4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

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

The individual resource discussions are generally presented by issue(s) and organized with the presentation of the effects analysis issues and indicators for the resource; a brief methodology for the analysis of impacts; an evaluation of the alternatives' impacts to the resource; irreversible and irretrievable commitments, and short-term uses versus long-term productivity. A table summarizing and comparing these quantitative and qualitative impacts to each resource by alternative is located in **Section 2.8**.

4.1.1 Effects Analysis Indicators and Methodology of Analysis

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

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

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

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

4.1.2 Impact Assessment

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

The word “significant” has a very particular meaning when used in a NEPA document. Significance is defined by CEQ as a measure of the intensity and context of the effects of a major federal action on, or the importance of that action to, the human environment. Significance is a function of the beneficial and adverse effects of an action on the environment. Impacts in this EIS are described as to their intensity, duration, and context as defined in **Table 4.1-1**.

Intensity refers to the severity or level of magnitude of an impact which can vary from barely perceptible up to large, measurable changes that result in major modification of an evaluated resource. Public health and safety, proximity to sensitive areas, level of controversy, unique risks, or potentially precedent-setting effects are all factors to be considered in determining intensity of effect.

Duration refers to the length of time an impact would occur ranging from a temporary duration through short-term, long-term, and permanent impacts.

Context means that the impacts of an action must be analyzed within a framework, or within physical or conceptual limits. Impacts can be limited within the localized area of the proposed action and action alternatives, or they can extend beyond these boundaries to a more regional nature.

Table 4.1-1 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.

Attribute	Term	Description
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.

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

4.1.3 Mitigation for Impacts

Prominent regulatory and Forest Plan requirements listed in **Table 2.4-12** have been included in conducting the impact analyses in the following sections of this chapter. Proponent proposed design features listed in **Table 2.4-13** have also been considered in the analyses.

In addition to the above requirements and design features and where applicable, mitigation measures are proposed in this document. Mitigation measures are a means to address environmental impacts that are identified in the impact analysis to reduce intensity or eliminate the impacts. To be adequate and effective, CEQ regulations (40 CFR 1508.20) require that mitigation measures fit into one of five categories: Avoiding the impact altogether by not taking a certain action or parts of an action; Minimizing impacts by limiting the degree or magnitude of the action and its implementation; Rectifying the impact by repairing, rehabilitating, or restoring the affected environment; Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; or Compensating for the impact by replacing or providing substitute resources or environments.

If residual or unavoidable impacts remain after mitigation is applied, those impacts are also described within the following sections.

4.1.4 Irreversible and Irretrievable Commitments of Public Resources

The CEQ regulations require an evaluation of “any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented” (40 CFR 1502.16). A discussion of this topic is included in each of the following resource evaluations.

A commitment of a resource is irreversible when the resource is used up, permanently limited, or impacted by an action such that it would return to its previous condition only after a long-time span.

A commitment of a resource is irretrievable where a resource, or its use, is lost for period of time but would be restored in the reasonably near future. Use of the resource may be foregone for the period of the action, during which the resource cannot be used, but the resource can be restored to an acceptable condition after the action.

4.1.5 Short-term Uses versus Long-term Productivity

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

4.1.6 Forest Plan Consistency and Potential Amendments

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

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

4.2 Geologic Resources and Geotechnical Hazards

4.2.1 Impact Definitions and Effects Indicators and Methodology

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

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

Indicators:

- Amount of ore extracted
- Depletion of mineral resources

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

Indicators:

- Alteration of natural topography
- Unstable slopes

Issue: Geological and geotechnical stability of the SGP facilities, including the TSF and other mine components.

Indicators:

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

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1**.

4.2.2 Direct and Indirect Effects

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

- A majority of the analysis area is on NFS lands within the Salmon River Mountains, a high-relief mountainous physiographic province of central Idaho with the presence of steep slopes that are subject to landslides and avalanches.
- The analysis area is comprised of relatively common types of rocks to the region and common landforms (e.g., glacial and fluvial geomorphic features, asymmetric hill slopes).
- The area lacks protected or managed geologic resources, such as cave and karst formations, and contains rock units that generally preclude preservation of fossils.
- The analysis area is within a seismically active region and it is anticipated to be subjected to earthquake ground shaking (URS 2013, Golder 2021).
- The mine site includes disturbed areas as a result of previous mining activities, resulting in the presence of legacy mine features with associated slope stability and seismic stability considerations.
- The ore of interest (i.e., gold-, silver-, and antimony-bearing material) is economically valuable and/or of strategic importance.

4.2.2.1 No Action Alternative

Under the No Action Alternative, there would be no large-scale mine operations by Perpetua, and geologic and mineral resources would continue to be impacted by past mining activities and by currently permitted Perpetua exploration activities.

Perpetua would continue to implement surface exploration and associated activities that have been previously approved on NFS lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project EA (Forest Service 2015c). These approved activities include construction of several temporary roads (approximately 0.32 mile) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads) and drilling on both NFS and private lands at and in the vicinity of the Operations Area Boundary. The continuation of approved exploration activities at the SGP by Perpetua would result in the continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip. Consequently, there would be little change in the current status of geologic and mineral resource conditions at the Operations Area Boundary other than natural erosive and weathering processes.

Past mining activities have resulted in long-term impacts to the pre-existing geologic and mineral resources by nature of the previous underground and surface mining of these resources. Legacy impacts from these activities include the existing mining disturbances such as underground openings, surface disposal of development rock, spent heap leach materials, and open pits. On-site processing of these ores has resulted in legacy tailings deposits. These mining wastes have resulted in documented environmental impacts to topography, soils, vegetation, groundwater, surface water, and biota. These legacy conditions have been compounded by forest fires over the past several decades. Under the No Action Alternative, these existing impacts would remain largely as they are today and are expected to continue to have long-term localized impacts.

In January 2021, Perpetua (then Midas Gold) entered into an ASAOC with the Forest Service and EPA for removal actions at the Stibnite legacy mining site. Phase 1 of this agreement includes removal of contaminated sediment, mine wastes, and tailings from within and along the banks of Lower Meadow Creek and the East Fork SFSR. It also includes construction of three stream diversions to prevent clean water from infiltrating source areas, and a study of selected adit discharges. The primary objective of these removal actions is to eliminate or reduce potential ecological and human exposure to metals by mitigating sources of contamination from contact with sediment and surface water. Following these construction activities, the disturbed areas would be reclaimed with growth medium and revegetated to stabilize the sites. This work is planned to occur between 2022 and 2024. These activities are expected to have long-term, localized beneficial impacts.

4.2.2.2 2021 MMP

Mining methods proposed in the 2021 MMP would include open pit mining and re-processing legacy tailings. In addition, the 2021 MMP includes limited underground exploration and sampling to be accessed via the Scout exploration decline. The legacy tailings are in the Meadow Creek valley. Open pit mining methods would be implemented for three known mineral deposits: Yellow Pine, Hangar Flats, and West End.

The legacy tailings, which were deposited in the Meadow Creek valley bottom without a liner system, are currently under the spent heap leach ore disposal area but within the planned footprint of the proposed TSF Buttress. The spent heap leach ore would be removed and reused for construction purposes as appropriate. The legacy tailings would then be removed and reprocessed. All of the new tailings from the

proposed milling operations would be deposited in a modern TSF and would be fully lined with a geosynthetic liner system.

Although there would be temporal overlap in the mine development and operations, the general sequence of mining would be the Yellow Pine deposit and legacy tailings reprocessing first, Hangar Flats deposit second, and the West End deposit third. This mining sequence would include backfilling the Yellow Pine pit with West End development rock to reclaim the approximate original gradient of the East Fork SFSR, to provide permanent fish passage, and facilitate aquatic habitat enhancement.

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

Mineral Resources

Geologic studies by Perpetua have reported approximately 132.3 million tons of measured and indicated ore resource (including historical tailings) for the SGP property with another 36.2 million tons of inferred ore (Table 1-2, M3 2021). This represents the in-place mineral resources before application of modifying factors to determine the estimated economically mineable portion (aka "reserves") of the mineral resources based on application of technical, economic, social, and government factors which tend to increase operating costs and therefore reduce the amount of mineral resource that can be economically mined. The 2021 consolidated mineral reserve summary for the SGP indicated total probable and proven mineral ore reserves of 104.625 million tons, including historical tailings (M3 2021).

Under the 2021 MMP, approximately 280 million tons of development rock and 112 million tons of ore would be mined. About 3.2 million tons of historical Bradley tailings "ore" would also be removed and reprocessed. Total ore processed would be 115.2 million tons.

The contained metal content in the 2021 proven and probable mineral reserve of the property is approximately 4.819 million ounces of gold, 6.431 million ounces of silver, and 148.686 million pounds of antimony (Table 1-4, M3 2021). From the total ore currently planned to be mined the SGP is estimated to recover, over 15 years of mill production, 4.238 million ounces of gold, 1.710 million ounces of silver, and 115.342 million pounds of antimony (M3 2021).

According to the 2021 USGS Minerals Commodity Summaries (USGS 2021b), no marketable antimony was produced by U.S. mines in 2020. The apparent domestic consumption of elemental antimony in 2020 was 22,000 metric tons with an estimated value of $193 million. The main uses of antimony in the U.S. are for flame retardants, metal products, and non-metal products including ceramics, glass, and rubber. Recycling (largely at secondary lead smelters processing spent lead-acid batteries) supplied about 18 percent of the estimated consumption and the rest was imported. Imported antimony metal and oxide came mostly from China, Belgium, Thailand, and India. The SGP would change the domestic mine production of antimony in the U.S. from the current zero production to 52,319 metric tons of contained antimony over the life of the mine, which is roughly 2.4 times the U.S. antimony consumption in 2020. Unless and until a significant domestic smelting capacity to treat this concentrate was available, this mineral material would be exported for smelting and then the antimony products could be imported to the U.S. for use.

In May 2021, Perpetua Resources signed a collaboration agreement with U.S. Antimony Corporation, Thompson Falls, Montana, to explore the feasibility for U.S. Antimony processing the stibnite concentrate produced at the SGP. U.S. Antimony owns an antimony smelting facility and has experience producing various antimony products as well as precious metals from mineral concentrates provided by others. In its public statements, U.S. Antimony has expressed confidence that it can develop the processing technique to handle the SGP antimony concentrate.

In August 2021, Perpetua entered into an agreement with Ambri Inc., a U.S. company to provide antimony to support commercialization of Ambri's liquid metal battery technology.

In 2020 the apparent U.S. silver consumption was approximately 8,000 metric tons for electronics, jewelry and silverware, coins and medals, photography, and others such as pharmaceuticals, solar cells, water purification, dental amalgam, biocides etc. (USGS 2021b). A metric ton of silver is equivalent to 32,150.7 troy ounces. Approximately 6,500 metric tons of that silver consumed was imported, mostly from Mexico, Canada, Peru, and Poland. Silver production from the SGP over the life of the mine would be about 53.19 metric tons which is less than one percent of the 2020 U.S. consumption rate.

In 2020, the U.S. exported approximately 270 metric tons of gold and consumed approximately 160 metric tons of gold, mostly for jewelry, electronics, coins, and other (USGS 2021b). A metric ton of gold is equivalent to 32,150.7 troy ounces. Gold is a mineral commodity where the U.S. is a net exporter and the domestic gold production in 2020 was valued at about $11 billion (USGS 2021b). Gold production from the SGP property over the LOM would be about 131.82 metric tons which is just over 82 percent of the 2020 U.S. gold consumption.

Mining is planned to provide approximately 7.68 million tons of ore to the mill feed annually over 15 years and produce about 20 million tons of development rock per year through Mine Year 12 of the operations (including 2 years of pre-stripping). Mining would be phased to produce mill feed only from the Yellow Pine pit and historic tailings until Mine Year 5 of operations after which Yellow Pine ore delivery would ramp down and be completed in Mine Year 7. Hangar Flat ore would be added to the production in Mine Year 4 and be completed in Mine Year 7. West End ore delivery would begin in Mine Year 7 and continue until Mine Year 12.

Long-term ore stockpiling would be practiced early in the operations to optimize process ore feed value through the mine life, improve overall utilization of the mineral resources, and other operational improvements. Stockpiled ore would be blended with direct ore feed from the pits beginning in Mine Year 2 of the operations and continue until the end of mill operations in Mine Year 15. Stockpiled ore exclusively would be fed to the mill in the last 3 years of mill operations.

Ore stockpiling would be particularly helpful during the first half of the operations when higher-value Yellow Pine ore would be mined at a higher rate than the process plant capacity. This stockpiling of early, higher-grade ore production from the Yellow Pine pit would increase utilization of the mineral resource.

Gold and silver occurs in all three deposits within arsenical pyrite and arsenopyrite and some free gold in oxidized portions of the West End pit. High antimony sulfide ore would be treated by standard flotation methods to extract a stibnite concentrate and then a gold/silver sulfide concentrate. The antimony

concentrate would be shipped offsite for further processing. Low antimony sulfide ore would be treated by flotation to only produce a gold/silver concentrate and not an antimony concentrate. High-antimony ore makes up about 30 percent of the ore in the Yellow Pine deposit and 54 percent of the ore in the Hangar Flats deposit; there is no high antimony ore in the Bradley tailings or West End deposit (2021 MMP).

On-site processing of antimony concentrate has been investigated by Perpetua including caustic leaching and electrowinning. While testing indicated it was possible to design and build an antimony processing circuit, the risk of not being able to economically and consistently produce marketable products was deemed too high to include this in the SGP.

Some gold and significant amounts of silver would also be contained in the stibnite concentrate. The gold and silver values in the precious metals sulfide concentrate are poorly recoverable by direct cyanide leaching so this concentrate would be pressure oxidized to make it amenable to leaching in a standard cyanidation circuit. Pressure oxidation of the gold/silver concentrate is intended to better utilize the mineral values in the concentrate. Some oxide ore, largely encountered in the West End pit, would be leached directly without producing a flotation concentrate.

The proposed mining plans would highly utilize the economically minable mineral resources. The proposed processing plant would extract a high proportion of the contained target metal values from the ore feed. The projected mining and processing of the described proven and probable mineral reserves would constitute a major and permanent reduction of the measured and indicated mineral resources that have been identified at the SGP. This is by design to fully utilize the economically minable mineral resources. These impacts would be localized to the specific open pit areas.

Topography

Mining under the 2021 MMP would result in expanded open pits at the Yellow Pine and West End deposits and a new open pit at the Hangar Flats deposit. Each of these pits would result in highwalls developed in rock that would permanently remain after mining. These highwalls are geotechnically designed to be stable and would be permanent features imposed on the topography of the site. Each of these pits would also be backfilled with development rock to a certain degree which would bury certain portions of the open pits and their highwalls. Other major changes to local topography would include the proposed TSF and the TSF Buttress. Smaller changes to topography would occur due to engineered cuts and fills at constructed haul roads, processing facilities, and ancillary facilities. The Burntlog Route access road would also be constructed with engineered cuts and fills that would change the topography along its route.

Pit design parameters were based on economics and geotechnical characteristics of the rock. Overall pit slope designs were based on geotechnical studies to develop an understanding of the physical characteristics of the material to be mined and design overall slopes that would be stable (STRATA 2014b). The inner slopes, or highwalls, of each pit would include step-like catch benches at regular spacings up the highwalls. The highwalls would be developed with final bench heights of 40 feet, bench widths of 20 feet and inter-bench faces angled at 63 degrees from vertical in rock and 45 degrees in alluvium. Overall highwall heights and slope angles are described below for each pit.

Yellow Pine Pit

The Yellow Pine pit would be approximately 222 acres in plan extent and 720 feet deep to a bottom elevation of 5,360 feet (**Figure 2.4-2**). It would be roughly circular in plan with a lobe extending into the Homestake area to the northeast and another lobe in the south end of the pit. The western highwall would extend to a height of about 600 feet above the approximate pit backfill top elevation and the eastern highwall would extend to a height of about 900 feet above the pit. The overall pit slope angle would vary from about 39 degrees on the east and northeast pit walls to about 47 degrees on the west highwall (M3 2021). The pit would be backfilled with development rock, largely produced in the West End pit, up to the elevation of the valley floor which would permanently bury the highwalls below this elevation leaving the east and west highwalls permanently extending above the pit backfill. Remaining pit highwalls at the Yellow Pine open pit would be permanent and constitute major impacts on the localized topography.

Hangar Flats Pit

The Hangar Flats pit would have a plan area of 66 acres with a central pit bottom elevation of 6,080 feet which would be about 460 feet deep (**Figure 2.4-2**). The pit haul road would exit the pit in a ramp extending to the northeast in the valley bottom from the pit. The northwest highwall of the pit would extend about 800 feet up the valley side above the proposed pit backfill. The pitwalls in rock would have an overall slope of 44 degrees and 36 degrees in alluvium (M3 2021). The pit would be backfilled with development rock, largely produced in the West End pit, up to the elevation of the valley floor which would permanently bury the highwalls below this elevation and permanently leave the northwest highwall extending above the pit backfill. The remaining pit highwall at the Hangar Flats open pit would be a permanent and major impact on the localized topography of the site.

West End Pit

The West End pit would have a plan area of 185 acres with a complex interior that would include the limestone quarry area, the main pit, the Midnight area, and the southwest end (**Figure 2.4-2)**. It would have a bottom elevation of about 6,180 feet, which would be about 440 feet deep. This pit would not be backfilled and the remaining highwalls would be about 1,000 feet high. The overall pit slopes would largely be 45 to 47 degrees (Fig. 15-4, M3 2021). The remaining pit highwall at the West End open pit would be a permanent and major impact on the localized topography of the site.

Tailings Storage Facility and TSF Buttress

The TSF would contain, at final capacity, about 120 million tons of tailings solids. This TSF would disturb approximately 423 acres and be contained behind an embankment with 2h:1v side slopes that would be constructed in phases using a downstream construction method (**Figures 2.4-10** and **2.4-11**). The ultimate height of the embankment would be about 475 feet above native ground and it would have a crest width of 135 feet. The outer face of the embankment would be backfilled with development rock contained in the TSF buttress. This buttress would be constructed at the same time as the embankment itself and would variably extend downslope of the ultimate embankment profile 1,000 to 2,000 feet. It would eventually contain 81 million tons of development rock. The final outer slopes of the buttress upon mine closure would be 3h:1v. The TSF and TSF Buttress would be permanent, major impacts on the local topography of upper Meadow Creek valley.

Burntlog Route

To maintain grades of less than 10 percent and provide a road width of 26 feet, including shoulders, the existing topography along the route would be modified with cuts and fills of various lengths and heights. Topographic lows along the newly constructed roadway would be crossed with earth fills incorporating culverts and bridges to pass drainages under the roadway.

During final reclamation, the 23 miles of existing and widened roads would be returned to their previous widths by scarifying and regrading. The 15 miles of newly constructed road would be reclaimed by pulling back fills and re-contouring roadcuts consistent with surrounding topography as practicable. The regraded areas would be revegetated.

The cuts and fills of the Burntlog access route would be long-term and moderate to major impacts to local topography during operations. When the route is reclaimed, the topographic impacts would be reduced to minor to moderate and permanent local impacts.

Other Facilities

The other 2021 MMP facilities would require localized grading to build level sites for the facilities. These would include the maintenance and processing facilities at the mine site, the SGLF, Burntlog Maintenance Facility, Stibnite Worker Housing Facility, and multiple smaller facilities. Each of these sites would be balanced cuts and fills with cut and fill slopes designed to be stable.

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

The final reclaimed slopes for these cuts and fills are described in the Reclamation and Closure Plan (Tetra Tech 2021a) and summarized in **Section 2.4.7**. Most fill slopes would be regraded to approximate original contour or 3h:1v gradients and many of the cuts would be backfilled to various degrees. These final slopes are intended to be stable in the long term and able to be reclaimed with vegetation to reduce erosion.

The cuts/fills of the other facilities of the SGP would be localized, moderate, long-term impacts to topography when constructed. The outer slopes of these other cut/fills would generally be reclaimed to approximate 3h:1v gradients that would be revegetated and over time would tend to blend in with the surrounding topography. These reclaimed disturbances would permanent, moderate impacts to the local topography of those sites.

The SGLF has a post-mining land use designation of light industry, where it would remain un-reclaimed after mine operations and transferred to a third-party for light industrial uses.

Utilities

Construction of the proposed electric power transmission line would involve upgrading approximately 63 miles of existing transmission line and upgrading five existing substations. For this portion of the

transmission line, improvement to the existing access roads and structure sites may be required but would be expected to result in negligible impacts to topography.

About 6.3 miles of transmission line would be rerouted to new alignments; a new substation would be built (Johnson Creek substation); and a new 9-mile-long transmission line segment would be built from the Johnson Creek substation to the SGP mine site. During construction, the new section of transmission line between the Johnson Creek substation and SGP would require major improvements to Horse Heaven Road (FR 416W), NFST 233 (no name), and approximately four miles of new spur roads would be constructed. Minor upgrades to Cabin Creek Road (FR 50467) would also be required. This construction would involve building cuts and fills as needed with the intent to minimize grading to what is necessary for construction. Surficial geology would be affected in localized areas within the expanded utility easements for pole replacement, grading, or footings as needed. Similarly, surficial geology and landforms would be directly impacted during utility upgrades. Impacts would be localized to areas where new utility infrastructure (or upgrades) are needed and negligible.

The disturbed areas would be revegetated following construction which would mute the appearance of the topographic impacts.

During final reclamation, the transmission line right-of-way from Johnson Creek substation to the mine site, and spur roads used to access power pole structure sites, would be removed, recontoured to match surrounding topography, and revegetated. The topographic impacts to construct the transmission line would be localized, minor, and long term. After reclamation, these impacts would be minor and permanent.

Geotechnical Stability

Certain proposed SGP facilities would have exposure to potential geotechnical impacts from existing landslides, rockfalls, and avalanche paths. SGP facilities to be located in the vicinity of these hazards would include designs and operational procedures to reduce risk to workers and operations.

Geotechnical stability of the proposed SGP facilities would be ensured by application of state-of-the-art practices for design, construction, and operation of the facilities. Studies have been conducted to characterize the geologic conditions of the foundation areas of these facilities and these characteristics have been incorporated into the designs of the facilities.

The designs of major earth fills such as the TSF and TSF Buttress have incorporated slope stability analyses including the potential effects of earthquakes. Impacts from earthquakes on other SGP facilities would be minimized by incorporation of existing geotechnical design standards and building code standards, as well as construction quality control, operations and maintenance, and surveillance.

<u>Landslides and Rockfalls</u>

Landslides and rockfalls have been identified within the SGP mine operations area and along the Burntlog Route (**Figure 3.2-6**). Known landslides and rockfalls are not anticipated to cause adverse effects on mine operations (STRATA 2014a). These natural features could be destabilized to various degrees by proposed construction disturbances. The geographic extent of effects would be localized, within the immediate vicinity of these rockfall and landslide features. Each of these potential hazards would be addressed in the

final designs of the various SGP components and site-specific, geotechnical design features would be installed to avoid or control these natural hazards. Impacts caused by landslides and rockfalls during construction and operations would be localized and are expected to be short-term and moderate.

The Meadow Creek valley site is surrounded by mountain topography that would be above the TSF. There are identified rockfalls above the Meadow Creek valley site (STRATA 2014a) that could impact the integrity of the liner during initial construction, but these risks can be mitigated with engineering controls (e.g., berms, rock nets, rock-fall berms). Although several mass wasting features have been identified in the vicinity of proposed mine support facilities and infrastructure (**Figure 3.2-5**), the proposed facility sites would be located on satisfactory foundation material (STRATA 2014a).

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

Widening of existing access roads and construction of new segments of the Burntlog Route would increase the size of existing cut-slopes, exposing bedrock upslope of the road corridor. Exposed bedrock could become more susceptible to mechanical weathering such as ice heave and wedging, which could dislodge fragments of bedrock into road corridors. The Riordan Creek Valley segment of the Burntlog Route crosses areas of active landslides. Application of appropriate engineering design features would be incorporated into all road construction and foundation planning for the SGP, which is intended to minimize the effects of frost heave and wedging of rock road cuts.

Rock fall occurs from rock fragments released from steep, rocky overhangs and creates debris on the roadways in steep sections of the access routes. This is particularly notable along sections of Stibnite Road, and there is potential for rockfall on the Black Lake and Riordan Creek Valley segments of the Burntlog Route. Rock falls are caused by diurnal freeze/thaw cycles more prevalent of spring weather conditions. Potential impacts from rock falls include roadway blockage and/or damage, and there is also a significant human health and safety concern due to the potential to strike vehicles if they are in the path of falling rocks.

EDFs such as rock bolts, netting, and signage would be installed along segments susceptible to rock falls. Responsibility for removal of rock debris from the roadways would be detailed in the maintenance agreement with Valley County.

Perpetua would employ appropriate design features and construction considerations to minimize the effects of landslides and rockfalls including:

- Avoid known occurrences of slope failures to the degree practicable.
- Incorporate appropriate cut slopes and stabilizing features (e.g., retaining walls, soil nails) into road design to reduce the potential for slope failure.
- Road layback design to prevent the formation of steep overhangs and prevent spalling.
- Consider rock bolts, netting and catch benches in areas subject to rockfalls.

- A Maintenance Agreement between Perpetua Resources and Valley County would be developed defining the procedure and protocols for removing material debris from the access route.
- Slope dewatering or other stabilizing structural features as control measures.
- Where necessary, realign the roadway.

Most of the effects within the immediate vicinity of the existing rockfalls and landslide features would be localized, temporary, and minor. Although there is a low probability of localized, moderate, and long-term effects where rockfalls and landslides create regular maintenance responses during the life of the operations.

Avalanches

Several areas of the Operations Area Boundary are within avalanche hazard zones based on information from DAC (2018) (**Section 3.2.4.7**). Avalanche hazards are already present in the analysis area. Avalanche occurrence is largely a result of a combination of three factors: weather, snowpack, and terrain. The SGP would not substantially alter these factors, but components of the SGP in the paths of avalanches could be impacted. The most significant concern for avalanche impacts to the 2021 MMP would be along the access routes where avalanches could directly impact vehicles and personnel who were in the path of the avalanches when they occurred (**Figure 3.2-6**). Such accidents could harm the involved persons, damage impacted vehicles, or even potentially cause the vehicles to upend or leave the road. The later situations could then lead to secondary environmental effects from spills of fuel, coolant, or cargoes.

A more likely impact would be cases where an avalanche deposited snow and forest debris on the affected roadway which would then require response by plows or other equipment to clear the road and reopen access to the Operations Area Boundary. The effects of these cases would depend on the relative size of the avalanche, described by DAC (2021) in the project areas as potentially size D1 through D4. Size D1 and D2 avalanches would involve displacement of 10 to 100 tonnes of snow respectively, would be more common than larger avalanches, and could cause an accident or stop traffic until the road was cleared. However, even these smaller avalanches could present a severe safety hazard to persons on foot in the avalanche paths. Less likely, but larger D3 avalanches would displace 1,000 tonnes and could bury or destroy a car and damage a truck. The largest potential avalanche path found by DAC (2021) in the analysis area are size D4 avalanches which would displace 10,000 tonnes of snow and have the potential to destroy even large trucks as well as a substantial amount of forest.

Avalanche hazard areas also are present in proximity to the proposed mine support facilities and infrastructure (**Figure 3.2-5**). These existing avalanche hazards would be addressed in the siting and design of proposed facilities at the mine site, but the increased number of personnel present at the mine facilities, and increased value of facilities and equipment at the mine as a result of the 2021 MMP would increase the potential risk of damage, injury, and loss of life from the existing avalanche hazards. Blasting associated with mine operations could trigger avalanches in the vicinity of the mine operations.

Mears and Wilber Engineering (2013) evaluated the avalanche hazard around the TSF and the TSF Buttress. The assessment identified areas of high, moderate, and low risk of avalanche activity. The assessment indicates that both the TSF and TSF Buttress areas have a risk of being impacted by

avalanches. Associated impacts from avalanches would be expected to be contained within these areas and are not expected to cause additional impacts. The risks posed by avalanches in these areas would be higher during construction when more work activities might be present.

