Stibnite Gold Project

Climate Change Specialist Report

Prepared by:
USDA Forest Service
Payette National Forest

for:
Payette and Boise National Forests

August 2022

Table of Contents

List of Tables

List of Figures

Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
ANFO	Ammonium nitrate, fuel oil
ARPA	Archeological Resources Protection Act
ASAOC	Administrative Settlement Agreement and Order on Consent
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CH_4	Methane
CO_2	Carbon dioxide
CO_{2e}	Carbon dioxide equivalent
CR	County Road
CWA	Clean Water Act
EIS	Environmental Impact Statement
East Fork SFSR	East Fork South Fork Salmon River
EO	Executive Order
EPCRA	Emergency Planning and Community Right to Know Act
EPA	Environmental Protection Agency
Forest Service	United States Forest Service
GHG	Greenhouse gases
IDEQ	Idaho Department of Environmental Quality
IPCC	Intergovernmental Panel on Climate Change
IPCo	Idaho Power Company
IRA	Inventoried Roadless Area
Kg	Kilogram
LOM	Life of Mine
MT	Metric tons
MMBtu	Million British Thermal Units
MMT	Million metric tons
MW	Megawatts

MWh	Megawatt hours
N_2O	Nitrous oxide
NEPA	National Environmental Policy Act
NF	National Forest
NHPA	National Historic Preservation Act
NICC	National Interagency Coordination Center
NIFC	National Interagency Fire Center
OHV	Off-highway Vehicle
Perpetua	Perpetua Resources Idaho Inc.
PM	Particulate matter
RCP	Representative Concentration Pathways
SGP	Stibnite Gold Project
SPCC	Spill Prevention Control and Countermeasures
TSF	Tailings storage facility
U.S.	United States
USGCRP	United States Global Change Research Program

1.0 Introduction

The United States (U.S.) Department of Agriculture Forest Service (Forest Service) received the Stibnite Gold Project (SGP) Plan of Restoration and Operations, (Midas Gold Idaho, Inc. 2016) for review and approval in accordance with regulations at 36 Code of Federal Regulations (CFR) 228 Subpart A for the proposed SGP in central Idaho. A revised Plan, also known as ModPRO,[1] was submitted to the Forest Service in 2019 (Brown and Caldwell 2019). A further modified Plan, also known as ModPRO2,[2] was then submitted in October of 2021 (Perpetua 2021). Midas Gold changed their name to Perpetua Resources Idaho Inc. (Perpetua[3]) in February 2021.

The SGP would consist of mining operations, including an open pit hard rock mine and associated processing facilities, located within Valley County in central Idaho on federal, state, and private lands (**Figure 1-1**). The SGP would produce gold and silver doré, and antimony concentrate, for commercial sale by Perpetua. The SGP would have a life (construction, operation, closure, and reclamation), not including post-reclamation monitoring, of approximately 20 years, with active mining and ore processing occurring over approximately 15 years.

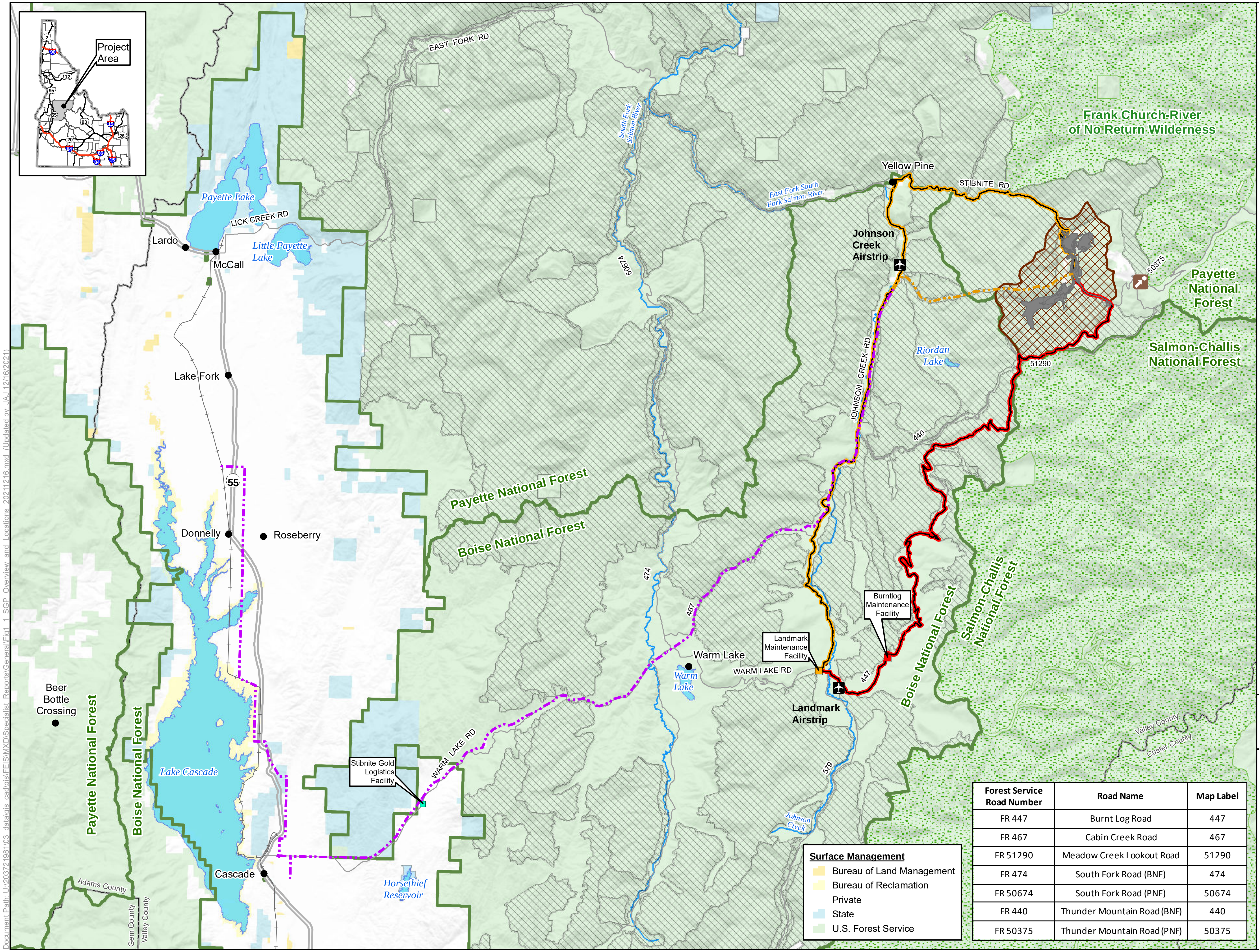
The United Nations Framework Convention on Climate Change (United Nations 1992) defined climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." According to Runkle et al. 2017, the global climate is changing, and is projected to continue to change, with the degree of change varying based on different greenhouse gas (GHG) emissions scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) and regional geographic variation. Increasing variation in temperatures, precipitation, and snowpack, along with the increasing frequency and intensity of extreme weather events are indicators of a changing climate in Idaho (Runkle et al. 2017). These varying conditions on a regional scale may affect conditions in the analysis area.

GHGs consist of compounds in Earth's atmosphere that absorb outgoing long-wave radiation emitted from its surface, resulting in warming of the atmosphere, which affects Earth's climate. GHGs occur naturally from volcanoes, forest fires, and biological processes such as fermentation and aerobic decomposition; however, during the past century human activities have released increasingly large amounts of GHGs through the combustion of fuels, industrial processes, agricultural operations, waste management, and land use changes such as loss of farmland to urbanization. The most common anthropogenic GHG emissions are in the form of carbon dioxide (CO_2), followed by methane (CH_4) and nitrous oxide (N_2O) (U.S. Environmental Protection Agency [EPA] 2017). Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful GHGs that are emitted from a variety of industrial processes.

[1] Associated project documents may reference the Revised Plan as the ModPRO.

[2] Associated project documents may reference the Modified Plan as the ModPRO2.

[3] Documents provided by Perpetua prior to the February 2021 name change will still be cited and referenced as Midas Gold.



Surface Management

- Bureau of Land Management
- Bureau of Reclamation
- Private
- State
- U.S. Forest Service

Forest Service Road Number	Road Name	Map Label
FR 447	Burnt Log Road	447
FR 467	Cabin Creek Road	467
FR 51290	Meadow Creek Lookout Road	51290
FR 474	South Fork Road (BNF)	474
FR 50674	South Fork Road (PNF)	50674
FR 440	Thunder Mountain Road (BNF)	440
FR 50375	Thunder Mountain Road (PNF)	50375

LEGEND

Project Components
- SGP Features
- Operations Area Boundary

Access Roads and Trail System
- Burntlog Route *
- Johnson Creek Route

Utilities
- Upgraded Transmission Line
- New Transmission Line

Offsite Facilities
- Burntlog Maintenance Facility *
- Landmark Maintenance Facility **
- Stibnite Gold Logistics Facility

Other Features
- U.S. Forest Service
- Wilderness
- IRA and/or Forest Plan Special Area
- County
- City/Town
- Monumental Summit
- Airport/Landing Strip
- Railroad
- Highway
- Road
- Stream/River
- Lake/Reservoir

* Associated with 2021 MMP only
** Associated with Johnson Creek Route Alternative only
Note:
The McCall – Stibnite Road (CR 50-412) consists of Lick Creek Road, East Fork South Fork Salmon River Road (East Fork Road) and Stibnite Road.

0 2 4 Miles
1 inch = 4 miles when printed at 11x17

Figure 1-1
SGP Overview and Location
Stibnite Gold Project
Stibnite, ID

Base Layer:
Other Data Sources: Perpetua; State of Idaho Geospatial Gateway (INSIDE Idaho); Boise National Forest; Payette National Forest

A common property among GHGs is their relative chemical stability and persistence in the atmosphere, which allows the gases to accumulate and become relatively well-distributed in the atmosphere before eventually being decomposed by physical or chemical mechanisms. From 1880 to 2012, the global average combined land and ocean surface temperature data show a warming of 0.85 degrees Celsius (°C) (i.e., 1.5 degrees Fahrenheit [°F]) (IPCC 2021). This trend is expected to continue, which could cause large-scale changes including variability in precipitation, increases in annual average temperatures, and increases in extreme weather events (e.g., severe storms, prolonged droughts, flooding) (IPCC 2021). The time horizon for many of these effects is during the 21st century, though projections are subject to variability and uncertainty. The extent to which these effects can be predicted to occur in a given geographic area or be attributed to a single source is uncertain; however, given the potential for GHG emissions associated with the SGP, these effects warrant discussion as a part of the analysis.

The tendency for GHGs to be stable and well distributed spreads their effects over a large region, beyond the initial location of the emissions. Additionally, climate is characterized on a regional scale, not by a specific boundary. Consequently, the overall potential effects on climate change attributable to GHGs are evaluated over large regional or global scales, rather than in a given airshed or project-specific area. As such, a specific analysis area for GHGs is not relevant to the assessment of potential GHG contributions by any one project and it is not currently feasible to quantify the effects of individual or multiple projects on global climate change (Forest Service 2009).

The scope of analysis for the qualitative discussion of GHG emissions associated with the SGP is tied to the baseline GHG emissions and current climate conditions and trends that are discussed further in **Section 6.1**, Existing Condition of the Affected Environment. The scope of analysis for the effects of climate change on resources in the analysis area is discussed within the context of the analysis area for each particular resource. The current climate change trends related to social, physical, and biological resources are discussed further in **Section 6.1.2**, Climate Change Trends, and **Section 7.0**, Environmental Consequences impacts related to resources in the SGP Area.

2.0 Alternatives, Including the Proposed Action

The SGP 2021 Modified Mine Plan (MMP) Alternatives Report (Forest Service 2022a) contains the details of the alternatives that are being considered and fully analyzed in this report. For reader usability, the alternatives are briefly summarized here.

2.1 No Action Alternative

The No Action Alternative provides an environmental baseline for comparison of the action alternatives. Under the No Action Alternative, the mining, ore processing, and related activities under the 2021 MMP or the Johnson Creek Route Alternative would not take place. In addition, certain legacy and existing mining impacts would be addressed as directed in the 2021 Administrative Settlement Agreement and Order on Consent, including installation of stream diversion ditches designed to avoid contact of water with sources of contamination and removal of development rock and tailings currently impacting water quality. However, existing and approved activities (i.e., approved exploration activities and associated reclamation obligations) would continue and Perpetua would not be precluded from subsequently submitting another plan of operations pursuant to the General Mining Law of 1872.

2.2 2021 MMP

The 2021 MMP is based upon Perpetua's Revised Plan (ModPRO2) and is considered the Proposed Action. The description of this alternative has been updated per the Revised Plan submitted in 2021 (Perpetua 2021a). The SGP operations footprint has been modified but would still be within the previously identified Operations Area Boundary **(Figure 2-1**).

