNA. Human caused fire ignitions that spread into Chilcoot Peak RNA could change the existing fire regime and reduce the RNA's research values related to ecological process. Changes to the vegetation community composition would result in a loss of research values and ecological conditions within an RNA. Indirectly, if forest visitors avoid areas near Burntlog Route or the mine site there could be an increase in recreation use on trails and roads adjacent to an RNA. If recreation use increased, non- native plant species could spread into Circle Creek and Belvidere RNAs. Culverts along an approximately 0.7-mile segment of FR 447 of Burntlog Route could change the movement of sediment woody debris and other organic material. Additional culverts installed on the 0.7-mile segment of Burntlog Route could indirectly change local hydrologic conditions within Chilcoot Peak RNA and long-term alter ecological process. Changes in ecological processes would reduce Chilcoot Peak RNA values.	Effects on RNAs would be the same as Alternative 1 except the decrease in mine traffic on Burntlog Route to 50 vehicles per day could reduce the potential for non-native invasive plant species to spread into the Chilcoot Peak RNA relative to Alternative 1.	Effects on RNAs would be the same as Alternative 1, except closing public access through the mine site could indirectly increase recreation use in the South Fork Salmon River and Big Creek drainages. The potential loss of RNA values could be less than Alternative 1 as the roads and trails open to public use are several miles from Phoebe Creek and Circle Creek RNAs. Indirect increases in recreation use on forest trails could increase the potential for non-native plant species to spread into Circle Creek and Belvidere RNAs. The potential for recreation use to increase or the potential for non-native plant species to spread into these RNAs is unknown.	The use of Yellow Pine Route for mine access could increase recreation use along the South Fork Salmon River and Big Creek drainages from forest visitors avoiding the mine site. Increased recreation use on trails could increase the potential for non- native invasive plant species to spread into Circle Creek and Belvidere RNAs. The potential loss of RNA values could be less than Alternative 1 as the roads and trails open to public use are several miles from Circle Creek RNA.	Surface exploration and seeding of disturbed areas at the mine site would be over 5 miles from the six RNAs. The research values and ecological site conditions within the RNAs would be the same as existing conditions.

4.24 Tribal Rights and Interests

4.24.1 Effects Analysis Indicators and Methodology of Analysis

Public and tribal access were identified as a significant issue during scoping for the Stibnite Gold Project (SGP). Construction and operation of the mine and infrastructure may impact public access to National Forest System (NFS) lands, travel routes, and tribal rights to access, hunt, and fish in the SGP area. Other issues related to tribal rights and interests were identified during the scoping process, consultation, and through professional research.

The analysis of effects to tribal rights and interests includes the following issue and indicators:

Issue: The SGP would affect tribal rights and interests through physical, audible, and visual disturbances to tribal resources, through restricting access of tribal members from usual and accustomed hunting, fishing, and plant gathering areas, and through changes to the viability and availability of culturally significant fish, wildlife, and plant species.

Indicators:

- Presence of traditional cultural properties (TCPs), cultural landscapes (CLs), sacred sites, and tribal resource collection areas that may be physically impacted by ground disturbance.
- Presence of TCPs, CLs, sacred sites, and tribal resource collection areas that may be impacted by an increase in audible elements (noise and vibrations).
- Presence of TCPs, CLs, sacred sites, and tribal resource collection areas that may be impacted by an increase in visual intrusions caused by tall or massive SGP components.
- Changes in access to TCPs, CLs, sacred sites, and tribal resource collection areas due to the restricted access within the Operations Area Boundary.
- Changes to species viability and/or availability for tribal harvest of culturally significant fish, wildlife, and plants.

Effects are discussed in terms of magnitude or intensity, duration, geographic extent, and context. The magnitude or intensity of an impact refers to the severity of the impact (e.g., the level of impact compared to an established quantitative or qualitative measurement). The duration and geographic extent assess the temporal and physical expanse of the impacts, respectively. Context refers to the setting, such as society as a whole (human, national), regional, and/or the local or site-specific.