Along the Burntlog Route, the potential impacts resulting from existing avalanche hazards would increase due to increased vehicular traffic during mine operations and reclamation/closure activities. DAC (2021) identified 38 avalanche paths along the Burntlog Route, mostly D2-sized avalanche paths and four potential D3-sized paths.

Existing avalanche hazards on the Johnson Creek Route would continue to exist and could impact travel during the construction period when this route would be the primary access to the SGP. DAC (2021) identified 94 avalanche paths along the Johnson Creek Route, mostly D2- and D3-sized avalanche paths and five D4 paths.

The Burntlog Route is generally viewed as having less susceptibility to avalanche hazards than the Johnson Creek Route (**Section 3.2**), as the proposed Burntlog Route generally runs higher up on the ridgelines; therefore, not crossing through potential large avalanche paths (DAC 2021). Potential for small avalanches (i.e., D2-sized) would increase due to the higher position of the road in the avalanche track.

Perpetua is using information collected on avalanche hazards to develop potential EDFs with respect to avalanches including:

- Map locations where small-sized avalanches frequently occur and include these locations in safety plans to inform drivers of areas of potential risk.
- Periodically update the mapping before the next snow season if wildfire or any other large scale vegetation modification alter the size or frequency following the methods described in the Snow Avalanche Hazard Assessment for Access Roads (DAC 2021).
- Review all avalanche paths with summer and winter imagery, review topographic contours, and slope classes.
- Construct catchment areas for smaller avalanche paths on slopes on the west side of the Warm Lake Summit.
- Frequently remove snow from catchment areas/ditches or design ditches to hold most of the snow for the winter with “Jersey” barriers to increase the depth. The appropriate size of the ditch could be evaluated on a site-specific basis, which is a function of the length and incline of the slope above and the depth of the snow in a design (e.g., 10-year) winter.
- Implement an avalanche hazard management program for larger avalanches with return periods of 1 to 10 years. This could include avalanche control and/or road closure.
- Post permanent warning signage in avalanche-prone areas of D3- and D4-sized avalanches.
- Monitor winter avalanche parameters and take appropriate actions, including:
  - Daily region-scale assessments.
  - Daily weather observations, including snowpack and avalanche observations.
  - Notify SGP staff when conditions are highly unstable.
  - Close roads during periods of elevated hazard or blocked roadways.

- Control avalanche initiation with explosives using helicopters, case charging, Avalauncher, hand charging, or remote control.

With the EDFs proposed by Perpetua, the size and timing of avalanche impacts to the roadways and facilities could be managed to reduce the effects. In this case, most of the effects within the immediate vicinity of the existing avalanche paths would be localized, temporary, and minor. There would be potential for localized, temporary, and major impacts from infrequent large avalanches. Once operations cease and frequency of exposure to avalanches decreases, the impacts would be localized, temporary, and negligible to minor.

Pit Slopes

Slope stability is an important aspect of designing an open pit. Pit slope instability is a safety concern for mine workers exposed to the effects of the slope instability. Additionally, slope instability issues can impact mine operations and even result in loss of ore production in extreme situations. The main concern is for overall pit slope stability which can vary with the rock characteristics around an open pit. Stronger rock characteristics can support steeper pit slopes than weaker rock. The pit slopes are built with benches that step back moving up the pit highwalls. The benches are left in place on the highwalls and act to catch and retain loose rocks that may release from the pit slopes. This raveling of individual rocks or even minor, interbench slope failures that are retained on the benches are accepted conditions but large slope failures are to be prevented during mine operations.

A probabilistic geotechnical analysis was used to evaluate overall pit slope stability and compute a Probability of Instability (POI) along specific cross-sections within each of the proposed open pits (STRATA 2014b). The slope stability analyses relied on measured characteristics of the geologic units involved in the pits and accepted modeling techniques. POI was used to design highwall overall slopes and bench configurations. In typical mining applications an acceptable POI value is in the range of 0.03 to 0.15, depending on the potential impacts of slope movement. The higher the POI number, the less stable the slope. Temporary slopes, such as the pit walls in short-lived pit operations, may have POI values near the upper end of this range, while long-term slopes have values near the lower end of the range. The calculated POI ranges for each of the proposed pits are as follows:

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

The design of the pits includes the appropriate overall slope selection and benching design in accordance with standard engineering principles and practices. Based on the 2021 MMP pit designs, and the strength of the underlying bedrock, the relatively low POI values indicate that significant instability of the pit walls in the final pit configurations would be unlikely. Additionally, backfilling the Yellow Pine and Hangar Flats pits would eliminate slope stability concerns for the backfilled portions of the pits and reduce the overall heights of the portions of the highwalls that would extend above the backfills.

It is unlikely that failure of the pit slopes during mining would result in significant environmental impacts, other than to actual mine operations, because the effects of the slope failures would be confined

to the open pits. This conclusion is based on the durable rock types in the pit walls (granite, marble, etc.), and also because the edges of the existing open pits are still well defined since historic mining ceased.

After mining ceases, raveling of bench faces and small slope failures would largely be contained on the benches presenting localized, negligible to minor, and permanent effects. Although unlikely, any large-scale slope failure after mining ceases in the West End pit could temporarily affect pit lake level.

Tailings Storage Facility and TSF Buttress

The proposed locations of the TSF and TSF Buttress were evaluated in a screening process of available sites in the SGP mine area that considered: meeting design criteria and considerations for tailing storage; a TSF with low-permeability liner; tailings dewatering methodology; construction of a TSF underdrain system; containment capacity; avoidance of side-hill locations and steep topography; avoidance of excessive embankment (i.e., dam) heights; avoidance of areas that would preclude using placement of development rock as buttress material; and downstream embankment construction (Midas Gold 2016a, Appendix G).

The TSF and TSF Buttress area include a discontinuous 5-foot-thick layer of peat which would be removed along with topsoil and other potentially compressible/weak silt and clay soils encountered during construction. The underlying bedrock is more than sufficiently competent to support the proposed structures because the rock types consist of quartz monzonite, diorite, granite and rhyolite (Tierra Group 2018).

The tailings embankment would be constructed using material removed from the SODA and the Hecla heap during starter embankment construction followed by development rock sourced from on-going mine operations. The rock used in tailings embankment construction would be placed in horizontal lifts and compacted by routing the mine's haul fleet over previously placed rock. The tailings embankment's interior face would have a zone at least 10 feet wide that would be placed by a contractor (not mine fleet) using traditional construction methods. Rockfill would be placed in horizontal lifts of approximately 18 to 24 inches thick and compacted using traditional compaction equipment (vibratory compactor or sheepsfoot roller) to provide a non-yielding base for liner construction. A fine-grained bedding layer would be placed and compacted for liner deployment. The liner bedding material's compaction would be tested using traditional means (nuclear density gage and/or sand cone) to ensure compaction specifications are met.

All planned raises of the TSF embankment would be by downstream methods. This means that incremental raises of the embankment height would be placed on top of previously constructed portions of the engineered embankment. This style of construction provides the strongest foundation material for all portions of embankment raises, and therefore maximizes the overall strength of the embankment against failure.

The tailings embankment has been designed to meet regulatory stability criteria even in the absence of the downstream buttressing provided by the TSF Buttress. However, the tailings embankment and buttress would be constructed concurrently, with the mine haul fleet routed to the respective construction lifts as needed. The buttress would be developed in horizontal lifts, abutting the engineered tailings embankment fill (**Figures 2.4-10** and **2.4-11**). The presence of the buttress would enhance the overall tailings

embankment stability by providing significant additional resisting mass (70 million tons) to resist tailings embankment deformation in static or earthquake conditions.

Slope stability analyses were performed for static, or normal conditions, and for earthquake event conditions, representing pseudo-static conditions. The TSF embankment and TSF Buttress were analyzed to determine factors of safety for two potential failure surfaces: 1) full height failure of the downstream slope of the TSF Buttress; and 2) TSF dam failure assuming the buttress was not present (**Table 4.2-1**).

The term "factor of safety" is used to express how much stronger a feature is (e.g., tailings dam) to withstand the calculated load imposed on the structure. At a factor of safety of 1.0 the two forces (design dam strength and load) are in balance – meaning the feature is not designed with any additional safety margin to withstand the intended load. Calculated factors of safety greater than 1.0 indicate the feature has an additional safety margin against failure. The required regulatory ratio per IDAPA 37.03.05 for tailings dams under static (normal) conditions is 1.50 and under pseudo-static (earthquake) conditions is 1.0. The TSF embankment must also conform to the requirements outlined in the NDSP, which are defined in multiple FEMA publications, primarily FEMA 65 (Earthquake Analyses and Design of Dams), FEMA 93 (Federal Guidelines for Dam Safety), FEMA 94 (Selecting and Accommodating Inflow Design Floods for Dams), and FEMA 333 (Hazard Potential Classification System for Dams).

Table 4.2-1 Calculated Factors of Safety for the TSF Embankment and TSF Buttress

Case	Static Factor of Safety	Pseudo-Static (Operations) Factor of Safety	Pseudo-Static (Closure) Factor of Safety
TSF Buttress[1]	4.99	1.95	3.85
TSF Dam	4.09	3.17	1.81

Source: Tierra Group 2017
Factor of Safety Values are for maximum design heights of the embankment and buttress.
Minimum factor of safety for static load is 1.50; minimum factor of safety for earthquake load (pseudo-static) is 1.0 (IDAPA 37.03.05).
[1] The TSF Buttress has been expanded since the calculations were made; therefore, these calculations are conservative.

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

Results of the Tierra Group (2017) study indicate the TSF dam and TSF Buttress would be stable under pseudo-static conditions. Pseudo-static conditions refer to additional load potential placed on the structure due to external forces, in this case an earthquake (Tierra Group 2017).

Earthquakes are a common geologic phenomenon in central Idaho and development of certain structures (e.g., dams, bridges, pipelines) is governed by regulation. In the event of an earthquake near the analysis area, effects to 2021 MMP support facilities and associated infrastructure are expected to range from low intensity effects (e.g., ground shaking) that may or may not be noticeable, to moderate intensity (e.g., design is adequate to withstand earthquakes), with a low probability of high-intensity effects at certain structures. Effects would range from temporary (e.g., minor damage that is easily reparable) to permanent (e.g., lateral displacement at fault crossings). The geographic extent of effects would be mostly localized, within the immediate vicinity of the various facility footprints. Impacts would be reduced to moderate intensity effects through incorporation of existing geotechnical design standards and building code standards, as well as construction quality control, operations and maintenance, and surveillance.

Midnight Pit Backfill

The load imposed from waste rock placed in the Midnight pit backfill would be much less than the TSF Buttress and the TSF embankment. The Midnight pit backfill is large, but has a low slope, and would be placed on competent underlying bedrock with the soil removed. As such, based on currently available design and site information, this site is suitable for the proposed backfill with adherence to standard construction protocols for the placement and construction of this type of facility.

The Midnight pit backfill would be constructed within the Midnight pit once mining in that pit is completed. In the unlikely event of a large earthquake in the vicinity of the Midnight pit, some displacement of the rock fill slopes could potentially occur but this displacement would be confined to the open pit. Such impacts would be localized, permanent, and minor to moderate.

Burntlog Route

Access road cuts and fills would be designed to be stable under static and psuedo-static conditions. Therefore, potential impacts from constructed slope failures would be expected to be low. In the unlikely event that a large earthquake occurs in the vicinity of the Burntlog Route, local displacement of cut slopes and road fills could potentially occur. These effects would likely be temporary (e.g., damage that is repaired), localized, and minor to moderate.

Other Facilities

Other facilities associated with the 2021 MMP would be sited in discrete, localized areas that would be prepared with grading and engineered fills. The foundation characteristics of the proposed facilities would be examined and the facilities structurally designed for the site-specific foundation characteristics intended purposes of the facilities. Structural designs would incorporate existing geotechnical design standards and building codes.

Facilities would be designed to withstand moderate intensity seismic events. Therefore, impacts from anticipated seismic events are anticipated to be low. However, in the unlikely event that a large

earthquake occurs in the vicinity of a facility, the effects would be local, temporary (e.g., damage that is reparable), and negligible to moderate.

Utilities

Design and construction of the transmission line would allow siting of support structures to avoid obvious geotechnical hazards like landslides and rockfalls. It is expected that geotechnical issues arising from these components would be minor and their construction would follow standard engineering practices that address and prevent geotechnical failures.

Employment of current geotechnical and structural design standards during utility upgrades would allow facilities to withstand moderate intensity seismic events. Therefore, impacts from anticipated seismic events would be low. However, in the unlikely event that a large earthquake occurs in the vicinity of the SGP, effects would be expected to be temporary (e.g., damage that is reparable), localized, and negligible to minor.

4.2.2.3 Johnson Creek Route Alternative

Impacts associated with construction of the Burntlog Route would not occur under the Johnson Creek Route Alternative. However, impacts from the upgrade of the Johnson Creek Route (road widening and curve straightening along Johnson Creek Road and Stibnite Road (CR 50-412)) would require blasting, road cuts and retaining walls. Newly exposed bedrock along the constructed road cuts would become more susceptible to ice heave and wedging, which could dislodge large blocks of bedrock into the road corridor. Topographic impacts associated with Johnson Creek Road and Stibnite Road upgrades would be permanent.

The hazards from mass wasting events along the Johnson Creek Route would be increased compared to the Burntlog Route. There are more areas of landslides and rockfalls along the Johnson Creek Route (45) than there are along the Burntlog Route (26) (**Figure 3.2-6**). Potential avalanche paths crossed by the Johnson Creek Route (94) are more numerous than the Burntlog Route (38) and are more significant in size (D2 to D4) than along the Burntlog Route (D2 to D3). The increased numbers of mass wasting hazards along the Johnston Creek Route would be expected to result in an increased number of temporary road closures and possible accidents involving vehicles than the Burntlog Route.

As described above the number of mass wasting and avalanche hazards would be greater for the Johnson Creek Route compared to the Burntlog Route. Similar to the Burntlog Route, the size and timing of avalanche impacts to the Johnson Creek Route could be managed to reduce the effects. Most of the effects within the immediate vicinity of the existing mass wasting areas and avalanche paths would be localized, temporary, and minor to major depending on the scale of an individual avalanche or mass wasting event.

Construction of the Johnson Creek Route would require geotechnical design considerations related to widening of the existing road from the current width to up to 21 feet along with required rock blasting for bedrock cut slopes to achieve this width resulting in multiple, temporary road closures required for this construction activity. Construction of the Burntlog Route would not require as many road construction activities along the Johnson Creek Route.

The proposed helicopter access for construction and maintenance of radio repeater and cell tower sites within IRAs would reduce the area of topography and geology disturbed by construction of access to such facilities.

Impacts associated with the Maintenance Facility would occur near Landmark, a different location than under the 2021 MMP.

Topographic, geologic, and geotechnical impacts related to all other components of the SGP would be the same under this alternative as the 2021 MMP.

4.2.3 Mitigation Measures

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. Any mitigation measures are in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Geologic Resources and Geotechnical Hazards.

4.2.4 Irreversible and Irretrievable Commitments of Public Resources

4.2.4.1 No Action Alternative

Under the No Action Alternative there is no irreversible and irretrievable commitment of public resources related to geology and geotechnical hazards.

4.2.4.2 Action Alternatives

The predominant commitment of resources for the action alternatives would be from the mining, which would deplete the mineral resources in the targeted ore bodies. Gold, silver, and antimony are non-renewable resources that would be removed and then used, constituting an irreversible commitment.

Substantial labor, energy, and materials needs are anticipated throughout the life of the SGP. Utility upgrades and new infrastructure are required to facilitate mine operations and reclamation of historically damaged areas. Legacy mined waste rock would be incorporated into new construction to the extent feasible. Contaminated areas would be remediated during new construction as required and consumption of these resources would represent an irretrievable commitment for the action alternatives.

Implementation of the SGP for the action alternatives would remove the land from other uses while it is in operation, but the use would be converted back to habitat for native species and recreational uses through reclamation activities that could take up to 5 years and once successful revegetation of disturbed areas occurred which could take considerably longer, especially for previously forested areas. The temporal loss of the land for some uses would be irretrievable. However, due to the current geotechnical condition of the land, some uses are not currently possible.

4.2.5 Short-term Uses versus Long-term Productivity

4.2.5.1 No Action Alternative

Under the No Action Alternative there are no short-term use impacts to the long-term productivity of the analysis area as it relates to geology and geotechnical hazards.

4.2.5.2 Action Alternatives

Development of the 2021 MMP or the Johnson Creek Route Alternative would result in short-term and long-term impacts to geology in the area for the action alternatives. Surficial deposits and topography would undergo changes throughout the life cycle of the mine. Bedrock would primarily be impacted by depletion of the targeted ore bodies in the three pits. Short-term uses of the mineral resources would represent a beneficial use of these resources.

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

4.3 Air Quality

4.3.1 Impact Definitions and Effects Analysis Indicators and Methodology

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

Issue: The SGP may affect air quality characteristics and resources that are affected by air pollutants.

Indicators:

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

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1** (Forest Service 2012c).

Environmental consequences related to air quality are evaluated by comparing to objective, usually numerical, standards. In this case, the assessment of potential air quality impacts relies on a quantification of the emissions from the construction and operations phase of the action alternatives. It is typical practice

for analysis of air quality effects to evaluate the period during which emissions are predicted to be highest. If the resulting indicators for that period are below the appropriate standards, then impacts for other periods can be reasonably concluded to be of lower magnitude and extent. Estimated construction, mining, and processing emissions for the 2021 MMP are discussed in the SGP Air Quality Specialist Report (Forest Service 2022a) and Appendix A of the report entitled Air Quality Analysis (Air Sciences 2021a) and from an updated modeling analysis submitted to support the air quality permitting process (Air Sciences 2020).

The assessment of potential effect regarding the air quality issue and indicators is analyzed for each action alternative in its entirety (i.e., the combined emissions of the SGP construction/operation, transmission line construction/operation, and access road activities). For the air quality impacts analysis, the basis for emissions of pollutants, including criteria air pollutants, HAPs, sulfuric acid mist (H_2SO_4), Hg, and hydrogen cyanide, was the year of mine operations with the highest level of overall emissions.

4.3.1.1 Analysis Area Methodology

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

Four Class II wilderness areas, also shown in **Figure 3.3-2**, were selected by the Forest Service for far-field evaluation: FCRNRW, Gospel-Hump (GOSPEL), Hemingway-Boulders (HEMBLD), and Cecil D. Andrus - White Clouds (WHTCLD). Also, at the request of the Nez Perce Tribe, a fifth far-field region was included: the Nez Perce Requested Analysis Area.

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

4.3.1.2 Air Emissions Inventory Methodology

Direct effects are defined as those which are caused by the action and occur at the same time and place. Indirect effects are those that are caused by the action and occur later in time or are farther removed in distance but are still reasonably foreseeable. Because the direct and indirect air quality effects related to concurrent construction and operations are not distinguishable, a complete air emission inventory is to consider mine operations, ore processing (including refining), ongoing development of the SGP, support facilities, access roads, utilities (transmission line construction), and off-site facilities. For purposes of these analyses and IDEQ permitting, separate air pollutant emission inventories were assembled for:

- Criteria air pollutants addressed by NAAQS: CO, NO_2, $PM_{2.5}$, PM_{10}, SO_2, O_3, and ozone precursors (e.g., NO_X and volatile organic compounds [VOCs]);

- HAPs, including Hg, arsenic, antimony and hydrogen cyanide (HCN);
- Non-criteria pollutants: total PM, H_2SO_4, hydrogen sulfide; and
- GHGs.

The detailed emission inventories described in the Air Resources Specialist Report (Forest Service 2022a) provide the source and selection rationale for the various factors that were used. This methodology applies to criteria, non-criteria, and HAP emissions estimates. The selected emission factors and estimation techniques are provided in regulatory and industry technical documents (Forest Service 2022a).

The air emissions inventory for the 2021 MMP is based on calculations for each emission source, for each LOM year.

Criteria Pollutant Inventory Methods

Mine operations involve numerous emission source categories characterized by the type of process, material processed, and equipment used. Most of the methods used to estimate emissions follow the accepted techniques that are described in EPA Document AP-42, Compilation of Air Pollutant Emission Factors (EPA 1995). This compilation is the largest single reference used to develop air emission estimations and is maintained as an EPA website resource. Emission inventories were developed for two different mine operating scenarios. One inventory was applied to support the full range of analyses (including the processes non-regulated by IDEQ) and a second inventory applied only to the NAAQS regulatory analysis by IDEQ that supported the New Source Review for the state PTC (Forest Service 2022a). For each inventory, activity-specific (e.g., drilling, blasting, material crushing and conveying, refining, and other ancillary sources and activities) emissions were estimated based on the maximum activity rates for mining and production sources, coupled with applicable emission estimation techniques. Emissions were calculated on a short-term (hourly) and a long-term (annual) basis for ore processing, mine operations, and construction activities.

During full production, the daily ore-milling and processing rate would range from 20,000 to 25,000 tons per day (tpd). To ensure a conservative analysis, maximum daily ore processing emissions for the two inventories were based on the maximum design rate of 25,000 tpd, and this rate was assumed to be maintained for each annual operating scenario. Maximum annual emissions for the processing sources were based on the maximum daily emissions and multiplied by 365 days per year. Both the 2021 MMP and New Source Review inventories from a processing perspective are essentially identical.

Non-Criteria and HAP Inventory Methods

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

- Organic and inorganic HAP from combustion of propane and diesel fuel in stationary sources, non-road engines, and vehicles;

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

Combustion of propane and diesel fuels in stationary and mobile sources comprise a substantial source of HAP emissions for the SGP. Most notably, in line with permitting procedures, the mobile engine tailpipe emissions were not considered in the IDEQ New Source Review regulatory inventory. The non-regulatory inventory for the analysis did include these mobile source tailpipe criteria and HAP emissions.

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

Evaluation of potential Hg emission impacts was conducted, in part, to verify that emissions would comply with the EPA Hg emission standards provided in 40 CFR 63, Subpart EEEEEEE, for gold ore processing and production facilities.

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

Comparison of 2021 MMP and New Source Review Inventories

The 2021 MMP inventory examined projected levels of mine development and operation for each LOM year. Emissions from mine operations (drilling, blasting, material extraction and movement, mobile machinery use, lime kiln and other ancillary sources) vary significantly year to year. Therefore, annual emissions were calculated based on the maximum annual activity/production rates for each LOM year. The year with the highest level of overall criteria pollutant emissions, LOM 6, has been used for the analyses.

IDEQ, as the regulatory authority for the NAAQS compliance analysis, has approved an alternative emissions inventory to support the state PTC New Source Review process. This inventory, referred to here as the PTC New Source Review inventory, included the same emissions sources (both fugitive and

stationary), but excludes mobile source tailpipe emissions. Additionally, the PTC New Source Review inventory is the basis for a multitude of hypothetical operating scenarios for NAAQS modeling.

The full inventories of emissions for the 2021 MMP analysis and for the operating scenario comprising the approved PTC New Source Review inventory are provided in Appendices A and B of the Air Quality Specialist Report (Forest Service 2022a). There are a number of differences to note between the emissions inventories for the IDEQ permit and this EIS. The inventories used for the 2021 MMP analysis include fugitive dust emissions from the Burntlog Route, as well as mobile tailpipe emissions from on-site mobile equipment. These sources were not included in the PTC New Source Review inventory because state regulations do not require mobile sources to be covered by the PTC. Other emission levels have been revised in the PTC New Source Review emissions inventory in accordance with IDEQ's specific operating condition assumptions. This resulted in a PTC New Source Review inventory with generally larger emission rates for the SGP than those reflected in the 2021 MMP analysis inventory (Air Sciences 2020). For further detail refer to **Section 4.3.2**. **Table 4.3-1** summarizes the different source categories and action alternatives that were considered in each of the emission inventories.

Table 4.3-1 Comparison of 2021 MMP and PTC New Source Review Inventories

Emission Inventory	Used for 2021 MMP Analysis	Used for IDEQ NAAQS Analysis	Action Alternative Basis	Mobile Source Tailpipe Emissions	Burntlog Route Fugitive Dust
2021 MMP[2]	Yes	No	2021 MMP	Included	Included
PTC New Source Review[1]	No	Yes	2021 MMP	Not Required	Not Required

Table Sources: [1]From Perpetua PTC application (Air Sciences 2020); [2]Air Sciences 2021a

The 2021 MMP inventory includes both dust and tailpipe emissions from vehicle travel for mine construction and operation periods. The traffic emissions included projected workforce, supply, and haulage vehicles (buses, light, and heavy trucks) and road maintenance equipment (graders and dozers).

4.3.2 Near Field Air Quality Analyses

This section provides an overview of the air dispersion modeling methods, procedures, and datasets used for the near-field assessment. Additional details are provided in the Air Quality Analysis (Air Sciences 2018a, 2021a). **Figure 3.3-1** illustrates the extent of the near-field modeling domain. The near-field air quality analyses were conducted in accordance with EPA Guidelines for regulatory air modeling (40 CFR 51, Appendix W) and included the following:

- Ambient air quality analyses to evaluate compliance with NAAQS and compare to Class II increments and Significant Impact Levels (SILs);
- O_3 and secondary fine particulate formation analysis;
- Screening visibility and plume blight analysis;
- Screening Hg deposition analysis; and
- Screening nitrogen and sulfur species deposition analysis.

The PTC New Source Review inventory indicates that the SGP would qualify as a minor source for New Source Review applicability (based on IDEQ review and approval). Additionally, an analysis was required to ensure that the new emission sources do not cause or contribute to an exceedance of ambient air standards provided in the NAAQS. The PTC New Source Review emissions are based on a hypothetical maximum possible production mining rate of 180,000 tons/day of ore and development rock. This is higher than the 2021 MMP analysis that proposes a highest realistic annual production of 36.3 million tons, or approximately 99,500 tons per day (Air Sciences 2021a). This is the actual highest total mining rate proposed by Perpetua in the 2021 MMP and is considered to be reasonably foreseeable for the analysis. Lastly, the PTC evaluated numerous scenarios where all 180,000 daily tons were allocated to specific locations throughout the mine. This approach was performed to ensure ease of permitting and not representative of real-world operations.

SILs are defined concentrations of criteria pollutants in the ambient air that are considered inconsequential in comparison to the NAAQS. A project impact shown to be below a SIL can be presumed to not cause or contribute to the violation of a NAAQS.

4.3.2.1 Ambient Air Quality Refined Modeling

The current version at the time of analysis (19191) of the American Meteorological Society/EPA Regulatory Model (AERMOD) dispersion analysis modeling system was used for this air quality analysis. Details of the modeling approach may be found in the Air Quality Specialist Report (Forest Service 2022a).

Modeling of background sources was not warranted for this near-field analysis, because the region is generally rural, and large sources of air emissions are absent. The contribution to air quality conditions from background sources is accounted for in the selected baseline concentrations for the NAAQS analysis. These baseline concentrations were added to the highest modeled off-site concentrations due to the SGP sources, as represented in the PTC New Source Review inventory.

Monitored background or baseline concentrations should reflect the existing air pollutant concentrations in the modeling domain. The total ambient concentrations were estimated by aggregating existing baseline concentrations to the modeled future ambient concentrations resulting from the SGP. Background concentrations for CO, O_3, NO_X, and SO_2 used in the modeling were in accordance with IDEQ recommendations.

The baseline concentrations for particulate species were derived from on-site monitoring data provided by Perpetua, obtained by operation of an IDEQ- approved monitoring program (IDEQ 2015). The pollutant baseline concentrations accepted by IDEQ for the PTC air quality analysis, in units of $\mu g/m^3$, are listed in **Table 4.3-2**.