The following mine components would be common to the action alternatives:

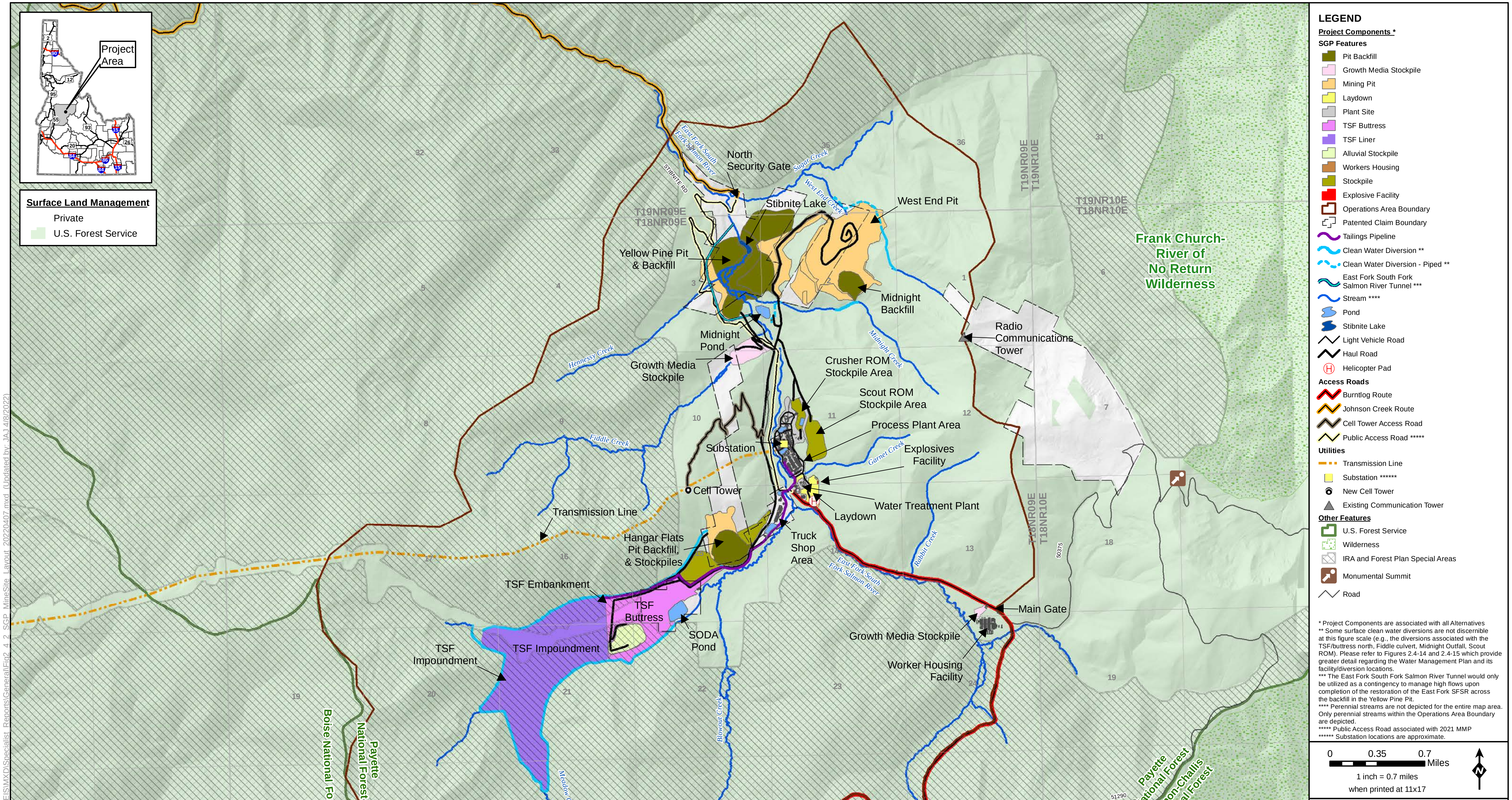
- Mine pit locations, areal extents, and mining and backfilling methods
- Transportation management on existing and proposed roads
- Pit dewatering, surface water management, and water treatment
- Ore processing
- Lime generation
- Tailing storage facility (TSF) construction and operation methods
- TSF Buttress construction methods
- Water supply needs and uses
- Management of mine impacted water and stormwater runoff
- Stibnite Gold Logistics Facility (SGLF)
- A road maintenance facility
- Surface and underground exploration
- Stibnite Gold Project worker housing facility

For access, the 2021 MMP would utilize Warm Lake Road, Johnson Creek Road, and Stibnite Road during construction of the Burntlog Route; then once constructed, the Burntlog Route would be utilized during operations and reclamation. The actions proposed under the 2021 MMP would take place over a period of approximately 20 years, not including the long-term, post-closure environmental monitoring or potential long-term water treatment.

2.3 Johnson Creek Route Alternative

The Johnson Creek Route Alternative was developed to evaluate potential reductions in impacts to various resources. The mining portion of this alternative would be the same as under the 2021 MMP. Therefore, the primary focus of the Johnson Creek Route Alternative would be using an existing route for mine access during operations and reclamation instead of the Burntlog Route that under the 2021 MMP requires new road construction in Inventoried Roadless Areas. The Johnson Creek Route Alternative would require extensive upgrades to both Johnson Creek Road and Stibnite Road. Construction schedule for upgrading the roads and construction of the SGP would increase from 3 years to 5 years.

The action alternatives are summarized in **Table 2-1**.



* Project Components are associated with all Alternatives
** Some surface clean water diversions are not discernible at this figure scale (e.g., the diversions associated with the TSF/buttress north, Fiddle culvert, Midnight Outfall, Scout ROM). Please refer to Figures 2.4-14 and 2.4-15 which provide greater detail regarding the Water Management Plan and its facility/diversion locations.
*** The East Fork South Fork Salmon River Tunnel would only be utilized as a contingency to manage high flows upon completion of the restoration of the East Fork SFSR across the backfill in the Yellow Pine Pit.
**** Perennial streams are not depicted for the entire map area. Only perennial streams within the Operations Area Boundary are depicted.
***** Public Access Road associated with 2021 MMP
****** Substation locations are approximate.

Figure 2-1
Mine Site Layout
Stibnite Gold Project
Stibnite, ID

Base Layer: Hillshade derived from LiDAR supplied by Midas Gold
Other Data Sources: Perpetua; State of Idaho Geospatial Gateway (INSIDE Idaho); Boise National Forest; Payette National Forest

Table 2-1 Action Alternatives Summary

SGP Phase	Component/ Subcomponent	2021 MMP	Johnson Creek Route Alternative
All Phases	SGP timeline	• Construction: Approximately3 years. • Operations: Approximately 15 years. • Exploration: Approximately 17 years (during construction and operations). • Reclamation: Approximately 5 years (except for the TSF which would require an additional 9 years for tailings dewatering and consolidation). • Closure/Post-Closure Water Treatment: Approximately through Mine Year 40. • Environmental Monitoring: As long as needed.	Same as 2021 MMP except: • Construction: Approximately 5 years (upgrading the existing Johnson Creek and Stibnite Roads to provide permanent mine access).
All Phases	Access Roads	Construction/Operations: • Warm lake road from State Highway (SH) 55 to Johnson Creek Route intersection (34 miles). • Johnson Creek Route for SGP access during early construction with minor improvements within the road prism. • Burntlog Route (38 miles) for SGP access during last year of construction, mining and ore processing operations, and closure and reclamation. Includes improvements of existing segments (23 miles) and road construction for new segments (15 miles). • Up to eight borrow areas developed along Burntlog Route for materials needed for road improvements and maintenance. • Access route around the Yellow Pine pit for public access. Closure and Reclamation: • New sections of Burntlog Route to be reclaimed after the closure and reclamation period.	• Warm lake road from SH 55 to Johnson Creek Route intersection (34 miles). • Johnson Creek Route (39 miles: Johnson Creek Road 25 miles, Stibnite Road 14 miles) upgraded and used for access throughout life of mine (LOM) instead of the Burntlog Route. • Access route around the Yellow Pine pit for public access, employee access, and deliveries of supplies and equipment to the processing, warehouse, worker housing facility, and administration areas. • No improvements or construction of new segments for Burntlog Route. • Up to seven borrow sources developed along the Johnson Creek Route for materials needed for road improvements and maintenance. Closure and Reclamation: • Improved Johnson Creek and Stibnite roads would not be reclaimed to pre-existing conditions.
All Phases	Public Access	Construction: • Temporary groomed over-snow vehicle (OSV) trail on the west side of Johnson Creek from	Construction and Operations: Same as 2021 MMP except: • OSV trail on the west side of Johnson Creek from Wapiti

SGP Phase	Component/ Subcomponent	2021 MMP	Johnson Creek Route Alternative
		Trout Creek to Landmark while Burntlog Route is constructed (8 miles). • OSV trail on west side of Johnson Creek from Wapiti Meadows to Trout Creek campground closed during construction (9 miles). • OSV trail from Warm Lake to Landmark closed during construction through operations (8.5 miles). • Cabin Creek Road Groomed OSV trail (11 miles). • Public roads remain open through the SGP with temporary closures as needed to accommodate construction. Operations: • Groomed OSV trail moves from west side of Johnson Creek Road to Johnson Creek Road from Landmark to Wapiti Meadows (16.7 miles). • Stibnite Road (County Road [CR] 50-412) / Thunder Mountain Road (FR 50375) closed through the SGP. • Seasonal public access through the Operations Area Boundary provided by constructing new road through Yellow Pine pit and below mine haul road to link Stibnite Road (FR 50412) to Thunder Mountain Road (FR 50375). • Public access allowed on Burntlog Route to Thunder Mountain Road (FR 50375). Closure and Reclamation: • New road constructed over the Yellow Pine Backfill (backfilled Yellow Pine pit) connecting Stibnite Road (FR 50412) to Thunder Mountain Road (FR 50375).	Meadows to Trout Creek campground would be closed from construction through mine closure (9 miles). • Groomed OSV trail on the west side of Johnson Creek from Trout Creek to Landmark lasting from construction through mine closure. Closure and Reclamation: Same as 2021 MMP.
Operations	Utilities – Transmission Lines	• Upgrade approximately63 miles of the existing 12.5 kilovolt (kV) and 69 kV transmission lines. • New approximate 9-mile, 138 kV line would be constructed from	Same as 2021 MMP.

SGP Phase	Component/ Subcomponent	2021 MMP	Johnson Creek Route Alternative
		the Johnson Creek substation to a new substation at the mine site. • Upgrade the substations located at Oxbow Dam, Horse Flat, McCall, Lake Fork, and Warm Lake. • Reroute approximately 5.4 miles of transmission line to avoid the Thunder Mountain Estates subdivision. • Reroute approximately 0.9 miles of transmission line between Cascade and Donnelly to use an old railroad grade on private property. • Installation of approximately 3 miles of new underground distribution line along Johnson Creek Road from the Johnson Creek substation south to Wapiti Meadows.	
Operations	Utilities - Communication Towers and Repeater Sites	• One cell tower located north of the Hangar Flats pit. • Locations along Burntlog Route for very high frequency (VHF) repeater sites. • Use existing access roads to repeater site locations along Burntlog Route. • Communication site at the SGLF. • Upgrades to existing communication site.	Same as 2021 MMP except: • Cell tower sites constructed and maintained using helicopter (instead of constructing access roads) for sites within IRAs managed for Backcountry/Restoration. • Locations along Johnson Creek route for repeater sites.
Operations	Off-site Maintenance Facility	• SGLF located along Warm Lake Road. • Burntlog Maintenance Facility located at one of the borrow source locations 4.4 miles east of the junction of Johnson Creek Road and Warm Lake Road along the proposed Burntlog Route.	• SGLF same as 2021 MMP • Landmark Maintenance Facility located at junction of Warm Lake Road at Johnson Creek Road.
Closure and Reclamation	Access road segments	• Removal and reclamation of new road segments constructed for Burntlog Route. • Return of previously existing road segments to pre-construction width and condition.	• No removal or reclamation of pre-existing access routes.

Table Source: Perpetua 2021a

2.4 Applicable Environmental Design Features

The SGP must comply with all laws and regulations that apply to the proposed activities (Forest Service 2022a). Standards and guidelines in the Payette and Boise National Forest Land and Resource Management Plans (Forest Service 2003, 2010) that are designed to reduce or prevent undesirable impacts resulting from proposed management activities are incorporated into the action alternatives by reference. In addition, best management practices outlined in the Best Management Practices for Mining in Idaho (Idaho Department of Lands 1992) would be implemented where appropriate and applicable for operations to minimize site disturbance from mining and drilling activities.

In the design of the 2021 MMP, Perpetua has already considered many of the potential environmental impacts that might be caused by the SGP. This has led to an internal evaluation of project design features and operational characteristics that may have the effect of reducing and/or eliminating potential environmental impacts of the SGP. Such project-specific measures intended by a proponent to inherently reduce and/or avoid potential environmental impacts of a proposed action are referred to as environmental "design features."

Based on the application of permits and regulatory compliance requirements (Forest Service 2022a) to the SGP, there are several regulatory requirements associated with air quality (Forest Service 2022b), but nothing explicit to climate change. However, Perpetua is proposing two environmental design features that would help reduce impacts on climate change and they include:

- All off-highway diesel engines would be EPA Tier IV or better.
- Perpetua would utilize “smart grid” technology to reduce energy consumption, such as auto dimming lights in offices.

3.0 Relevant Laws, Regulations, and Policy

There are currently no federal or state regulatory programs that require GHG emission reductions or controls on new or existing facilities in Idaho. The sections below describe the existing regulatory guidance for GHGs and climate change under the National Environmental Policy Act (NEPA) and from the Forest Service, as well as other guidance from the EPA and state of Idaho for monitoring, reporting, and reducing GHG emissions.

3.1 Land and Resource Management Plan

There are no specific standards or guidelines related to climate change in the Payette National Forest Land and Resource Management Plan (Forest Service 2003) or the Boise National Forest Land and Resource Management Plan (Forest Service 2010). However, Climate Change Considerations in Project Level NEPA Analysis (Forest Service 2009) provides Forest Service guidance on how to consider climate change in project-level NEPA analysis and documentation. The following basic concepts are outlined in this document:

1. Climate change effects include the effects of agency action on global climate change and the effects of climate change on a proposed project.
2. The agency may propose projects to increase the adaptive capacity of ecosystems it manages, mitigate climate change effects on those ecosystems, or to sequester carbon.

3. It is not currently feasible to quantify the indirect effects of individual or multiple projects on global climate change; therefore, determining significant effects of those projects or project alternatives on global climate change cannot be made at any scale.
4. Some project proposals may present choices based on quantifiable differences in carbon storage and GHG emissions between alternatives.