4.24.2 Direct and Indirect Effects

Tribal rights and interests were analyzed using information obtained from documentation including: SGP-specific ethnographies provided by the Nez Perce Tribe and Shoshone-Paiute

Tribes (in consultation with each tribe to determine appropriate information to share), public records, Idaho State Historic Preservation Office records, information from the Payette National Forest and the Boise National Forest Heritage Program Offices through 2018, general literature reviews, and information and analysis documented in reports on other resources prepared for the SGP. Public records reviewed for this analysis include a suit filed in Federal District Court in Idaho by the Nez Perce Tribe against Midas Gold Idaho, Inc. (Midas Gold) under the Clean Water Act, seeking to require Midas Gold to address unpermitted pollutant discharges at the site (Nez Perce v. Midas Gold 2019: Case 1:19-cv-00307-BLW). In addition, the Nez Perce Tribe has made publicly available a whitepaper entitled *Nez Perce Tribe's Interests and Activities in and Around the Stibnite Gold Project Area* (2019). Additional data from ethnographies prepared by the tribes with interest in the analysis area (the Nez Perce Tribe, the Shoshone-Bannock Tribes, and the Shoshone-Paiute Tribes) will be included prior to the Record of Decision.

Tribes with interests in the area have identified resources of concern within the analysis area; however, specific locations for TCPs, CLs, sacred sites, and resources collection areas are not disclosed. The United States Forest Service (Forest Service) is in ongoing consultation with the tribes to glean what information can be made public. The Forest Service is continuing to work in consultation with the tribes to develop ways to avoid, minimize, and mitigate effects to tribal rights that would be impacted by the SGP.

The following analysis of effects associated with tribal rights and interests is considered in the overall context of local, regional, and national history.

Elements of this context include:

- Native American traditions (site-specific, local, regional, national)
- Native American rights and interests (site-specific, local, regional, national)

4.24.2.1 All Action Alternatives (Alternatives 1 through 4)

All action alternatives would cause disturbances that would be anticipated to impact tribal rights and interests.

Tribal resources, including culturally important fish, wildlife, and plants, are present in the SGP area. In addition, sacred sites and resource collection areas are present (Battaglia 2018; Walker 2019). There is a potential for TCPs and CLs to be disclosed in the future, although there are currently no TCPs or CLs, as defined per the National Park Service (2020), included in this analysis. The numbers and locations of tribal resources is the subject of on-going government-to-government consultation with tribes and ethnographic reporting for individual tribes and the Forest Service is in consultation to discern the type of information that may be disclosed. However, certain travel and waterway corridors previously known to have tribal significance include the tribal travel corridor now occupied by the Old Thunder Mountain Road (National Forest System Road [FR] 440), the streams and rivers of the East Fork South Fork Salmon River (EFSFSR) system, the Riordan Lake shore, and gathering areas in the upper reaches of the EFSFSR.

All action alternatives have the potential to physically impact tribal resources through ground disturbance, although the alternatives differ in the amounts of acreages and locations of impacts. Alternative 1 would affect approximately 3,533 acres. Alternative 2 would have a slightly smaller footprint of approximately 3,423 acres because the West End Development Rock Storage Facility (DRSF) would not be constructed, and realignment of two new segments of the Burntlog route would shorten the route length under Alternative 2. Activities proposed under Alternative 3 would affect the largest area, approximately 3,610 acres. Under Alternative 3, the Hangar Flats pit and DRSF, and the Meadow Creek TSF would be relocated to the EFSFSR. Alternative 4 would affect the smallest area (3,219 acres), with nearly 400 fewer acres than Alternative 3, which would have the most acreage affected at 3,610 acres. Under Alternative 4 the Yellow Pine Route would be the primary access to the mine site throughout the life of the SGP, and the Burntlog Route would not be constructed. Another reason Alternative 4 would involve less ground disturbance is because helicopters would be used for installation and maintenance of communications towers.

Under Alternative 1 the Old Thunder Mountain Road (FR 440), known to be a traditional travel corridor, and the EFSFSR system would be impacted, as well as an undisclosed number of other tribal resources. Alternative 2 is similar to Alternative 1, however, slightly less of the Old Thunder Mountain Road would be impacted due to re-route of the Burntlog Route. Impacts under Alternative 3 also would be similar to Alternative 1, except the EFSFSR system would be more heavily impacted than under any of the other alternatives creating more potential impacts to undisclosed tribal resources. Physical effects to the Riordan Lake shore are not anticipated and would be the same for all action alternatives. In general, reduced ground disturbance should reduce the potential for direct physical impacts to tribal resources but would not eliminate impacts of the SGP to tribal resources under any of the action alternatives.

New noise and vibration disturbances could impact tribal resources. Currently, noise and vibration disturbance is from approved activities in the SGP area, which are confined to a relatively small area of private and NFS lands and use of existing roads and facilities located primarily on private lands. Under all action alternatives, noise and vibrations would increase from baseline and include blasting, drilling, and ore crushing at the mine site. Other noise increases would occur due to construction activities at off-site facilities and access roads; however, this increase would be temporary during construction. Increased use of roads during construction and operations also would cause an increase in noise levels. The increase in noise and vibrations would likely be perceived by tribal members as a reduction in the integrity of the natural setting and may discourage or detract from tribal use of TCPs, CLs, sacred sites, and resource collection areas (e.g., during religious and spiritual activities).