Table 4.3-2 Background Pollutant Concentrations for IDEQ PTC Air Quality Analysis

Pollutant	Averaging Time	Background Conc. (µg/m^3)	Primary NAAQS[1]
CO	8 hours	1,110	10,000 µg/m^3
CO	1 hour	1,740	40,000 µg/m^3
NO_2	Annual	0.9	100 µg/m^3
NO_2	1 hour	4.3	188 µg/m^3
O_3	8 hours	117.7	137 µg/m^3
PM_{10}	24 hours	37.0	150 µg/m^3
$PM_{2.5}$	Annual	3.5	12 µg/m^3
$PM_{2.5}$	24 hours	15.0	35 µg/m^3
SO_2	1 hour	12.3	196 µg/m^3
SO_2	3 hours	16.8	1300 µg/m^3

Source: Air Sciences 2021a, WSU 2018

[1]NAAQS units are shown to agree with the modeling analysis approved by IDEQ. Gaseous pollutant µg/m^3 to ppb conversion 1 ppb equals: NO_2: 1.88 µg/m^3; SO_2: 2.62 µg/m^3; CO: 1.145 µg/m^3; O_3: 2.0 µg/m^3.

µg/m3 = micrograms per cubic meter. CO = carbon monoxide. NO_2 = Nitrogen dioxide. PM_{10} = particulate matter 10 microns in diameter and smaller. SO_2 = Sulfur dioxide. O_3 = ozone. $PM_{2.5}$ = particulate matter 2.5 microns in diameter and smaller.

AERMOD requires an input of hourly meteorological data to estimate pollutant concentrations in ambient air resulting from modeled source emissions. For this analysis, 1 year (January 1, 2014 to December 31, 2014) of site-specific hourly surface meteorological data collected at the Stibnite monitoring station was used. The methods and procedures used to collect this dataset were reviewed by IDEQ and approved in December 2013 (IDEQ 2013) based on the PSD meteorological data quality requirements specified in the EPA Appendix W Guidelines.

As the SGP is considered a minor source for New Source Review, it is not required to show compliance with the PSD increments as part of its minor New Source Review air permit application unless requested by IDEQ to do so. However, due to its proximity to the FCRNRW area and the Nez Perce Requested Analysis Area, the Class II air quality analysis performed for the 2021 MMP analysis did include an assessment of the significance of SGP air quality impacts by comparison to the Class II PSD increments (Air Sciences 2018b). The near-field modeling performed using the 2021 MMP inventory was used to compare predicted ambient concentrations to the Class II increments at the areas of interest.

The following descriptions of the air impact analyses methods apply to the 2021 MMP impact analyses only. Additional details on the methods and approaches used in the air quality impact analysis can be found in the Air Quality Specialist Report (Forest Service 2022a).

4.3.2.2 Ozone and Secondary $PM_{2.5}$ Analyses

A quantitative evaluation of the impacts of ozone and secondary $PM_{2.5}$ resulting from action alternative sources was performed, applying guidance issued by the EPA (Air Sciences 2018b). These two criteria air pollutants are formed through chemical reactions in the atmosphere, so they are referred to as “secondary pollutants.”

In January 2017, the EPA promulgated an update to its Guideline on Air Quality Models (EPA 2017) in 40 CFR 51, Appendix W (1978), to incorporate a tiered demonstration approach to address the secondary chemical formation of ozone and $PM_{2.5}$ associated with precursor emissions from single sources. The 2017 Guideline on Air Quality Models which outlined a two-tiered approach for addressing single-source ozone and secondary $PM_{2.5}$ impacts was used for the SGP analysis (Forest Service 2022a).

According to the EPA guidance, air quality modeling of hypothetical industrial sources that have similar source characteristics and emission rates of ozone precursors, and which are in similar atmospheric environments, are generally suitable for comparative assessments. To evaluate ozone impacts for the SGP analysis, an assessment was performed based on review of the EPA's Modeled Emission.

The EPA Rates for Precursors guidance document, which includes hypothetical source photochemical grid model (PGM) results was applied for this analysis (EPA 2019d). The PGM is a regional-scale atmospheric model that accounts for ozone-forming reactions and assigns the predicted ozone results as background to hypothetical sources of ozone precursors. This selected PGM source used in this case (number 18 in the PGM source roster) is the geographically closest to the SGP—210 miles (336 km) west-northwest of the SGP—in northeastern Oregon. Ozone impacts reported for the selected hypothetical source at a specified emission level were scaled to reflect the action alternative emission levels to estimate ozone impacts. The calculated estimates for ozone and secondary $PM_{2.5}$ concentration changes were added to the baseline concentrations to determine total estimated SGP ozone impacts for comparison to the NAAQS (Air Sciences 2018b).

4.3.2.3 Plume Visibility Screening Analysis

Plume visibility analysis is a means of quantifying the ability of a viewer to discern a visible plume released from a source and is usually evaluated for an observer at the closest point on the boundary of a Class I or Class II wilderness area of concern. For the SGP plume visibility analysis, the most recent version of the EPA visibility impairment screening model (VISCREEN, version 13190) (EPA 1992) was used to determine if a plume released from the 2021 MMP sources could potentially be visible by a human observer.

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

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

Both daytime and nighttime hours were included in this analysis, although it should be recognized that any plume that occurs at night would not have sunlight to illuminate it.

The VISCREEN modeling treated PM emissions from combustion as soot and PM emissions larger than PM_{10} were added to the model. For details refer to Appendix C of the Air Quality Analysis Addendum ModPro2 memorandum (Air Sciences 2021a).

4.3.2.4 Mercury Deposition Analysis

In the atmosphere, the forms of Hg that contribute to the deposition to land and surface waters are gaseous Hg (Hg^{2+}), particulate-borne Hg (HgP), and gaseous elemental Hg (Hg^0). Further speciation of the particulate forms of Hg is possible such as fine HgP, which is analogous to filterable and condensable PM_{10}. Essentially, the PM_{10} associated with HgP is the mercury bound within the particles of the particulate smaller than 10 microns. Appropriate particle distribution of mercury can be established using proper test methods and techniques, but the overall percentage of HgP compared to total Hg is small, with HgP PM_{10} being even less (~14.1 percent vs 2.4 percent from a coal boiler as an example) (Peng 2021). However, as discussed below, and in further detail in **Section 4.3.4.2**, the approach applied for this analysis did not speciate HgP. The assessment of Hg deposition for the locale of the SGP was conducted using two different tools. EPA computer simulation results based on the Regional Modeling System for Aerosols and Deposition (REMSAD) are available to quantify Hg deposition in each of the lower 48 states (EPA 2008).

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

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

The second analysis tool to assess the contribution to Hg deposition due to the 2021 MMP sources was screening-level dispersion simulation using AERMOD. It is recognized that AERMOD does not simulate the key physical processes affecting Hg in the environment (e.g., chemical transformation, re-emission, wet deposition, etc.) that are included in other models of Hg deposition. However, AERMOD was used in this case as a screening tool, to quantify the potential for increases in deposition of Hg species that could lead to impacts to biota. Complete discussion of the AERMOD method details and calculations are provided in the Air Quality Analysis report (Air Sciences 2018b).

4.3.2.5 Nitrogen and Sulfur Deposition Screening Analysis

To evaluate near-field deposition due to action alternative sources of NOx and SO_2, screening-level modeling was conducted using AERMOD for nitrogen and sulfur species. As in the case of Hg deposition, it is recognized that AERMOD does not include several physical processes involved in chemical deposition (e.g., atmosphere chemical transformation of NO_2 and SO_2) found in traditional acid

deposition models. However, for purposes of this assessment, it served as a screening tool to conservatively identify potential for adverse deposition effects.

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

4.3.3 Far-Field Air Quality Analyses

Another area of air quality impacts was analysis of potential effects in Class I and Class II areas surrounding the SGP area. The Class I areas within 300 km of the Operations Area Boundary are shown in **Figure 3.3-2**. The distances and direction between the proposed SGP and the closest boundary of these Class I areas are listed provided in the SGP Air Quality Specialist Report (Forest Service 2022a). As described below, a less extensive area was defined as the far-field modeling domain, and several Class II wilderness areas were considered along with the selected Class I areas.

The far-field analysis focused on four Class I areas that were among the closest to the SGP, and in different cardinal directions relative to the SGP area: SAWT, Selway-Bitterroot Wilderness (SELW), HECA, and CRMO. The adopted approach was to discern if potential impacts above thresholds were predicted in these areas. Assessment of impacts in these closer Class I areas are conservatively representative of impacts in the areas not included in the model.

Four Class II wilderness areas also were included in the far-field analysis: FCRNRW, GOSPEL, HEMBLD, and WHTCLD. The FCRNRW area is a large wilderness adjacent to the Operations Area Boundary that extends well beyond 50 km from this boundary. For purposes of the far-field analysis, only the portion of the FCRNRW that lies beyond 50 km was considered in far- field modeling. The Nez Perce Requested Analysis Area also was included in the far-field analysis of visibility effects and chemical deposition impacts. The locations of these Class II areas of concern within the modeling domain are illustrated in **Figure 3.3-2**.

4.3.3.1 Modeling Methodology for Far-Field Analyses

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

Additional details of the meteorological data assessment procedures for operation of CALPUFF are presented in the Air Quality Analysis report (Air Sciences 2018b).

Sources from the near-field AERMOD modeling files were used to build the CALPUFF inputs, with some significant differences. For point sources having exhaust at ambient air temperature (e.g., dust control baghouses), the CALPUFF model differs from AERMOD, because it sets a constant release temperature approximating ambient air temperature (293.15 degrees Kelvin). In AERMOD, the mine pit sources were modeled as rectangular volume sources (OPENPIT routine), with individual lateral

dimensions and release heights for each pit used to calculate initial vertical dispersion parameters. In CALPUFF, the pit sources were modeled as square area sources located with a release height at the top of the pit opening, with the pit located from the AERMOD lateral dimensions. The primary SGP plant access road (Burntlog) was modeled in AERMOD using several defined "line" sources. In CALPUFF, this access road was modeled as a set of widely spaced "volume" sources (Air Sciences 2018a).

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

4.3.3.2 Far-Field Regional Haze Assessment Procedures

For the far-field assessments of regional haze impacts, the MESOPUFF II five-pollutant (nitric acid [HNO_3], NO_x, NO_3, SO_2, and SO_4) conversion algorithm was applied in CALPUFF to simulate atmospheric chemistry effects and contribution to regional haze. Action alternative source emissions were set at the LOM 7 of the DEIS Alternative 2 maximum daily 24-hour emissions of NO_X, SO_2, SO_4, and fine and coarse PM. Additional details of the CALPUFF processing and post-processing methods are presented in the far-field modeling protocol and the Air Quality Analysis report (Air Sciences 2018a, 2018b). Note that Far-Field modeling was not completed a second time, rather a validation comparison was performed to demonstrate no significant changes to impact concentrations resulted between the DEIS and 2021 MMP. For further details refer to **Section 4.3.4.2 Far-Field Analysis**.

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

4.3.3.3 Far-Field Comparisons with Class I and Class II Increments

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

It should be noted that this modeling was based on the 2020 DEIS Alternative 2 inventory that includes the on-site generation of lime. This inventory was shown to have somewhat higher overall criteria pollutant emissions, generally due to the added combustion emissions of the lime kiln. Therefore, it was considered conservative to perform this increment comparison for the action alternative with the higher quantified emissions. This Alternative 2 inventory includes fugitive tailpipe emissions from vehicles

operating at the SGP, in common with other non-regulatory modeling analyses such as the regional haze contributions and deposition screening modeling.

4.3.3.4 Far-Field Deposition Assessments

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

4.3.4 Direct and Indirect Effects

4.3.4.1 No Action Alternative

In the No Action Alternative, there would be no surface (open-pit) mining or ore processing to extract gold, silver, and antimony, as described for the action alternatives. Therefore, the air emissions described for the 2021 MMP or similar emissions for other action alternatives, would not occur. Perpetua may continue to implement surface exploration and associated activities that have been previously approved on NFS lands as stated in the Golden Meadows EA (Forest Service 2015c). Air emissions and related minor impacts for these activities, which are much lower than emissions under the action alternatives, would continue. These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads) and drilling on both NFS and private lands at and in the vicinity of the SGP. Construction of these facilities in the future would result in temporary air quality effects due to earthmoving and equipment tailpipe emissions, which are described in the Golden Meadows Exploration Project EA (Golden Meadows EA) (Forest Service 2015c).

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

In January 2021 Perpetua entered into an ASAOC with the Forest Service and EPA 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 East Fork SFSR 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 temporary air quality effects related to the earthmoving and tailpipe emissions from the construction equipment and vehicles used to access the site. This work is planned to occur between 2022 and 2024.

If none of the action alternatives proceed, the current uses by Perpetua and other users on patented mine/mill site claims and on the PNF and BNF would continue to follow all existing applicable air quality regulations. Uses of NFS lands that may result in air pollutant emissions include mineral exploration, dispersed OHV use, snowmobiling, and other forms of recreation.

4.3.4.2 2021 MMP

Construction and Operations Description

The construction of the 2021 MMP includes building power transmission, access roads, and mining/processing facilities. These operations are to be performed during LOM 1 through LOM 3. Operations would begin in LOM 4 through LOM 18. Access road construction would consist of development of the Burntlog Route for mine access and minor improvements for the Johnson Creek route. Also, while the Burntlog Route is being developed, a temporary groomed OSV trail would be constructed on the west side of Johnson Creek from Trout Creek to Landmark for public access. Other public access construction would be a Cabin Creek Road groomed OSV trail. Eight borrow sources along the Burntlog Route would also be constructed.

During operations, public access through the site would be provided by constructing a new road around the Yellow Pine pit and below the mine haul road to link Stibnite Road to Thunder Mountain Road. Public access would also be allowed on the Burntlog Route.

Lastly, operations would include communication towers and an offsite logistics and road maintenance facilities. A cell tower would be located north of the Hangar Flats pit with very high frequency repeater sites. There would also be a communication site at the SGLF with upgrades to the existing site. The Burntlog road maintenance facility would be located approximately 4.4 miles east of the junction of Johnson Creek Road and Warm Lake Road along the proposed Burntlog Route.

Construction and Operations Air Emissions Inventory

Air pollutant emissions were initially estimated for activities and process sources included in the 2021 MMP for each LOM year. The LOM years presented in this discussion are based on years starting with LOM 1 as the first year of construction. LOM 6 is expected to produce the highest overall annual total of criteria pollutant emissions.

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

In the air emissions inventory, mining and ore processing operations are assumed to be capable of continually operating 365 days per year, so annual emissions, and ambient air and visibility impacts, were derived for that schedule. Most of the construction activities also are assumed to occur at a consistent rate for 355 days per year. Consideration of these schedules allowed emissions to be estimated on a daily-average and hourly bases for modeling purposes. This assumed schedule may produce an overprediction as weather conditions would affect the construction schedule and would suggest higher daily activity during the months of May through November, and higher short-term emission rates at these times. Details regarding the emission source roster, operating assumptions, and resulting emissions estimates are provided in Appendix A of the Air Quality Specialist Report (Forest Service 2022a).

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

Control measures for air pollutant emissions are incorporated at each step of the mining and processing operations. Air pollution control measures that were proposed by Perpetua are common to both action alternatives. For the 2021 MMP, emission control devices and designs would be put in place to abate emissions of particulate matter, Hg, and criteria pollutant emissions from internal combustion engines. Assessments of near-field and far-field impacts take these measures into consideration by applying emission factors based on data that include emission controls in compiling the SGP inventory. For off-highway truck travel, the efficiency of dust suppressants was based on vendor information (Air Sciences 2018c).

Tailpipe emissions for off-highway diesel engines included in the SGP are controlled by use of engines that meet Tier IV or better EPA performance standards (e.g., stationary internal combustion new source performance standards, 40 CFR 60, Subparts IIII and JJJJ). Roadway dust and tailpipe emissions from vehicle travel on Burntlog Route from the SGP to Landmark also were calculated for both construction and operation periods. The traffic emissions included projected workforce, supply, and haulage vehicles (buses, light, and heavy trucks) and road maintenance equipment (graders and dozers).

Perpetua would design, construct, and operate SGP facilities with air pollution controls stipulated in applicable regulations and the air quality permit issued by IDEQ. The Idaho PTC, issued June 17, 2022, includes stipulations that are based on applicable state and federal regulations, and that are consistent with best available control technology for new surface mining and processing operations. Details on the control measures and estimated control effectiveness for the action alternatives, including additional measures that would be stipulated by the Forest Service, are provided in **Section 2.4.9** and the SGP Air Quality Specialist Report (Forest Service 2022a). Specific examples include:

- Adherence to a fugitive dust control plan, containing standard operating procedures for dust control, surveillance, record-keeping, and reporting as may be required under best operating practices and/or conditions of air permits under IDEQ.

- The main ore processing facility building, and coarse ore stockpile would be enclosed.
- Water sprays and dust collection systems for ore processing facility material handling activities would be installed.
- Water sprays and/or bag house dust collectors would be installed at the ore-crushing system and at ore reclaim feeders that deliver ore to the grinding circuit.
- Hg emission controls, including particulate filters and carbon adsorption filters, would treat exhaust from the precipitate retort, autoclaves, carbon regeneration kiln, and induction furnaces.
- Internal combustion engines used for the construction and operational phases (diesel- or gasoline-powered) would be maintained in a manner that would promote fuel-efficient operation, and thereby reduce tailpipe emissions.
- Off-highway diesel engines would be rated for EPA Tier IV or better emission performance; operated in compliance with federal air quality applicable to internal combustion engines (e.g.,40 CFR 60, Subparts IIII and JJJJ); and would observe limitations required by IDEQ air quality rules.
- Ultra-low sulfur diesel fuel would be used for mobile sources and stationary diesel engines, to comply with state regulations.

Figure 4.3-1 presents the annual emissions inventory used in the 2021 MMP air analyses for the criteria pollutants for each LOM construction and operation year as derived from the maximum operating schedule for each type of operation. The construction emissions occur primarily in the pre-production year years (LOM 1 through LOM 3 [Mine Year -3 through -1 on **Figure 2.4-3**]), the mining emissions and ore processing emissions occur from LOM 4 through LOM 18 (Mine Year 1 through 15). Emissions from certain mine construction components that continue during the mine operation years are included with the applicable LOM year mining emissions. Note that the maximum potential ore processing emissions would not vary over the life of the mine. This is because ore processing emissions were calculated conservatively based on constant operation at the maximum daily ore production rate of 25,000 tpd, regardless of actual yearly ore production rates each day of the year. The maximum emission rate LOM 6 shown in **Figure 4.3-1** was selected as the emission inventory basis for detailed 2021 MMP assessment. Note that NAAQS compliance dispersion was conducted for all criteria pollutant for both LOM 6 and LOM 10 (Mine Year 3 and 7, respectively). A separate full New Source Review regulatory assessment was completed for the IDEQ PTC process and will not be discussed in this report (refer to the State of Idaho Statement of Basis on the IDEQ website for details).

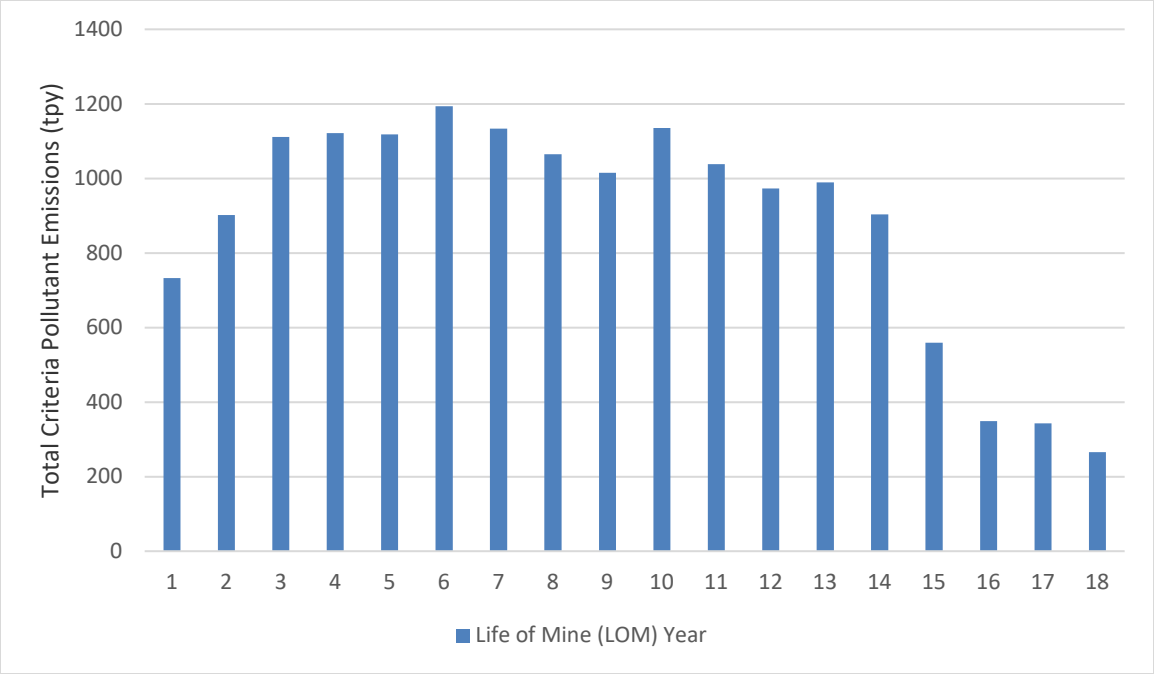


Figure 4.3-1 Timeline of Maximum Annual Emissions by Life-of-Mine Year

Figure Source: Total Controlled Emissions Data from Air Sciences 2021a.
LOM Years shown on the figure use the timeline proposed for the SGP. Perpetua timelines presented in the 2021 MMP (Perpetua 2021a) start with Mine Years -3 through -1 being construction phase (**Figure 2.4-3**), which equate to LOM Years 1 through 3 in this timeline.

The maximum annual pollutant emissions for the 2021 MMP analyses for each LOM year are further detailed in **Table 4.3-3**. The highest aggregated controlled criteria pollutant annual emissions (including fugitives) would be approximately 1,260 tons per year (tpy) and are predicted to occur in LOM 6 (Mine Year 3 on **Figure 2.4-3**), which would be the highest ore production year (289.7 PM_{10}, 65.9 $PM_{2.5}$, 535.4 CO, 335.3 NO_x, 7.3 SO_2 and 26.1 VOC). The variation in annual emissions reflects the progression in levels of mining activity in different open pits, and differing levels of haul road transport for the pits during their development (Air Sciences 2018a).

Table 4.3-3 Maximum Controlled Criteria Pollutant Emissions Summary by LOM Year

LOM Year [1, 2]	TSP (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	CO (tpy)	NO_X (tpy)	SO_2 (tpy)	VOC (tpy)	Total Criteria Emissions[3] (tpy)
1	208.0	61.7	14.7	461.7	156.2	0.8	52.3	732.5
2	302.3	92.2	24.3	531.3	220.8	0.9	56.8	902.0
3	544.0	145.6	28.5	641.2	272.1	1.1	50.9	1,110.9
4	923.1	268.8	63.9	495.6	323.7	7.3	26.5	1,121.8
5	922.8	270.4	64.7	491.3	323.0	7.3	26.3	1,118.3
6 [4]	995.3	289.7	65.9	535.4	335.3	7.3	26.1	1,193.8
7	904.7	267.7	63.3	506.3	326.1	7.3	26.0	1,133.4

LOM Year [1, 2]	TSP (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	CO (tpy)	NO_X (tpy)	SO_2 (tpy)	VOC (tpy)	Total Criteria Emissions[3] (tpy)
8	834.7	249.9	62.1	480.1	301.9	7.2	26.0	1,065.1
9	871.5	255.3	62.6	459.2	268.7	7.2	25.0	1,015.3
10	1,130.6	320.1	69.1	478.6	304.6	7.2	24.9	1,135.4
11	848.3	250.9	61.5	473.2	282.7	7.2	24.2	1,038.1
12	744.7	224.3	58.2	460.1	258.3	7.1	23.1	972.9
13	749.9	225.8	59.1	471.0	262.5	7.1	23.4	989.8
14	796.7	237.3	60.4	392.8	245.3	7.1	20.8	903.3
15	491.4	159.1	51.0	239.0	139.2	6.9	15.2	559.4
16	346.8	119.9	46.5	122.6	88.0	6.7	12.2	349.4
17	370.7	126.3	46.4	107.5	91.4	6.7	11.3	343.2
18	271.0	101.5	43.2	83.7	63.7	6.6	9.9	265.4

Source: Air Sciences 2021a

[1] The LOM Years presented on the table represent LOM Years as numbered in this EIS. Perpetua's ModPro2 (Perpetua 2021a) portrays the pre-operation years as negative numbers, so Mine Years are numbered as -3, -2, -1, 1 through 15 (**Figure 2.4-3**).

[2] LOM 1 through 3 (Mine Years -3 through -1) represent construction and pre-production period. Mining and processing operations are fully active in LOM 4 (Mine Year 1).

[3] Total 2021 MMP emissions are the sum of PM_{10}, CO, NO_X, SO_2, and VOC emission rates. $PM_{2.5}$ is a portion or subset of PM_{10}. Total suspended particulate is not a criteria pollutant per the EPA and is more of a nuisance pollutant.

[4] The highest overall annual emissions would occur in LOM 6 (Mine Year 3), which corresponds to the year of highest predicted annual mine output.

The predicted annual emissions summaries by source category for each criteria pollutant are provided in **Table 4.3-4**. It should be recognized that the stationary sources represented by the process and auxiliary category are the sources used to determine the applicability of Title V and PSD major source permitting status (mobile sources are excluded from the applicability analysis). As shown in **Table 4.3-4**, these emissions are less than the annual threshold of 100 tpy that would trigger Title V or 250 tpy for PSD permitting status. Emissions of particulate matter (total suspended particulate, PM_{10}, and $PM_{2.5}$ from fugitive sources represent the largest contributor to overall emissions. The operation of off-highway trucks and fuel-combusting equipment would constitute the largest sources of CO and NO_x. Due to the low sulfur content of liquid fuels that would be used for the equipment at the SGP, and the more stringent federal emission standards for the recent model-year diesel engines, the emissions of SO_2 and VOC are relatively low.

Dust and tailpipe emissions due to the travel of off-highway trucks and other vehicles were accounted for in the dispersion modeling within the SGP Operations Area Boundary, in the mined pits, and along the Burntlog Route from the SGP. As listed in **Table 4.3-4**, these emissions were based on the access road and mine road configuration proposed in the 2021 MMP. The estimated operations phase emissions for SGP vehicle travel along Warm Lake Road (CR 10-579) from Landmark to Cascade also are included.

The level of traffic and related vehicle emissions impacts beyond the town of Cascade, such as the transportation of supplies and personnel to the SGP or the shipping of antimony concentrate from the SGP, are not sufficiently predictable to be quantified. Nor is that potential operation unique to the SGP.

The vehicles involved in this off-site transportation activity have separate utility only related to the SGP and are operating in relatively large areas where any potential emissions are relatively small compared to the baseline conditions. Based on current estimates, transport of concentrate would require two truck trips per day, so the contribution to SGP emissions would be minimal (~2.9 percent or 2 of 68 AADT during mine operation traffic). However, for informational purposes, emission factors per mile of travel for fully-loaded heavy transport trucks are provided in the Air Quality Analysis report for the 2021 MMP emission inventory (Air Sciences 2021a).