3.2 Federal Laws, Regulations, and Policy

3.2.1 Mandatory Reporting of Greenhouse Gases Rule

As an initial action under the federal Clean Air Act, the EPA established a program in October 2009 for Mandatory Reporting of Greenhouse Gases Rule (40 CFR 98) (Mandatory Reporting Rule). This program requires monitoring and annual reporting of GHG emissions for over 40 source categories if the facility's annual emissions exceed 25,000 metric tons of GHGs (as carbon dioxide equivalent [CO2e] units). The Mandatory Reporting Rule defines CO2e as the number of metric tons of CO2 emissions with the same global warming potential as one metric ton of another GHG. Stationary fuel combustion emissions of CO2, CH4, and N2O is identified in the Mandatory Reporting Rule as a separate category that may be present at facilities that qualify for reporting under another source category.

The Mandatory Reporting Rule facilitates collection of accurate and comprehensive emissions data to provide a basis for future EPA policy decisions and regulatory initiatives. This federal regulation stipulates the methodology for record keeping, emission estimation, and reporting of GHG emissions.

3.2.2 GHG Major Source Permitting – Tailoring Rule

In June 2010, EPA issued a final rule (referred to as the Tailoring Rule) setting GHG emission thresholds for Clean Air Act preconstruction permits under the Prevention of Significant Deterioration and Title V permitting programs (75 Federal Register 31514). The Tailoring Rule established a Title V major source permitting threshold of 100,000 short tons per year for GHGs measured in CO_2e. This framework was codified in several sections of 40 CFR 51, 52, 70, and 71 (40 CFR 51.166, 52.21, 52.22, 70.2, 70.12, 71.2, and 71.13). In addition, the Tailoring Rule also imposed the requirement for new major sources of GHG to implement best available control technology to reduce GHG emissions through the new source review process.

In June 2014, the Tailoring Rule provisions regarding GHG major source permitting were remanded by the U.S. Supreme Court (U.S. Supreme Court 2014). The ruling allowed EPA to continue to regulate GHG for sources already subject to regulation as Prevention of Significant Deterioration or Title V sources for conventional criteria pollutants.

3.2.3 2016 Council on Environmental Quality Guidance

On August 1, 2016, the Council on Environmental Quality (CEQ) issued final guidance describing how federal departments and agencies should consider the effects of GHG emissions and climate change in their NEPA reviews (81 Federal Register 51866). This guidance provided an updated approach to describe climate change impacts. It advises agencies to quantify projected direct and indirect GHG emissions whenever the necessary tools, methodologies and data are available. It also allows for agencies to act on an appropriate level basis on previous experience when complying with NEPA. It also recommends that when appropriate data is nor reasonably available to support quantitative analyses, qualitative discussion be applied (CEQ 2016). As discussed below, it was rescinded in 2019, but reinstated in 2021.

3.3 Executive Orders

3.3.1 National Environmental Policy Act; EO 13783

Executive Order (EO) 13783 on Promoting Energy Independence and Economic Growth directed CEQ to rescind the final 2016 guidance, and the CEQ guidance was withdrawn on April 5, 2017 (82 Federal Register 16576). After further consideration of EO 13783, CEQ released draft guidance on June 26, 2019 (85 Federal Register 30097) on how NEPA analysis and documentation should address GHG emissions.

This order was rescinded by the Biden Administration on February 19, 2021.

3.3.2 Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, EO 13990

This order was issued on January 20, 2021, to establish a national policy to better promote and protect public health and the environment. Section 7(e) of the associated Federal Register notice (86 FR 7037, January 25, 2021) directs CEQ to rescind the 2019 Draft GHG Guidance and to review, revise, and update its 2016 Guidance. Additionally, CEQ will provide a separate notice of its review and potential revisions at a later date. Executive Order 14008 also was issued on February 1, 2021, outlining a government-wide approach toward combating the "climate crisis". Currently, the 2016 Guidance and other available resources and tools should be employed to assess GHG impacts.

3.4 State and Local Policy

On May 16, 2007, the Governor of Idaho signed EO 2007-05, Establishing a State Policy Regarding the Role of State Government in Reducing Greenhouse Gases (Idaho Administrative Bulletin 2007). This EO recognized that, "the causes and effects of rising greenhouse gases, to the degree they are understood, may extend to the Western U.S. and the State of Idaho, and it is incumbent upon states to take a leadership role in developing responsive state-level policies and programs to reduce greenhouse gas emissions, develop alternative energy sources, and use energy efficiently." The EO identified two types of actions to be taken: 1) the Director of the Idaho Department of Environmental Quality (IDEQ) is to take a lead role in coordinating GHG reduction efforts; and 2) the Director of IDEQ is to develop a state GHG emission inventory and develop recommendations on how to reduce GHG emissions in the state. Refer to **Table 6-1** showing the statewide GHG emissions inventory for Idaho (by sector). GHG emission reduction strategies and/or initiatives have not yet been identified for the state.

3.5 Federal Permits, Licenses, or Other Entitlements

The SGP would need to comply with a variety of government regulatory programs as listed in the SGP 2021 MMP Alternatives Report (Forest Service 2022a).

4.0 Issues and Resource Indicators

4.1 Significant Issues

Significant issues are those which are used to formulate alternatives to the Proposed Action and to develop mitigation measures. No significant issues were identified for climate change.

4.2 Resource Issues and Indicators

Although climate change was not identified as a significant issue, it was identified by the public, the Forest Service, and cooperating agencies as a relevant consideration. The analysis of effects of the 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:

- GHG emissions from SGP activities (construction, operations, and closure and reclamation), expressed as metric tons (MT) of carbon dioxide (CO_2) equivalent (CO_2e) of GHGs.

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

5.0 Methodology

5.1 Mining and 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 would be 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 sources each would 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 (IDEQ 2010). For the industrial sector, nationwide emissions in 1990 were about 854 million MT CO_2e and have decreased to 823 million MT CO_2e by 2019 (EPA 2021a). Additional details regarding the historic trends in GHG emission inventory for Idaho and the U.S. are provided in **Section 6.1.1**, GHG Inventory Information.

5.2 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 the action alternatives, the required equipment would be fueled with conventional, low-sulfur No. 2 distillate diesel fuel. In addition, there would be gasoline vehicles, propane-fired heaters, and 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 5-1**.

Table 5-1 Fuel-Combustion Source Emission Factors

Emission Source Category	Carbon Dioxide (CO2) (kg/MMBtu)	Methane (CH4) (kg/MMBtu)	Nitrous Oxide (N2O) (kg/MMBtu)
Stationary/Mobile Combustion Units - Propane Fuel	62.87	3.00E-03	6.00E-04
Stationary/Mobile Combustion Units - Diesel Fuel	73.96	3.00E-03	6.00E-04
Motor Gasoline	70.22	3.00E-03	6.00E-04

Source: 40 CFR Part 98 Table C-1 and C-2
Kg – kilogram; MMBtu – Million British Thermal units

6.0 Affected Environment

6.1 Existing Condition

Existing conditions for climate change are discussed for the affected resources in terms of baseline GHG emissions in the analysis area, as well as potential effects from climate change on the social, physical, and biological resources in the analysis area.

6.1.1 GHG Inventory Information

The GHG compounds of interest are those that would be released due to operation of diesel-fueled and gasoline-fueled engines, and propane combustion for either process needs or heating of buildings. The use or release of any hydrofluorocarbons or perfluorocarbons would not be necessary for the SGP. To provide context for emissions associated with the SGP, this section also presents GHG inventory information for national and regional sources (see Section 7.2 for details).

6.1.1.1 National GHG Inventory Data

Compared to 1990, annual GHG emissions in the U.S. have increased by about 1.79 percent, based on 2019 reported data (EPA 2021a). However, year-to-year emissions are shown to increase or decrease due to changes in the economy, the price of fuel, weather, and other factors.

The EPA reports that 2019 annual total emissions of CO_2 were 2.8 percent higher than 1990 totals, while total emissions of CH_4 were 15.1 percent lower, and total emissions of N_2O were 0.1 percent higher (EPA 2021a). GHG emissions in the U.S. were partly offset by carbon sequestration in managed forests, trees in urban areas, agricultural soils, landfilled yard trimmings, and coastal wetlands. In recent years, there has been a general nationwide trend of declining GHG emissions across most sectors (EPA 2021a).

In 2019, the latest reporting year available, transportation vehicles and electric power generation accounted for 28.6 and 25.1 percent, respectively, of U.S. emissions of GHG. Industrial sources (the reporting category that includes mining activities other than coal) accounts for 22.9 percent of GHG emissions nationwide. GHG emissions from industry are mainly associated with burning fossil fuels (e.g., coal, natural gas) for heat energy, as well as emissions from non-road vehicles and equipment, and manufacturing processes to produce goods from raw materials (EPA 2021a).

6.1.1.2 GHG Inventory for Idaho

Table 6-1 shows reported statewide GHG emissions within Idaho from 2018. Idaho is a relatively small contributor to U.S. GHG emissions. Based on the total data available from the EPA State Inventory and Project Tool, Idaho produced approximately 31.44 million metric tons (MMT) of CO_2e in 2018 (EPA 2021b). These emission estimates are based in large part from representative default values as provided by the EPA. Total national CO_2e emissions for 2018 was 5,870 MMT (EPA 2021a). Both yearly estimates include both sources and sinks. Idaho's total GHG emissions accounted for less than 0.6 percent of U.S. GHG emissions during that period. The Idaho data is broken down into five general categories. These include energy consumption, industrial processes, agriculture, waste (municipal solid waste, wastewater), and land-use and forestry (sinks). Note that the total amount associated with land-use/forestry is a net reduction but included are potential emissions from forest fires. During 2020, approximately 127,214 hectares (314,352 acres) were burned from forest fires (NICC 2021). For the purposes of this analysis, it was assumed that all forest burned was temperate forest such as species like fir and pine.

The three highest contributing sectors to Idaho GHG emissions are energy (19.77 MMT), agriculture (12.64 MMT), and industrial (1.53 MMT). The overwhelming energy contributor is general fossil fuel combustion (primarily industrial and transportation petroleum usage). Mineral mining is not designated separately and is assumed to be a small overall contributor.

Table 6-1 Statewide GHG Emissions Inventory for Idaho, by Sector

Source Category	Fuel Type or Process Activity	2000 MMT CO_{2e}	2010 MMT CO_{2e}	2018 MMT CO_{2e}	2018 Sector Portion of Annual Emissions (%)	2000-2018 Average MMT CO_{2e}	% Change, 2000 to 2018
Energy	Fossil Fuel Combustion	17.31	16.70	19.50	62.01	17.15	12.64
	Stationary Combustion	0.09	0.10	0.19	0.60	0.12	101.18
	Mobile Combustion	0.27	0.11	0.08	0.26	0.14	-69.80
	Subtotals of all Fuel Types	17.67	16.92	19.77	62.87	17.42	11.86
Industrial	Industrial Processes	1.42	1.20	1.53	4.87	1.38	7.75
Agriculture (Ag)	Enteric Fermentation	4.15	4.89	5.50	17.50	4.87	32.57
	Manure Management	1.94	2.88	3.20	10.17	2.74	64.95
	Ag Soil Management	3.63	3.59	3.81	12.11	3.72	5.00
	Rice Cultivation	0.00	0.00	0.00	0.00	0.00	0.00
	Liming	0.02	0.00	0.04	0.12	0.03	117.64
	Urea	0.09	0.08	0.07	0.21	0.10	-23.07
	Burn of Ag Waste	0.03	0.03	0.03	0.09	0.03	-2.51
	Subtotals of Ag Types	9.85	11.47	12.64	40.19	11.48	28.35
Land-use/ Forestry	Land Use, Land Use Change, and Forestry (Sink)	-9.96	-3.42	-3.10	-9.85	-5.04	68.91
Waste	Municipal Solid Waste	0.48	0.52	0.41	1.30	0.48	-14.61
	Wastewater	0.16	0.18	0.20	0.64	0.18	24.97
	Subtotals of all Waste Types	0.64	0.70	0.61	1.94	0.64	-4.58
Grand Total	Sources & Sinks	19.62	26.87	31.44	100	25.89	N/A

Source: USEPA 2021b

CO_2 emissions are the vast majority of fuel combustion and industrial processes (~95 percent). Agriculture GHG emissions are primarily comprised of CH_4 (~74 percent). All land use and forestry sinks are calculated as carbon sequestration (CO_2). All solid waste is CH_4 and municipal waste is also mostly CH_4 (~70 percent).

6.1.2 Climate Change Trends

Climate change is often discussed in terms of plausible futures or scenarios based on precipitation and temperature projections. These scenarios are built on different trajectories of future GHG concentrations, land use, and other factors, due to the uncertainty associated with GHG emissions and concentrations, and uncertainty in climate functions. IPCC released new emission scenarios in 2013 called Representative Concentration Pathways (RCP). RCPs are based on a range of potential future rates of factors such as economic growth, population, and energy consumption, which are translated into emissions and concentrations of GHGs over time and then run through climate models to predict future values of temperature and precipitation. RCP 8.5 represents a scenario where high emissions continue through 2100 (FHWA 2017); the discussion of emissions and climate change trends throughout this section are based on the projected scenarios under RCP 8.5.

In general, managers are recommended to use the RCP 8.5 scenario for planning and project purposes. This is based on information in the 2018 National Climate Assessment informing that without major reductions in global emissions, it is expected that the temperatures would reach RCP 8.5 levels or even higher temperatures in the future. The RCPs are scenarios of future climate projections based on different levels of GHG emissions and other human activity pollutants. The RCP 4.5 is a scenario that factors in lower levels of GHG emissions and other pollutants than RCP 8.5, and factors in a peaking of fossil fuel carbon emissions mid-century followed by a decrease (USGCRP, Chapter 2, 2018).