The SGP would add new visual elements that could impact tribal resources. Under all action alternatives, the locations of TSFs and DRSFs or open pits where screening landscape features are lacking could cause visual disturbances, and the viewsheds of portions of the EFSFSR systems and the Old Thunder Mountain Road would be altered. However, under Alternative 3 there would be increased impacts on the EFSFSR system compared to the other action alternatives because the TSF and DRSF would be placed in the EFSFSR drainage. The Riordan Lake shore would not experience visual impacts from the mine under any alternative, but would have an altered viewshed by introducing the new Burntlog Route under Alternatives 1, 2, and 3. The increase in visual elements would likely be perceived by tribal members as a reduction in the integrity of the natural setting and may discourage or detract from use of TCPs, CLs, sacred sites, and resource collection areas.

The SGP would affect tribal rights and interests by preventing tribal access to tribal resources. Tribal rights guarantee access to “usual and accustomed” traditional subsistence resources and areas. Tribal access and use of the region has long-standing and on-going current cultural importance and subsistence value. Currently there is no restricted access on NFS lands in the SGP area. Some restrictions are in place on private lands. Under all action alternatives, there would be changes in access due to the new restricted access Operations Area Boundary around the mine site. Under Alternatives 1, 2, and 4, the restricted Operations Area Boundary includes 13,446 acres of public land. Under Alternative 3 the Operations Area Boundary would be approximately 17,034 acres of public land.

The access restrictions would be in place during construction, operations, and closure and reclamation, or a period of approximately 20 years. Members of the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes that access this area to obtain subsistence resources or for spiritual purposes would no longer be able to do so. Prohibiting use of a culturally important area for 20 years could result in loss of cultural practices and identity to a generation of tribal members. The Forest Service is consulting with the tribes about the locations and numbers of tribal resources that may be affected by restricted access within the Operations Area Boundary, and the impacts caused by restricted access is considered to be the same across all action alternatives.

The SGP also would affect tribal rights and interests through changes to the viability and availability of tribal resources, including fish, wildlife, and plants. The EFSFSR is considered an aquatic stronghold and recovery area for fish species of cultural significance, and the Nez Perce Tribe co-manages fish and is restoring habitat within this area. All action alternatives would result in impacts to fish and fish habitat, although the degree of impacts would vary by alternative. The resulting effect on fish and aquatic habitat in the analysis area would be temporal losses or degradation of habitat and behavioral disturbances, along with some long-term beneficial effects from habitat improvements. The SGP would affect fish and fish habitat, including species of cultural importance, through the combination of physical stream channel changes, changes in stream flow and temperature, direct effects to individuals, and other changes. Loss of habitat and behavioral changes could impact a tribe’s ability to harvest and manage their traditional fish resources in the SGP area.

Under all action alternatives, population-level effects based on mortality to individuals are not expected from direct effects of construction, but, following reclamation, the net effect on fish would be a loss of both quality and quantity of habitat for culturally significant fish species, including Chinook salmon, bull trout, and other fish species. For all alternatives, chemical contamination issues affecting water quality may improve over baseline conditions in some areas but would remain above standards in other locations during and after operations. The water quality improvements predicted from removal of legacy mine materials would partially, but not completely, offset geochemical impacts associated with the SGP. Therefore, the SGP would affect viability and availability of fish for tribal harvest, which would be considered an adverse impact to tribal rights. For a comparison of how each alternative would impact fish and fish habitat see **Table 4.12-81**, Comparison of Fish Resources and Fish Habitat Impacts by Alternative, included in Section 4.12, Fish Resources and Fish Habitat.

The SGP would affect wildlife under all action alternatives, including special-status species and species of cultural importance, through loss of habitat. The alternatives differ in the amount of acreages that would be affected. Overall, a loss of habitat would be anticipated to impact a tribe's ability to harvest and manage their traditional wildlife resources in the SGP area. See Section 4.13, Wildlife and Wildlife Habitat (including Threatened, Endangered, Proposed, and Sensitive Species) for further details on impacts to specific species and habitats.