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

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

Table 4.3-4 Maximum Annual Criteria Pollutant Emissions Summary – LOM 6

Source Category	CO (tpy)	NO_X (tpy)	TSP (tpy)	PM_{10} (tpy)	$PM_{2.5}$ (tpy)	SO_2 (tpy)	VOC (tpy)
Processing & Refining	30.6	38.0	86.7	55.8	35.9	6.5	5.3
Mining Pit/Tailings Activity[1]	157.0	107.7	51.9	13.0	6.2	0.3	8.8
Blasting[2]	240.1	6.5	20.6	10.7	0.6	0.01	--
Stockpiles[3]	--	--	0.6	0.3	0.04	--	--
Process Area	5.7	4.3	0.3	0.2	0.1	0.01	0.3
Hauling	96.7	173.8	721.9	180.7	20.0	0.5	11.1
Access Roads/Heliport	5.3	4.9	113.2	29.1	3.1	0.02	0.6
Mining Activity Total (does not include Processing/Refining)	504.9	297.2	908.6	233.9	30.0	0.8	20.8
Total (Mining, Processing and Refining)[4]	535.4	335.3	995.3	289.7	65.9	7.3	26.1

Source: Air Sciences 2021a
[1] Mining pits include: the Yellow Pine, Hangar Flats and the West End pits. The Tailings include Bradley Tailings and the TSF.
[2] Blasting emissions are the aggregate total from the three pits mentioned above.
[3] Emissions are the aggregate total from the Hangar Flats and Limestone stockpiles.
[4] Mobile sources and fugitive sources are included in the total emissions. Mobile sources are not included in the permit applicability and fugitive emissions are not considered unless the project is one of 27 PSD list Source Categories. SGP is not a PSD listed source category.

The annual HAP and toxic pollutant emissions for LOM 6 are listed in **Table 4.3-5**, with Hg reported in pounds per year, and the other toxics in tpy. Details regarding the HAP and air toxics operating assumptions, and resulting emissions estimates for the 2021 MMP, are provided in Appendix A of Forest

Service (2022a). Additionally, facility-wide dispersion modeling was conducted for all HAPs and compared to the IDEQ AAC/AACC as defined in IDAPA 58.01.01.585/586.

Regarding HCN emissions from gold mines, the EPA has examined U.S. gold ore processing and production facilities and concluded that measurements of HCN concentrations at these gold facilities "showed ambient concentrations below levels of public health and environmental concerns" (EPA 2010a). The HCN emissions factors were derived from the final report from a 2009 fugitive HCN report from three Nevada gold mines (Cortez, Gold Quarry and Rocky Mountain). For further detail, see Appendix A of the Air Quality Specialist Report (Forest Service 2022a) and EPA 2010b. This group of existing facilities reported HCN emission rates ranging from 0.2 to 8.8 tpy, with an average of 3.8 tpy (EPA 2010a). Therefore, the SGP estimates (1.9 tpy) are approximately one half the average rate as determined by the study.

Hg is introduced to the ore processing system through the Hg content of the ore itself. Evaluation of potential Hg emission impacts was conducted, in part, to verify that emissions would comply with the EPA Hg emission standards provided in 40 CFR 63, Subpart EEEEEEE, for gold ore processing and production facilities. The SGP would be subject to these federal standards using a carbon-in-pulp process for capturing gold that has been extracted from the crushed ore using dilute NaCN solutions and use of a retort for purifying the gold-laden precipitate from electrowinning. The projected Hg emissions from the gold ore processing sources would be controlled. Control of the autoclave includes the uses of a venturi scrubber, vent gas cleaning tower, vent gas stream condensing tower and at least one sulfur-impregnated activated carbon filter.

The retort emissions are based on an average of two refinery reports in 2015/2016 (NDEP 2015, 2016). The corresponding calculations are 20 percent of the retort standard of 0.8 lb/ton. The emissions released from gold-refining processes are controlled as listed below to mitigate particulate and gaseous Hg emissions. These process exhaust control technologies are accounted for in the maximum emissions estimates in **Table 4.3-5**:

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

Table 4.3-5 Maximum Annual HAP and Air Toxics Emissions Summary

Source Category	HCN (tpy)	H_2SO_4 (tpy)	As (tpy)	HAP (tpy)	Hg (lbs/yr)
Process and Auxiliary	1.9	8.9	0.02	4.7	5.8
Mining fugitive	0.0	0.0	0.4	4.0	7.8
Total	1.9	8.9	0.4	8.7	13.6

Near-Field Analysis NAAQS

Assessment of conformance to the NAAQS is based on the highest receptor concentration in the modeling domain for the pollutants and averaging times corresponding to the standards. The modeled maximum concentration at each receptor is added to the selected background concentrations that represent current

existing conditions. If the results from this computation are below the NAAQS, then impacts at other locations in the domain would be below the NAAQS as well.

For NAAQS modeling inputs, the highest emissions of each pollutant during any LOM year were determined and provided in **Table 4.3-6**. For the 2021 MMP, the highest criteria pollutant emissions occur during two different years, LOM 6 (CO, NO_X, and SO_2) and LOM 10 ($PM_{2.5}$ and PM_{10}). Therefore, to capture the highest modeled concentration for each pollutant, separate modeling was performed for LOM 6 and 10 (i.e., two models). Note that VOC emission maximums from LOM 3 were not modeled because there is no specific NAAQS for these emissions, however VOCs are addressed as part of the secondary $PM_{2.5}$ analysis.

Table 4.3-6 LOM Years for Pollutant-Specific Maximum Annual Emissions

Pollutant	LOM Year	SGP Total Annual Emissions (tpy)
CO	6	535.5
NO_2	6	335.2
PM_{10}	10	320.1
$PM_{2.5}$	10	69.2
SO_2	6	7.3
VOC	3	27.4
HAPs	10	8.5
Hg	10	13.3 (lb/yr)

The 2021 MMP would include a 12-foot wide gravel road to provide public access from Stibnite Road (FR 50412) to Thunder Mountain Road (FR 50375) through the SGP. Perpetua received a final PTC from IDEQ on June 17, 2022. This application proposed to exclude the public road on the basis of restricted access and maintaining full control, and that people traveling on the road would be considered "guests of the mine." IDEQ accepted the private road concept proposed by Perpetua (see PTC Condition 2.7, Response to Comments #16 and Statement of Basis on the IDEQ website) and in response to comments on February 18, 2021, also states that the roadway between Stibnite Road at Sugar Creek and Thunder Mountain Road at Meadow Creek was appropriately excluded from ambient air. Additionally, the EPA Region X has indicated that the access road could possibly be excluded from ambient air if sufficient enforceable measures are taken to comply with the 2019 revised policy (EPA 2019a). To comply with this measure, Perpetua has developed a transportation management plan and is included as Appendix D of the Air Quality Specialist Report (Forest Service 2022a).

The AERMOD dispersion modeling results for the 2021 MMP analysis emissions and comparison with the applicable NAAQS are provided in **Table 4.3-7**. The geographic location of the maximum impacts amongst the criteria pollutants and averaging periods between LOM 6 and 10 are provided in Figure 4 of the Air Quality Analysis Addendum ModPro2 (Air Sciences 2021a). The results demonstrate compliance with all NAAQS and would be considered to have a moderate impact locally and minor impact regionally. Additionally, **Table 4.3-8** provides geographic locations of the NAAQS maximums.

Table 4.3-7 Near-Field NAAQS Compliance Demonstration

Pollutant	Averaging Time	Maximum Modeled Conc. (µg/m³)	Background Conc.[3] (µg/m³)	Total Impact Conc. (µg/m³)	NAAQS (µg/m³)	NAAQS Compliance
CO	8 hours	404.6	1,110	1,515	10,000	Yes
CO	1 hour	495.5	1,740	2,236	40,000	Yes
Lead	3-month rolling	Not Required[1]	Not Required[1]	Not Required[1]	Not Required[1]	Not Required[1]
NO_2	Annual	19.8	0.9	20.7	100	Yes
NO_2	1 hour	129.8	4.3	134.1	188	Yes
O_3	8 hours	3.0	117.7	120.7	137	Yes
PM_{10}	24 hours	15	37.0	51.9	150	Yes
$PM_{2.5}$ [2]	Annual	1.1	3.5	4.6	12	Yes
$PM_{2.5}$ [2]	24 hours	2.7	15.0	17.7	35	Yes
SO_2	1 hour	3.0	12.3	15.3	196	Yes
SO_2	3 hours	1.8	16.8	18.6	1,300	Yes

[1] Lead modeling is not required per IDEQ as the facility-wide emissions are less than 10 percent of the lead significant emission rate of 0.6 tpy and considered "Below Regulatory Concern".
[2] Includes the secondary impacts.
[3] All background concentrations are derived from the NW Airquest data (WSU 2018).

Table 4.3-8 Near Field NAAQS Maximum Geographic Locations

Pollutant	Averaging Time	Easting (m)	Northing (m)	Distance to Boundary (miles)	Nearest Boundary Direction
CO	8 hours	634,478.09	4,972,209.38	0	East Boundary
CO	1 hour	634,493.79	4,972,189.94	0	East Boundary
NO_2	Annual	635,049.52	4,977,883.80	0.62	Northeast
NO_2	1 hour	635,124.52	4,977,758.80	0.59	Northeast
PM_{10}	24 hours	632,174.39	4,969,258.68	0	South Boundary
$PM_{2.5}$	Annual	634,999.52	4,978,033.81	0.60	Northeast
$PM_{2.5}$	24 hours	634,999.52	4,978,033.81	0.60	Northeast
SO_2	1 hour	635,199.52	4,977,533.80	0.56	East
SO_2	3 hours	634,999.52	4,975,933.79	0.56	East

Comparison of Maximum Pollutant Impacts with PSD Class II Increments

The results in **Table 4.3-9** based on the 2021 MMP maximum annual inventory show the near-field maximum modeled ambient concentrations The geographic location of the maximum impacts amongst the criteria pollutants and averaging periods between LOM 6 and 10 are provided in Figure 3 of the Air Quality Analysis Addendum ModPro2 (Air Sciences 2021a).

Given there are no substantial existing minor or major sources in the immediate vicinity of the SGP, it is viewed as unlikely that significant consumption of the PSD increment occurs in this area. Due to the relatively low maximum concentrations from near-field modeling for SGP, which are well below the PSD

increment for all pollutants, it also is unlikely the SGP would cause or contribute to a violation of a PSD increment. The impact would be considered minor to Class II PSD areas as the project is well below the significance levels for all pollutants and averaging periods.

Table 4.3-9 Near Field Class II PSD Increment Comparison

Pollutant	Averaging Time [1]	Maximum Conc. (µg/m³)	Maximum Allowable Increase (µg/m³)	PSD Increment Compliance
NO_2	Annual	19.8	25	Yes
PM_{10}	Annual	6.5	17	Yes
PM_{10}	24 hours	14.9	30	Yes
$PM_{2.5}$[2]	Annual	1.1	4	Yes
$PM_{2.5}$[2]	24 hours	3.3	9	Yes
SO_2	Annual	0.2	20	Yes
SO_2	3 hours	1.8	512	Yes
SO_2	24 hours	0.7	91	Yes

Source: Air Sciences 2021a; EPA 2018c

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

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

Hazardous Air Pollutant Modeling

A supplemental air quality dispersion modeling analysis was conducted based on federally regulated HAP emissions associated with the 2021 MMP. The analysis consisted of several metal HAPs which were: antimony, arsenic, beryllium, cadmium, chromium, cobalt, manganese, nickel, and selenium from all potential emitting sources at SGP. The main source of metals emissions was from dust produced in mining and hauling/handling ore and development rock. The metals were present in this dust in natural mineral forms. Note that lead and mercury were not assessed in this modeling exercise because lead emissions are considered less than significant (see **Table 4.3-7**). Mercury is discussed in the Deposition Screening section below and other resource report (Air Sciences 2018a and 2021a).

The highest LOM emissions in terms of tons/yr were evaluated to establish the status of SGP from a HAP perspective, which was determined to be LOM 10. **Table 4.3-10** illustrates all HAP emissions from LOM 10. The only federal requirement pertaining to HAPs is to determine whether the facility would be categorized as a Major or Area source facility for HAPs. If a source is less than 10 tpy of any single HAP and less than 25 tpy of all HAPs in aggregate, the facility is considered to be an Area Source. Based on the information provided in **Table 4.3-10**, SGP is an Area Source or a minor source for HAPs. IDEQ developed a toxics air pollutant program in the early 1990's. The program is based upon health and risk standards that would apply to potential new sources and implemented with appropriate ambient levels. In addition to ambient levels, it was decided to incorporate a stack-based emission levels at or below which it could be reasonably expected that the ambient standard would not be exceeded. The reason the stack-based levels were incorporated was that often stack emissions are easier to calculate than it is to model for ambient concentrations (IDEQ 2001).

Table 4.3-10 Highest HAP Annual Emissions LOM 10

Pollutant	Emissions (tons/yr)
1,3-Butadiene	0.005
Acetaldehyde	0.107
Acrolein	0.014
Antimony	0.017
Arsenic	0.394
Benzene	0.403
Beryllium	0.004
Biphenyl	0.0002
Cadmium	0.003
Carbon Disulfide	0.063
Chromium	0.020
Cobalt	0.005
Cyanide	1.988
Dichlorobenzene	0.000
Formaldehyde	0.193
Hexane	0.503
Hydrogen Chloride	3.666
Lead	0.009
Manganese	0.217
Mercury	0.007
Naphthalene	0.009
Nickel	0.005
Phenol	0.001
Phosphorus	0.424
POM[1]	0.090
Selenium	0.002
Toluene	0.283
Xylene	0.237
Total	8.668

Source: Air Sciences 2021b
POM = polycyclic organic matter; emissions include polycyclic aromatic hydrocarbons.

The Acceptable Ambient Concentration (AAC) 24-hour average values for non-carcinogenic HAPs were based on the American Conference of Government Industrial Hygienists (ACGIH) threshold limit values (TLV). IDEQ equates the ACC to the Occupational Exposure Limit (OEL) divided by 20. For Acceptable Ambient Concentration for Carcinogenic HAPs (AACC) the unit Risk Factors (URF) from EPA (IRIS) was used and set them equal to a risk level of a one in a million (IDEQ 2001). The AACC values are annual averages.

Note that only those HAP pollutants identified at the beginning of this section were modeled because they were the only pollutants that exceeded the State of Idaho screening Emissions Levels as defined by IDAPA 58.01.01.585/586. All other HAPs did not exceed the screening level and were therefore deemed to meet state permitting requirements without further evaluation. It should be noted that the state regulations were applied for the analysis because no federal standards applied. **Table 4.3-11** identifies the State of Idaho AAC/AACC as defined by the IDAPA rules referenced above. All mining years from LOM Year 3 through LOM Year 18 were modeled as discussed below.

AERMOD Modeling was conducted for the HAPs in identical fashion to the 2021 MMP NAAQS modeling (Air Sciences 2021a and 2021b). For further detail refer to the Supplemental HAP Air Quality Analysis Addendum – ModPro2 (Air Sciences 2021b).

Table 4.3-11 Idaho AAC/AACC for HAPs

CAS #	Pollutant	Carcinogenic[1]	Averaging Time	AAC/AACC (µg/m^3)
7440-36-0	Antimony	No	24 hours	25
7440-38-2	Arsenic	Yes	Annual	0.00023
7440-41-7	Beryllium	Yes	Annual	0.0042
7440-43-9	Cadmium	Yes	Annual	0.00056
7440-47-3	Chromium	No	24 hours	25
7440-48-4	Cobalt	No	24 hours	2.5
7439-96-5	Manganese	No	24 hours	250
7440-02-0	Nickel	Yes	Annual	0.042
7782-49-2	Selenium	No	24 hours	10

Source: Air Sciences 2021b
Carcinogenic pollutants are averaged annually; non-carcinogenic pollutants are averaged daily (24-hrs). Both emissions rates applied to the model are lb/hr or g/s averages based on the applicable timeframe 24-hr or annually.

The potential ambient concentration was calculated at each receptor for LOM 3–18. The estimated total concentrations were then compared with the Idaho AACs. For each acute HAP with a 24-hour averaging time (AAC), the highest modeled concentration (HMC) across all modeled receptors and modeling scenarios was compared with the applicable AAC, provided in **Table 4.3-12**.

Table 4.3-12 AAC HAP Modeling Results

CAS #	Pollutant	Averaging Time	AAC (µg/m^3)	HMC[1] (µg/m^3)	HMC < AAC
7440-36-0	Antimony	24 hours	25	0.0002	Yes
7440-47-3	Chromium	24 hours	25	0.0004	Yes
7440-48-4	Cobalt	24 hours	2.5	0.0001	Yes
7439-96-5	Manganese	24 hours	250	0.0103	Yes
7782-49-2	Selenium	24 hours	10	0.00004	Yes

Source: Air Sciences 2021b
[1] HMC = highest modeled concentration amongst all mining years

Table 4.3-12 shows that the highest modeled 24-hour concentrations for the HAPs are less than the applicable acute AACs. The location of the maximum 24-hour modeled concentration for each acute HAP is shown in Figure 2 of the Supplemental HAP Air Quality Analysis Addendum – ModPro2 (Air Sciences 2021b).

The annual AACC values are based on IDAPA 58.01.01.586 and were developed "based on the probability of developing excess cancers over a seventy (70) year lifetime exposure to one µg/m^3 of a given carcinogen and expressed in terms of a screening level or an acceptable ambient concentration for a carcinogenic toxic air pollutant."

Each modeled HAP with an AACC was evaluated in the 2021 MMP analysis for a HMC 70-yr lifetime exposure, calculated as follows, on a receptor-by-receptor basis:

$$70\ yr\ exposure\ \frac{\mu g}{m^3} = \frac{\sum LOM\ Yrs\ 3\ to\ 16\ annual\ conc\ \frac{\mu g}{m^3}}{70(yrs, exposure)}$$

The highest estimated 70-year lifetime exposure across all receptors was then compared with the AACC for each HAP modeled for the annual averaging time, as shown in **Table 4.3-13**.

Table 4.3-13 AACC HAP Modeling Results

CAS #	Pollutant	Averaging Time	AACC (µg/m^3)	HMC[1] (µg/m^3)	HMC < AACC
7440-38-2	Arsenic	Annual	0.00023	0.00015	Yes
7440-41-7	Beryllium	Annual	0.0042	0.00001	Yes
7440-43-9	Cadmium	Annual	0.00056	0.000003	Yes
7440-02-0	Nickel	Annual	0.042	0.00001	Yes

Source: Air Sciences 2021b
[1] HMC = highest 70-yr exposure concentration amongst all mining years

Table 4.3-13 shows that the estimated highest 70-year lifetime exposure concentrations are less than AACCs. The location of the 70-year lifetime exposure concentration for each chronic HAP is shown in Figure 3 of the Supplemental HAP Air Quality Analysis Addendum – ModPro2 (Air Sciences 2021b). The results illustrate that the overall impact from the associated HAPs would be moderate, but well below the IDEQ permitting thresholds.

Ozone and Secondary $PM_{2.5}$ Impact Assessment

To evaluate ozone impacts from VOC and NO_X precursor emissions, an assessment was performed based on the SGP 2021 MMP emissions inventory for LOM 6, the year of highest projected mine production. For that inventory, the facility-wide potential ozone precursor emissions were estimated in that inventory to be 335 tpy of NO_X and 26.1 tpy of VOCs. This assessment included SGP mobile source tailpipe emissions. Additional discussion regarding the ozone and secondary $PM_{2.5}$ analysis is provided in the Air Quality Analysis report (Air Sciences 2021a).

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

On this basis, the corresponding ozone impact due to the 2021 MMP sources was estimated by linearly scaling the source number 18 ozone impact by the relative precursor emission rates of the PGM source and the 2021 MMP. The result is provided in **Table 4.3-14**. This table also shows the baseline ozone concentration and the estimated total concentration for the highest modeled receptor. This analysis shows that the maximum modeled contribution to ozone levels is a small fraction of the existing baseline conditions. The overall project ozone impact is considered negligible relative to the baseline.

Table 4.3-14 Maximum 8-hour Ozone Impact

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

Source: Air Sciences 2021a
ppb = parts per billion air concentration.
µg/m^3 = micrograms per cubic meter.

To evaluate secondary $PM_{2.5}$ impacts resulting from emissions of secondary $PM_{2.5}$ precursor emissions, an assessment was performed based on the 2021 MMP emissions inventory. For this inventory, the maximum facility-wide potential emissions of secondary $PM_{2.5}$ precursor emissions would be 335 tpy of NO_X and 7.3 tpy of SO_2. This assessment used the same EPA- modeled hypothetical industrial source (number 18 in northern Oregon) for $PM_{2.5}$ precursor emissions and corresponding $PM_{2.5}$ maximum impacts.

Results of the analysis of primary and secondary $PM_{2.5}$ impacts are shown in **Table 4.3-15**. The PGM industrial source results provided both the primary (as emitted) $PM_{2.5}$ impacts and secondary $PM_{2.5}$ impacts that were scaled to represent the 2021 MMP sources. For this analysis, the concentrations of both forms of $PM_{2.5}$ were added together and combined with the baseline $PM_{2.5}$ concentration. This comparison indicates that predicted primary and secondary $PM_{2.5}$ impacts from the 2021 MMP would be about one-third or less of existing background conditions. The overall secondary $PM_{2.5}$ project impact is considered negligible relative to the baseline.

Table 4.3-15 Primary and Secondary $PM_{2.5}$ Impact

Pollutant	Averaging Time	Max. Primary $PM_{2.5}$ Concentration ($\mu g/m^3$)	Max. Secondarily-Formed $PM_{2.5}$ Concentration ($\mu g/m^3$)	Baseline Concentration ($\mu g/m^3$)	Total $PM_{2.5}$ Impact ($\mu g/m^3$)
Total $PM_{2.5}$	Annual	1.1	0.01	3.5	4.7
Total $PM_{2.5}$	24 hours	2.6	0.15	15.0	17.7

Source: Air Sciences 2021a
$\mu g/m^3$ = micrograms per cubic meter.
$PM_{2.5}$ = Particulate matter less than 2.5-micron diameter.

Class II Wilderness Area Plum Visibility Screening Results

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

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

Perpetua performed a revised VISCREEN analysis in October 2020 which is based on combined NOx, PM, and soot emissions of 8,953 lbs/day. Updates included the addition of non-point and mobile equipment emissions; the background visual range was increased to 270 km and large-diameter particle matter emissions were incorporated. However, there was a slight variation in total emissions from the analysis and those emissions produced by the 2021 MMP. The 2021 MMP is expected to produce a combined emissions of 8,204 lbs/day, approximately an 8 percent reduction. The October 2020 analysis was not redone and is considered conservative.

A summary of the VISCREEN results is provided in **Table 4.3-16** for daytime and nighttime hours, and for combinations of terrain or sky background and two solar angles (Forest Service 2019i). These results show the frequency of visible plumes expressed as the highest percentage of time a plume could be visible for a given combination of viewing background and solar angle. **Table 4.3-17** provides the magnitude of the visible plumes.

Table 4.3-16 Frequency of Modeled Visible Plumes – Screening Results for FCRNRW Percent of Time when Perceptibility Threshold is Exceeded

Plume Parameter	Background	% Day Hours: 10 Degrees[1]	% Night Hours: 10 Degrees	% Day Hours: 140 Degrees[2]	% Night Hours: 140 Degrees
Plume Contrast (C)	Terrain	0	0	0	0
Color Contrast (ΔE)	Terrain	0.02	2.9	0	0
Plume Contrast (C)	Sky	0	0	0	0.38
Color Contrast (ΔE)	Sky	0	2.3	0	0

Source: (Forest Service 2019i) based on Level 2 VISCREEN modeling (Appendix C of Air Sciences 2021a)
[1] The 10-degree solar angle reflects conditions after sunrise (day), and before sunset (night).
[2] The 140-degree solar angle reflects mid-day conditions.
C = modeled plume parameter that quantifies overall contrast or light impeded by a plume.
ΔE = modeled plume parameter that reflects the color difference or contrast with viewing background.
Results tabulated combine the stability classes and wind speed conditions that exhibit plume parameters above perception thresholds. Stability classes are not adjusted for elevation difference.

Table 4.3-17 Magnitude of Modeled Visible Plumes – Screening Results for FCRNRW: Ration of Maximum Impact when Perceptibility Threshold is Exceeded

Plume Parameter	Background	Day: 10 Degrees[1]	Night: 10 Degrees	Day: 140 Degrees [2]	Night: 140 Degrees
Plume Contrast (C)	Terrain	--	--	--	--
Color Contrast (ΔE)	Terrain	1.0	2.2	--	--
Plume Contrast (C)	Sky	--	--	--	1.3
Color Contrast (ΔE)	Sky	--	1.9	--	--

Source: (Forest Service 2019i) based on Level 2 VISCREEN modeling (Appendix C of Air Sciences 2021a)
[1] The 10-degree solar angle reflects conditions after sunrise (day), and before sunset (night).
[2] The 140-degree solar angle reflects mid-day conditions.
C = modeled plume parameter that quantifies overall contrast or light impeded by a plume.
ΔE = modeled plume parameter that reflects the color difference or contrast with viewing background.
Results tabulated combine the stability classes and wind speed conditions that exhibit plume parameters above perception thresholds. Stability classes are not adjusted for elevation difference.

Mercury Deposition Screening Results

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

One tool that describes the background effects for Hg deposition is the REMSAD. This model has been implemented by the EPA across the continental 48 states to quantify Hg deposition on a regional basis. The inventory information for this model was gathered between the years 2000 and 2006; therefore, it is likely higher than current emissions levels due to regulatory controls on Hg emissions (e.g., on coal-fired power plants) implemented since 2006, and the trend to replace coal-fired generation with gas-fired units. The sources of Hg deposition used in the EPA REMSAD modeling analysis included sources in the U.S.,

Mexico, and Canada; and contributions from global background deposition from Chemical Transport Model, the Global/Regional Atmospheric Heavy Metals model, and the GEOS-Chem model (EPA 2008).

The EPA REMSAD model was used to estimate the background Hg deposition in the SGP area, and three immediately surrounding hydrographic "sub-basins" that extend approximately 20 to 50 miles (32 to 80 km) from the SGP. Results of the REMSAD include both wet and dry deposition mechanisms. As listed in **Table 4.3-18**, total annual Hg deposition flux rate in the three hydrographic sub-basins ranges from 12.7 to 13.9 grams per square km per year (g/km^2-yr).

An AERMOD screening assessment included the point and fugitive Hg emissions from the SGP that are in the form of elemental, Hg^{2+}, and HgP. Gaseous elemental Hg0 emission sources at the SGP would be controlled by activated carbon absorbers. A source of bias in the analysis in the use of this screening level modeling approach is that it does not account for recent findings showing the importance of Hg0 deposition to plants, and this flux being the largest point of entry for atmospheric Hg into terrestrial environments. Taking these factors into account suggests that total Hg deposition predicted by the model is likely biased low.

The results of the AERMOD screen modeling of Hg deposition based on the 2021 MMP inventory are listed in **Table 4.3-18**. This analysis indicates a maximum estimated increase in Hg deposition rate of 0.4 percent or less of the existing background rate. However, it should be recognized that this rate underestimates the total Hg deposition, as the mechanism of Hg0 flux is not included in the screening model.

The range of increased deposition is less than 5 miles (8 km) from the SGP, covering the area generally east of the SGP Operations Area Boundary (OAB). Outside of this area, Hg deposition contribution due to 2021 MMP sources is estimated to be less than the minimum value that can be quantified by AERMOD. Additional details and mapping of the Hg deposition rates from REMSAD and the AERMOD analysis are provided in the Air Quality Analysis report (Air Sciences 2021a).

Table 4.3-18 SGP Contribution Above Estimated Hg Background

Hydrographic Sub-basin	REMSAD Background (g/km^2-yr)	AERMOD Screen Results[1] (g/km^2-yr)	2021 MMP Contribution to Existing Background
Within SGP area and the sub-basin east of the SGP	13.9	0.056	0.40%
Sub-basin northeast of the SGP	13.6	0	0.00%
Sub-basin southeast of the SGP	12.7	0	0.00%

Source: Air Sciences 2021a; EPA 2008

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

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

Nitrogen/Sulfur Screening Acid Deposition Analysis

A screening analysis using the AERMOD dispersion model was performed to predict the near- field deposition of nitrogen and sulfur species from NO_X and SO_2 precursor emissions as estimated in the 2021 MMP inventory. Although AERMOD is not designed to simulate several natural processes that affect chemical deposition (e.g., atmospheric chemical transformations to acid compounds), it was used in this case as a conservative screening tool. The analysis assumed that 100 percent of the alternative emissions of NO_X would be completely transformed into NO_2, and then HNO_3 on release to the atmosphere. This assumed extent of conversion is expected to result in a conservative over-estimation of nitrogen deposition.