The IPCC Sixth Assessment Report documents evidence for the warming of the global climate system since the 1950s, based on observed changes over time periods ranging from decades to millennia (IPCC 2021). In this assessment, the IPCC reports that most land areas have seen a global surface temperature increase of 0.1ºC (0.18 ºF) per decade since 1960, and each of the last three decades has been successively warmer than any preceding decade since 1850. In the Northern Hemisphere, 1983 to 2012 was likely the warmest 30-year period of the last 1,400 years (IPCC 2021).

As described below, the effects of climate change in the analysis area can be seen by review of reported trends in the temperature, precipitation, snowpack, and other indicators of regional climatology. Similarly, statewide climate trends also reflect the measurable effects of regional climate change that will continue to affect the environmental conditions in the analysis area regardless of the alternative implemented. These statewide and regional trends are used as a proxy to discuss current climate trends in the analysis area.

Average annual temperature is an important climate indicator that directly reflects regional energy balance. Overall, temperature trends affect energy use, snowmelt, and runoff, as well as a host of biological life functions. Most of Idaho has seen an increase in average temperatures of 0.56 to 1.1ºC (1 to 2 ºF) over the last century, with the last two decades being the warmest on record (EPA 2016). Temperatures have generally increased across the northwest region of the U.S. from 1895 to 2014, with a regionally averaged warming of about 0.83ºC (1.5°F). Average minimum and maximum temperatures for the middle Rockies region, which includes the Payette, Boise, Salmon-Challis, Sawtooth, and portions of the Caribou-Targhee National Forests, are projected to warm by about 5.6ºC (10°F) under RCP 8.5 by 2100, with increases projected to be the largest during summer months (Halofsky et al. 2018). A recent example being the summer 2021 drought throughout much of Idaho. The projected increase in minimum temperature in this region by the year 2100 under the RCP 8.5 scenario will bring the median temperature above freezing, suggesting that a biologically meaningful threshold could be crossed (Halofsky et al. 2018). Additionally, the intensity of heat waves is projected to increase, while cold wave intensity is projected to decrease (Runkle et al. 2017).

General precipitation trends in Idaho and the Pacific Northwest have been observed to be both increasing and decreasing among various locations, seasons, and time periods of analysis. Statewide precipitation is highly variable and showed no overall trend in annual average precipitation during the last century. However, the frequency of extreme precipitation events in Idaho has been above average over the past decade. Statewide winter and spring precipitation is expected to increase during the 21st Century, while precipitation in the summer is expected to decrease (Runkle et al. 2017). Overall, precipitation is projected to increase by 5 to 8 percent by the year 2100 under RCP 8.5 (Halofsky et al. 2018). Prolonged drought conditions, common throughout the 1920s and 1930s, have not been observed in recent decades

(University of Idaho 2011); however, increased intensity of drought events is expected to occur throughout the 21st Century (Runkle et al. 2017). Future projections show a highly variable change in annual average precipitation throughout the northwest region of the U.S., within a range of an 11 percent decrease to a 12 percent increase for 2030 to 2059 and a 10 percent decrease to an 18 percent increase for 2070 to 2095 (Halofsky et al. 2018).

Changes in river-related flood risk depends on many factors, but warming is projected to increase flood risk the most in mixed basins (those with both winter rainfall and late spring snowmelt-related runoff peaks) and remain largely unchanged in snow-dominant basins (Mote et al. 2014). Across the northwest region, much of the water supply comes from mountain snowpack, which melts in spring and summer and runs off into rivers, filling reservoirs. As the climate warms, less precipitation falls as snow and more snow melts during the winter, which decreases the snowpack. Since the 1950s, Idaho's overall snowpack has been decreasing (EPA 2016). Lower snowpack and increased drought are likely to lead to lower base flows, reduced soil moisture, wetland loss, riparian area reduction or loss, and more frequent and possibly severe wildfire. Places that experience temperatures near the melting point of snow are expected to be more sensitive than places where temperatures remain below freezing throughout much of the winter, despite warming (Halofsky et al. 2018). The projected rise in temperatures is expected to increase the average lowest elevation where the snowpack reliably accumulates throughout the winter, which may cause the tree line to shift, as subalpine fir and other high- altitude trees become able to grow at higher elevations. Warmer temperatures may increase the frequency of precipitation falling as rain instead of snow, reducing overall water storage in the snowpack. Rising temperatures also could result in earlier melting of the snowpack, further decreasing water availability during the dry summer months (Runkle et al. 2017).

Increasing air temperatures and decreasing summer flows associated with climate change are expected to warm streams by increasing long-wave radiation and warming groundwater inputs (Isaak et al. 2017). Catastrophic fire and drought can drastically alter water quality and temperature, woody debris, bank vegetation, and stream flow characteristics. Reduced stream cover from changes in woody debris and bank vegetation also can result in increased stream temperatures (Halofsky et al. 2018). A transition from snow to rain, resulting in diminished snowpack and shifts in streamflow to earlier in the season, also could cause changes in groundwater recharge to aquifers and groundwater discharge to groundwater-dependent ecosystems. Mean annual streamflow projections suggest a slight increase; however, despite these projections, summer low flows are expected to decline. Furthermore, higher minimum temperatures reducing the longevity of snowpack will decrease the length of time aquifer recharge can occur, potentially leading to faster runoff and less groundwater recharge (Halofsky et al. 2018).

Climate controls the magnitude, duration, and frequency of weather events (e.g., wind, temperature, relative humidity, and precipitation), which, in turn, drive fire behavior (Halofsky et al. 2018). A warming climate and earlier snowmelt patterns have led to longer fire seasons, and these trends are expected to continue; however, fire activity is limited by the availability of fuels, and future climate projections that influence fire occurrence and behavior are uncertain at the regional and local scale. Most visible and significant short-term effects of climatic changes on forest ecosystems are caused by altered disturbance regimes, such as insects and fire. The size and duration of forest fires, the length of the fire season, and size of areas burned in the West have increased over the past 30 years (Halofsky et al. 2018). The annual area burned, as well as the occurrence of very large wildfires, is projected to continue increasing as temperatures rise and longer fire seasons combine with regionally dry fuels. Future wildfire severity will be dependent on vegetation changes and fuel conditions (Halofsky et al. 2018).

6.2 Analysis Area

The climate change analysis area varies depending on the resource affected as described below. Given that climate change impacts are likely to persist in the region, analysis area resource conditions are expected to be affected. Due to the nature of the resource, climate change is not expected to impact noise, thus this resource is not discussed. Climate change trends are discussed below by resource.

6.2.1 Geological Resources and Geotechnical Hazards

Current climate change trends, such as increased heavy precipitation events and more precipitation falling as rain instead of snow, could lead to increased soil erosion and change in landcover, which could potentially impact slope stability and avalanche occurrence in the analysis area. Damage due to seismic activity in the area also could be exacerbated by climate-induced instability in the analysis area.

6.2.2 Air Quality

Climate-induced changes in weather and seasonality can strongly affect air quality in a specific region. The criteria air pollutants of most concern and potentially most affected by changes in climate, are particulate matter (PM), and ground-level ozone.

PM which primarily consists of sulfate and nitrate compounds, organic carbon, elemental carbon, soil dust, and sea salt. Of most concern to human health are the first four pollutants, because they are typically present as fine particles less than 2.5 microns in diameter ($PM_{2.5}$) and can be inhaled deep into the lungs. Sulfate, nitrate, and organic carbon are produced in the atmosphere by oxidation of anthropogenic emissions of sulfur dioxide, nitrogen oxides, and non-methane volatile organic compounds. Carbon particles also are directly emitted by combustion. Seasonal variation of PM is complex and location dependent; precipitation is the main atmospheric sink for PM (Jacob and Winner 2009). An overall increase in precipitation levels may improve the cleansing of the atmosphere and may increase chemical deposition.

Hotter, drier weather can allow PM and other pollutants to accumulate in the atmosphere or allow emitted PM precursors to persist longer in the atmosphere.

The effect of climate change on PM is complicated and uncertain. Precipitation frequency and mixing depth are important driving factors, but projections for these variables are often unreliable. As a result of climate change, more frequent and intensified wildfires could become an increasing PM source and decreases in summer precipitation could exacerbate high PM concentrations caused by wildfires (Jacob and Winner 2009).

During low fire years, $PM_{2.5}$ concentrations are typically found in the cooler months of the year. However, wildfires have the potential to cause simultaneous increases of $PM_{2.5}$ and ozone within smoke plumes. (Kalasnikov et al. 2022). Summertime fires allow for more frequent co-occurrence events of the two pollutants, which can be exacerbated by increasing temperatures due to climate change.

The increase in widespread $PM_{2.5}$/ozone co-occurrences during July to September highlights the role of increasingly severe and larger wildfires which contributes to compounding public health hazards throughout the western US. Although smoke can be transported regionally, there is a definitive correlation between burned area in the western US and extent of local PM2.5/ozone co-occurrences (Kalasnikov et al. 2022).

6.2.3 Soils and Reclamation Cover Materials

Reduced soil moisture is expected to result from lower snowpack due to higher variation in precipitation and increased annual average temperatures. Higher temperatures may increase the rate at which carbon stored in the soil degrades or is released by fire. In addition, carbon content in soils is expected to decrease in areas where the decomposition rate and wildfire frequency increase. More winter precipitation falling as rain instead of snow could generate a higher frequency of runoff and erosional processes from disturbance events, such as fire. Soil erosion by wind and/or water may result in loss of topsoil, which could lead to the degradation of soil quality (Halofsky et al. 2018) and negatively impact reclamation success.

6.2.4 Hazardous Materials

Although climate change would not impact the likelihood of a spill, it could potentially impact the severity of a spill. Warmer temperatures leading to shorter winters reduce the period of time that frozen ground could prevent a spill from reaching groundwater; however, lower groundwater tables from drier periods also would increase the distance for the substance (fuel or other hazardous material) to travel to reach the groundwater, reducing the potential severity of a spill. Periods of increased precipitation and flooding could have the highest impact on severity of impacts from a release of hazardous materials in proximity to a stream. Increased soil moisture content reduces the ability of oil to seep into the ground and increases the distance a spill could spread over land; however, this risk would be reduced in areas of decreased soil moisture. High stream flows after extreme precipitation events would mean a release into surface waters could travel longer distances before being contained; however, a spill occurring during a seasonal low-flow period would travel a shorter distance, reducing the risk of spill migration.

Although extreme precipitation events occur proportionally less than low-flow periods throughout the year, climate change is expected to increase their frequency and thus, the risk of coinciding spills migrating longer distances.

6.2.5 Surface Water and Groundwater (Quality and Quantity)

Streamflow, water quality, and water quantity is vital for the survival of numerous aquatic species, as well as for human use. Water is sensitive to several different physical factors, including precipitation, snowpack, evaporation, and runoff, making it an ideal indicator to determine the effects of climate variability and change. Observations compiled from 21 U.S. Geological Survey unregulated stream gauges across Idaho show a decrease in the cumulative water year streamflow by nearly 2 million cubic feet, or 15 percent, over the last half century (University of Idaho 2011). The magnitude of the peak streamflow is expected to increase slightly across the region; however, summer low flows are expected to decline (Halofsky et al. 2018). Additionally, the timing of peak streamflow from 1949 to 2008 has advanced about 1 week earlier into the spring. Advancement in the timing of peak streamflow is hypothesized to be indicative of changes in the timing of snowmelt and/or phase of precipitation (University of Idaho 2011). Spring and summer streamflow is expected to continue to decline in basins that have historically relied on snowmelt, and low flow periods are projected to be more prolonged and severe (May et al. 2018). The decline in streamflow is expected to reduce the rate of recharge of water supply in some basins (Halofsky et al. 2018).

The basin aquifer system in the central region of Idaho is recharged by precipitation and snowmelt, and reductions in the longevity of snowpack may lead to faster runoff and less groundwater recharge. The transition of watersheds from snow-dominated to rain-dominated, which diminishes snowpack and shifts streamflow to earlier in the season, would result in changes to groundwater recharge in aquifers and groundwater discharge to groundwater-dependent ecosystems (Halofsky et al. 2018). Because many biogeochemical processes are temperature-dependent, climate-induced changes in surface and groundwater temperature also could negatively impact the quality of these water resources (Halofsky et al. 2018).

6.2.6 Vegetation: General Vegetation Communities, Non-native Plants, and Botanical Resources

Gradual changes in the distribution and abundance of dominant plant species and short-term impacts on vegetation structure and age classes are expected as a result of rising temperatures. The region is currently dominated by coniferous and other forested vegetation such as subalpine fir, Engelmann spruce, grand fir, Douglas fir, lodgepole pine, western larch, Ponderosa Pine, and whitebark pine. The frequency of nonnative plant species is expected to rise, displacing native species, and altering fire regimes (i.e., the roles of fire in ecosystems and its interactions with dominant vegetation). Increased frequency and duration of drought could impact vegetation ecosystems through changes in soil moisture, which could cause mortality or result in higher species vulnerability to insects and disease. Dominance of nonnative species may be facilitated through more frequent and intense wildfires, causing increased disturbance where native species regenerate more slowly (e.g., sagebrush species). Consequentially, the dominance of nonnative plants could themselves encourage more frequent wildfires and cause changes in the ecology of vegetation assemblages (Halofsky et al. 2018).

Whitebark pine has suffered widespread mortality throughout its range from the combined effects of mountain pine beetle outbreaks and white pine blister-rust infection. Although it is not a dominant species in the area, it is a federally listed Candidate species and an important tree species to high-elevation ecosystems of western North America (see Vegetation specialist report [Forest Service 2022c]). Fire exclusion amplifies the climate change impacts from insects and disease by allowing succession to shade tolerant species, stressing mature whitebark pines, and limiting opportunities for seedling establishment. Projected warming and drying trends will likely further exacerbate this decline (Fryer 2002).