The SGP would affect plant species of cultural importance under all action alternatives through varying degrees of impacts to vegetation and special status plants that would be considered to permanently contribute to an adverse cumulative impact on these resources. Loss of habitat may in turn impact a tribe's ability to harvest and manage their traditional plant resources in the SGP area. However, revegetation in these areas would contribute to benefits, including ability of tribes to harvest and manage their traditional plant resources in the SGP area. See Section 4.10, Vegetation, for further details on impacts to specific species and habitats.

Also see Section 4.17, Cultural Resources, and Section 4.22, Environmental Justice, for additional information related to impacts to tribes.

4.24.2.2 Alternative 5

Alternative 5, the No Action Alternative, would preserve the current ability of tribes to access NFS lands in the analysis area. Ground disturbance, visual and audible impacts, and impacts to culturally significant subsistence resources including fish, wildlife, and plant species would be minimal in comparison with those under Alternatives 1 through 4 (e.g., potential for ongoing mineral exploration activities under the Golden Meadows Exploration Project Plan of Operations [Midas Gold 2016]).

4.24.3 Mitigation Measures

Mitigation measures required by the Forest Service and measures committed to by Midas Gold as part of design features of the SGP are described in **Appendix D**, Mitigation Measures and Environmental Commitments; see **Table D-1**, Preliminary Mitigation Measures Required by the Forest Service, and **Table D-2**, Mitigation Measures Proposed by Midas Gold as Project Design Features, respectively. The preceding impact analysis has taken these mitigation measures into consideration, as well as measures routinely required through federal, state, or local laws, regulations or permitting, such that the identified potential impacts of the SGP are those that remain after their consideration.

Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Midas Gold and will be finalized in the Final EIS.

The Forest Service will continue to consult with interested and affected tribes on a government-to-government basis to develop specific avoidance, minimization, and mitigation measures that would resolve potential impacts to tribal rights and trust obligations. This consultation process will allow direct input from the appropriate tribes to address impacts to resources important to them with measures that they believe would be effective. The Forest Service would negotiate a binding agreement between the Forest Service and the affected tribe(s) if the agency identifies impacts to applicable tribal rights. The nature of this agreement would be dependent upon the type of the impact, the type of resource that is affected, and the agreed upon measures to resolve impacts to tribal rights and interests. To fulfill its trust obligations, the Forest Service would develop the agreement to be consistent with the Federal Government's legally enforceable fiduciary obligation to protect tribal rights, lands, assets, and resources (Forest Service 2016).

4.24.4 Cumulative Effects

Past, present, and Reasonably Foreseeable Future Actions (RFFAs) include activities, developments, or events that have the potential to change the physical, social, economic, and/or biological nature of a specified area. Existing and future activities, and other RFFAs are considered when analyzing cumulative impacts. A cumulative effect must overlap in space and time with the direct and indirect effects the SGP.

For tribal rights and interests, the analysis area for cumulative effects is larger than the analysis area for direct and indirect effects, encompassing lands administered by both the Payette National Forest and Boise National Forest, and other federal, state, and provide lands within and adjacent to these National Forests. Cumulative effects to the tribes extend well beyond NFS lands, and this larger area lends a broader landscape perspective to maintaining ecological sustainability in the National Forest, which support tribal rights and interests. The Nez Perce Tribe, Shoshone-Bannock Tribes, and the Shoshone-Paiute Tribes, and their traditional and cultural affiliations, trading networks, and other intertribal communication pathways existed long before current governmental and administrative boundaries and continue to exist irrespective of current delineations. For this reason, it is recognized that in addition to the SGP other mining projects, development expected to occur in the analysis area, Valley County, and possibly elsewhere in the region also may contribute to adversely affecting traditional tribal cultural practices and places that have significance to tribal cultural identities.

Past actions on federal, state, and private land have impacted tribal interests in the cumulative effects analysis area. Mining and other activities on federal lands have impacted tribal rights and interests primarily by restricting access, but also by removing natural resources protected under treaties. Many of the past human activities (primarily historic mining in the analysis area) were conducted prior to statutory and regulatory protection measures for natural resources resulting in the loss of an unknown number of tribal resources and practices.

Descriptions of existing and RFFAs considered as part of the cumulative effects analysis for all resources are included in Section 4.1.5, Cumulative Effects. **Table 4.24-1** is presented here to summarize impacts from these types of activities for tribal rights and interests.