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

The resulting range of predicted screening-level nitrogen and sulfur deposition rates at the SGP Operations Area Boundary and at receptors approximately 10 km beyond that boundary are listed in **Table 4.3-19** in units of grams per square meter per year (g/m^2-yr).

Table 4.3-19 Summary of Predicted Near-Field Nitrogen and Sulfur Deposition Rates

Chemical Element	Receptor Locations	Deposition Flux Rate (g/m^2-yr)
Nitrogen (N)	OAB	0.00081 – 0.0039
Nitrogen (N)	10 km from OAB	0.00011 – 0.0098
Sulfur (S)	OAB	0.00001 – 0.0043
Sulfur (S)	10 km from OAB	0 – 0.0002

Source: Air Sciences 2018b, 2021a
g/m^2-yr = grams per square meter per year.

Stibnite Public Access Route

As previously discussed, the SGP public access route (Figure 1 of Air Sciences 2021a) was excluded from the ambient boundary. However, Perpetua did conduct a NAAQS compliance demonstration by applying 25-m spacing receptors along the public access route which was completed as part of a feasibility assessment. The public access route analysis was evaluated for LOM 6 and 10. **Table 4.3-20** illustrates the NAAQS impact results at the public access route through the SGP.

Table 4.3-20 SGP Public Access Route Receptor Results and NAAQS Compliance Demonstration

Pollutant	Averaging Time	Maximum Modeled Conc. (µg/m^3)	Baseline Conc. (µg/m^3)	Total Impact Conc. (µg/m^3)	NAAQS (µg/m^3)	NAAQS Compliance
CO	8 hours	201.9	1,110	1,312	10,000	Yes
CO	1 hour	486.8	1,740	2,227	40,000	Yes
NO_2	Annual	39.0	0.9	39.9	100	Yes
NO_2	1 hour	124.4	4.3	128.7	188	Yes
PM_{10}	24 hours	65.3	37.0	102.3	150	Yes
$PM_{2.5}$	Annual	5.3	3.5	8.8	12	Yes
$PM_{2.5}$	24 hours	12.2	15.0	27.2	35	Yes
SO_2	1 hour	13.6	12.3	25.9	196	Yes
SO_2	3 hours	6.0	16.8	22.8	1,300	Yes

Far-Field Analysis

The far-field analysis for regional haze contributions, increment, and chemical deposition was performed for four selected Class I areas: SAWT, SELW, HECA, and CRMO. In addition, four Class II wilderness areas were evaluated in the same manner: FCRNRW (beyond 50 km), GOSPEL, HEMBLD, and the WHTCLD. The nearby Nez Perce Requested Analysis Area also was included in this analysis. The far-field analyses described in this section are based on the 2021 MMP inventory for criteria pollutant emissions.

Additionally, the 2018 modeling report (Air Resources 2018b) conducted far-field NAAQS analysis from 50 km to 300 km. Due to slight differences between the 2018 modeling report and the 2021 MMP a verification analysis was conducted to ensure no significant far-field impact changes.

50-km Ring NAAQS Verification

Additional AERMOD modeling was completed to estimate concentrations at receptors located on a 50-km radius ring around the SGP; the maximum approved range of AERMOD. The 50-km ring modeling was performed for the applicable AQRV pollutant averaging time combinations. The 50-km ring modeling result comparison for 2018 modeling and the 2021 MMP modeling is provided in **Table 4.3-21**.

Table 4.3-21 50-km Ring AERMOD Results for 2018 Modeling and 2021 MMP

Pollutant	Averaging Time	2018 Modeling (µg/m^3)	2021 MMP (µg/m^3)
NO_2	Annual	0.53	0.50
$PM_{2.5}$	Annual	0.09	0.09
$PM_{2.5}$	24 hours	0.40	0.38
PM_{10}	Annual	0.14	0.11
PM_{10}	24 hours	0.51	0.57
SO_2	Annual	0.01	0.01

Pollutant	Averaging Time	2018 Modeling (µg/m^3)	2021 MMP (µg/m^3)
SO_2	24 hours	0.07	0.06
SO_2	3 hours	0.23	0.20

Source: Air Sciences 2021a

Table 4.3-21 shows that the 50-km ring results are nearly identical for the 2018 modeling and the 2021 MMP modeling. The 2021 MMP results shown represent the highest concentrations for the two modeled scenarios (LOM 6 and 10).

The 50-km ring AERMOD analysis demonstrates that the 2021 MMP changes are not expected to affect the far-field analysis results, and therefore, the 2018 far-field analyses are representative of the 2021 MMP. **Table 4.3-22** illustrates a summary of the far-field impacts.

Table 4.3-22 Far-Field Impacts Summary

Pollutant / AQRV	Averaging Time	Class I Impacts (µg/m^3)	Class II Impacts (µg/m^3)	Class I Visibility 98th Percentile Extinction[1]	Class II Visibility 98th Percentile Extinction[1]	Class I N, S Deposition g/ha-yr[1]	Class II N, S Deposition g/ha-yr[1]
NO_2	Annual	0.0101	0.0392	--	--	--	--
$PM_{2.5}$	Annual	0.0021	0.0082	--	--	--	--
$PM_{2.5}$	24 hours	0.0370	0.1272	--	--	--	--
PM_{10}	Annual	0.0101	0.0394	--	--	--	--
PM_{10}	24 hours	0.1622	0.5628	--	--	--	--
SO_2	Annual	0.0002	0.0009	--	--	--	--
SO_2	24 hours	0.0057	0.0179	--	--	--	--
SO_2	3 hours	0.0118	0.0529	--	--	--	--
Nitrogen	Annual	--	--	--	--	1.1832	4.6284
Sulfur	Annual	--	--	--	--	0.1581	0.7551
Visibility	Annual	--	--	1.47%	4.84%	--	--
Threshold		Variable[2]	Variable[2]	5%	N/A[3]	5	N/A[3]

Source: Air Sciences 2021a
[1] Maximum results are shown, g/ha-yr = grams per hectare-year
[2] See **Table 4.3-23**
[3] There are no regulatory standards or thresholds to compare to the results provided in these columns.

SILs are defined concentrations of criteria pollutants in the ambient air that are considered inconsequential in comparison to the NAAQS. A project impact shown to be below a SIL can be presumed to not cause or contribute to the violation of a NAAQS. **Table 4.3-23** shows the Class I and Class II Area SILs for comparison to the results provided in **Table 4.3-22**. As shown by these two tables, the far-field impacts of criteria pollutants on Class I and II areas are below the SIL. **Table 4.3-22** also shows that the Class I visibility and deposition impacts are below the regulatory thresholds (Air Sciences 2021a).

Table 4.3-23 Class I and Class II Area SIL

Pollutant/ AQRV	Averaging Time	Class I SIL (µg/m^3)	Class II SIL (µg/m^3)
NO_2	Annual	0.1	1
$PM_{2.5}$	Annual	0.05	0.3
$PM_{2.5}$	24 hours	0.27	1.2
PM_{10}	Annual	0.2	0.2
PM_{10}	24 hours	0.3	1
SO_2	Annual	0.1	1
SO_2	24 hours	0.2	5
SO_2	3 hours	1	25

Far-Field Evaluation of Regional Haze Impacts

For the analysis of the impairment of atmospheric clarity, or regional haze, maximum 24-hour the 2021 MMP source emissions of SO_2, NO_X, SO_4, and fine and coarse PM were modeled using CALPUFF for the roster of Class I and Class II wilderness areas of interest. To account for atmospheric chemistry, the MESOPUFF II five-pollutant (SO_2, SO_4, NO_X, HNO_3, nitrate) conversion scheme was used.

The CALPUFF-ready wind field was evaluated against 15 regional station observational data benchmarks for a span of three calendar years (2015 to 2017) using the MMIFStat statistics program. Because much of the modeling domain is in mountainous terrain the “complex conditions” benchmarks were applied to evaluate whether the CALPUFF datasets were acceptable. These evaluations demonstrated that the meteorological data sets generally met acceptance benchmarks that have been commonly reported for mesoscale model evaluation for air quality modeling (Air Sciences 2018b).

The Class I and Class II wilderness area visibility analysis results are presented in **Tables 4.3-24** and **4.3-25**, respectively. These results show the modeled 98th percentile highest daily change in extinction parameters in each analyzed area. The net predicted reduction in atmospheric visibility is less than the 5 percent change in extinction threshold that is considered the significance criteria for Class I areas (FLAG 2010). Using the same stringent Class I criteria for the Class II wilderness areas included in this analysis demonstrates that the level of regional haze impact in these areas is predicted to be minor.

Table 4.3-24 Predicted Regional Haze Contributions in Class I Areas due to SGP Sources

Class I Areas	98th Percentile 2015	98th Percentile 2016	98th Percentile 2017	Maximum 98th Percentile	Class I Extinction Threshold	Below Threshold (Yes/No)
CRMO	0.15%	0.07%	0.09%	0.15%	5%	Yes
HECA	0.33%	0.24%	0.61%	0.61%	5%	Yes
SAWT	0.54%	0.36%	0.46%	0.54%	5%	Yes
SELW	1.29%	1.12%	1.47%	1.47%	5%	Yes

Source: Air Sciences 2021a; FLAG 2010
CRMO – Craters of the Moon National Monument.
HECA – Hells Canyon Wilderness.
SAWT – Sawtooth Wilderness.
SELW – Selway-Bitterroot Wilderness.

Table 4.3-25 Predicted Regional Haze Contributions in Class II Area due to SGP Sources

Class I Areas	98th Percentile 2015	98th Percentile 2016	98th Percentile 2017	Maximum 98th Percentile
HEMBLD	0.27%	0.17%	0.22%	0.27%
GOSPEL	0.77%	0.95%	2.08%	2.08%
NPRAA	1.87%	1.50%	2.63%	2.63%
FCRNRW	3.54%	4.84%	4.70%	4.84%
WHTCLD	0.39%	0.26%	0.34%	0.39%

Source: Air Sciences 2021a; FLAG 2010
HEMBLD = Hemingway-Boulders Wilderness.
GOSPEL = Gospel-Hump Wilderness.
NPRAA = Nez Perce Requested Analysis Area.
FCRNRW = Frank Church-River of No Return Wilderness, area beyond 50 km from SGP Operations Area Boundary
WHTCLD = Cecil D. Andrus-White Cloud Wilderness.

Far-Field Nitrogen and Sulfur Deposition

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

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

For the three modeled years of 2015 through 2017, the maximum predicted annual deposition rates were below the DAT in each Class I and Class II area evaluated. The estimated maximum N and S deposition in g/ha-yr for the Class I areas evaluated for this analysis are provided in **Tables 4.3-26** and **4.3-27**.

Predicted deposition rate in SELW is the highest, with N deposition rate of 1.13 g/ha-yr at the highest receptor location. This is well below the DAT of 5 g/ha-yr and indicates that deposition impacts from the SGP in Class I areas would likely be undetectable.

Table 4.3-26 Summary of Predicted Nitrogen Deposition Rates in Class I Areas due to SGP Sources

Class I Area	Max. Receptor N Deposition Rate 2015 (g/ha-yr)	Max. Receptor N Deposition Rate 2016 (g/ha-/yr)	Max. Receptor N Deposition Rate 2017 (g/ha-yr)	3-Year Maximum N Deposition Rate (g/ha-yr)	Class I DAT (g/ha-yr)	Below Threshold (Yes/No)
CRMO	0.06	0.11	0.11	0.11	5	Yes
HECA	0.21	0.13	0.09	0.21	5	Yes
SAWT	0.44	0.44	0.48	0.48	5	Yes
SELW	1.00	0.99	1.18	1.18	5	Yes

Source: Air Sciences 2021a; NPS 2011
g/ha-yr = grams per hectare per year.
DAT = Deposition Analysis Threshold.

Table 4.3-27 Summary of Predicted Sulfur Deposition Rates in Class I Areas due to SGP Sources

Class I Area	Max. Receptor N Deposition Rate 2015 (g/ha-yr)	Max. Receptor N Deposition Rate 2016 (g/ha-/yr)	Max. Receptor N Deposition Rate 2017 (g/ha-yr)	3-Year Maximum N Deposition Rate (g/ha-yr)	Class I DAT (g/ha-yr)	Below Threshold (Yes/No)
CRMO	0.01	0.01	0.01	0.01	5	Yes
HECA	0.03	0.01	0.01	0.03	5	Yes
SAWT	0.05	0.05	0.05	0.05	5	Yes
SELW	0.12	0.11	0.16	0.16	5	Yes

Source: Air Sciences 2021a; NPS 2011
g/ha-yr = grams per hectare per year.
DAT = Deposition Analysis Threshold.

Similarly, the estimated maximum N and S deposition in g/ha-yr for the four Class II areas and closest Tribal lands evaluated for this analysis are provided in **Tables 4.3-28** and **4.3-29**.

Predicted deposition rate in FCRNRW is the highest, with N deposition rate of 4.63 g/ha-yr at the highest receptor location. This reflects the position of the FCRNRW as the closest area of concern, essentially adjacent to the SGP area. Despite the proximity to the SGP, the highest deposition rate contribution is still predicted to be below the protective Class I DAT of 5 g/ha-yr.

Table 4.3-28 Summary of Predicted Nitrogen Deposition Rates in Class II Wilderness Areas and Nez Perce Requested Analysis Area

Class II Wilderness Area	Max. Receptor N Deposition Rate 2015 (g/ha-yr)	Max. Receptor N Deposition Rate 2016 (g/ha-yr)	Max. Receptor N Deposition Rate 2017 (g/ha-yr)	3-Year Maximum N Deposition Rate (g/ha-yr)	Class I DAT (g/ha-yr)	Below Threshold (Yes/No)
HEMBLD	0.25	0.19	0.18	0.25	5	Yes
GOSPEL	0.98	0.90	0.81	0.98	5	Yes
NPRAA	1.35	1.07	1.00	1.35	5	Yes
FCRNRW	3.20	3.20	4.63	4.63	5	Yes
WHTCLD	0.40	0.53	0.33	0.53	5	Yes

Source: Air Sciences 2021a; NPS 2011
g/ha-yr = grams per hectare per year.
DAT = Deposition Analysis Threshold.

Table 4.3-29 Summary of Predicted Sulfur Deposition Rates in Class II Wilderness Areas and Nez Perce Requested Analysis Area

Class II Wilderness Area	Max. Receptor S Deposition Rate 2015 (g/ha-yr)	Max. Receptor S Deposition Rate 2016 (g/ha-yr)	Max. Receptor S Deposition Rate 2017 (g/ha-yr)	3-Year Maximum S Deposition Rate (g/ha-yr)	Class I DAT (g/ha-yr)	Below Threshold (Yes/No)
HEMBLD	0.03	0.02	0.02	0.03	5	Yes
GOSPEL	0.10	0.08	0.07	0.10	5	Yes
NPRAA	0.14	0.09	0.07	0.14	5	Yes
FCRNRW	0.40	0.39	0.76	0.76	5	Yes
WHTCLD	0.04	0.06	0.04	0.06	5	Yes

Source: Air Sciences 2021a; NPS 2011
g/ha-yr = grams per hectare per year.
DAT = Deposition Analysis Threshold.

4.3.4.3 Johnson Creek Route Alternative

The Johnson Creek Route Alternative would be used for access during mine construction, operations, and closure and reclamation (the Burntlog Route would not be constructed). The approximately 36-mile Route consists of Johnson Creek Road (CR 10-413) and McCall-Stibnite Road (CR 50-412) from the village of Yellow Pine to the SGP. The road design and maintenance for the Johnson Creek Route would be similar to the road design and maintenance described for the 2021 MMP. Construction material borrow sources would be developed along the Johnson Creek Route ROW. Several changes to water and wildlife habitat management also would be included, but these would only affect air quality impacts during the construction phase.

Controlled public access through the SGP during mine operations would be provided by an access road connecting McCall-Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) through the mine area. Similar to this same feature described under the 2021 MMP, this public access road would be constructed during the first year of mine operation and public access to this road would be carefully controlled; fences would prohibit public visitors on this road from having access to the SGP mining or support activities.

Construction

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

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

This alternative would require an extra 2 years (3 vs 5) for construction of the upgrades to the Johnson Creek Route and the SGP. As a result, operations would start in LOM 6 instead of LOM 4 and the highest impact years for emissions would be LOM 8 and 12 (as compared to LOM 6 and 10 for the 2021 MMP).

Operations

The Johnson Creek Route would be used to access the SGP. The length of this route is approximately 1.5 miles shorter than the Burntlog Route, so that the overall tailpipe emissions for vehicles accessing the SGP would be slightly less for this alternative. The location of ambient air pollutant concentrations due to vehicle traffic would differ, with such effects being located along the Johnson Creek Route.

Providing public access through the SGP reduces the miles of new motorized trails open to all vehicles in the Meadow Creek IRA, and this is expected to reduce net air quality effects due to vehicles traversing the SGP area.

Several air pollution design features proposed by Perpetua are common to both action alternatives and are described in **Section 2.4.9**. Emission control devices and designs would be put in place to abate emissions of particulate matter, Hg, and criteria pollutant emissions from internal-combustion engines the same as

the 2021 MMP. Operational and reclamation air emission impacts for this alternative would therefore be the same as the 2021 MMP.

The stationary facilities would be designed, constructed, and operated with the same air pollution controls as the 2021 MMP to comply with applicable regulations and any air quality permits issued by IDEQ. The PTC includes stipulations for control of airborne dust from vehicle traffic along the Johnson Creek Route that are based on applicable state and federal regulations, and that are consistent with best available control technology for new surface mining and processing operations.

4.3.5 Mitigation Measures

Mitigation measures required by the Forest Service would represent reasonable and effective means to reduce the impacts identified in the previous narrative or to reduce uncertainty regarding the forecasting of impacts into the future. These mitigation measures would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Air Quality impacts.

4.3.6 Irreversible and Irretrievable Commitments of Public Resources

4.3.6.1 No Action Alternative

Under the No Action Alternative, the SGP would not be undertaken. Consequently, there would be no change in the current status of air resources in the SGP area, except for the temporary effects of implementing the ASAOC, and irretrievable or irreversible commitments of public resources with respect to air quality would not occur.

4.3.6.2 Action Alternatives

There are no irreversible commitments for air quality resources under the action alternatives. The pollution resulting from action alternatives air emissions would occur over the construction through reclamation phases and then stop. Concentrations of pollutants in the analysis area would rapidly decrease to the ambient conditions then existing in the area. This short-term impact to the air resource would constitute an irretrievable commitment of that resource.

4.3.7 Short-term Uses versus Long-term Productivity

4.3.7.1 No Action Alternative

For the No Action Alternative, the impacts to the air quality resource would be roughly the same as current conditions.

4.3.7.2 Action Alternatives

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

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

4.4 Climate Change

4.4.1 Impact Definitions and Effects Analysis Indicators and Methodology

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 MT of 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).

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1**.

4.4.1.1 Emissions, Assumptions, and Uncertainties

As described in **Section 3.4**, 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. 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.

Information regarding the recent climatological conditions for Idaho and the Northwest is summarized in **Section 3.4**. 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 SGP Air Quality Specialist Report (Forest Service 2022a), 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.

4.4.1.2 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.

4.4.1.3 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 4.4-1**.

Table 4.4-1 Fuel-Combustion Source Emission Factors

Emission Source Category	Carbon Dioxide (CO_2) (kg/MMBtu)	Methane (CH_4) (kg/MMBtu)	Nitrous Oxide (N_2O) (kg/MMBtu)
Stationary/Mobile Combustion Units - Propane Fuel[1]	62.87	3.00E-03	6.00E-04
Stationary/Mobile Combustion Units - Diesel Fuel[1]	73.96	3.00E-03	6.00E-04
Motor Gasoline[1]	70.22	3.00E-03	6.00E-04

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

4.4.2 Direct and Indirect Effects

4.4.2.1 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 Perpetua entered into an ASAOC with the Forest Service and EPA 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 East Fork SFSR 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 between 2022 and 2024.

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 BNF would continue to comply with all existing applicable air quality regulations. Uses of NFS lands that may result in GHG emissions include mineral exploration, dispersed OHV use, snowmobiling, recreational driving, and other forms of recreation.

No long-term direct effects on GHG emissions or climate change are anticipated for 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 and ASAOC activities at the SGP and associated reclamation and monitoring commitments would be small and intermittent across a limited area within the 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.

4.4.2.2 2021 MMP

The following analysis of effects are considered in the overall context of regional and statewide GHG emissions and climate change trends. Additional details of the climate change impact analysis can be

found in the Climate Change Specialist Report (Forest Service 2022b). Several aspects of the context for this analysis include:

1. GHG emission inventory for the State of Idaho (represents a basis for comparison with action alternative GHG emission estimates);

2. 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;

3. How GHG emissions may be mitigated for the action alternatives, given the lack of a regulatory framework for managing and permitting GHG sources; and

4. 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.

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 2009a). 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.

GHG Emissions

Implementation of the 2021 MMP 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 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, CH_4, and N_2O emitted from the exhaust of diesel engine-driven vehicles and, to a much smaller extent, from other fuel-fired equipment. Mobile sources working at the Operations Area Boundary would include bulldozers, rubber-tired dozers, motor graders, haul trucks, 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 would contribute smaller amounts of GHGs to the overall direct effects. These activities may produce fuel combustion emissions from heaters, engines, boilers, etc. Blasting explosives also are recognized as a source of 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 mine operations. Commuting is broken into two categories. One is from Highway 55 to the SGLF and the other is from the SGLF to the Operations Area Boundary.

An overall estimate of GHG emissions (expressed in CO_2e) for annual operations is provided in **Tables 4.4-2a** and **4.4-2b**. Based on estimated annual use of petroleum fuels for all uses, the total GHG emissions would vary by operational year. Note that processing and mining would begin during 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 mine operations, LOM 4 through LOM 18 are assumed to be identical to the maximum year.

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.

Table 4.4-2a GHG Emission Estimates LOM 1 through 9

Activity	Yr 1 (tpy)	Yr 2 (tpy)	Yr 3 (tpy)	Yr 4 (tpy)	Yr 5 (tpy)	Yr 6 (tpy)	Yr 7 (tpy)	Yr 8 (tpy)	Yr 9 (tpy)
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

Approximately 99.9 percent of all processing GHG emissions are CO_2. Similarly, construction, mining and commuting CO_2 emissions comprise approximately 99 percent of the total GHG emissions from those activities.

Table 4.4-2b GHG Emission Estimates LOM 10 through 18

Activity	Yr 10 (tpy)	Yr 11 (tpy)	Yr 12 (tpy)	Yr 13 (tpy)	Yr 14 (tpy)	Yr 15 (tpy)	Yr 16 (tpy)	Yr 17 (tpy)	Yr 18 (tpy)
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

Approximately 99.9 percent of all processing GHG emissions are CO_2. Similarly, construction, mining and commuting CO_2 emissions comprise approximately 99 percent of the total GHG emissions from those activities.

Indirect GHG Emissions

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

The 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 a 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 fuel. 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 SGP Air Quality Specialist Report (Forest Service 2022b).

Off-Site Generation Power

Electricity for the SGP would be provided via a transmission line connected to the grid through 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 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 0.097MMT 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 of GHGs.

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. It is unknown at this time where or how the concentrate from the mine would be processed.

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 would be speculative. 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 Operations Area Boundary. About 22.5 pounds (10.2 kg) of CO_2 are produced from burning one gallon of diesel fuel (EPA 2021e), 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 MT 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 could generate an additional 8,940,000 pounds (4,055 MT) 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.

Overall, the SGP direct and indirect GHG emissions would be a negligible and long-term increase in regional GHG emissions.

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. Additional information on the potential effects of climate change on the resources of the SGP area can be found in **Section 3.4** and in the Climate Change Specialist Report (Forest Service 2022b).

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. 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 that would be provided to minimize traffic, which also would reduce dust emissions, sediment runoff, and GHGs from vehicle tailpipes.

These EDFs 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 2016a). 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 Operations Area Boundary. 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 Operations Area Boundary. 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 Operations Area Boundary.

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 Operations Area Boundary. Although 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 would all factor into potential changes of spill severity.

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.

Regional climate change could affect the ability of Operations Area Boundary 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 mine operations and approximately 80 percent of this water would be continually recycled. This practice would improve resiliency of water availability and would help reduce 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.

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. 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 that 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 mining, construction, and operation activities in the Operations Area Boundary.

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. Longer periods of precipitation deficit in the summer paired with decreasing snowpack could create new challenges for vegetation ecosystems (Halofsky et al. 2018). Long-term reclamation may require adaptive revegetation strategies as initial revegetation plans may 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 Operations Area Boundary 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).

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. 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 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.

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. Post-closure, disturbed areas would be revegetated. To address losses of vegetation from disturbance, the Reclamation and Closure Plan (Tetra Tech 2021a) proposes to replant with conifer and other tree species, which would be located completely within the Operations Area Boundary. The success of the reclamation could be impacted due to the increased risk to timber from wildfire, insects, and disease due to climate change (American Forests 2017; Halofsky et al. 2018).

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. 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 Operations Area Boundary would be maintained during construction, operation, and closure and reclamation. There would be public access through the Operations Area Boundary during construction and operations via a new gravel road constructed 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.

Heritage Resources and Tribal Rights and Interests

The 2021 MMP could 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 heritage 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 fuels 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 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 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. 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.

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 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 VQOs 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 associated impacts to scenic resources.

Social and Economic Conditions

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

Environmental Justice

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

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 WSRs, IRAs, and 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.

4.4.2.3 Johnson Creek Route Alternative

Under this Alternative, the Johnson Creek Route would be used for access to the Operations Area Boundary during mine construction, operations, and closure and reclamation. 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 (CR 10-413) and the Stibnite portion of the McCall-Stibnite Road (CR 50-

412). Controlled public access through the Operations Area Boundary during mine operations for the Johnson Creek Route Alternative would be provided by a road connecting Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 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.

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 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 Operations Area Boundary 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.

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, heritage 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.

<u>Wetlands and Riparian Resources</u>

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 Route Alternative compared to the Burntlog Route.

<u>Vegetation: General Vegetation Communities, Botanical Resources, and Non-Native Plants; Fish Resources and Fish Habitat; Wildlife and Wildlife Habitat; and Special Designations</u>

The Burntlog Route would not be constructed under the Johnson Creek Route Alternative, avoiding the construction of approximately 20 miles of new roadway. 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 proposed-threatened plant species (whitebark pine), federally listed fish species, wildlife and wildlife habitat, and IRAs.

4.4.3 Mitigation Measures

Mitigation measures required by the Forest Service would represent reasonable and effective means to reduce the impacts identified in the previous narrative or to reduce uncertainty regarding the forecasting of impacts into the future. At this time, no mitigation measures have been identified for Climate Change impacts.

4.4.4 Irreversible and Irretrievable Commitments of Public Resources

4.4.4.1 No Action Alternative

Under the No Action Alternative, the SGP would not be implemented. The GHGs 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.

4.4.4.2 Action Alternatives

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.

4.4.5 Short-term Uses versus Long-term Productivity

4.4.5.1 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.

4.4.5.2 Action Alternatives

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.

4.5 Soils and Reclamation Cover Material

4.5.1 Impact Definitions and Effects Analysis Indicators and Methodology

The analysis of effects to soils and RCM includes the following issues and indicators:

Issue: The SGP may result in long-term adverse impacts to soil resources.