6.2.7 Wetlands and Riparian Resources

Changes in groundwater levels in wetlands can reduce groundwater inflow, leading to lower water table levels and altered wetland water balances. These altered water table elevations and streamflow volumes may affect riparian areas and their plant communities by reducing hydrological connectivity between uplands, wetland ecosystems and riparian areas. Climate-induced changes in precipitation, drought, and streamflow would influence the distribution of riparian vegetation via changes in local hydrological regimes, especially if summer base flows decrease. If water table elevation can be assumed to be in equilibrium with water levels in the stream, reduced base flows could result in lower riparian water table elevations and subsequent drying of streamside areas, particularly in wide valley bottoms. Wetland and riparian plant communities will respond to climate-induced changes in hydrological variables differently as a function of species composition (Halofsky et al. 2018). Changes in hydric soils and other soils properties, also as a function of species composition.

6.2.8 Fish Resources and Habitat

Warmer air temperatures causing decreased snowpack and reduced stream flows can dramatically influence stream temperature and a host of ecosystem processes. Between 1976 and 2015 average August stream temperatures in the western U.S. showed a warming trend of 0.17°C (0.31°F) per decade. These temperatures are predicted to increase an average of 0.72°C (1.3°F) by 2040 and 1.4°C (2.6°F) by 2080 (Isaak et al. 2017). These warmer water temperatures and lower flows are expected to impact salmon, trout, and other cold-water fish (EPA 2016). For species dependent upon cold water, such as the federally listed Threatened bull trout, even small rises in temperature can significantly reduce spawning success (Knowles and Gumtow 1996). Additionally, increased wildfire may cause more extensive geomorphic disturbances and debris flows into streams, contributing to more variable environments and declining fluvial connectivity of aquatic habitats (Halofsky et al. 2018). Although the length of connected habitat needed to support cold water fish populations varies by local conditions, current estimates suggest a minimum of 20 to 30 miles for bull trout (30 miles is associated with a 90 percent probability of occupancy) and 3 to 6 miles for cutthroat trout (6 miles is associated with a 90 percent probability of occupancy) (Halofsky et al. 2018). Added to other stressors, such as habitat loss and fragmentation, invasive species, and disease, warmer stream temperatures could impact current spawning and rearing habitat (USFWS 2010).

6.2.9 Wildlife and Wildlife Habitat

The complex habitats and communities that have been established by many species in the analysis area are being disrupted by climate change. The region is currently facing unprecedented rates of change in climatic conditions that may outpace the natural adaptive capacities of several native species (Halofsky et al. 2018). Increased climate variability and frequency of extreme conditions will favor species adapted to frequent disturbance, potentially increasing the abundance of invasive species. Impacts to terrestrial species as a result of climate change are already being experienced through habitat loss and fragmentation, physiological sensitivities, alterations in the timing of species life cycles (e.g., seasonal changes impacting migration, hibernation, and reproductive success), and indirect effects (e.g., disruption of species interaction across communities). Most species are expected to exhibit sensitivity to changes in the climate, especially those restricted to high elevations or surface water habitats. Of the special status wildlife species occurring in the analysis area, the flammulated owl (*Otus flammeolus*), wolverine (*Gulo gulo*), and Columbian spotted frog (*Rana luteiventris*) are expected to be the most vulnerable terrestrial populations in the region (Halofsky et al. 2018). Other special status species expected to be impacted include the Canada lynx (*Lynx canadensis*) and Rocky Mountain bighorn sheep (*Ovis canadensis*) (Halofsky et al. 2018).

6.2.10 Timber Resources

Timber resources are an important ecosystem service (the natural environment providing benefits to humans) in the area. Forests in the interior Northwest are experiencing rapid change due to increasing wildfires and insect and disease damage, largely attributed to a changing climate (May et al. 2018). Changing climatic conditions are predicted to more than double the area in the Northwest burned by forest fires during an average year by the end of the 21st Century. An increase in wildfires would likely decrease the amount of timber available for harvests and degrade the soil, as well as threaten homes and pollute the air (EPA 2016). The area of pine forests in the Northwest infested with mountain pine beetles is expected to increase due to climate change over the next few decades, which also could lead to decreased timber harvests (EPA 2016).

Higher temperatures and decreased water availability can make trees more susceptible to pests and disease; consequentially, trees that have been damaged or killed burn more readily than living trees. Increases in spring and summer temperatures in recent decades are hypothesized to have increased the frequency of large fire seasons since the 1980s. An earlier snowmelt due to warmer temperatures can lead to greater drying of soils and vegetation, creating opportunities for earlier and larger wildfires (Westerling et al. 2006). Combined with other stressors exacerbated by climate, the rate of change in vegetation assemblages may be accelerated, reducing the productivity and carbon storage in most systems.

6.2.11 Land Use and Management

Long-term temperature and other climatic changes may potentially affect how lands in the analysis area are used. The majority of the analysis area is National Forest System lands, which is frequently used for recreational purposes. Climate change may impact recreational use of the land by changing the range and types of species present through changing habitat conditions (e.g., water quality, temperatures, and streamflow), as well as accessibility for both humans and animal species to various areas through disturbance of roadways or degradation of habitat (e.g., avalanches, flooding, landslides, and wildfires).

6.2.12 Access and Transportation

Higher annual average temperatures, extreme weather events such as heavy rainfall and extreme heat, as well as changes in freeze/thaw patterns and snowpack dynamics, can impact to roadways and other infrastructure (e.g., bridges and culverts). Higher temperatures can add chronic damage to infrastructure systems, while extreme weather events can cause sudden catastrophic failures. Additionally, warmer overall temperatures could result in fewer freeze-thaw cycles, which could be beneficial to road longevity and minimize impacts from extreme heat and weather events. Roads and other infrastructure that are near or beyond their design life are at the highest risk to damage from flooding, geomorphic disturbances (e.g., landslides), and avalanches (Halofsky et al. 2018). An increase of these events could impact access to and infrastructure within the analysis area (e.g., floods, landslides, or avalanches washing out roads, bridges, and culverts).

6.2.13 Cultural Resources

Several archaeological sites have been identified in the analysis area, including sites within the Stibnite Mining District. Some aspects of climate change may exacerbate natural damage and loss of cultural resources in the analysis area. Increasing wildfires, flooding, melting of snowfields, and erosion can uncover, displace, or destroy artifacts and other cultural or historic resources before they have been identified. Additionally, large disturbances as a result of climate change can alter the condition of vegetation, streams, and other landscape features valued by native populations (Halofsky et al. 2018).

6.2.14 Public Health and Safety

Impacts from climate change on public health and safety could be experienced through poor air quality from wildfires, decreased water quality from lower streamflow, more frequent extreme heat events, as well as the hazards associated with flooding or other severe weather from more frequent extreme weather events. Additionally, wildfires, extreme heat, and weather events could impact worker health and their ability to perform work outside, while warmer winter temperatures may create safer and more comfortable working conditions.

6.2.15 Recreation

The changing climate is expected to alter the supply of and demand for outdoor recreation opportunities. Recreational use patterns could be impacted by variable precipitation and rising temperatures, and by the change in conditions that may alter the characteristics and ecological condition of recreation settings. For example, warmer temperatures may affect individual decisions to visit a certain area, and warmer stream temperatures may affect the quantity and quality of aquatic populations for recreational fishing. Higher temperatures and decreased snowpack would affect winter activities dependent on cold temperatures and snowfall, such as skiing and snowmobiling. Other activities may benefit from longer warm and dry seasons (e.g., hiking, camping, mountain biking), but the need for supplemental resources to manage and maintain these recreational areas for a longer period of time may cause personnel and budgetary issues (Halofsky et al. 2018).

6.2.16 Scenic Resources

Changing climatic conditions could affect viewers experience of the landscape within the analysis area. Large portions of the analysis area have been affected by wildfires, shifting the landscape from homogenous and continuous even-aged timber stands to a mosaic of tree species and structural conditions influenced by fire. In much of the area, stand-replacing fire have occurred, and other portions of the area have experienced understory surface fire while maintaining timbered overstory. Climate change may increase the frequency, but frequent wildfires decrease fuel loading and fire severity. Additionally, fire return intervals in lethal and mixed regimes range from 75 to 130 years; however, small low intensity fires would likely occur with more frequency due to climate change (Halofsky et al. 2018).

As climate conditions change, vegetation types may experience more mortality from invasive pests, such as beetle kill, and pathogens due to further stress, temperature related or otherwise, which would impact scenery. Hydrologic impacts within scenic areas are also impacted. These include: a shift from snow to rain, increased flooding, earlier runoff, and potential increased drought.

6.2.17 Social and Economic Conditions

Changing climatic conditions could affect the viability of local communities. Communities near the analysis area are rural and rely heavily on tourism and the trade industry to support their economies. The social and economic conditions of the area could be both negatively or positively impacted by climate-induced changes in recreational use (e.g., degraded water quality and low streamflow could decrease recreational use, but increased temperatures could create longer seasons for recreating); however, it is difficult to discern the potential magnitude of these impacts on current socioeconomic conditions. Climate change also could increase the social and economic cost of some public services, such as road repair and transportation infrastructure maintenance, as a result of increased damages caused by extreme weather events; however, the impacts of climate change on infrastructure could add trade employment to the area.

6.2.18 Environmental Justice

Environmental justice populations, such as the tribal communities in the analysis area, are disproportionally vulnerable to climate change impacts (USGCRP 2016). There are no census tract block groups in Valley and Adams counties that meet the definition of an environmental justice community; however, the Nez Perce Census County Subdivision, Fort Hall Reservation (reservation of the Shoshone-Bannock Tribes), and Duck Valley Reservation (reservation of the Shoshone-Paiute Tribes) are considered environmental justice populations based on their American Indian populations and total minority populations which are meaningfully greater than Idaho’s statewide averages (Census 2017). The tribes have specific rights to the land in accordance with the Nez Perce Tribe Treaty of 1855, the Fort Bridger Treaty of 1868 (Shoshone-Bannock) and the Shoshone-Paiute Executive Order of 1877. For further details please refer to the Tribal Rights and Interests Special Report (Forest Service 2022d). The tribes also use these lands as a part of their traditional use areas for activities including fishing, hunting, and gathering. The environmental justice communities could be impacted by climate change, as it may exacerbate vulnerability to health threats, economic disadvantages, and social inequity (USGCRP 2016). Environmental justice populations commonly do not have equitable access to resources to help cope with or adapt to changing environmental conditions, such as air conditioning for more frequent extreme heat events.

6.2.19 Special Designations

Areas of special designations in the analysis area include wilderness, Wild and Scenic Rivers, Inventoried Roadless Areas, and Research Natural Areas. Although climate change would not directly impact the designations, it could potentially affect the environmental conditions within these areas. Changes in resource availability and quality, or changes to characteristics in these areas would not necessarily cause a change in designations.

6.2.20 Payette Forest Carbon Assessment

The Forest Service developed a Forest Carbon Assessment for the Payette National Forest (PNF) in August 2020. The assessment indicated that the carbon storage levels have remained fairly stable with a 1.9% increase between 1990-2013. Additionally, negative impacts due to changes in environmental conditions have been limited and offset by forest growth (Forest Service 2020). Satellite imagery illustrates that fire has been the most prevalent disturbance detected on the PNF since 1990, affecting about 18.2% of the PNF, followed by 1.4% by insects, 1.2% by harvest, and 0.1% by abiotic factors (Forest Service 2020).

Climate and environmental factors, including elevated atmospheric CO_2 and nitrogen deposition, have also influenced carbon accumulation with the PNF. Recent warmer temperatures and precipitation variability may have stressed forests, causing climate to have a negative impact on carbon accumulation in the 2000s. Conversely, increased atmospheric CO_2 and nitrogen deposition may have enhanced growth rates and helped to counteract ecosystem carbon losses due to historical disturbances, aging, and climate, for some of the forest types located on the PNF (Forest Service 2020).

Under changing climate and environmental conditions, forests within the PNF may be increasingly vulnerable to a variety of stressors. These potentially negative effects might be balanced somewhat by the positive effects of longer growing season, greater precipitation, and elevated atmospheric CO_2 concentrations. However, it is difficult to judge how these factors and their interactions will affect future carbon dynamics on the PNF, especially with regards to large fire disturbances and increasing insect losses (Forest Service 2020).

Forested areas on the PNF will be maintained as forest in the foreseeable future, which will allow for a continuation of carbon uptake and storage over the long term. Across the broader region, land conversion for development on private land is a concern and this activity can cause substantial carbon losses (FAOSTAT 2013; Forest Service 2016). The PNF will continue to have an important role in maintaining the carbon sink, regionally and nationally, for decades to come.

7.0 Environmental Consequences

7.1 Impact Definitions

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 7-1**.

Table 7-1 Impact Definitions

Attribute	Term	Description
Intensity	Negligible	Impacts would result in a change in current conditions that would be too small to be physically measured using normal methods or would not be perceptible. There is no noticeable effect on the natural or baseline setting. There are no required changes in management or utilization of the resource.
Intensity	Minor	Impacts would result in a change in current conditions that would be just measurable with normal methods or barely perceptible. The change may affect individuals of a population or a small portion of a resource, but it would not result in a modification in the overall population, or the value or productivity of the resource. There are no required changes in management or utilization of the resource.
Intensity	Moderate	Impacts would result in an easily measurable change in current conditions that is readily noticeable. The change affects a large percentage of a population, or portion of a resource which may lead to modification or loss in viability, value, or productivity in the overall population or resource. There are some required changes in management or utilization of the resource.
Intensity	Major	Impacts are considered significant. Impacts would result in a large, measurable change in current conditions that is easily recognized. The change affects a majority of a resource or individuals of a population, which leads to significant modification in the overall population, or the value or productivity of the resource. This impact may not be in compliance with applicable regulatory standards or impact thresholds, requiring large changes in management or utilization of the resource.
Duration	Temporary	Impacts that are anticipated to last no longer than 1 year.
Duration	Short-Term	Impacts that are anticipated to begin and end within the first 3 years during the construction phase.
Duration	Long-Term	Impacts lasting beyond 3 years to the end of mine operations and through reclamation, approximately 20 years.
Duration	Permanent	Impacts that would remain after reclamation is completed.
Context	Localized	Impacts would occur within the analysis area or the general vicinity of the Operations Area Boundary.
Context	Regional	Impacts would extend beyond the Operations Area Boundary and local area boundaries.