Table 4.24-1 RFFA and Potential Cumulative Effects to Tribal Rights and Interests

Cumulative Project Type	Potential Effects to Tribal Rights and Interests
Mineral exploration and mining activities	Historic mines in the analysis areas have changed the landscape over time through removal of vegetation and displacement of soils. Currently planned or future mine development would further alter the landscape from its natural state during exploratory drilling, development; and operations of the mine. During exploratory drilling, development, and operations, the increased ground disturbance may disturb tribal resource collection areas, sacred sites, TCPs, and CLs.
Closure and Reclamation Projects/ Comprehensive Environmental Response, Compensation, and Liability Act Actions	Projects that are currently undergoing reclamation or will in the future would likely cause further damage to any tribal resource collection areas, sacred sites, TCPs, and CLs in the area. These projects would likely be closed and reclaimed, which involves the removal of some of the infrastructure and reclamation of the land to restore native wildlife and plant habitats that are important to Native American tribes. However, mature forest types would not be available for decades. Several Comprehensive Environmental Response, Compensation, and Liability Act Removal Actions were conducted by the Forest Service, U.S. Environmental Protection Agency, and Exxon-Mobil Corporation in the mine site and nearby. These actions have the potential to restore landscapes that can eventually restore traditional tribal resources by removing potentially hazardous wastes, mining tailings, and capping historic dumps.
Transportation projects	Road maintenance, improvement projects, and culvert replacements are likely in the analysis area. These types of improvements cause ground disturbance that represents a potential impact to tribal resource collection areas, sacred sites, TCPs, and CLs. Maintenance of existing roadways would likely involve short-term construction activity, while new roadways would have a more permanent effect and would impact previously undisturbed areas. Also related to transportation projects are gravel quarry or gravel pit development to provide fill material for road construction. This activity would be a potential impact to any tribal resources present in those areas.
Infrastructure Development	Local communities preform or obtain permits to upgrade infrastructure such as electrical transmission lines. These development activities can cause ground disturbance than could impact tribal resources. These activities can introduce visual impacts to tribal religious sites.
Recreation and tourism	Recreational activities (i.e., camping, hiking, hunting, trapping, trail riding, firewood harvest, fishing, etc.) are likely to continue to impact traditional tribal resources in the future. Increased road and trail networks open new areas to additional human disturbance, which can lead to potential vandalism or accidental destruction of tribal resource collection areas, sacred sites, TCPs, and CLs.
Wildfire and noxious weed control projects	Wildfires and noxious weeds have affected tribal resources collections areas throughout the analysis areas either by burning vegetation or by increasing visibility of precontact archaeological sites. Additional wildfires are likely to affect tribal resources in the future in the same way. Control of invasive and noxious plant species is likely to have a minimal effect on tribal resources as mechanical or hand-pulling would increase ground surface visibility and would cause ground disturbance.
Development projects	Private residential developments are likely to impact tribal interests in the future. Cultural Landscapes could be lost, while additional human presence would potentially affect tribal resource areas.
Watershed Management	This can involve repairs and reclamation of roads and recreation site repairs to prevent erosion into watersheds, but many projects involve only monitoring of erosion of roadway sediments into watersheds and this would not have an impact on tribal resources.

4.24.4.1 All Action Alternatives

The action alternatives, taken together with other concurrent actions and RFFAs would create an increase in ground disturbance, visual and noise intrusions, increased public access in some areas and restricted access in other areas within the analysis area. These cumulative actions would cause disturbances that may harm Tribal traditional practices and resources of concern within the cumulative effects analysis area.

4.24.4.2 Alternative 5

Cumulative effects associated with the No Action Alternative could occur with approved activities associated with the Golden Meadows Exploration Project, such as exploratory drilling for mineral resources and construction of support facilities either by Midas Gold or other groups on private land. Cumulative impacts in the analysis area to Tribal resources would be minimal in comparison with those under Alternatives 1 through 4.

4.24.5 Irreversible and Irretrievable Commitment of Public Resources

The Council on Environmental Quality guidelines require an evaluation of “any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented” (40 Code of Federal Regulations Part 1502.16). Resources that would be irreversibly or irretrievably used during implementation of the SGP would include a range of natural, physical, human, and financial resources.

Irreversible commitments occur when a resource is permanently affected, consumed, or renewable only over lengthy time spans limiting the future options for use of the resource.

An irretrievable commitment occurs when a resource is not consumed or destroyed, but rather becomes unavailable for use for the foreseeable future. These opportunities are foregone for the period of the proposed action, during which the resource cannot be used. These commitments are reversible, but the utilization opportunities foregone are irretrievable.

The destruction of tribal resources, including subsistence resources, gathering areas, sacred sites, TCPs, or CLs, is a permanent and irreversible effect. They are generally non-renewable resources that continue to be important to, used by, and relied upon by the tribes with interest in the area. If tribal rights are disrupted by restricted access due to implementation of the SGP, these uses become unavailable. If traditional use areas and subsistence resources become no longer viable and/or unavailable for use for the foreseeable future by tribes with rights in the SGP area this would constitute an irretrievable commitment of resources.