Indicators:

- Acres and proportion of the TSRC activity area that are converted from a productive site to a non-productive site (as defined in the both the Payette Forest Plan and Boise Forest Plan).
- Acres and proportion of DD activity area that have altered soil characteristics resulting in a loss of productivity and altered soil-hydrologic conditions (as defined in both the Payette and Boise Forest Plans).

Issue: Available RCM may not be of sufficient quantity or quality to achieve reclamation objectives of returning disturbed areas to productive conditions that sustain long-term wildlife, fisheries, land, and water resources, as defined in the Reclamation and Closure Plan (Tetra Tech 2021a).

Indicators:

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

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

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

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

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

    3. To estimate TSRC it is essential that the glossary definitions for “activity area, detrimental soil disturbance and total soil resource commitment” are clearly understood.

Effects are determined for a defined "activity area", which for TSRC is “an all-inclusive area where effects to soil commitment could occur or are occurring” (Payette Forest Plan 2003 and Boise Forest Plan 2010). The Forest Plans further describe activity areas as “the smallest logical land area where the effect that is being analyzed or monitored is expected to occur.” The activity area for TSRC has been defined as the NFS lands within the sixth field Hydrologic Unit Codes within which the SGP takes place. The sixth level classification of these units, subwatersheds, was selected as it is a reasonable extent to which some

of the potential indirect effects of the SGP might extend, such as soil erosion and sedimentation. The activity area excludes private lands per established methodology for TSRC analysis on the PNF, which in the case of the SGP is Perpetua's patented mining claims. The activity area also excludes from the TSRC analysis IRAs, RNAs, and Wilderness because these areas of NFS lands typically do not meet the "expected to occur" criteria for TSRC analysis. However, it should be noted that the SGP proposes certain facilities with portions that would occur within IRAs. Thus, the TSRC activity areas specific to each of the two action alternatives retain the footprints of those portions of facilities that occur within IRAs for the purpose of TSRC analysis. The TSRC analysis includes a determination of existing conditions of TSRC and anticipated post-SGP conditions within the activity area. Two separate activity areas are analyzed based on Forest Plan jurisdiction: one for the PNF subwatersheds and one for the BNF subwatersheds (**Figure 3.5-1**).

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

RCM: The discussion of volume of available RCM is based largely from the soil salvageability calculations from the Reclamation and Closure Plan and the stated commitments made by Perpetua for salvage and creation of growth media through composting (Tetra Tech 2019a). The assessment of quality and suitability of the available RCM focuses on the primary site-specific challenges for reclamation that are associated with low organic matter, high rock content, and background metals concentrations of the soils, as well as challenges with long-term stockpiling of RCM. Note that the information in this discussion with respect to metals concentrations in soils is strictly limited to plant growth and issues of phytotoxicity; consideration of ecological effects of elevated metals concentrations is presented in the Fish Resources and Fish Habitat, and the Wildlife and Wildlife Habitat specialist reports (Forest Service 2022i, 2022j), and consideration of human health risks is presented in **Section 4.18**.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1.**

4.5.2 Direct and Indirect Effects

4.5.2.1 No Action Alternative

Under the No Action Alternative, there would be no large-scale mine operations by Perpetua, and soil resources would continue to be affected by currently permitted Perpetua drilling activities for exploration under the Golden Meadow Exploration Plan. Consequently, there would be little change in the current status of soil resource conditions at the SGP other than natural erosive and soil formation processes.

Past mining activities have resulted in long-term impacts to soils, and past cleanup/remediation projects have attempted to mitigate some of those mining impacts. Under the No Action Alternative, existing

impacts would remain as developed roads, on existing waste piles (historic development rock and tailings), and at other past mining related locations (Tetra Tech 2019a). It is not anticipated that soils in most of these areas would recover naturally.

Perpetua would continue to implement surface exploration and associated activities that have been previously approved on NFS lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project EA (Forest Service 2015b). These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads) and drilling on both NFS and private lands at and in the vicinity of the SGP. The continuation of approved exploration activities at the SGP by Perpetua would result in the continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip. Perpetua would be required to continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and EA.

In January 2021, Perpetua entered into an ASAOC with the Forest Service and EPA 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 East Fork SFSR 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. Following these construction activities, the disturbed areas would be reclaimed with growth medium and revegetated to stabilize the sites in concert with the Reclamation and Closure Plan developed by Perpetua for the SGP. This work is planned to occur between 2022 and 2024.

4.5.2.2 2021 MMP

Total Soil Resource Commitment

The analysis of environmental consequences associated with soils includes two specific terms from the PNF and BNF Forest Plans: TSRC and DD. TSRC is required to be measured across an all-inclusive area, and not just within a proposed disturbance footprint.

Payette National Forest

The 2021 MMP would occur within three subwatersheds in the PNF, totaling approximately 45,356 acres: Headwaters East Fork SFSR (approximately 15,974 acres); Sugar Creek (approximately 11,497 acres); and No Man’s Creek-East Fork SFSR (approximately 17,885 acres). These three subwatersheds would contain the entire 2021 MMP and portions of the Burntlog Route and new transmission line corridor. The TSRC activity area for the PNF (i.e., excluding IRAs, RNAs, Wilderness, and Perpetua’s private patented mining claims) and existing conditions of TSRC within this activity area is provided in **Table 3.5-3** and **Figure 3.5-1**.

An additional 511 acres of SGP-related disturbance would occur within the private patented mining claims (excluded from the TSRC activity area) of which approximately 381 acres would occur over existing soil disturbance.

Construction of the various facilities, structures, infrastructure, and water management features at the 2021 MMP would result in the removal of native soils that results in TSRC. The majority of construction, mining production, and closure activities would involve excavation, grading, and/or filling of the existing soils that would reduce or eliminate soil productivity. Various portions of the SGP would be affected at different times during the life of the mine. The portion of Burntlog Route within this activity area consists of its approach into the SGP from Thunder Mountain Road (FR 50375) down into and along the East Fork SFSR drainage, including two borrow source areas along the approach. TSRC associated with construction activities for this portion of Burntlog Route would include cut and fill, culvert installation, and retaining walls. The portion of the new transmission line corridor within this activity area consists of its approach into the SGP from Horse Heaven/Powerline Road (FR 416W) and NFST 233 (no name) along the ridge north of the Meadow Creek drainage down into the central portion of the SGP near confluence of Meadow Creek and East Fork SFSR. TSRC would be associated with structure work areas, transmission line access roads, laydown yards, pulling and tensioning sites, and access roads for the one cell tower location.

The 2021 MMP consists of a 3-year construction period, approximately 12-year production period, 5-year closure period, and 5-year plus post-closure period. All the SGP-related disturbance at the mine site would be subject to reclamation activities, with the exception of approximately 278 acres associated with the Hangar Flats high walls, the West End pit lake and high walls, Yellow Pine pit high walls, the Stibnite Lake feature, plus the Midnight, West End, and Plant Site ponds. These areas would remain a permanent commitment of soil resources (a large portion of which would occur on private patented mining claims). For all other areas in the activity area, disturbance would be subject to the reclamation activities detailed in the Reclamation and Closure Plan (Tetra Tech 2019a, 2021a).

Achieving persistent vegetation cover and slope stabilization also would benefit soil amelioration processes. However, the rate of recovery of soil productivity would vary greatly based on the quality and quantity of the RCMs, and site characteristics including slope position, shape and gradient, aspect; elevation, parent materials, seed and propagule sources, and other considerations. As a general rule, the processes responsible for restoration of soil productivity occur over a very long timeframe (centuries to millennia) and do not directly correlate to successful reclamation, which is mainly oriented to short-term objectives. The short timeframe for achievable reclamation measures (e.g., 5 to 10 years) would not be sufficient to establish trends in soil resources and productivity that would take many centuries to millennia to develop within the conditions that pertain to the activity area, especially with respect to the short growing season and harsh winters. Important measures of long-term soil productivity would include: development of a litter layer, biotic crust and/or A horizon (organic matter-enriched surface layer); development of soil structure to support water and air movement; physical and chemical weathering of coarse fragments to add soil fines and nutrients; and development of the soil food web, nutrient cycles, and microbial community, especially the mycorrhizal network. Thus, the recovery of greater than 40 percent soil productivity within a 50-year timeframe is unlikely (Forest Service 2022c).

Reclamation challenges associated with mine facilities are consistent with observations of nearby, previously reclaimed mining areas having mixed vegetative cover success (e.g., Dewey Mine/Thunder Mountain Mining District), as well as previous efforts by Perpetua and others at the SGP to establish a self-sustaining cover of vegetation on previously mined lands that were met with limited success (Greystone 1994). To conservatively address uncertainty in reclamation success, this analysis of TSRC

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

SGP-related TSRC within the PNF activity area under the 2021 MMP would total approximately 1,302 acres, with approximately 104 of these acres occurring over areas of existing TSRC (e.g., existing roads and trails, past mining disturbance, etc.). Adding the remaining 155 acres of existing TSRC within the activity area that do not overlap with the disturbance associated with the 2021 MMP, the total area of committed soil resources would be approximately 1,457 acres, or approximately 17 percent of the activity area (**Table 4.5-1** and **Figure 4.5-1**).

It should be noted an additional 511 acres of SGP-related disturbance would occur within areas excluded from the activity area (associated with Perpetua's private patented mining claims) of which approximately 381 acres would occur over existing soil disturbance (**Table 4.5-1**).

Table 4.5-1 2021 MMP Total Soil Resource Commitment

National Forest	TSRC	Activity Area[1] (acres)	TSRC within Activity Area (acres)	Overall TSRC in Activity Area (acres)[2]	Percent TSRC in Activity Area
Payette	Existing TSRC[3]	7,468	259	259	3%
Payette	TSRC with the 2021 MMP	8,466	1,302	1,457	17%
Boise	Existing TSRC[3]	76,196	904	904	1%
Boise	TSRC with 2021 MMP	76,387	9,023	1,740	2%

Source: AECOM 2020d updated for 2021 MMP activity

[1] Activity area differences between Existing TSRC and TSRC with 2021 MMP are due to the addition of the footprints of 2021 MMP facilities that would occur within IRAs.

[2] 155 (PNF) 838 (BNF) acres of existing TSRC outside of the disturbance footprint is TSRC that is within the activity area (affecting the percent TSRC) but is not overlapped by or attributed to the SGP. It is included within the "Overall TSRC in Activity Area" column.

[3] 2021 MMP overlaps approximately 66 acres of existing TSRC (which is included in this total). Acreage also incorporates the existing portions of access route including portions of the Burntlog Road that would be subject to upgrades and maintenance.

The magnitude of impacts to soil resources within the PNF activity area includes excavation, grading, or filling of 1,457 acres (approximately 120 acres of which are already disturbed to some degree from historical mining activities or other TSRC), and a net increase of TSRC in the PNF activity area of approximately 1,198 acres (from an existing 259 acres to 1,457 acres).

The duration of impacts would vary by component based on the disturbance and reclamation schedule. Most disturbances would be initiated during the construction or early production phase and continue for a number of years until final reclamation is initiated. A select number of components would be reclaimed concurrently during active mine operations, so that duration of impacts would be lessened. Nevertheless, this analysis assumes recovery of greater than 40 percent soil productivity of natural background within a 50-year timeframe would not occur (due to the nature of disturbance and the conditions at the site) and, therefore, the duration of impacts would be longer-term, well beyond the 50-year threshold. For the TSF and TSF Buttress, where selected development rock would serve as the rooting zone for reclamation-related planting instead of native regolith, recovery of soil productivity to 40 percent of natural background would be on a much longer timescale (e.g., likely centuries to millennia) such that they would

be considered permanent TSRC. Unreclaimed areas associated with the open pits (pit lake and highwalls) also would be permanent TSRC.

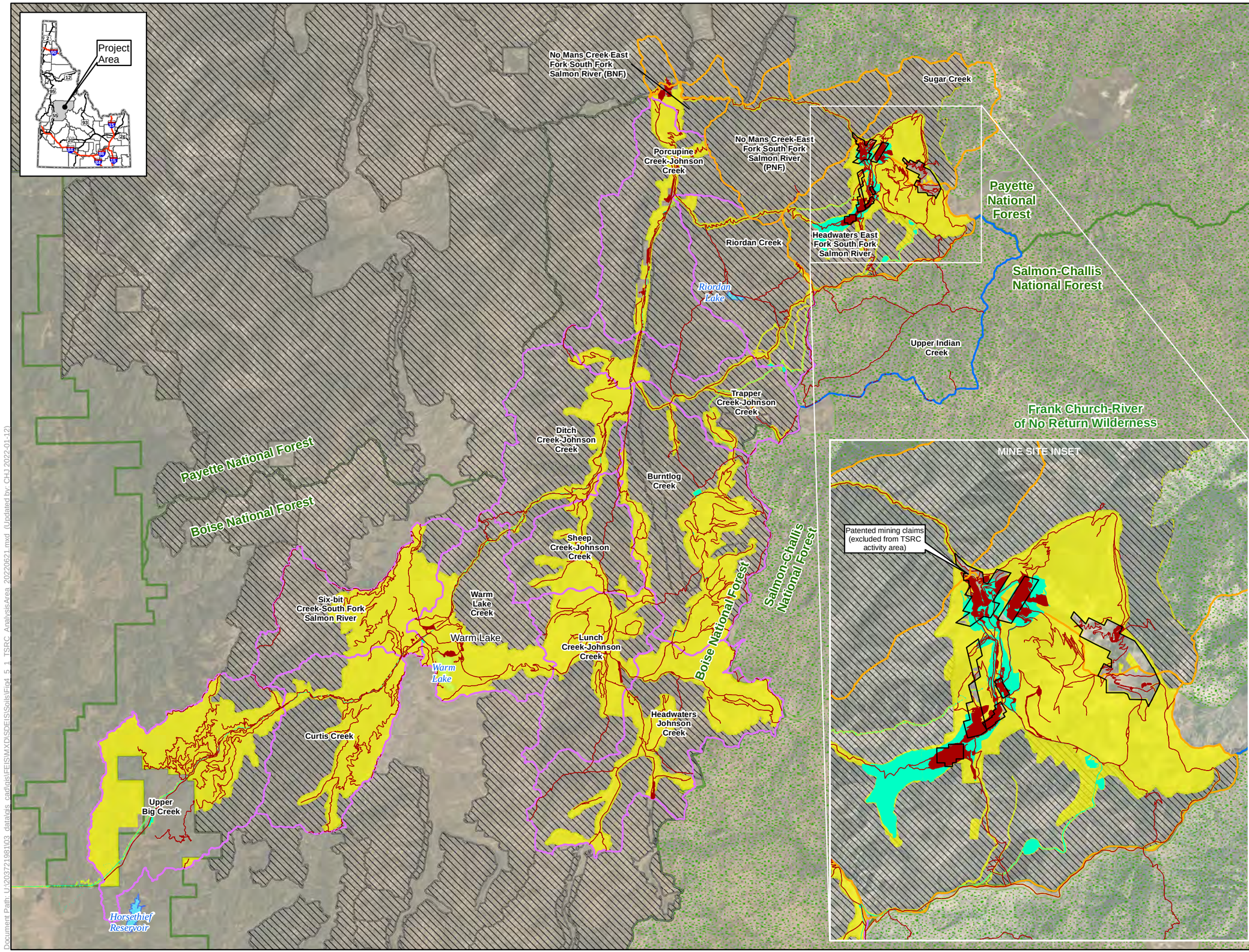
Not included in the 2021 MMP TSRC total in **Table 4.5-1** are approximately 65 acres associated with new surface exploration pads and temporary roads (no spatial information is available for these pads and roads but they are assumed to be on PNF-administered lands; Tetra Tech 2021a). Adding 65 acres to the overall 1,616 acres of TSRC within the PNF activity area would still result in TSRC as approximately 17 percent of the activity area.

Boise National Forest

The 2021 MMP-related TSRC within the BNF differs from the PNF in that the commitment of soil resources would occur along two relatively narrow supporting infrastructure corridors (access and transmission) that traverse numerous subwatersheds. The 2021 MMP would occur within 13 subwatersheds in the BNF, totaling approximately 206,604 acres (**Table 4.5-1**). These 13 subwatersheds would contain the majority of the Burntlog Route, portions of the new and upgraded transmission line corridor, and the Burntlog Maintenance Facility. The TSRC activity area for the BNF (i.e., excluding IRAs, RNAs, Wilderness, and private land ownership) is comprised of these subwatersheds and totals approximately 76,196 acres. Existing conditions of TSRC within this activity area was estimated to cover approximately 904 acres, or 1 percent (**Table 4.5-1** and **Figure 3.5-1**).

Construction of the Burntlog Route would begin during the first year of the 2021 MMP construction phase. It would not be reclaimed until all final closure/reclamation and related environmental closure monitoring work has been completed at the end of the post-closure phase. During construction, some portions of the existing Burnt Log Road (FR 447) would be abandoned in areas where sharp corners or steep slopes require short new road segments to be constructed. These abandoned road segments would be obliterated as part of the construction process. For reclamation, the new road sections would be obliterated and reclaimed, while the upgrades to existing road portions would be narrowed to their current conditions, and the excess width would be reclaimed. However, due to the improved road layout of certain parts of the upgraded road sections (flatter grades and gentler curves), these improved roadway conditions would remain.

The Forest Service would require road obliteration design features to restore slope contours to the natural slope profile, improve soil productivity, improve soil-water infiltration, and re-establish ground water flow paths and hydrologic function. Obliteration of roads includes creation of erosionally stable slopes by recontouring cut and fill sections to restore slope contours, as well as removing culverts and creating armored stream crossings in their place, roughening disturbed surfaces and seeding all disturbance. As appropriate, water bars or other erosion control structures would be left in place.



LEGEND

- PNF Sub-Watersheds
- BNF Sub-Watersheds
- Other Sub-Watershed
- Existing TSRC Area
- Burntlog Route TSRC
- TSRC Activity Area
- IRA and Forest Plan Special Area
- Patented Claims

Other Features

- U.S. Forest Service
- Wilderness
- Lake/Reservoir

0 2 4 Miles

1 inch = 4 miles when printed at 11x17

Figure 4.5-1
Burntlog Route TSRC Activity Areas and Soil Disturbance
Stibnite Gold Project
Stibnite, ID

Base Layer: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Other Data Sources: Midas Gold; State of Idaho Geospatial Gateway (INSIDE Idaho); Boise National Forest; Payette National Forest

Document Path: U:\2037\198\03_data\gis_earth\gis\FEIS\MXD\SDEIS\Soils\Fig4_5_1_TSRC_AnalysisArea_20220621.mxd (Updated by CHJ 2022-01-12)

Compacted surfaces of reclaimed roads would be scarified, deep-ripped or otherwise left in a roughened condition prior to placement of GM and revegetation. At least 6 inches of GM would be placed over most of the reclamation areas, except where steep slopes (>45 percent) limit the use of equipment. GM placement on the widened road segments would be placed as practical, but this area is not included in the GM salvage and replacement balance calculated for the Burntlog Route. Additionally, the soil nail retaining walls on the cut side would be left in place, with regrading performed to the foot of the wall.

The new and upgraded transmission line corridor and access roads would be constructed during the 3-year SGP construction phase (Mine Years -3 through -1). Soil disturbance associated with upgrading the existing transmission line and construction of the new transmission line would involve laydown yards, pulling and tensioning areas, new access/spur roads, and structure work areas. The construction laydown areas, tensioning areas, and some of the new roads would be reclaimed immediately following construction. Final reclamation of the new transmission line corridor would occur during the post-closure period beginning after Mine Year 15. After final closure of the mine, the upgraded section of transmission line to the Johnson Creek Substation would remain in use by IPCo, so there would be no post-closure reclamation or monitoring requirements for Perpetua. The new transmission line between the Johnson Creek Substation and the SGP would be removed and reclaimed during the closure and reclamation phase. Any remaining access roads or disturbed areas would be recontoured to match surrounding topography, scarified, capped with 6 inches of GM, seeded and mulched. Culverts would be removed, and stream channels in the access road corridor would be excavated to original grades.

The Burntlog Maintenance Facility also would be located within the BNF and would be constructed on approximately 3.5 acres. Interim reclamation at this site would entail seeding slopes and other disturbed areas that would not be actively used for vehicle traffic, equipment, or materials storage. Final reclamation would occur during the closure and reclamation phase and would entail grading to smooth slopes, placement of 6 inches of GM, and reseeding, which may include planting trees.

The same considerations made for the analysis of TSRC on the PNF apply to the access and transmission infrastructure corridors and the off-site facility on the BNF. This analysis of TSRC assumes that all SGP-related disturbances in the BNF activity area would be considered TSRC due to the site-specific challenges and the duration and nature of soil disturbance.

Table 4.5-1 provides an overall summary of TSRC considerations as a proportion of the BNF activity area, which also is depicted in **Figure 4.5-1**. SGP-related TSRC within the BNF activity area under 2021 MMP would total approximately up to 902 acres, with approximately 66 of these acres occurring over areas of existing TSRC (e.g., existing roads and trails, past borrow sources, etc.). Overall TSRC under 2021 MMP would be approximately 1,740 acres, or 2 percent of the activity area.

As discussed for the PNF, the duration of impacts would be longer-term, well beyond the 50-year threshold. For full bench road construction and road cuts, including soil nail walls and rock cuts, recovery of soil productivity to 40 percent of natural background would be on a much longer timescale (e.g., likely hundreds to thousands of years) such that they would be considered permanent TSRC. Transmission line access roads and structure footings associated with the upgraded transmission line would be retained and used by IPCo after mining ceases, which also would be permanent TSRC. The SGLF (approximately 25 acres) would be located on private land outside of NFS lands, and therefore is not considered in the

analysis of TSRC. However, it should be noted that the post-mining land use for the SGLF site is designated as light industry, where the facility would remain un-reclaimed after mine operations (a permanent commitment of land) and transferred to a third-party for light industrial uses.

The effects of the 2021 MMP on TSRC would be major, localized, and long-term. In the case of pit high walls and pit lakes, effects on TSRC would be permanent.

Detrimental Disturbance

DD is measured within the specific area where proposed actions may have detrimental soil impacts but excludes dedicated uses such as roads and mining facilities, which are covered under the TSRC analysis area. Thus, the DD analysis area excludes all the SGP, access roads, and off-site facilities, and focuses only on the transmission line ROW on NFS lands where vegetation clearing could occur. It also should be noted that some of the transmission line ROW would be considered in the TSRC analysis (e.g., access roads, construction laydown, and structure work areas serving the SGP), and thus is encompassed by the TSRC analysis area.

This analysis of DD addresses clearing of vegetation using heavy equipment within the transmission line ROW. Up to 500 acres of the transmission line ROW could be affected by vegetation clearing (Tetra Tech 2019a). This represents the maximum extent of clearing because many areas contain only low shrubs or herbaceous vegetation and would not require clearing. Only tall trees and shrubs would be cleared.

Initial vegetation clearing would occur during the 3-year SGP construction phase (Mine Years -3 through -1). Vegetation management to remove trees or maintain low vegetation height would continue throughout the operations phase. After final closure of the mine, the upgraded section of transmission line up to the Johnson Creek Substation would be retained by IPCo, so there would be no post-closure reclamation or monitoring requirements for Perpetua. Final reclamation of the new transmission line corridor from the Johnson Creek Substation to the SGP would occur during the closure and reclamation phase beginning after Mine Year 15. Reclamation of the cleared transmission line ROW would simply entail letting the vegetation grow back and managing weeds and invasive plant species.

DD resulting from clearing of tall vegetation within the transmission line ROW could occur as a result of equipment operations on steep slopes, uncohesive soils, and/or wet soils. DD could occur where at least 2 inches of the A horizon is removed through impacts of wheeled or tracked equipment or dragging of logs across the site. Detrimental soil compaction and soil puddling/rutting could occur through equipment use mainly on poorly drained mineral or organic soils. Compaction in deep soil layers would not normally occur without repeated disturbance. Burned areas also may be susceptible to DD where the organic litter layer has been removed. Conditions of DD can potentially reduce soil productivity by reducing soil fertility and aeration, limiting root growth, reducing soil infiltration and permeability, and increasing runoff and soil erosion.

DD within the transmission line ROW would be limited by the fact that clearing would typically only occur within forested areas, which for this analysis are assumed to make up approximately one-third of the ROW. It is estimated that SGP-related vegetation clearing could initially result in DD as high as 16 percent of the ROW. This is the highest Forest Service-modeled average extent of DD based on variables of land type, topography, and harvest season for ground-harvesting in Northern Region forests (Reeves et

al. 2012). However, based on the estimate of forest land within the ROW, proportion of highly erodible soils, the limited extent of forested wetlands, and the infrequency and short duration of ground disturbing impacts, DD would more likely be somewhere between 8 percent and 15 percent. Additionally, the Forest Service and Perpetua have established EDFs designed to minimize DD impacts. Measures that would reduce DD involve soil moisture operability requirements, slope restrictions for ground-based operations, guidelines for skidding (i.e., tree removal within forest) and skid trail construction/use, etc.

The DD activity area is the area within the transmission line ROW that would be subject to vegetation clearing only and is estimated at up to 500 acres. The magnitude of impacts from vegetation clearing potentially include DD, compaction and puddling on a conservative estimate of up to 75 acres (15 percent) within the ROW, which would be further reduced by the Forest Service-required environmental protection measures that target DD.

The duration of impacts from vegetation clearing would be considered moderate, localized and long-term. Disturbance would begin the first year of the construction phase (Mine Year -3) and would continue at least through Mine Year 15. Clearing impacts would continue indefinitely on the upgraded transmission line corridors that would continue to be maintained by IPCo after mining ceases.

Reclamation Cover Materials

Suitable RCM (also referred to as GM) within the Operations Area Boundary would be salvaged for subsequent use in reclamation. The salvaged material would come from the soil O (approximately 28 percent), A and B (approximately 33 percent), and C (approximately 39 percent) horizons. GMSs would be strategically placed and located around the SGP to prevent erosion, disturbance, and/or contamination. Measures would be taken to divert water around the stockpiles, and the stockpiles would be stabilized with an interim seed mix to minimize erosion. Salvaged material from the SGP would be redistributed directly on the disturbed areas of the SGP to the extent possible or stockpiled in designated areas for later use.

The GM balance refers to the volume of suitable soils available for salvage within the disturbance footprint versus the volume of GM needed for replacement to achieve reclamation goals (Tetra Tech 2019a). Volume of GM needed for reclamation of the 2021 MMP is based on specified placement depths which vary according to SGP facility and proposed “root zone” material. The “root zone” refers to the near surface materials underlying the GM layer, either native regolith or waste rock, into which reestablished native plant communities would extend roots for moisture and anchoring.

Depth of GM placement would be dictated by the nature of the root zone material. Reclamation of uplands on the TSF and TSF Buttress would involve placement of 3 feet of suitable waste rock at the surface, on top of which 12 inches of suitable GM would be placed. Reclaimed upland sites over native regolith or C horizon material would only receive 6 inches of GM. Reclaimed wetlands and channel reaches would receive a combined 6 inches of GM and SBM, except for wetlands and channel reaches on the TSF, which would receive 6 inches of GM and 6 inches of SBM (Tetra Tech 2019a).

According to the GM balance calculations in the Reclamation and Closure Plan, a total of approximately 1,658,075 bank cubic yards (BCY) of suitable soils (GM and SBM) would need to be salvaged from the SGP for reclamation. A total of approximately 860,373 BCY of GM, chipped wood blend, and SBM are

available for salvage at the SGP. The GM deficit is thus estimated at approximately 797,702 BCY (Tetra Tech 2021a).

Options being considered by Perpetua for developing additional GM for the SGP include: utilizing materials from off-site borrow areas and supplementing additional salvage of GM through composting.

Quality and Suitability of Available RCM

There are three primary challenges associated with the quality and suitability of available RCM for the SGP: (1) the overall relatively poor existing quality of the upland soils (unit mixed typic cryorthents) that make up approximately 62 percent of the salvageable volume at the SGP and Burntlog Route; (2) the long-term stockpiling of material; and (3) the high background concentrations of metals in the soil.