Intensity is the severity or levels of magnitude of an impact.
Duration is the length of time an effect would occur.
Context is the effect(s) of an action that must be analyzed within a framework, or within physical or conceptual limits.

7.1.1 Emissions, Assumptions, and Uncertainties

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, and increased wildfires, among other effects. As described in **Section 3.0**, 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.

The CEQ 2016 guidance is again the current policy that individual agencies have the discretion to disclose such an analysis if it would be relevant to the evaluation of 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 analysis, 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 as described below. Consequently, a social cost of carbon calculation has not been conducted for this analysis.

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 6.1.2**. 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 the Air Quality Specialist Report (Forest Service 2022b), 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.

7.2 Direct and Indirect Effects

7.2.1 No Action Alternative

Under the No Action Alternative, the analysis area would continue to be impacted by current climate change trends. The No Action Alternative 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 SGP, 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 fires 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.

In January 2021 Midas Gold (now Perpetua) entered into an Administrative Settlement and Order on Consent (ASAOC) with the Forest Service and USEPA for removal actions at the Stibnite legacy mining site. Phase 1 of this agreement includes removal of tailings and other mining wastes from the stream channels of lower Meadow Creek and EFSFSR and placing the excavated wastes in selected, on-site locations where they would no longer impact water quality in these streams. It also includes construction of three stream diversions to avoid contact of runoff with legacy mining wastes. There would be GHG emissions related to the construction equipment and vehicles used to access the site. This work is planned to occur in 2022 through 2024.

7.2.1.1 GHG Emissions

If the SGP does not proceed, it can be assumed that current uses by Perpetua and other users on patented mine/mill site claims and on the PNF 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 off-highway vehicle (OHV) use, snowmobiling, recreational driving, and other forms of recreation.

No long-term direct effects on GHG emissions or climate change are anticipated for the No Action Alternative. 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 SGP and associated reclamation and monitoring commitments would be small and intermittent across a limited area within the SGP Operations Area Boundary. Given these characteristics of the No Action Alternative, GHG emissions would not be expected to change compared to current conditions, and an emissions analysis has not been performed.

7.2.2 2021 MMP Alternative

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 (**Section 6.1.2**).

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 2016). Guidance provided by the 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 estimated 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.

7.2.2.1 GHG Emissions

Implementation of the 2021 MMP (**Figure 1-1**) 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 15 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.

Direct GHG Emissions

The direct GHG emissions associated with the 2021 MMP 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 SGP 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 SGP 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 SGP 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 associated emissions are broken down into three general categories. The first is construction of the facilities and infrastructure, access roads, and the associated powerlines. Each of these includes stationary and mobile tailpipe fuel combustion sources. Secondly, process emissions are provided which include diesel and propane combustion, autoclaving, and lime kiln operations (converting limestone to lime). The third element is mining associated GHG emissions. Mining emissions are based on non-road and on-road sources. Also note that emissions from commuting traffic and supply/deliveries are included for construction and mining operations. Commuting is broken into two categories. One is from Highway 55 to the Stibnite Gold Logistics Facility (SGLF) and the other is from the SGLF to the SGP. There would also be onsite housing that would limit commuting for some workers, but emission estimates include gasoline usage assuming 500,000 gallons per year. Solar panels would be used during the construction phase.

An overall estimate of GHG emissions (expressed in CO_2e) for annual operations is provided in **Table 7-2**. Based on estimated annual use of petroleum fuels for all uses, the total GHG emissions would vary by operational year (yr). Note that processing and mining would begin during life of mine (LOM) year 3 (LOM 3) as facility infrastructure/powerline construction ends. Processing operations during its first year would be at 88 percent of the expected maximum for all other years. While it is possible that processing may differ similar to mining operations, LOM 4 through LOM 18 are assumed to be identical to the maximum year.

The overall SGP maximum potential of CO_2e emissions would occur during LOM 3 at 221,201 short tons/yr (200,671 MT CO_2e), with the mining only maximum occurring in LOM 6 at 83,520 short tons/yr (75,768 MT CO_2e). The combustion product CO_2 accounts for over 99 percent, even though CH_4 and N_2O have substantially higher global warming potential factors (see Appendix A of Air Quality Specialist Report; Forest Service 2022b). Note that gasoline combustion emissions are based on 500,000 gallons consumed per year. The distribution of each source category is illustrated in **Figure 7-2**.

Table 7-2 Life of Mine GHG Emission Estimates

Activity		Life of Mine Years (Tons per year)								
		1	2	3	4	5	6	7	8	9
On/Off Road Diesel	Mining	0	0	65,431	82,770	81,552	83,520	81,720	77,109	69,450
On/Off Road Diesel	Construct	74,143	74,143	38,857	0	0	0	0	0	0
On/Off Road Diesel	Powerline	18,300	36,600	18,300	0	0	0	0	0	0
Process	Propane	0	0	25,413	28,878	28,878	28,878	28,878	28,878	28,878
Process	Diesel	0	0	216	246	246	246	246	246	246
Process	Autoclave	0	0	41,638	47,316	47,316	47,316	47,316	47,316	47,316
Process	Lime Kiln	0	0	26,674	30,311	30,311	30,311	30,311	30,311	30,311
Gasoline	Commuting	4,673	4,673	4,673	4,673	4,673	4,673	4,673	4,673	4,673
	Total	97,116	115,416	221,201	194,194	192,976	194,944	193,143	188,532	180,874

Activity		Life of Mine Years (Tons per year)								
		10	11	12	13	14	15	16	17	18
On/Off Road Diesel	Mining	73,842	67,617	60,367	63,550	62,016	36,037	22,756	20,734	12,424
On/Off Road Diesel	Construct	0	0	0	0	0	0	0	0	0
On/Off Road Diesel	Powerline	0	0	0	0	0	0	0	0	0
Process	Propane	28,878	28,878	28,878	28,878	28,878	28,878	28,878	28,878	28,878
Process	Diesel	246	246	246	246	246	246	246	246	246
Process	Autoclave	47,316	47,316	47,316	47,316	47,316	47,316	47,316	47,316	47,316
Process	Lime Kiln	30,311	30,311	30,311	30,311	30,311	30,311	30,311	30,311	30,311
Gasoline	Commuting	4,673	4,673	4,673	4,673	4,673	4,673	4,673	4,673	4,673
	Total	185,265	179,040	171,791	174,974	173,440	147,460	134,180	132,158	123,848

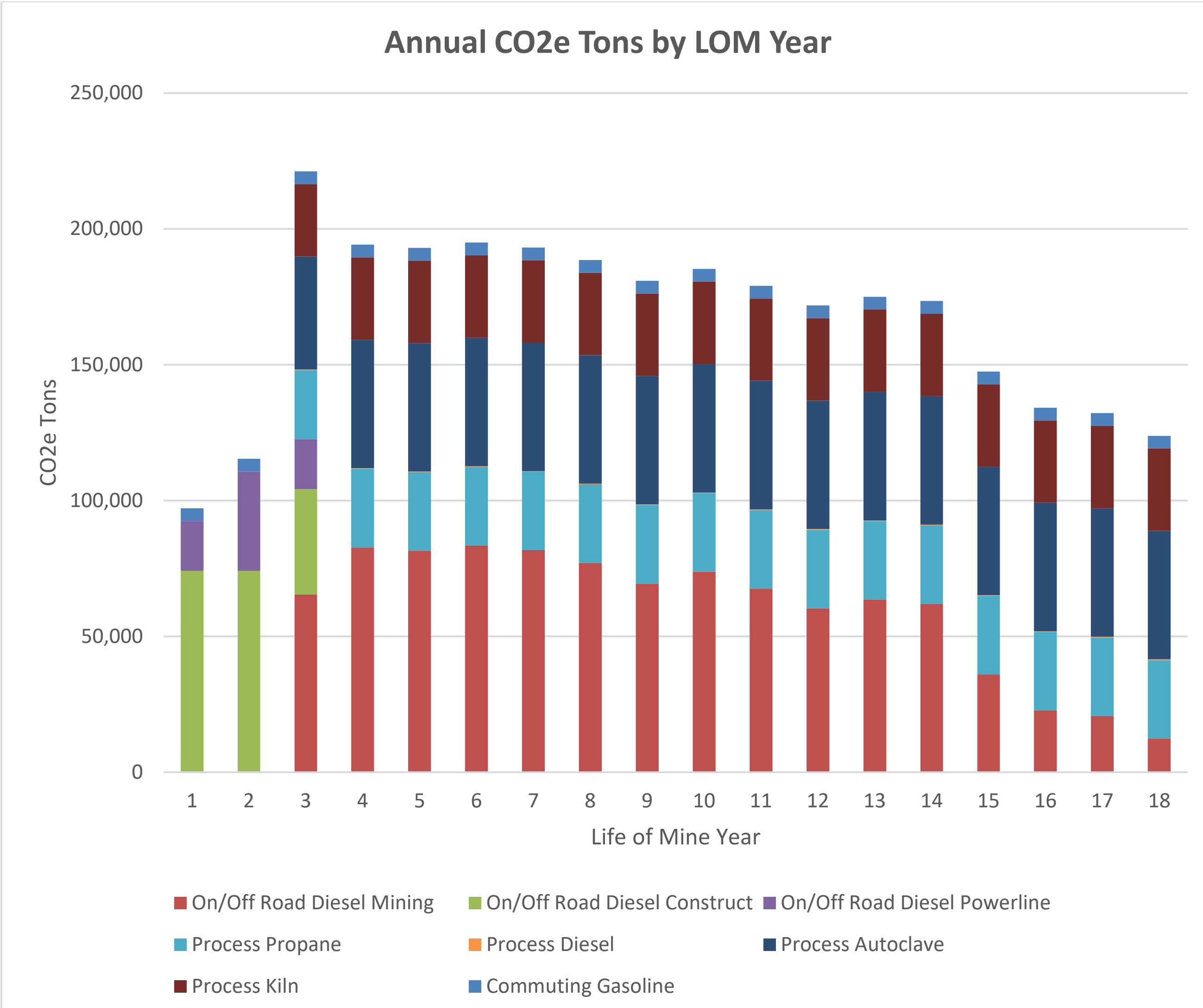


Figure 7-1 CO_{2e} Distribution by Category

There is no guidance for GHG significance levels considering mobile source emissions, which represent a large portion of the emissions from the 2021 MMP. It also should be noted the stationary source emissions for the Alternative would exceed the 25,000 MT CO_2e reporting threshold for the 2009 Mandatory GHG Reporting Rule, which considers contributions from stationary sources only. The combined stationary and mobile source emissions of the Alternative would also exceed the EPA's threshold of 100,000 MT/year CO_2e, per the EPA Taylor Rule. IDEQ does not issue Title V or PSD permits solely for GHG emissions. Another regulated air pollutant as defined by IDAPA 58.01.01.006.99 or 40 CFR Part 70 must also exceed the major source threshold for IDEQ to issue a Title V or PSD permit. However, final determination would be made by IDEQ when the final air quality permit is issued, but it is very unlikely that a Title V or PSD permit would be issued.

The 2021 MMP includes several design and operational features, such as implementing air emission controls on the ore slurry 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 this 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. 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 the 2021 MMP GHG emissions to climate change effects at the state, regional, or global level cannot be provided.

Indirect GHG Emissions

Three indirect sources of GHG emissions associated with the 2021 MMP are: 1) Access Road Vehicle travel to and from the site, 2) electrical power generated off-site but used on-site; and 3) energy costs for transport and refinement of antimony concentrate.

Access Road Vehicle Travel

2021 MMP has the potential to generate ancillary vehicle travel to and from the mine site. This may include workforce traffic such as crew personal vehicles, supply/haulage traffic such as food delivery, trash and recyclable haulage. The vehicles were determined to be either light or heavy duty. The workforce vehicles are mostly light duty, while other supply vehicles and hauling trucks were considered heavy duty. Light duty vehicle fuel economy was based on Ford F-350, 14.0 mile per gallon (mpg) and the heavy duty vehicles assumed 6.5 mpg from the American Transportation research Institute (ATRI 2016).

Annual miles traveled of light duty vehicles is 236,807 and heavy duty is 374,344 (derived from a 37.5 one-way distance along the access road). All vehicles were assumed to operate using diesel duel. Total diesel gallons consumed was 16,915 for light duty and 57,591 for heavy duty or 74,506 gallons in total. GHG emissions were calculated using diesel factors from 40 CFR 98 Table C-1 for fuel oil #2. The 100-year potential is 835.6 tpy (758 Metric tons) CO_2e. For further details refer to Appendix A of the Air Quality Special Report (Forest Service 2022b).

Off-Site Generation Power

Electricity for the SGP would be provided via a transmission line connected to the grid through 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).

The 2021 MMP is estimated to utilize approximately 40 to 50 megawatts (MWs) at full production, which would be equivalent to approximately 394,200 MWh annually (average of 45 MW per year). Therefore, the Alternative would indirectly be responsible for emissions of approximately 0.097 MMT 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.

Emissions from Antimony Transport and Processing

Gold would be refined 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 concentrate would be separated and processed off-site. The antimony concentrate would be transported from the SGP 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. Because it is unknown at this time where the concentrate from the mine would be processed, total 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. The 2021 MMP estimates one truck per day of antimony concentrate hauled from the SGP. About 22.5 pounds (10.2 kilograms) of CO_2 are produced from burning one gallon of diesel fuel (EPA 2021c), 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, 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.