4.24.5.1 All Action Alternatives

4.24.5.1.1 IRREVERSIBLE

Traditionally collected or used natural resources of interest to the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes as reserved in treaties that could be destroyed by the action alternatives constitute an irreversible commitment, regardless of mitigation. Many of these natural resources, such as salmon, plant populations, and trees, are only renewable over long periods of time. Other traditional use areas, such as TCPs, CLs, or sacred sites, that could be destroyed or otherwise altered by any action alternative are often non-renewable, particularly if they are landscape features. Once gone, the resources cannot be used for any additional purposes by the tribes with rights and interests in the area.

4.24.5.1.2 IRRETRIEVABLE

Under the action alternatives, the restriction of public access in the Operations Area Boundary would remove the land from other uses while the mine is in operation, but the use would eventually be reversed through removal of the exclusion area and reclamation.

Implementation of the action alternatives could result in irretrievable and irreversible commitment of tribal rights and interests if avoidance measures are not implemented and access restrictions are enforced. For example, prohibiting use of a culturally important area for 20 years over the life of the SGP could result in the irretrievable and irreversible loss of cultural practices and identity to a generation of tribal members.

4.24.5.2 Alternative 5

Under Alternative 5, the No Action Alternative, the SGP would not be undertaken. Consequently, there would be no irreversible and irretrievable commitment of public or tribal resources as it relates to tribal rights and interests.

4.24.6 Short-term Uses versus Long-term Productivity

This section evaluates the extent to which the alternatives would balance short-term uses, associated with this long-term project, of tribal resources with long-term productivity of the resource. Short-term refers to uses with duration of a few years or less. The goal of this section is to provide a sense of the resilience or sustainability of tribal resources and sacred sites to short-term disturbances associated with the SGP. The relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity is applicable only to action alternatives.

The resilience of tribal resources or tribal interests is very low in comparison to other social or biological resources, because actions associated with the SGP (i.e., ground disturbance) that may affect tribal resources, subsistence gathering areas, TCPs, CLs, and sacred sites would be irreversible. Short-term uses, even uses such as temporary staging areas for transmission line construction or access roads that would later be returned to their pre-construction state, have the potential to permanently impact tribal resources and use areas of importance to the tribes with interests in the area. There is the potential for the loss of long-term productivity to any tribal resources subjected to short-term use. The long-term productivity would be damaged due to the length of time of the SGP. Tribes and tribal members would be restricted from accessing their tribal resources for a period of 20 or more years.

4.24.6.1 All Action Alternatives

Under the action alternatives, all short-term direct impacts to tribal resources and interests would lead to a loss of long-term productivity. Some short-term protection measures could lead to long-term productivity (use of more tribal resource collection areas following mine closure) of resources. If collection areas, sacred sites, TCPs or CLs are identified, short-term use may be denied while protecting long- term productivity.

4.24.6.2 Alternative 5

Under Alternative 5, the SGP would not be undertaken. Consequently, there would be no short-term use that would affect tribal rights and interests, and no effect on long-term productivity.

4.24.7 Summary

All action alternatives would cause disturbances that may harm tribal resources and that would adversely affect tribal rights and interests. Locations of resources important to tribes identified through consultation and in the tribal ethnographic studies are not able to be publicly disclosed at this time but are known to be present in the analysis area. Tribal fishing, hunting, and plant gathering activities occurred for millennia in this area, as supported by the archaeological record (see Section 3.17, Cultural Resources), and descendant tribes continue to use the area of analysis and exercise their rights to take resources from their usual and accustomed areas.

Construction and operation of the mine would directly and indirectly harm tribal resources through physical impacts during construction, through visual impacts due to alteration of the landscape, as well as through audible elements that would impact tribal use of the analysis area, for example during spiritual practices and resource harvesting.

Tribal access to certain areas would be restricted during the SGP’s construction, operations, and closure and reclamation phases, preventing tribal members from exercising their off-reservation rights to hunt, fish, gather, and pasture in usual and accustomed areas, for a period of 20 years.

The Proposed Action also would impact endangered salmon and other aquatic species and essential fish habitat. Harm to fish, wildlife, and habitat would in turn impact availability and harvestability of these resources by tribes at their usual and accustomed fishing, hunting, and gathering areas. Although the action alternatives differ in the acres of habitat affected for cultural fish, wildlife, and plant species, there would be an impact to the availability and harvestability of tribal resources caused by the SGP. The Forest Service has therefore concluded that the SGP would have adverse impacts to tribal rights under all action alternatives.