Quality of Existing Soils

The quality of RCM would vary based on its source, the best material coming largely from the organic and alluvial soils of the Meadow Creek valley. Most of this material would be used for GM and SBM for wetland restoration. Organic matter and fine and large (coarse) woody debris (critical components to achieve sustainable improvement of soil quality and productivity) are limited at the SGP due to past mining activities in valley bottoms and stand replacement fires. GM used for upland reclamation sites would mostly come from relatively poor upland soils. Overall, the majority of GM used would rate as poor or fair (per suitability criteria), due primarily to texture and coarse fragment content (Tetra Tech 2019a).

Perpetua anticipates that compost (and potentially other soil amendments) would be applied to salvaged GM to improve their suitability. The Reclamation and Closure Plan identifies 10 tons per acre of compost would be incorporated into the top 3 to 6 inches of GM. This small amount of compost is not expected to provide sufficient long-term benefits to the GM that would be important for revegetation. On disturbed areas with greater than 30 percent slope, Perpetua also would apply certified weed-free straw mulch to aid in stabilizing the area and promote revegetation. Mulch would be applied over a roughened seed bed at a rate of about 2,200 pounds per acre. The straw mulch would have a short duration of effectiveness due to its quick rate of decomposition and susceptibility to wind.

The Forest Service would require measures to incorporate coarse woody debris (>3 inches diameter) onto reclaimed lands as evenly distributed as possible in the tonnages and diameters described in the Forest Plan. The objective would be to meet the upper range of tons per acre by PVG or greater with larger-diameter material. Its use in reclamation of forest communities on disturbed sites has been shown to provide numerous long-term benefits, including: improved infiltration and reduced runoff and erosion; regulation of soil temperature and moisture; increased soil organic matter content; creation of microsites for flora and fauna; increase in populations and diversity of microorganisms; and improved nutrient cycling (Kwak et al. 2015).

Stockpiling

RCM quality also would vary with the duration and depth of stockpiling, ranging from live-handled material to material that remains in deep stockpiles for 10 or more years. The Reclamation and Closure Plan prioritizes live-handling of GM where possible. However, due to the extended period of operations,

and logistical issues, only about 51,000 BCY out of a total of 1,658,075 BCY needed of GM would be live-handled. The remainder would be stored in deep stockpiles with combined holding capacities of 1.79 million BCYs. These stockpiles would be up to 200 feet tall, and the time between GM salvage and placement would vary greatly between different SGP facilities but could remain in stockpiles for as long as 1 to 42 years with the upper end of the range representing the duration from the initial construction phase until the end of the reclamation phase (Tetra Tech 2021a). Potential adverse effects associated with salvage and stockpiling activities include: Soil compaction and disturbance of soil structure; Loss/oxidation of soil organic matter and reduction in microbial populations; and Increase in bulk density, reduction in nutrient cycling, and loss or reduction of viable propagules and seeds (Strohmayer 1999).

Anaerobic conditions approximately 2 to 3 feet below the surface of the GMSs are anticipated to predominate and would likely lead to a decline in microbial respiration and a shift from an aerobic respiration endpoint of carbon dioxide to an anaerobic endpoint of anhydrous ammonia or, depending on the soil moisture content, nitrogen gas or nitrous oxide. Oxygen may, however, penetrate to a greater depth in stockpiles composed of coarse-textured soils when compared to stockpiles composed of fine-textured soils, thereby slightly reducing the impacts of stockpiling on soil productivities. Regardless, soil productivity within the majority of the GM/SBM mass stored with stockpiles would decline during the time of residence within stockpiles. Anaerobic conditions tend to be more prevalent in deeper and older stockpiles (Harris et al. 1989; Sheoran et al. 2010) and would certainly occur in some of the GMS at the SGP. Although conditions would be expected to improve upon placement of the GM, there is uncertainty as to how long it would take for full recovery of microbial communities, including mycorrhizal communities, nutrient cycling and soil structure that are the basis of soil productivity. Fresquez and Aldon (1984) noted that RCM stored for years has little biological resemblance to the undisturbed surface soil, and the resulting reduction to the fungal genera and microorganisms result in an unstable and unbalanced soil ecosystem. Prolonged storage increases the loss of the bacterial element in soil, and mycorrhizal fungi are often destroyed or reduced. Additionally, salvage and stockpiling of wet soils and organic soils present special problems as these are easily compacted, and organic carbon becomes susceptible to oxidation when these soils dry out.

Perpetua would implement salvage and stockpile measures to minimize the loss of soil productivity within stockpiled GM/SBM, which would include:

- Live-handling of soil, when and where practicable;
- Maximizing the surface area of the stockpile according to GM/SBM volume and stockpile area constraints;
- Using the most recently placed GM/SBM during concurrent reclamation to minimize the length of time GM is stored;
- Conducting soil salvage and storage operations when and where practicable during dry periods; and
- When GM/SBM are removed from the stockpile for reclamation, mixing the upper 2 to 3 feet of the GMSs with the lower, non-rhizosphere stockpiled material.

Despite these measures the storage of GM within deep stockpiles for years would still result in the loss of soil productivity, which would affect the overall quality of this material at the time of placement.

Suitability of Available RCM (Metals)

The SGP occurs in an area containing numerous highly mineralized zones, and natural background concentrations of some metals are known to be relatively high in some soils and regolith. In addition, elevated levels of arsenic, antimony, and mercury have been observed in soils contaminated by legacy mine operations (URS 2000a). Some known locations of contamination were cleaned up in the past, but it is possible that additional areas of contamination would be exposed and observed during SGP-related construction and operations. Note that the information in this discussion is strictly limited to plant growth and issues of phytotoxicity with respect to metals concentrations in soils (i.e., arsenic, antimony, and mercury); consideration of ecological effects of elevated metals concentrations are discussed in Forest Service (2022i and 2022j).

Soils near the SGP that exceed the screening-level phytotoxicity criteria do continue to sustain native vegetation. How this would translate to use of similar soils for RCM in reclamation is unknown. Potential phytotoxicity would depend on the natural variability of soils based on geology and other environmental factors, and the natural variability in plant tolerances to each metal and the various forms that the metals occur in.

Recommendations in the Reclamation and Closure Plan's Development Rock and Tailings Root Zone Suitability Analysis are that "the upper-quartile values be used to assess whether on-site soils could support plant growth and development, therefore Chebyshev's rule of inequality value for arsenic of 450 ppm would likely provide an upper statistical bound for the concentration in soil that would be expected to support plant growth and development on site." Using the rule, the upper bound is determined as the mean plus two standard deviations. For antimony this would be 68.33 ppm; for mercury 17.07 ppm. Based on these values in the Development Rock and Tailings Root Zone Suitability Analysis, it appears that over 95 percent of the soil samples would be within the upper bounds for supporting plants (Tetra Tech 2021).

The Reclamation and Closure Plan does not include trace metal concentrations as part of the GM suitability guidelines for plant growth. Metal concentrations in growth media would be screened for comparison to baseline soil concentrations pre-reclamation per Forest Service requirements. Total arsenic concentration is used for the root zone suitability guidelines (material that would underlie the GM). However, the upper limit for suitable root zone material was set at 3,000 ppm, which is much higher than the 450-ppm suggested by Chebyshev's rule. This is justified in the Reclamation and Closure Plan based on three soil profiles at Hecla reclamation sites, where vegetation was found to occur on sites with up to 3,000 ppm arsenic. This concentration of arsenic is similar to concentrations found in mine waste from the Yellow Pine pit. The root zone material is intended to provide a cap 2 to 3 feet deep of suitable development rock for plant roots above mine tailings and undifferentiated development rock.

Arsenic was identified in the Reclamation and Closure Plan as the primary trace metal of concern in native undisturbed soils as well as mine wastes. The ratio of maximum arsenic concentrations in development rock and tailings to the highest and lowest screening-level criteria was at least 9 to 11 times higher than any other trace metal of concern. A review of the soils and reclamation literature did not provide any readily applicable suitability/screening levels for naturally occurring arsenic in RCM and revegetation of native plant communities, hence, the statistical measure described above was applied. Some studies in reclamation of soils contaminated with arsenic and other trace metals do provide information that could be useful for reclamation of the SGP.

Arsenic found in soils normally forms insoluble complexes with iron, aluminum, and magnesium oxides found in soil surfaces. This form of arsenic is relatively immobile and not bioavailable to plants (Nejad et al. 2017). However, certain conditions can cause arsenic to become mobile, typically relating to differences in reducing conditions, pH, sulfide concentrations, temperature, salinity, and soil biota. Arsenic that is in solution becomes available for plant uptake, primarily by roots, which can lead to accumulation of phytotoxic levels. Conditions for arsenic mobility would not be prevalent in site soils but localized variability, especially in arsenic-bearing sulfide concentrations, introduces uncertainty into forecasts of how arsenic will react in RCM locally. Planned screening of soils for arsenic content would reduce this uncertainty.

The use of phosphate fertilizers has been known to induce arsenic solubility in soils (Kilgour et al. 2008; Peryea 1991). This phenomenon has been observed in lead arsenate-contaminated soils and others that have been amended with ammonium phosphate. The released arsenic becomes available for uptake by plants, and phytotoxicity has been observed, even after multiple wetting and drying cycles. The use of chemical fertilizers is a proposed activity identified in the Reclamation and Closure Plan and Perpetua has identified some measures to limit the transport and exposure to soil-borne arsenic (e.g., surface water runoff routed to sediment basins, erosion-, sediment-, and dust-control BMPs, etc.).

Overall, the naturally high background levels of trace metals at the SGP represents a challenge with regards to the suitability of RCM and reclamation-related revegetation efforts. The 3,000-ppm arsenic limit for suitable root zone material is high (and much higher than the mean plus 2 standard deviations for soil samples taken). However, in addition to the root zone limits, the Forest Service also would require limits on the GM (that would overlay the root zone material) for arsenic, mercury, and antimony based on the range of baseline concentrations in site soils (**Section 3.5.4.7**) and would require a Sampling and Analysis Plan that would include in-situ screening of soils as well as laboratory testing.

4.5.2.3 Johnson Creek Route Alternative

Only impacts that differ from those discussed under the 2021 MMP are discussed in this section.

Total Soil Resource Commitment

Payette National Forest

SGP-related TSRC within the PNF activity area under the Johnson Creek Route Alternative would total approximately 1,260 acres, with approximately 153 of these acres occurring over areas of existing TSRC (e.g., existing roads and trails, past mining disturbance, etc.). Adding the remaining 106 acres of existing TSRC within the activity area that do not overlap with the disturbance associated with the Johnson Creek Route Alternative, the total area of committed soil resources would be approximately 1,366 acres, or approximately 17 percent of the activity area (**Table 4.5-2** and **Figure 4.5-2**). TSRC within the PNF activity area under Johnson Creek Route Alternative would be the same as for the 2021 MMP for SGP-related components but would differ due to use of the Johnson Creek Route instead of the Burntlog Route for SGP access and the public access route through the SGP because of the differences in road disturbance locations.

Table 4.5-2 Johnson Creek Route Alternative Total Soil Resource Commitment

National Forest	TSRC	PNF Activity Area[1] (acres)	TSRC within Activity Area (acres)	Overall TSRC in Activity Area (acres)[2]	Percent TSRC in Activity Area
Payette	Existing TSRC	7,468	259	259	3%
Payette	TSRC with Johnson Creek Route Alternative	7,972	1,260[3]	1,366	17%
Boise	Existing TSRC	56,474	716	716	1%
Boise	TSRC Johnson Creek Route Alternative	56,480	321[3]	904	2%

Source: AECOM 2020d updated for 2021 MMP activity

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

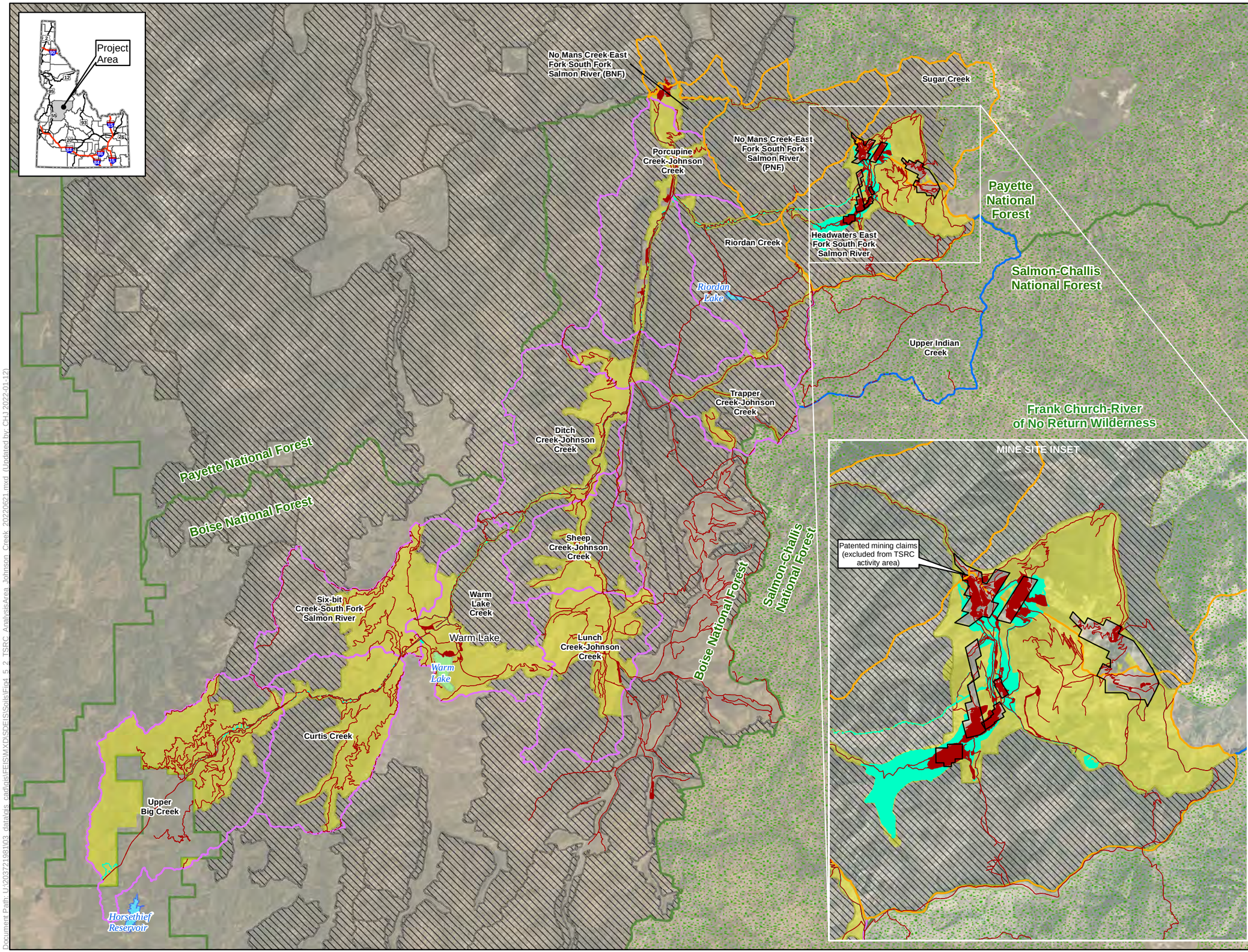
[2] 106 (PNF) 583 (BNF) acres of existing TSRC outside of the disturbance footprint is TSRC that is within the activity area (affecting the percent TSRC) but is not overlapped by or attributed to the SGP. It is included within the "Overall TSRC in Activity Area" column.

[3] The Johnson Creek Route Alternative overlaps approximately 153 (PNF) 133 (BNF) acres of existing TSRC (which is included in this total).

An additional 516 acres of SGP-related disturbance would occur within Perpetua's private patented mining claims (excluded from the TSRC activity area) of which approximately 382 acres would occur over existing soil disturbance.

Boise National Forest

Under the Johnson Creek Route Alternative, access to the SGP would be provided via the Johnson Creek Route instead of constructing the Burntlog Route. Not constructing the Burntlog Route would reduce the BNF activity area under the Johnson Creek Route Alternative from 13 to 11 subwatersheds, totaling approximately 158,025 acres (**Table 4.5-2** and **Figure 3.5-1**).



LEGEND

- PNF Sub-Watersheds
- BNF Sub-Watersheds
- Other Sub-Watershed
- TSRC Activity Area
- Existing TSRC Area
- Johnson Creek Route TSRC
- IRA and Forest Plan Special Area
- Patented Claims

Other Features

- U.S. Forest Service
- Wilderness
- Lake/Reservoir

0 2 4 Miles

1 inch = 4 miles when printed at 11x17

Figure 4.5-2
Johnson Creek Route TSRC Activity Areas and Soil Disturbance
Stibnite Gold Project
Stibnite, ID

Base Layer: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
Other Data Sources: Midas Gold; State of Idaho Geospatial Gateway (INSIDE Idaho); Boise National Forest; Payette National Forest

Road widening and straightening, along with drainage and bridge improvements, would be required for the Johnson Creek Road (CR 10-579) portion of the Johnson Creek Route. The McCall-Stibnite Road (CR 50-412) portion of the Johnson Creek Route (occurring within the part of No Man's Creek-East Fork SFSR subwatershed within the BNF) would be improved by straightening curves, constructing retaining walls, and installing culverts. It is likely that most of these improvements would be permanent, and therefore considered permanent TSRC. SGP-related TSRC within the BNF activity area under the Johnson Creek Route Alternative would total approximately 321 acres, with approximately 133 of these acres occurring over areas of existing TSRC (e.g., existing roads and trails, past borrow sources, etc.). Overall TSRC under the Johnson Creek Route Alternative would be approximately 904 acres, or 2 percent of the activity area. **Table 4.5-2** provides an overall summary of TSRC considerations as a proportion of the activity area; refer also to **Figure 4.5-2**.

The effects of the Johnson Creek Route Alternative on TSRC would be major, localized, and long-term. In the case of pit high walls and pit lakes, effects on TSRC would be permanent.

Reclamation Cover Materials

Reclamation activities associated with the Johnson Creek Route Alternative would be the same as those in the 2021 MMP for the mine operations area. The amount of GM required for reclamation at the SGP, and the anticipated GM deficit, also would be the same and the same challenges and considerations regarding volume and quality/suitability of available RCM would apply. However, because the Johnson Creek Route Alternative would not include the Burntlog Route, reclamation of the access road would not be required, but any potential GM surpluses from the Burntlog Route would not be available to address the GM deficiency identified at the SGP.

4.5.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and project design features (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Soils and RCM.

4.5.4 Irreversible and Irretrievable Commitments of Public Resources

4.5.4.1 No Action Alternative

Under the No Action Alternative, there would be no open pit mining or removal of legacy waste material at the mine site except for material removed under Phase I of the ASAOC. Consequently, no changes would occur to current soil conditions in the analysis area, and no change to the current commitment of these resources would occur upon reclamation of the ASAOC removal area. Therefore, there would be no additional irreversible or irretrievable commitment of soil resources.

4.5.4.2 Action Alternatives

The un-reclaimed pit lakes and highwalls would be permanent (recovery of soil productivity to 40 percent of natural background would be on a much longer timescale compared to other disturbances) and

represent an irreversible commitment. Other areas such as the reclaimed TSF, TSF Buttress, and road cuts would also have a longer recovery time than other reclaimed areas such as areas of stream and wetland restoration which would receive seedbed material from organic soils and have underlying native regolith and represent an irreversible commitment. Areas of new soil disturbance within the SGP that would not be reclaimed would represent irreversible commitment of the growth media in these areas. Reclaimed areas and the salvage of soil resources for use in reclamation would generally represent an irretrievable commitment of soil resources.

4.5.5 Short-term Uses versus Long-term Productivity

4.5.5.1 No Action Alternative

Under the No Action Alternative, there would be no open pit mining or removal of legacy waste material at the SGP except for material removed under Phase I of the ASAOC. Consequently, no short-term use would occur that would affect soil resources, and no change in long-term productivity would occur.

4.5.5.2 Action Alternatives

The 2021 MMP and Johnson Creek Route Alternative would result in long-term uses of the soil resources for mining purposes. Development of the SGP and associated infrastructure would result in complete removal of native soil horizons in specific locations. A loss of productivity would occur in some soils from compaction, rutting, erosion, and other physical and chemical changes due to the removal of soils for stockpiling and reclamation.

Some residual impacts from legacy mine operations would be reclaimed prior to construction and operation of the Action Alternatives. Most of the proposed disturbance area is anticipated to be reclaimed upon completion of all mine operations. Long-term productivity of growth media that are respread during reclamation of disturbed areas would be less than the native soils, and soil productivity of un-reclaimed SGP disturbance would be reduced to near zero.

4.6 Noise

4.6.1 Impact Definitions and Effects Analysis Indicators and Methodology

The analysis of effects of noise includes the following issue and indicators:

Issue: The SGP construction and operations may cause disturbance to the NSRs described in **Section 3.6**.

Noise impacts from construction of mine facilities, roads, and the transmission line upgrade, as well as mine operations, mine traffic on haul roads, and mine traffic on area access roads, may affect area residents, recreationists, and wildlife. This section evaluates only SGP noise impacts to humans; refer to **Sections 4.12** and **4.13** for noise impacts to fish and wildlife.

Indicators:

- SGP-attributed noise exceeds a threshold of 55 dBA L_{DN} at the exterior use area of an NSR, or 55 dBA L_{EQ1h} at any time at an exterior use area.

- SGP-attributed noise exceeds a threshold of 45 dBA L_{DN} at the interior portion of a residential NSR.
- SGP-attributed noise causes the baseline outdoor ambient noise level to increase by more than 5 dBA in the vicinity of an NSR.
- SGP-attributed noise causes the resulting indoor or outdoor ambient noise level to exceed 60 dBA L_{EQ}.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1.**

Predicted increases in outdoor noise levels due to the SGP were calculated at a given sensitive receiver using reference sound levels of typical equipment, with typical acoustical usage factors (i.e., its loudest condition) for each type of equipment (Federal Highway Administration [FHWA] 2006), and baseline ambient noise data. Except where otherwise specified, noise levels were calculated using the noise analysis tool developed by the USDOT, FHWA Roadway Construction Noise Model (RCNM) version 1.1 (FHWA 2006). Traffic noise levels were calculated using the noise analysis guidance provided in the Federal Transit Administration's (FTA's) Transit Noise and Vibration Assessment Guidance and blasting noise levels are calculated using guidance provided in Blasting and Explosive Quick Reference Guide (Dyno Nobel 2010). All calculation methods and calculation assumptions are described in detail in the Noise Specialist Report (Forest Service 2022d).

For purposes of this noise analysis, and because the distance between the SGP and the nearest NSR (**Figure 3.6-1**) is considerably greater than the largest dimension of the area that encompasses the mine pits, backfills, and all facilities associated with the SGP, the entire SGP is represented by a single aggregate acoustical point source that is co-located in the Ore Processing Plant Area (**Figure 2.4-2**).

4.6.2 Direct and Indirect Effects

4.6.2.1 No Action Alternative

Under the No Action Alternative, there would be no large-scale mine operations by Perpetua, and existing noise from exploration-related activities of the previously approved Golden Meadows Exploration Project (Forest Service 2015b) would continue through reclamation of disturbances. These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads) and drilling on both NFS and private lands at and in the vicinity of the Operations Area Boundary. This includes continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip.

4.6.2.2 2021 MMP

Construction

Noise generated during the construction phase would include noise from SGP construction activities and construction of off-site access roads, utilities, and facilities. Noise levels generated by these activities are

described below, followed by a discussion of noise impacts on identified NSRs. A threshold noise level of 55 dBA is applied to the predicted noise levels to evaluate the environmental impact to humans, fish, and wildlife.

EDFs as presented in **Section 2.4.9** would be implemented and have been considered in the analysis of construction noise impacts.

Operations Area Boundary

Construction activities at the SGP would require the use of a variety of heavy industrial-type equipment. A complete list of the noise levels for construction equipment that would likely be used at the SGP during the construction phase is provided in the Noise Specialist Report (Forest Service 2022d).

The estimated total average hourly noise levels from the Operations Area Boundary during the construction phase would be 94 dBA L_{EQ} at the reference distance of 50 feet and would attenuate to the threshold of 55 dBA approximately 0.8 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from the SGP would attenuate to 55 dBA approximately 0.38 miles from the source of activity. Mine development and associated noise during the construction phase would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.). Noise impacts from construction within the Operations Area Boundary would be minor to moderate, short term, and localized.

Access Roads

Access roads associated with the SGP include the Johnson Creek Route and Burntlog Route. The Johnson Creek Route is the current summer access from SH 55 via Warm Lake Road. The Burntlog Route includes a combination of existing roads and new road connector segments from SH 55 via Warm Lake Road. For the Burntlog Route, segments of Burnt Log Road and Thunder Mountain Road would be upgraded, and the Burnt Log Road would be extended to connect to Thunder Mountain Road. The evaluation of noise impacts from the access roads includes separate analyses for road construction activities along the Burntlog Route, for SGP-related traffic on both the Johnson Creek Route (during construction for the first 2 years only) and on the Burntlog Route once it is completed, and from borrow areas along the Burntlog Route.

Road Construction

Road construction activities along the Burntlog Route would involve upgrading existing roads (Burnt Log Road and Thunder Mountain Road) and constructing a new section of roadway to connect the Burnt Log Road to Thunder Mountain Road. Road construction would include cut and fill; embankment stabilization; laying road base and surfacing material; installing new bridges, drainage channels and culverts; replacing or upgrading existing bridges, culverts, and drainages; and associated activities. Construction activities along the Burntlog Route would be limited to the first year of the construction phase (Mine Year -3, **Figure 2.4-3**). Construction noise would be short-term, intermittent, and transitory in any one location.

A 5.3-mile segment of the Burntlog Route would be along Riordan Creek, with varying distances to the NSR sites discussed in **Section 3.6**, and would be the closest segment to the FCRNRW, resulting in the potential for elevated noise levels to extend further into the FCNRNW along this segment.

A complete list of the major noise sources and estimated maximum noise levels on the Burntlog Route during the construction phase is provided in the Noise Specialist Report (Forest Service 2022d). In the absence of a detailed schedule of equipment for road construction, it was assumed that equipment used would be similar to road maintenance mobile equipment detailed for use during the operations phase, along with a dozer, crane, and two haul trucks.

The estimated total average hourly noise levels from construction on the Burntlog Route would be 91 dBA L_{EQ} at the reference distance of 50 feet. Noise from access road construction would attenuate to the threshold of 55 dBA approximately 0.57 miles from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from access road construction would attenuate to 55 dBA approximately 0.28 mile from the source of activity. Road construction and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.).

SGP-Related Traffic During Construction

During the first year of construction, while the Burntlog Route is being built, access to the Operations Area Boundary would be via the Johnson Creek Route. Once construction of the Burntlog Route is completed, SGP-related traffic is assumed to be on the mine access road 24 hours per day.

During the first year of the construction phase, SGP-related traffic volumes on the Johnson Creek Route access roads are estimated at 65 AADT. Heavy vehicles are estimated at 45 AADT and light vehicles at 20 AADT (Midas Gold 2016a, Perpetua 2021a). Vehicles per peak hour were assumed to be 10 percent of AADT (Washington State Department of Transportation 2018). Based on the estimated traffic volumes and vehicle mix, and typical vehicle speeds of 25 mph, estimated average hourly noise levels from SGP-related traffic on the mine access route during the construction phase would be 48 dBA L_{EQ} at 50 feet from the roadway, which is well below the impact threshold level of 55 dBA. Noise impacts from, SGP-related traffic during the first year of the construction phase would be negligible, short-term, and localized.