7.2.2.2 Climate Change Impacts to Analysis Area Resources

Effects of ongoing climate change in the SGP area following implementation of the 2021 MMP 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.

Geological 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 the 2021 MMP. 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.

Air Quality

The 2021 MMP would require obtaining an air quality permit from IDEQ 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 environmental design measures would be adopted to reduce air quality impacts that would also reduce GHG emissions. An example is busing and/or vanpooling would be provided to minimize traffic, which also would reduce dust emissions, sediment runoff, and GHGs from vehicle tailpipes.

These environmental design features would tend to reduce particulate matter emissions that otherwise could be higher as a result of climate change. One example is disposal of thickened tailings that would form a hardened crust at the 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 SGP. 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 would help to reduce impacts to air quality as a result of climate change during construction and operation of the 2021 MMP; 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).

Soils and Reclamation Cover Materials

The 2021 MMP would include reclamation of existing 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 this Alternative, 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 reduce the climate-induced impacts to soils in the short-term; however, changes in soil moisture and temperature due to climate change 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.

Hazardous Materials

Under the 2021 MMP, various materials and chemical reagents, including fuel, explosives, and ore processing reagents, would be transported for use at the SGP. Aboveground tanks would be used to store fuels, lubricants, coolants, hydraulic fluids, propane, explosive materials, and nitric and sulfuric acid. To minimize risk of spills, Perpetua would comply with the EPA Toxic Release Inventory Program; develop a SPCC Plan; and develop a Hazardous Materials Handling and Emergency Response Plan. Although these proposed handling 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 potential changes of spill severity. These impacts would be experienced during construction, operation, and closure and reclamation, and would be considered in the development of the SPCC Plan and Hazardous Materials Handling and Emergency Response Plan.

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 the 2021 MMP. 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. Impacts to local stream flows from the 2021 MMP could be altered by the simultaneous effects of climate change on the same streams. For example, it is predicted that natural winter flows could slightly increase while spring and summer flows could decrease under the effects of climate change (Halofsky et al. 2018). The effects of these natural changes cannot be accurately quantified.

Streams in the SGP could potentially be less impacted than nearby natural streams if water handling methods associated with the 2021 MMP 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). SGP has developed a Water Management Plan to mitigate potential water loss and/or diminished water quality associated with lower average streamflows. These measures include temporary stream-diversion channels, long term channels and restored stream reaches among other measures. Please refer to the Water Management Plan and the Water Quantity Specialist Report (Forest Service 2022e) for details.

A portion of the water supply for the SGP 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 East Fork SFSR. 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. However, severity of climate change would be lessened 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, and piping low flows in stream diversions to prevent water warming during seasonal low flows. Climate change induced changes in precipitation and evaporation could also impact the overall site-wide water balance which could result in significant changes to the amount of water being treated and discharged.

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

Construction activities under the 2021 MMP would require removal of vegetation, including whitebark pine individuals, which is a federally listed Candidate species and can be naturally impacted by wildfire and 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, the 2021 MMP 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 forb 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 SGP and legacy impacted areas could be more 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 challenging due to changing climate conditions and land use requirements (Stanturf et al. 2014). Possible future changes in weather patterns, precipitation amounts and seasonality, and resilience of species to fire and drought would be considered when identifying reclamation methods and goals.

Wetlands and Riparian Resources

Final closure and reclamation of the SGP, conducted under an agency-approved Reclamation and Closure Plan, would reestablish wetlands impacted by the 2021 MMP 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 long-term climate change trends such as lower streamflows and less groundwater recharge (Halofsky et al. 2018). This Alternative 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.

Fish Resources and Fish Habitat

Fish habitat would be reconstructed and shade improvement measures incorporated 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 creation of Stibnite Lake 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 Stibnite Lake (Fish Resources and Fish Habitat Specialist Report, Forest Service 2022f). Habitat connectivity also is an important consideration during operations and reclamation because sensitive species like bull trout and other migratory species would be the most vulnerable to climate change impacts and loss of habitat connectivity. The SGP area could experience natural climate change impacts to fish resources and fish habitat by lowering streamflows, increased water temperatures, and decreased water quality which 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 the complete backfill of Hangar Flats pit that would improve streamflow and temperature in Meadow Creek, would help to reduce these impacts.

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). Construction and operation of the SGP, access roads, utilities, and off-site facilities would additionally impact wildlife impacts from habitat loss and fragmentation. Reclamation activities are intended to achieve post-mining land use for wildlife habitat as reasonably possible, which would help to reclaim habitat connectivity. However, some displacement and habitat fragmentation would be a long-term effect. The post-closure reclamation activities were developed to help offset wildlife impacts and were not designed to offset wildlife impacts due to climate change impacts.

Timber Resources

Timber resources in the SGP area are vulnerable to climate change impacts from 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).

The 2021 MMP would result in ground disturbance in locations currently covered by forested vegetation, and constructing facilities associated with the SGP, 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. This would be achieved through a combination of infrastructure removal, soil preparation, direct seeding, and tree planting. To address losses of vegetation from disturbance, the Reclamation and Closure Plan (Perpetua 2021b) proposes to replant with conifer and other tree species, which would be located completely within the SGP. Some reclamation efforts would be concurrent with operations, but the success of the reclamation could be impacted due to the increased risk to timber from 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 the 2021 MMP.

Land Use and Land Management

The 2021 MMP 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 also impact how lands in the SGP area are used in the long term, altering the surrounding environment (e.g., decreasing ground cover, larger wildfire burn areas, decreased stream flows impacting how the area is used for recreational or tribal purposes) and impacting accessibility. This Alternative would maintain public access in recreational areas surrounding the SGP but would restrict activities at the SGP during construction, operation, and closure and reclamation, which minimize climate change impacts to land use by helping to support current recreational land uses within the SGP area. Land management effects caused by the SGP are not expected to be noticeably impacted by climate change.

Access and Transportation

Access to and through the SGP area would be maintained during construction, operation, and closure and reclamation. There would be public access through the SGP during construction and operations via a new gravel road constructed along a widened bench within the Yellow Pine pit to connect Stibnite Road to Thunder Mountain Road. Climatic changes causing an increase in severe 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.

Cultural Resources and Tribal Rights and Interests

The 2021 MMP would impact historic properties, due to 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 utilized by tribes for activities 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.

Public Health and Safety

Climate change impacts to public health and safety would be experienced through impacts to air, soil, and water quality. The 2021 MMP has the potential to impact public health and safety through the transportation and use of fuel and chemicals, natural environmental hazards, economic impacts, changes to public services and infrastructure, and impacts to the local population.

Climate change could exacerbate some impacts to public health and safety by affecting the way potential hazardous material 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).

Recreation

Much of the SGP area is used for recreation year-round, which would be both directly and indirectly impacted by climate change. The 2021 MMP 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 winters (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 water recreation and hiking (Askew and Bowker 2018).

Scenic Resources

The 2021 MMP 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. 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 SGP and impacts to scenic resources.

Social and Economic Conditions

Socioeconomic impacts are predominantly associated with the development and operations at the SGP and off-site facilities. The 2021 MMP 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 due to climate change could increase participation in some warm-weather recreation activities, many other recreation activities could be negatively impacted by climate change. Mine site construction and operations could help support the viability of local communities and offset potential adverse climate change impacts.

Environmental Justice

The tribes have specific rights to the land in accordance with the Nez Perce Tribe Treaty of 1855, the Fort Bridger Treaty of 1868 (Shoshone-Bannock) and the Shoshone-Paiute Executive Order of 1877. For further details please refer to the Tribal Rights and Interests Special Report (Forest Service 2022d). The 2021 MMP has the potential to impact Native American communities by restricting their access to traditional hunting, gathering, and fishing lands and/or impacting the quality or availability of traditional resources. 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.

Special Designations

Climate change impacts would not directly impact the special designations of areas under the 2021 MMP but could impact the environmental conditions in these areas and cause indirect effects within these designations. Variable precipitation, decreased streamflow, and more precipitation falling as rain instead of snow could impact the characteristics and quality of special designation areas. The 2021 MMP would be constructed adjacent to or within wilderness areas, eligible wild and scenic rivers, Inventoried Roadless Areas (IRAs), and Research Natural Areas (RNAs). 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 add 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.

7.2.3 Johnson Creek Route Alternative

Under this Alternative, the Johnson Creek Route would be used for access to the SGP during mine construction, operations, and closure and reclamation (**Figure 1-1**). 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 Johnson Creek 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 SGP during mining operations for the Johnson Creek Route Alternative would be provided by a road connecting Stibnite Road (CR 50-412) to Thunder Mountain Road (National Forest System Road 50375), the same as the 2021 MMP.

Similar to the 2021 MMP, the SGP under the Johnson Creek Route Alternative also would provide potential opportunities to affect the severity of local GHG and climate change impacts.

7.2.3.1 GHG Emissions

The Johnson Creek Route Alternative would have the effect of decreasing overall construction phase GHG emissions; however, the construction activities to complete major improvements on the Johnson Creek Route would likely offset the decrease and would likely end up very similar to the 2021 MMP. The Stibnite Road (CR 50-412) portion of the Johnson Creek Route would be improved by widening curves to accommodate 55-foot-long semi-truck trailers. Approximately one mile of road through the village of Yellow Pine would be paved. Based on relative roadway length affected, these changes in roadway construction would represent a slight decrease of overall construction phase GHG emissions. The magnitude of the GHG emissions difference between the access road alternatives would be small compared to total SGP construction emissions during the construction phase.

For this alternative, controlled public access through the SGP would be provided the same as the 2021 MMP. 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.

7.2.3.2 Climate Change Impacts to SGP Area Resources

The anticipated climate change impacts for the Johnson Creek Route Alternative would be the same as those discussed under the 2021 MMP for the following resources: 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 the Johnson Creek Route Alternative are described below.

7.2.3.3 Wetlands and Riparian Resources

Although the impacts of climate change would generally be the same as the 2021 MMP, the severity of impacts to wetlands and riparian resources would be less for the Johnson Creek road alternative compared to the Burntlog route.

7.2.3.4 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 the Johnson Creek Route Alternative, avoiding the construction of approximately 20 miles of new roadway by using Johnson Creek for mine access. Although the impacts of climate change would be the same as 2021 MMP, it is expected that not constructing the Burntlog Route would help to reduce the severity of impacts to threatened 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.

7.3 Idaho DEQ Air Permit Emissions

The 2021 MMP evaluates potential GHG emissions for projected actual operations over the life of the SGP. Alternatively, the Idaho state air quality Permit to Construct (PTC), issued by IDEQ, focuses its emissions on a hypothetical worst-case operating scenario. This approach is done for ease of permitting. The total annual estimated GHG emissions for processing only is 106,580 short tons (~96,688 MT). For further details of the calculation process and other air quality pollutants refer to the Air Quality Specialist Report (Forest Service 2022b).

7.4 Mitigation and Monitoring

Mitigation measures required by the Forest Service would represent reasonable and effective means to reduce the impacts identified in the previous section or to reduce uncertainty regarding the forecasting of impacts into the future. These mitigation measures are in addition to the Forest Service requirements and project design features (**Section 2.4**) accounted for in the preceding impact analysis.

Mitigation measures may be added, revised, or refined based on public comment, agency comment or continued discussions with Perpetua regarding this specialist report or subsequent analysis under NEPA. The adopted mitigation measures will be finalized in the Final EIS.

7.5 Cumulative Effects

7.5.1 Past, Present, and Reasonably Foreseeable Activities Relevant to Cumulative Effects Analysis

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). 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. However, cumulative regional emissions can be estimated by including SGP values to current and predicted future numbers. A specific regional impact directly from those emissions or sources would not be definitive because of the numerous other factors described above.

As described in **Section 3.0**, 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. The CEQ 2016 final guidance has been reinstated and currently under review for potential changes. The guidance states that the identification and analysis of direct and indirect effects (see Section 7.2) is essentially equivalent to a cumulative effects analysis requirement under NEPA (CEQ 2016).

7.5.2 No Action Alternative

Under the No Action Alternative, 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 7-3** describes the current and reasonably foreseeable activities that may affect cumulative GHG emissions.

Areas of the SGP disturbed by previous mining activities would remain as they are, except those identified in the ASAOC, 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.

Table 7-3 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 SGP. 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.[1]
Forest Maintenance and Fire Risk Reduction	Big Creek Fuels Reduction Project, approximately 10 miles north of SGP South Fork Restoration and Access Management, approximately 25 miles southwest of SGP East Fork Salmon River Restoration and Access Management, approximately 5 miles northwest of SGP	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.[1]

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. Granite Meadows,	
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 SFSR and Sugar Creek. In 2020, the Buck Fire burned 19,474 acres in the Johnson Creek Road area north of Warm Lake.	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 are 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.[1]
Reclamation Activities	ASAOC Reclamation of certain legacy mining impacts including construction of stream diversion ditches, removal of 325,000 tons of development rock and tailings from Meadow Creek or East Fork SFSR that are currently impacting water quality.	Local emissions from tailpipe GHG emissions. Expected to have GHG emissions that are temporary and a very small portion of the Idaho inventory.[1]
Recreation and tourism	Recreation and Tourist activities: Sport hunting, fishing, trapping Snowmobile trails/OSV use 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.[1]
Other	Nez Perce Tribe Research Equipment Propane tank replacement project for a fish detection system	Short-term VOC and GHG emissions during installation. This source is already included in the Idaho inventory.[1]

[1] The total Idaho GHG emissions estimates are 31.44 MMT (EPA 2021c).

7.5.3 2021 MMP and Johnson Creek Route Alternative

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 Perpetua 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 7-4**) would be the same for both action alternatives.

7.6 Short-term Uses and Long-term Productivity

7.6.1 No Action Alternative

Under the No Action Alternative, 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.