Table 4.24-2 provides a summary comparison of tribal rights and interests by issues and indicators for each alternative. The table discusses tribal concerns in a general sense, because the Forest Service is consulting with the tribes about which types of tribal resources in the SGP area can be publicly disclosed.

Table 4.24-2 Comparison of Tribal Rights and Interests Impacts by Alternative

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
The SGP would impact tribal resources, restrict tribal access, and reduce viability and/or availability of culturally significant fish, wildlife, and plants.	Presence of TCPs, CLs, sacred sites, and resource collection areas impacted by an increase in ground disturbance.	Tribal resource collection areas and sacred sites are in the analysis area, including Old Thunder Mountain Road (FR 440), the EFSFSR system, and the Riordan Lake shore. Ground disturbance is currently from approved activities confined to a small area of private and NFS lands and use of existing roads and facilities.	Direct ground disturbances would increase over baseline and would physically impact Old Thunder Mountain Road (FR 440) and the EFSFSR system, plus an undisclosed number of other tribal resources. Alternative 1 includes 3,533 acres affected See **Table 2.3-1**, Land Management and Acreage by Component, Alternative 1	Same as Alternative 1 except: • Slightly less impact to Old Thunder Mountain Road (FR 440) due to re-route of Burntlog Route. • 3,423 acres affected See **Table 2.4-2**, Land Management and Acreage by Component for Alternative 2.	Same as Alternative 1 except: • EFSFSR system would be more heavily impacted than under the other alternatives. • 3,610 acres affected See **Table 2.5-2**, Land Management and acreage by Component for Alternative 3.	Same as Alternative 1 except: • Tribal resources along Burntlog Route would be avoided as would Old Thunder Mountain Road (FR 440). • 3,219 acres affected See **Table 2.6-2**, Land Management and Acreage by Component for Alternative 4.	No new ground disturbance, but approved activities would continue.
	Presence of TCPs, CLs, sacred sites, and resource collection areas impacted by an increase in audible elements (noise and vibrations).	Tribal resource collection areas and sacred sites are in the analysis area, including Old Thunder Mountain Road (FR 440), the EFSFSR system, and the Riordan Lake shore. Currently the only noise and vibrations disturbance is from approved activities, including underground exploration on private land, with occasional blasting (short-term high noise levels and ground vibrations).	Noise and vibrations would increase from baseline and include blasting, drilling, and ore crushing at the mine site; temporary increases during construction; and increases due to use of roads during construction and operations. The increase in noise and vibrations would likely be perceived by tribal members as a reduction in the integrity of setting and may discourage or detract from tribal use of traditional areas.	Same as Alternative 1.	Same as Alternative 1.	Same as Alternative 1 except: Upgrades to Yellow Pine Route and use of Warm Lake, Johnson Creek, and Stibnite roads as the primary route to the mine site during construction would result in greater impacts to tribal resources along these roads due to increased noise and traffic.	Same as baseline conditions.
	Presence of TCPs, CLs, sacred sites, and resource collection areas impacted by the visual range of new tall or massive SGP components.	Tribal resource collection areas and sacred sites are in the analysis area, including Old Thunder Mountain Road (FR 440), the EFSFSR system, and the Riordan Lake shore. The Yellow Pine pit and tailings piles from historical mining activities are present along with a large capped heap leach pile from mining in the 1980s.	Alternative 1 would include increased visual components through new open pits, a TSF, and DRSFs; new access routes; and new transmission line. The viewsheds of portions of the EFSFSR systems, Riordan Lake, and Old Thunder Mountain Road, would be altered. The increase in visual impacts would likely be perceived by tribal members as a reduction in the integrity of setting and may discourage or detract from tribal use of traditional areas.	Same as Alternative 1, except: Under Alternative 2 the Midnight Pit portion of the West End Pit would be backfilled, and the West End DRSF would be eliminated which would reduce the overall amount of visual disturbance.	Same as Alternative 1, except: Alternative 3 would relocate the Hangar Flats DRSF and the TSF to the EFSFSR. This is not a change to the overall visual impacts but would increase impacts on the EFSFSR system compared to the other action alternatives.	Same as Alternative 1, except: Alternative 4 would not include the Burntlog Route, which would reduce visual effects at Riordan Lake.	Same as baseline.
	Changes in tribal access due to the restricted access Operations Area Boundary.	Tribal access and use of the region has long-standing and on-going cultural importance and subsistence value. Currently there is no restricted access on NFS lands in the	The SGP would restrict tribal access in the 3,533-acre SGP footprint and the 13,446 acres of public land within the Operations Area Boundary. Burntlog Route, a new off-	Same as Alternative 1, except for:	Same as Alternative 1, except for:	Same as Alternative 1, except for:	Except for the Golden Meadows Exploration mine site area, future access to subsistence resources and for cultural uses in the existing SGP area would remain