7.6.2 2021 MMP and Johnson Creek Route Alternative

The operation of either action alternative generates 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 SGP may help to reduce 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.

7.7 Irreversible and Irretrievable Commitments of Resources

7.7.1 No Action Alternative

Under the No Action Alternative, the SGP would not be implemented. The GHG associated with the SGP would not be produced. There would be no irreversible and irretrievable commitment of resources that contribute to climate change from the SGP.

7.7.2 2021 MMP and Johnson Creek Route Alternative

Either action alternative would result in an increase in the use of fuels and other resources (40 to 50 MWs of electrical power) in the region; this would result in additional GHG emissions.

The SGP would be expected to have negligible impacts to irreversible and irretrievable commitments on climate change.

7.8 Summary

The 2021 MMP would create a maximum of 200,671 MT CO_2e annual direct GHG emissions. Indirect GHG emission sources associated with this Alternative include electrical power generated off-site (but used on-site [97,119 MT]), and emissions from antimony transport and processing (4,055 MT). Therefore, the total direct and indirect GHG emissions are 301,845 MT. This equates to approximately 0.96 percent of the most recent annual Idaho statewide total GHG emissions (2018). Changes in hydrologic patterns, temperature, and extreme weather events would contribute to a varying level and degree of impacts to resources.

Changes in hydrologic patterns and overall increasing temperatures are expected to result in decreased or degraded soil moisture and quality, air quality, annual streamflow, 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 the alternatives 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 lessen the extent of potential stability impacts, 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.

Direct and indirect GHG emissions and their associated impacts would be the same under the Johnson Creek Route Alternative as those discussed under the 2021 MMP. Direct impacts would be the same as those discussed; however, the Burntlog Route would not be constructed under the Johnson Creek Route Alternative, 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 RNA.

Exploration activities associated with the Golden Meadows Exploration Project would continue under the No Action Alternative. 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, 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 7-4 presents a comparison of climate change impacts amongst the alternatives for the SGP.

Table 7-4 Comparison of Climate Change Impacts by Alternative

Issue	Indicator	Baseline Conditions	No Action	2021 MMP	Johnson Creek Route
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_2e of GHGs.	No emissions.	Same as baseline condition.	Maximum LOM 3 200,671 MT (221,201 short tons/yr; **Table 7-2**) of CO_2e of total annual GHG emissions.	Small incremental differences from the Burntlog Route. GHG emissions would be reduced because the Burntlog Route would not be constructed; however, the construction activities required on the Johnson Creek Route would likely offset the decrease and would likely end up very similar.
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.	Same as baseline condition.	Changing climatic conditions would be 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 the 2021 MMP, 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.

8.0 References

Air Sciences. 2018. Stibnite Gold Project. Air Quality Analysis. Prepared for Midas Gold Idaho, Inc., Air Sciences, Inc. Project No. 335-1-2, October 10, 2018.

American Forests. 2017. Forests as Carbon Sinks. Loose Leaf, the Official Blog of American Forests. American Forests. July 18, 2017. Available at: https://www.americanforests.org/blog/forests-carbon-sinks/, accessed September 2019.

American Transportation Research Institute (ATRI). 2016. A Survey of Fuel Economy and Fuel Usage by Heavy-Duty Truck. Report No. SWT-2016-12, October.

Askew, A.E. and J.M. Bowker. 2018. Impacts of climate change on outdoor recreation participation: Outlook to 2060. The Journal of Park and Recreation Administration. 36(2): 97-120. 24 p. https://doi.org/10.18666/JPRA-2018-V36-I2-8316.

Brown and Caldwell. 2019. Stibnite Gold Project Modified PRO Alternative Modeling Report. September.

Council on Environmental Quality (CEQ). 2016. Final Guidance: Memorandum for Heads of Federal Departments and Agencies, Council of Environmental Quality (CEQ). August 2016. Available at: https://ceq.doe.gov/docs/ceq-regulations-and-guidance/nepa_final_ghg_guidance.pdf accessed January 2022.

CEQ. 2019. Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions. Federal Register, Vol. 84, No. 123. Docket No. CEQ-2019-0002. June 26, 2019.

FAOSTAT. 2013. Food and Agriculture Organization of the United Nations. Statistical Database.

Federal Highway Administration (FHWA). 2017. Synthesis of Approaches for Addressing Resilience in Project Development. FHWA-HEP-17-082. 224 pp.

Fryer, J.L. 2002. *Pinus albicaulis*. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available at: https://www.fs.fed.us/database/feis/plants/tree/pinalb/all.html.

Halofsky, J.E., D.L. Peterson, J.J. Ho, N.J. Little, and L.A. Joyce. 2018. Climate change vulnerability and adaptation in the Intermountain Region. Gen. Tech. Rep. RMRS-GTR-375. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Part 1. pp. 1–197, Part 2. pp. 199-513.

Idaho Administrative Bulletin. 2007. Establishing a State Policy Regarding the Role of State Government in Reducing Greenhouse Gases. Executive Order 2007-05. The Office of the Governor. May 2007.

Idaho Department of Environmental Quality (IDEQ). 2010. Final Idaho Greenhouse Gas Inventory and Reference Case Projections 1990-2020. Center for Climate Strategies, July 2010.

Idaho Power Company (IPCo). 2019. Path Away from Coal. Idaho Power Company website. Available at: https://www.idahopower.com/energy/delivering-power/emissions-data/.

Intergovernmental Panel on Climate Change (IPCC). 2021. Climate Change 2021: The Physical Science Basis. Contribution of Working Groups I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou, B. (eds.)]. Cambridge University Press. In Press.

Isaak, D.J., S.J. Wenger, E.E. Peterson, J.M. Ver Hoef, D.E. Nagel, C.H. Luce, S.W. Hostetler, J.B. Dunham, B.B. Roper, S.P. Wollrab, G.L. Chandler, D.L. Horan, and S. Parkes-Payne. 2017. The NorWEST summer stream temperature model and scenarios for the western U.S.: A crowd-sourced database and new geospatial tools foster a user community and predict broad climate warming of rivers and streams. Water Resources Research, 53, 9181-9205. https://doi.org/10.1002/2017WR020969.

Jacob, D.J., and D.A. Winner. 2009. Effect of climate change on air quality. Atmospheric Environment, Volume 43, pp. 51-63.

Kalashnikov, D.A, J.L. Schnell, J.T. Abatzogolou, D.L. Swain, and D. Singh. 2022. Increasing co-occurrence of pine particulate matter and ground-level ozone extremes in the western United States. Science Advances. https://www.science.org/doi/pdf/10.1126/sciadv.abi9386

Keane, R.E., L.M. Holsinger, M.F. Mahalovich, and D.F. Tomback. 2017. Restoring whitebark pine ecosystems in the face of climate change. Gen. Tech. Rep. RMRS-GTR-361. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 123 p.

Knowles, C.J., and R.G. Gumtow. 1996. Saving the Bull Trout. The Thoreau Institute. April 1996. 21pp.

May, C., C. Luce, J. Casola, M. Chang, J. Cuhaciyan, M. Dalton, S. Lowe, G. Morishima, P. Mote, A. Petersen, G. Roesch-McNally, and E. York, E. 2018. Northwest. In Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R .Easterling, K.E. Kunkel, K.L.M Lewis, T.K. Maycock, and B.C. Stewart. (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, pp. 1036–1100. doi: 0.7930/NCA4.2018.CH24. Available at: https://nca2018.globalchange.gov/chapter/northwest.

Midas Gold Idaho, Inc. (Midas Gold). 2016. Stibnite Gold Project, Valley County, Idaho. Plan of Restoration and Operations. September 2016.

Mote, P., A.K. Snover, S. Capalbo, S.D. Eigenbrode, P. Glick, J. Littell, R. Raymondi, and S. Reeder. 2014. Ch. 21: Northwest. Climate Change Impacts in the United States: The Third National Climate Assessment, Melillo, J.M., T.C. Terese Richmond, and G.W. Yohe. Eds., U.S. Global Change Research Program, 487-513. doi:10.7930/J04Q7RWX. On the Web: http://nca2014.globalchange.gov/report/regions/northwest.

National Interagency Coordination Center (NICC). 2021. Wildland Fire Summary and Statistics Annual Report 2020. Available at: https://www.nifc.gov/fire-information/statistics. Accessed October 4.

Norgate, T. and N. Haque. 2012. Using life cycle assessment to evaluate some environmental impacts of gold production. J. Cleaner Production. 29, 53–63. January.

Perpetua Resources Idaho Inc. (Perpetua). 2021a. Stibnite Gold Project: Refined Proposed action ModPRO2. October.

Perpetua Resources Idaho Inc. (Perpetua). 2021b. Reclamation and Closure Plan (RCP), Stibnite Gold Project – Errata. Valley County, Idaho. Prepared for Midas Gold Idaho, Inc. October.

Runkle, J., K. Kunkel, R. Frankson, S. Champion, and L. Stevens. 2017. Idaho State Climate Summary. NOAA Technical Report NESDIS 149-ID, 4 pp.

Sankey, J.B., J. Kreitler, T.J. Hawbaker, J.L. McVay, M.E. Miller, E.R. Mueller, N.M. Vaillant, S.E. Lowe, and T.TT Sankey. 2017. Climate, wildfire, and erosion ensemble foretells more sediment in western USA watersheds, Geophys. Res. Lett., 44, 8884-8892, doi: 10.1002/2017FL073979.

Stanturf, J.A., B.J. Palik, and R.K. Dumroese. 2014. Contemporary forest restoration: A review emphasizing function. Forest Ecology and Management 331 (2014) 292-323.

The White House. 2017. Presidential Executive Order on Promoting Energy Independence and Economic Growth. The White House, March 2017.

U.S. Census Bureau (Census). 2017. 2013-2017 5-Year American Community Survey. Available at http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed July 10, 2019.

U.S. Environmental Protection Agency (EPA). 2015. Emission Factors for Greenhouse Gas Inventories. EPA Center for Corporate Climate Change Leadership. November 2015.

U.S. Environmental Protection Agency (EPA). 2016. What Climate Change Means for Idaho. EPA 430-F-16-014. 2 pp.

U.S. Environmental Protection Agency (EPA). 2017. Overview of Greenhouse Gases, Understanding Global Warming Potentials. Web URL: https:\\www.epa.gov/ghgemissions/understanding-global-warming-potentials. Accessed November 8, 2017.

U.S. Environmental Protection Agency (EPA). 2021a. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2019. Available at: http://epa.gov/climatechange/emissions/usinventoryreport.html, accessed August 2021.

U.S. Environmental Protection Agency (EPA). 2021b. State Inventory and Projection Tool. Available at https://www.epa.gov/statelocalenergy/state-inventory-and-projection-tool, accessed August 2021.

U.S. Environmental Protection Agency (EPA). 2021c. Emission Factors for Greenhouse Gas Inventories: April 2021. Available at: https://www.epa.gov/sites/default/files/2021-04/documents/emission-factors_apr2021.pdf, Accessed August 2021.U.S. Forest Service (Forest Service). 2003. Record of Decision for the Final Environmental Impact Statement and Revised Payette National Forest Land and Resource Management Plan. Revised July 2003.

U.S. Forest Service (Forest Service). 2003. Record of Decision for the Final Environmental Impact Statement and Revised Payette National Forest Land and Resource Management Plan. Revised July 2003.

U.S. Forest Service (Forest Service). 2009. Climate Change Considerations in Project Level NEPA Analysis. U.S. Forest Service. January 2009. 11pp.

U.S. Forest Service (Forest Service). 2010. Boise National Forest Land and Resource Management Plan. 2003-2010 Integration.

U.S. Forest Service (Forest Service). 2016. Future America's Forest and Rangelands: Update to the 2010 Resources Planning Act Assessment. General Technical Report WO-GTR-94. Washington DC, 250 pp.

U.S. Forest Service (Forest Service). 2020. Forest Carbon Assessment for the Payette National Forest in the Forest Service's Intermountain Region. August 31, 2020, 27 pp.

U.S. Forest Service (Forest Service). 2022a. SGP 2021 MMP and Alternatives Report. Payette National Forest.

U.S. Forest Service (Forest Service). 2022b. Air Quality Specialist Report. Payette National Forest.

U.S. Forest Service (Forest Service). 2022c. Vegetation Specialist Report. Payette National Forest.

U.S Forest Service (Forest Service). 2022d. Tribal Rights and Interests Specialist Report. Payette National Forest.

U.S Forest Service (Forest Service). 2022e. Water Quantity Specialist Report. Payette National Forest.

U.S. Forest Service (Forest Service). 2022f. Fish Resources and Fisheries Habitat Specialist Report. Payette National Forest.

U.S. Fish and Wildlife Service (USFWS). 2010. Additional Information Final Critical Habitat Designation for Bull Trout in Idaho, Oregon, Washington, Montana, and Nevada. 11pp.

U.S. Global Change Research Program (USGCRP). 2016. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N. Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J. Trtanj, and L. Ziska. Eds. U.S. Global Change Research Program, Washington, DC, 312 pp. http://dx.doi.org/10.7930/J0R49NQX.

U.S. Global Change Research Program (USGCRP). 2018. Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II. Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart Eds. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi: 10.7930/NCA4. 2018.

U.S. Office of Management and Budget. 2003. Regulatory Analysis, Circular A-4. U.S. Office of Management and Budget. September 2003.

U.S. Supreme Court. 2014. Utility Air Regulatory Group versus Environmental Protection Agency et al. Syllabus (134 S. Ct. 2427 [2014]).

United Nations. 1992. United Nations Framework Convention on Climate Change. 33pp.

University of Idaho. 2011. Indicators of Climate Change in Idaho – Report Summary. University of Idaho, January 2011.

Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam. 2006. Warming and Earlier Spring Increase Western U.S. Forest Wildfire Activity. Science, Vol. 313, pgs. 940-943. DOI 10.1126/science.1128834.