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
		SGP area. Some restrictions are in place on private lands.	highway vehicle connector, and new over-snow vehicle groomed trails would provide new and/or improved access to the SGP area and vicinity, which could have a positive impact by providing tribes year-round access to previously inaccessible traditional use areas. There would not be a public access road through the mine. Length of time of restricted access is 20 years. This could result in loss of tribal cultural practices important to tribal identity.	• The SGP footprint would occupy 3,423 acres. • Public access would be provided through the mine site. • The Riordan Creek Segment of the Burntlog Route could result in increased use of the Black Lake area and No Return Wilderness by recreational users, impacting tribal members if there is an actual or perceived decrease in their access to, availability, and/or quality of tribal resources.	• The SGP footprint would occupy 3,610 acres. • The public land within the SGP Operations Area Boundary would occupy a larger area of 17,034 acres. • Closure and reclamation would include a permanent roadway around the TSF that would provide improved SGP area access.	• The SGP footprint would occupy 3,219 acres. • Burntlog Route would not be constructed. • Public access would be provided through the mine site. • Stibnite Road would not be returned to its pre-mining width and traffic would be greatly reduced. This could encourage use of tribal resources east of the mine.	unchanged.
	Changes to species viability and/or availability for tribal harvest of fish.	Tribes fish, hunt, and gather plants in the SGP area. Currently the Yellow Pine Pit passage barrier blocks fish passage, and there are legacy chemical contaminants in downstream waters from historic mining. The South Fork Salmon River and tributaries are an aquatic stronghold and recovery area for fish species of cultural significance. Tribes are managing fish and restoring habitat within this area.	The SGP would affect fish and fish habitat through stream channel changes, loss of habitat and behavioral changes. This could impact a tribe's ability to harvest fish. Population-level effects are not expected from construction, but after reclamation the net effect would be: • A loss of habitat quality and quality for Chinook salmon, bull trout, and cutthroat trout. • A net gain of habitat quality and quantity for steelhead trout. Water quality improvements from removal of legacy mine materials would partially, but not completely, offset geochemical impacts associated with the SGP. See Section 4.12, Fish Resources and Fish Habitat.	Same as Alternative 1.	Same as Alternative 1, except: Increased magnitude of impacts to Chinook salmon steelhead trout, bull trout, and cutthroat trout at the mine site compared to other alternatives.	Same as Alternative 1, except: A loss of habitat quality and quantity of habitat for steelhead trout.	Same as baseline.
	Changes to species viability and/or availability for tribal harvest of wildlife.	Tribes fish, hunt, and gather plants in the SGP area.	The SGP would affect wildlife, including special-status species and species of cultural importance, through loss of habitat. Loss of habitat may in turn impact a tribe's ability to harvest and manage their traditional wildlife resources in the SGP area. Direct habitat impacts: 3,476.0 acres See Section 4.13, Wildlife and Wildlife Habitat	Same as Alternative 1, except: Direct habitat impacts: 3,368.3 acres	Same as Alternative 1, except: Direct habitat impacts: 3,573.0 acres	Same as Alternative 1, except: Direct habitat impacts: 3,153.2 acres	No additional wildlife habitats would be disturbed.

Issue	Indicator	Baseline Conditions	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Changes to species viability and/or availability for tribal harvest of plants.	Tribes fish, hunt, and gather plants in the SGP area.	The SGP would affect plant species of cultural importance through varying degrees of impacts to vegetation and special status plants that would contribute to an adverse cumulative impact on these resources. Loss of habitat may in turn impact a tribe's ability to harvest and manage their traditional plant resources in the SGP area. Revegetation in these areas would contribute to cumulative benefits, including ability of tribes to harvest and manage their traditional plant resources in the SGP area. Acres of vegetation disturbance: 2,466.2 acres See Section 4.10, Vegetation.	Same as Alternative 1, except: Acres of vegetation disturbance: 2,312.8 acres	Same as Alternative 1, except: Acres of vegetation disturbance: 3,048.3 acres	Same as Alternative 1, except: Acres of vegetation disturbance: 2,155.2 acres	No additional vegetation would be disturbed.

This page intentionally left blank