After construction of the Burntlog Route is completed, SGP-related traffic would move from the Johnson Creek Route to solely the Burntlog Route. SGP-related traffic volumes during this portion of the construction phase are estimated at 68 AADT (48 heavy vehicles and 20 light vehicles; vehicles per hour is assumed to be 10 percent of AADT for peak hour traffic). Estimated average hourly traffic noise levels would be approximately 49 dBA L_{EQ} at 50 feet from the roadway, also below the impact threshold of 55 dBA. Noise impacts from SGP-related traffic on the Burntlog Route during the construction phase would be negligible, short-term, and localized.

Borrow Areas

The extraction and processing of various types of granular material at borrow sites during the construction phase would require an excavator, loader, and portable rock crusher. A complete list of major noise sources and estimated maximum noise levels for construction equipment that would likely be used at the borrow sites is provided in the Noise Specialist Report (Forest Service 2022d).

The estimated total average hourly noise levels from each borrow site during the construction phase would be 84 dBA L_{EQ} at the reference distance of 50 feet. Noise from the borrow sites during construction would attenuate to the threshold of 55 dBA approximately 0.26 mile from the source based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from the borrow sites during construction would attenuate to 55 dBA approximately 0.15 mile from the source of activity. Facilities construction and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.). Noise impacts from borrow areas would be negligible to minor, short-term, and localized.

Utilities

Utilities associated with the SGP include transmission lines, substations, and radio and cell phone communications towers. The SGP involves upgrading 63 miles of IPCo's existing transmission lines from its Lake Fork Substation south of McCall along its existing right-of-way to the Warm Lake Substation to 138 kV and constructing approximately 9 miles of transmission line from the new Johnson Creek substation to the Operations Area Boundary. Transformers would reduce the voltage to 34.9 kV for distribution to facilities within the Operations Area Boundary. The SGP also would involve upgrades to the existing microwave relay tower located atop a 9,000-foot peak to the east of the Operations Area Boundary and installing radio repeaters and cell phone towers at existing communications sites, including the Meadow Creek Lookout, the Thunderbolt Lookout, the new Burntlog Maintenance Facility, and on additional private parcels as needed. Noise impacts associated with utilities would occur primarily during the construction phase. Construction activity associated with the transmission line upgrade and new transmission line construction work is expected to generate the highest noise levels. Substations and communications tower upgrades and construction work is expected to generate lower noise levels; therefore, these are not assessed as separate subcomponents.

Upgrading the existing 63 miles of transmission lines would involve replacing existing utility poles and associated equipment (e.g., transformers, cross arms, guy wires, fuses, switches, insulators, etc.). Tree removal and incidental brush and tree trimming also may be required. Constructing the 9-mile transmission line would involve construction of new permanent and temporary access roads, improvements to existing access roads, removal of danger trees, and the placement of utility poles, conductor, and associated equipment. Helicopters may be used to install utility poles and conductors. Noise associated with all construction activities and construction-related traffic would be short-term, intermittent, and localized, as construction proceeds along the transmission line corridor.

In the absence of a detailed schedule of equipment for utility construction, it was assumed that the equipment used would be similar to other transmission line projects. Further detail on the major noise sources and estimated maximum noise levels for transmission line upgrades and construction are provided in the Noise Specialist Report (Forest Service 2022d).

The estimated total average hourly noise levels for the Lake Fork to Johnson Creek substations transmission line upgrade and Johnson Creek Substation to the SGP transmission line construction would be 84 dBA L_{EQ} at the reference distance of 50 feet. Noise from transmission line construction would attenuate to the threshold of 55 dBA approximately 0.28 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from transmission line construction would attenuate to 55 dBA approximately 0.15 mile from the source of activity.

Johnson Creek Substation to the SGP construction may require helicopter use, which would temporarily increase average hourly noise levels up to 100 dBA L_{EQ} for short periods of time. Noise from transmission line construction with helicopter use would attenuate to the threshold of 55 dBA approximately 1.70 miles from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from transmission line construction with helicopter use would attenuate to 55 dBA approximately 0.66 mile from the source of activity.

The estimated total average hourly noise levels from transmission line access road construction or upgrades would be 91 dBA L_{EQ} at the reference distance of 50 feet. Noise from transmission line access road construction would attenuate to the threshold of 55 dBA approximately 0.57 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from access road construction would attenuate to 55 dBA approximately 0.28 mile from the source of activity. The Lake Fork to Johnson Creek substations transmission line upgrade is not expected to include new access road work. Transmission line work and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.).

The relocation of the Cascade Switching station to 1,217 feet from Site 8 affects estimated noise levels at the site. Additionally, approximately one mile east of Cascade includes the Thunder Mountain Estates Bypass as part of the upgraded transmission line, which relocates a 5.4-mile segment of the transmission line to avoid the Thunder Mountain Estates Subdivision.

Off-Site Facilities

Off-site facilities associated with the 2021 MMP include the SGLF on Warm Lake Road and the Burntlog Maintenance Facility located along the Burntlog Route, approximately 4.4 miles east of the junction of Johnson Creek Road and Warm Lake Road (midway between Sites 4 and 5).

Construction of the off-site facilities would require the use of a variety of heavy construction equipment, further details of which and estimated maximum noise levels from construction are provided in the Noise Specialist Report (Forest Service 2022d). The estimated total average hourly noise levels from each facility during the construction phase would be 85 dBA L_{EQ} at the reference distance of 50 feet. Noise from facility construction would attenuate to the threshold of 55 dBA approximately 0.67 mile from the source based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from facility construction would attenuate to 55 dBA approximately 0.32 mile from the source of activity. Facilities construction and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.). Noise impacts from the off-site facilities during construction would be minor, short-term, and localized.

Avalanches

During construction under the 2021 MMP, size D2, D3, or D4 avalanches to roads hazards are presented in **Table 4.6-1**. There are no size D5 avalanche paths that exist in the Operations Area Boundary under either alternative.

Table 4.6-1 Summary of Avalanche Hazards under the 2021 MMP

Zone	Miles affected	# Paths Affecting Road	Frequency Descriptor	Frequency Range (Years)	Size at Road	Comments
Warm Lake – Landmark	1.6	11	High	1-3	D2-D3	High snowfall area, south facing short slopes produce small (D2) loose avalanches, larger north facing paths can produce mixed flow to D3.
Landmark – Black Lake	0.5	7	Very Low – Moderate	10-11	D2-D3	Burnt forest with mostly low frequency south facing terrain. Typically, small (D2) loose avalanches.
Black Lake – Meadow Creek	1.3	13	Low – High	1-30	D2-D3	High frequency D2 and low frequency D3 terrain. The exception is path BKL-7 which will produce frequent D3 avalanches.
Meadow Creek Ridge	0.2	1	High	1	D2-D3	One path (MCR-1) will produce frequent D2 and infrequent D3 avalanches.
Stibnite Mine East	0.9	6	Very Low – Moderate	10-100	D2-D3	Very low frequency area, with the exception of SE3.
Totals	**4.5**	**38**	--	--	--	--

Source: DAC 2021

Avalanche risk abatement via explosive methods would be implemented for the SGP. Explosives would be used in higher elevations at the upper portions of the potential avalanche paths to dislodge the avalanche with minimum impact. Noise levels would be affected depending on the choice of explosive used and mechanism of delivery, as shown in **Table 4.6-2**, and the expected number and frequency of avalanche control measures used are provided in **Table 4.6-3**.

Table 4.6-2 Avalanche Control Method Noise Levels

Noise Event	Noise Level (dBA) at 100 feet*
Gazex explosion	124.0
2-pound hand charge	107.2
4-pound hand charge	107.8

Source: DAC 2021
dBA = A-weighted decibels
If not implemented using portable methods, Gazex explosions would involve placing charge installations at control locations during operations and closure.

Table 4.6-3 Expected Number and Frequency of Use of Avalanche Control for Each Access Route Option

Road Segment	# Targets[1]	# Targets/ Mission[1,2]	# Missions/ Year[2]	# Charges/ Year[3]	Road Total # Charges/Year[3]
Warm Lake Summit (Warm Lake to Landmark)	23	15	4.0	61	61
Burntlog South (Landmark to Black Lake)	8	7	0.3	2	85
Burntlog North (Black Lake to Stibnite Mine)	32	24	3.1	82	
Stibnite Mine (Burntlog Road Segment)	11	8	0.1	1	
Johnson Creek Road Landmark to Yellow Pine)[4]	26	15	0.3	4	85
Stibnite Road South (Yellow Pine to Stibnite Mine)[4]	97	71	1.0	81	

Source: DAC 2021
[1]Targets (control points) per path that may be used per mission.
[2]Missions are a function of the frequency estimate. Typically, control frequency was assumed to be three times more frequent than the natural return period of avalanches to the road. The relationship between return period and control frequency was adjusted for some paths.
[3]Charges are the targets per mission multiplied by missions per year, summed over all the paths on a road segment.
[4]The Johnson Creek Road and Stibnite Rod South would be used for site access until completion of the Burntlog Route construction.

The amount of avalanche control needed each winter would vary depending on winter conditions of the year. Based on the Gazex explosive method, the maximum noise level would be 124.0 dBA at 100 feet away (**Table 4.6-2**), and at 50 feet away, the maximum noise level would be 130.0 dBA. A single blast at 50 feet away causes for a maximum noise level of 144.0 dBA. There are approximately 7.5 missions per year, limiting the amount of avalanche abatement measures to a narrow timeframe of the year, with long-term, minor, and localized impacts. Based on the location of the SGP components (i.e., Operations Area Boundary, access roads) and the avalanche paths investigated, the probability of noise complaints would be expected to be low. The nearest residential areas to a potential avalanche risk abatement measures would be the village of Yellow Pine, a minimum of four miles away from any explosive, and the Warm Lake recreation tract, a minimum of two miles away from any explosive. Additional detail on predicted decibel levels from avalanche control measures are provided in the Noise Specialist Report (Forest Service 2022d).

Noise Impacts

A summary of predicted noise levels at NSR locations during the construction phase under the 2021 MMP is provided in **Table 4.6-4**, followed by a discussion of source-specific impacts at each NSR.

A threshold noise level of 55 dBA is applied to the predicted noise levels to evaluate the environmental impact to humans. Noise impacts to fish and wildlife are discussed in **Sections 4.12** and **4.13**, respectively.

Table 4.6-4 2021 MMP Noise Levels at NSR Locations During Construction

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})[1]	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	84 / 84 [2]	82 / 82[2]
Site 3	Meadow Creek Lookout	45	N/A	41 / 25	39 / 23
Site 5	Forest Service Camp at Landmark	N/A	34	52/51[2]	50/49
Site 6	Forest Service Summer Camp/ Warm Lake Recreation Areas	N/A	34	21 / 21	19 / 19
Site 7	Warm Lake Road/ Warm Lake Camp	N/A	47	21 / 21	19 / 19
Site 8	Granite Excavation Shop in Cascade	N/A	61	51 / 51	49 /49
Site 9	Southern Pines Plantation Property	N/A	51	64 / 64[2]	62 / 62[2]
Site 10	Yellow Pine	N/A	50	33 / 6	31 / 4
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	63 / 63[2]	61 / 61[2]
Site 12	Mule Hill Trailhead	40	N/A	40 /31	38 / 29

Source: AECOM 2020d
[1]Noise level with SGP-related traffic on Johnson Creek Route/Burntlog Route.
[2]Temporary Short-term exceedance of the recommended noise level, shaded in gray.
N/A = not available.

Site 2 Miller Residence Adjacent to Johnson Creek Road

Transmission line upgrade work, including utility access roads in the immediate vicinity, would be the only SGP-related activity that would contribute to the noise environment at Site 2 during the construction phase. Noise from the SGP, access road construction along the Burntlog Route, utility access road construction, off-site buildings, and borrow sites would not contribute to noise levels at Site 2 during the construction phase due to distance. SGP-related traffic on the Johnson Creek Route would generate average hourly noise levels below background ambient levels at the site and would have no effect on noise levels at Site 2.

The closest distance between Site 2 and transmission line work would be 53 feet and noise levels at Site 2 would fall below the 55-dBA impact threshold when transmission line work is approximately 800 feet away. Helicopter use would not be anticipated in this area.

Absent transmission line work, daytime noise levels at Site 2 are estimated to be below existing ambient noise levels during the construction phase. The 2021 MMP would have a negligible, temporary, and localized impact on the noise environment at Site 2 during construction while transmission line work is occurring in the immediate vicinity.

Site 3 Meadow Creek Lookout

Construction activity on the Burntlog Route would be the greatest contributor of SGP noise at Site 3 during the construction phase; however, combined noise levels would still be well below the 55-dBA threshold and background ambient noise levels. The 2021 MMP would have a negligible, short-term, and localized impact on the noise environment at Site 3 during construction.

Site 5 Forest Service Camp at Landmark

Access road construction on the Burntlog Route, facilities construction at the Burntlog Maintenance Facility, and SGP-related traffic on the Johnson Creek Route would be the greatest contributors of SGP noise at Site 5 during the construction phase. Noise from all SGP-related activities combined would result in a temporary increase in noise levels above the 55-dBA threshold.

SGP-related noise would decrease once construction activity on the Burntlog Route and Burntlog Maintenance Facility is completed and SGP-related traffic moves from the Johnson Creek Route to the Burntlog Route to below the 55 dBA threshold.

The closest distance between Site 5 and the access road is approximately 0.4 mile. When access road work moves approximately 0.5 mile away, noise levels from all SGP-related activities combined would fall to the 55-dBA impact threshold. The 2021 MMP would have a minor, temporary, and localized impact on the noise environment at Site 5 during access road and facilities construction.

Site 6 Forest Service Summer Camp at Warm Lake

Transmission line upgrade work is the only SGP-related activity that would contribute to the noise environment at Site 6 during the construction phase; however, daytime noise levels would still be well below the 55-dBA threshold and background ambient noise levels at the site. The 2021 MMP would have a short-term, negligible, and localized impact on the noise environment at Site 6 during construction.

Site 7 Warm Lake Camp

Transmission line upgrade work and construction activity on the Burntlog Route are the only SGP-related activities that would contribute to the noise environment at Site 7 during the construction phase; however, combined noise levels would still be well below the 55-dBA threshold and background ambient noise levels at the site. The 2021 MMP would have a negligible, short-term, and localized impact on the noise environment at Site 7 during construction.

Site 8 Granite Excavation Shop in Cascade

Transmission line upgrade work would contribute to the noise environment at Site 8 during the construction phase. The Cascade Switching station would be moved to the west, closer to Site 8. Noise from all other construction activities would not contribute to noise levels at Site 8 during the construction phase due to distance. Estimated noise levels would be well below the 55-dBA threshold and background ambient noise levels at the site. The 2021 MMP would have a negligible, short-term, and localized impact on the noise environment at Site 8 during construction.

Site 9 Southern Pine Plantations Property

Transmission line upgrade work, including utility access roads in the immediate vicinity, and facilities construction at the SGLF are the only activities that would contribute to the noise environment at Site 9 during construction. Noise from all other construction activities would not contribute to noise levels at Site 9 during construction due to distance.

Daytime noise levels at Site 9 would increase when transmission line work is occurring at the closest location along the transmission line but would be lower as the distance increases. The closest distance between transmission line work and Site 9 is 317 feet; when transmission line work is 800 feet away, SGP-related noise levels would fall to 55 dBA. Helicopter use is not anticipated in this area.

Absent transmission line work, noise from facilities construction would attenuate to well below the 55-dBA threshold and background ambient levels during construction.

The 2021 MMP would have a negligible, temporary, and localized impact on the noise environment at Site 9 during construction while transmission line work is occurring in the immediate vicinity.

Site 10 Yellow Pine

SGP-related traffic on the Johnson Creek Route access road would be the greatest contributor of noise at Site 10 during construction. Noise would attenuate to well below the 55-dBA threshold and background ambient noise levels. The 2021 MMP would have a negligible, short-term, and localized impact on the noise environment at Site 10 during construction.

Site 11 Ice Hole Campground in Boise National Forest

Transmission line upgrade work, including utility access roads in the immediate vicinity, and SGP-related traffic on the Johnson Creek Route are the only activities that would contribute to the noise environment at Site 11 during construction. Noise from all other construction activities would not contribute to noise levels at Site 11 during construction due to distance.

Daytime noise levels at Site 11 would increase when work is occurring at the closest location along the transmission line but would be lower as the distance increases. The closest distance between Site 11 and transmission line work is 370 feet; when transmission line work is at approximately 850 feet away, noise levels would fall to below 55 dBA.

Absent transmission line work, noise from SGP-related traffic on the Johnson Creek Route would attenuate to well below the 55-dBA threshold and background ambient levels. The 2021 MMP would have a negligible, temporary, and localized impact on the noise environment at Site 11 during construction while transmission line work is occurring in the immediate vicinity.

Site 12 Mule Hill Trailhead

SGP-related noise at Site 12 during the construction phase would be highest during the first year when construction is occurring on the Burntlog Route, with noise from access road construction on the Burntlog Route, the nearest borrow site, and construction in the Operations Area Boundary being the greatest noise contributors during construction. Noise from the transmission line upgrade work and SGP-related traffic on the Johnson Creek Route would not contribute to noise levels at Site 12 during the construction phase due to distance. Combined noise levels would still be well below the 55-dBA threshold and background ambient noise levels at the site. The 2021 MMP would have a negligible to minor, short-term, and localized impact on the noise environment at Site 12 during construction.

Frank Church-River of No Return Wilderness Areas

To evaluate potential noise impacts at dispersed recreational resource areas in the FCRNRW east of the Burntlog Route, noise levels from three construction-related scenarios/sources at a range of distances from the roadway were calculated (**Table 4.6-4** and **Table 4.6-5**). Based on sound levels measured at the Meadow Creek Lookout and along Burnt Log Road, ambient sound levels within the FCRNRW are estimated at 40 to 45 dBA L_{EQ1h}. The alignment of the 5.3-mile Riordan Creek section of the Burntlog Route would be the closest portion to the FCNRNW, resulting in the potential for elevated noise levels to extend further into the FCNRNW along this segment.

Table 4.6-5 Estimated Noise Levels with Distance from the Operations Area Boundary the Burntlog Route Construction

Distance from Access Route (feet)	SGP-Attributed Noise Level (dBA L_{EQ})	SGP Plus Baseline Level[1] (dBA L_{EQ})	Increase above Baseline Noise Level[2] (dBA L_{EQ})
500	66	66	21-26
1,000	59	59	14-19
1,500	55	55	10-15
2,000	52	52-53	8-12
4,000	44	45-48	3-5
8,000	34	41-45	0-1

Source: AECOM 2020d
[1]Based on ambient sound levels measured at the Meadow Creek Lookout and along Burnt Log Road, average ambient daytime sound levels within the FCRNRW Area are estimated at 40 to 45 dBA L_{EQ1h}.
[2]Reported increase over baseline is increase in combined SGP + baseline over baseline.

Noise levels were calculated at incremental distances of 500 up to 8,000 feet into the area since there are no discrete NSRs identified within the FCRNRW. Complete baseline ambient noise assumptions for the FCRNRW are described in the Noise Specialist Report (Forest Service 2022d). Predicted noise levels

assume line-of-sight noise transmission and do not take into account obstructions of this path due to terrain which would reduce the noise levels from those predicted.

Road construction activities along the Burntlog Route would result in noise level increases within the FCRNRW (**Table 4.6-6**). Roadway construction noise would dominate the noise environment at these distances and would be similar to noise levels in a busy commercial or urban environment. Resulting noise levels approximately 1,500 to 2,000 feet from the roadway would be below the recommended noise level of 55 dBA L_{EQ1h} for outdoor use areas; however, noise increases above ambient sound levels would be readily noticeable to twice as loud, depending upon actual distance. Direct effects on recreationists could include general annoyance or sleep annoyance at campsites in wilderness areas. Indirect effects could include a reduction in the overall quality of the remote wilderness experience.

Overall, the greatest potential noise impacts from road construction would occur where the Burntlog Route closely borders the FCRNRW and would be negligible to minor, temporary, and localized, impacting a discrete area of the FCRNRW.

In the vicinity of the Meadow Creek Lookout, a section of Burnt Log Road closely borders the FCRNRW. To evaluate potential noise impacts at dispersed recreational resource areas in this region of the FCRNRW, noise levels at a range of distances from the roadway also were estimated. SGP-related traffic noise from the Burntlog Route would attenuate to well below the average ambient daytime sound levels within the FCRNRW Area, within 500 feet from the roadway. Further detail on estimated noise levels from all distances from traffic on the Burntlog Route during construction are provided in the Noise Specialist Report (Forest Service 2022d).

Several potential borrow areas are located along the Burntlog Route close to the FCRNRW. To evaluate potential noise impacts at dispersed recreational resource areas in the FCRNRW east of the Burntlog Route and the potential borrow areas, noise levels at a range of distances from the borrow areas also were calculated (**Table 4.6-6**) and are further detailed in the Noise Specialist Report (Forest Service 2022d).

Table 4.6-6 Estimated Noise Levels from Borrow Areas along the Burntlog Route During Construction

Distance from Access Route (feet)	SGP-Related Borrow Area Noise Level (dBA L_{EQ})	SGP Plus Baseline Level[1] (dBA L_{EQ})	Increase above Ambient Noise Level[2] (dBA L_{EQ})
500	59	59	14-19
1,000	52	52-53	8-12
2,000	45	46-48	3-6
3,000	41	44-46	1-3
6,000	31	41-45	0-1

Source: AECOM 2020d

[1]Based on ambient sound levels measured at the Meadow Creek Lookout and along Burnt Log Road, average ambient daytime sound levels within the FCRNRW Area are estimated at 40 to 45 dBA L_{EQ1h}.

[2]Reported increase over baseline is increase in combined SGP + baseline over baseline.

Overall, potential noise impacts on recreationists from borrow areas would be limited to a discrete area within approximately 1,000 to 2,000 feet of borrow areas located along the Burntlog Route where it closely borders the adjacent wilderness area, resulting in general annoyance or sleep disturbance at campsites in wilderness areas. Noise from these borrow areas would likely be periodic or intermittent, but ongoing throughout the construction phase, resulting in negligible to minor, short-term, and localized impacts.

Operations

Noise generated during the operations phase would include noise from the Operations Area Boundary, in addition to noise from traffic and maintenance activities on the Operations Area Boundary access road, utility operations, and off-site facilities and borrow site operations. Noise levels generated by these activities are described below, followed by a discussion of noise impacts on identified NSRs. A threshold noise level of 55 dBA is applied to the predicted noise levels to evaluate the environmental impact to humans.

EDFs as presented in **Section 2.4.9** would be implemented and have been considered in the analysis of operations impacts.

Operations Area Boundary

Operations within the Operations Area Boundary would involve development rock and legacy tailings removal, ore mining, materials loading and transport, ore processing and legacy tailings reprocessing, and routine maintenance of mine-site support facilities and infrastructure. Major noise-generating activities would include: the operation of heavy industrial-type earth moving equipment; drilling and blasting activities to extract rock from the ground; materials loading, hauling, and unloading activities; and rock crushing and grinding at the process plant area. The primary rock crusher would be located outside at the process plant area, while rock grinding and other ore processing activities would be located inside a series of buildings. A complete list of noise levels for equipment that would be used within the Operations Area Boundary during the operations phase is provided in the Noise Specialist Report (Forest Service 2022d), with a summary of estimated maximum noise levels provided below.

The estimated total average hourly noise levels, without blasting, from SGP operations within the Operations Area Boundary would be 99 dBA L_{EQ} at the reference distance of 50 feet. Noise would attenuate to the threshold of 55 dBA at approximately 1.5 miles away based on distance alone and not considering terrain effects. Accounting for ground absorption and atmospheric absorption, noise from the SGP would attenuate to 55 dBA approximately 0.60 mile from the source of activity.

During blasting, noise levels could temporarily increase to 102 dBA L_{EQ}. Noise from the SGP with the addition of blasting would attenuate to the threshold of 55 dBA at approximately 2.2 miles based on distance alone and not considering terrain effects. Accounting for ground absorption and atmospheric absorption, noise from the Operations Area Boundary with the addition of blasting would attenuate to 55 dBA at approximately 0.78 mile from the source of activity. Mine operations and associated noise would occur 24 hours per day. Blasting noise would occur intermittently, in daytime, for short periods of time. Noise impacts from operations within the Operations Area Boundary would be moderate to major, long term, and localized.

Access Road

The evaluation of noise impacts from the access roads during the operations phase includes road maintenance and SGP-related traffic along the Burntlog Route.

Road Maintenance

A summary of the major noise sources and estimated maximum noise levels from maintenance on the Burntlog Route is provided below, with a detailed description included in the Noise Specialist Report (Forest Service 2022d).

The estimated total average hourly noise levels from road maintenance activity on the Burntlog Route would range from 88 dBA L_{EQ} at the reference distance of 50 feet during the summer months to 90.2 dBA L_{EQ} during the winter months when snow removal is required. Noise from access road summer maintenance would attenuate to the threshold of 55 dBA at approximately 0.42 miles based on distance alone and noise from access road winter maintenance would attenuate to the threshold of 55 dBA approximately 0.54 mile from the source of activity. Accounting for ground absorption and atmospheric absorption, noise from summer access road maintenance would attenuate to 55 dBA approximately 0.22 mile away and noise from winter access road maintenance would attenuate to 55 dBA approximately 0.27 mile from the source of activity. Access road maintenance and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.). Noise impacts from road maintenance during operations would be minor, long term but intermittent, and localized.

SGP-Related Traffic During Operation

During the operations phase, SGP-related traffic volumes on the Burntlog Route are estimated at 50 AADT. Heavy vehicles are estimated at 33 AADT and light vehicles at 17 AADT between the SGLF and the SGP (Perpetua 2021a). Heavy vehicles are estimated at 25 AADT and light vehicles at 131 AADT between the SH 55 and the SGLF (Perpetua 2021a). Based on the estimated traffic volumes and vehicle mix, and assuming typical vehicle speed of 25 mph and 10 percent of AADT traffic volume at peak hours conditions, estimated average hourly noise levels from SGP-related traffic on the Burntlog Route during the operations phase would be 49 dBA L_{EQ}, which is below the threshold of 55 dBA. SGP-related traffic is assumed to be on the Burntlog Route 24 hours per day. Noise impacts from SGP-related traffic during operations would be minor, long-term, and localized from SH 55 to the SGLF and from the SGLF to the SGP on the Burntlog Route.

Borrow Areas

Activity, equipment, and noise levels at borrow areas would be the same as during the construction phase. Noise impacts from borrow areas would be negligible to minor, long-term but intermittent, and localized.

Utilities

The existing transmission lines and substations that would be used to serve the SGP are not new sources of noise within the affected environment. New sources of noise associated with the operation of utilities would be limited to the Johnson Creek substation to the Operations Area Boundary transmission line and new substations. During stormy or very humid weather, audible corona noise from a wetted transmission

line operating at 230 kV or greater can contribute to ambient noise and, under the right conditions and at distances close enough to the conductors, be audible to a listener on the ground. But under such poor weather conditions (e.g., precipitation) that cause corona noise to be more audible, other acoustical contributors to the outdoor ambient sound environment like rainfall on leafy vegetation, road surfaces, and structure surfaces (rooves) also rise in magnitude. Under fair weather conditions, audible corona noise is much less and likely inaudible under most conditions. Hence, audible corona noise from the transmission line operating at 138 kV would likely not increase ambient levels beyond the transmission line right-of-way.

A typical operating substation might be expected to generate combined noise levels (due to on-site transformer hum, cooling fans, etc.) of up to 80 dBA L_{EQ1h} at 3 feet from a geographic acoustical center-point position. Substation noise would attenuate to the 55-dBA threshold approximately 53 feet from the substation. Noise impacts from utilities during operations would be negligible to minor, long-term, and localized.

Off-Site Facilities

Operational noise sources associated with the Burntlog Maintenance Facility and SGLF would generally be limited to vehicles entering and leaving these facilities, and heating, ventilation, and air conditioning equipment associated with facility buildings, but no heavy equipment routinely operating at these facilities. The combined noise generated by these sources would be substantially less than SGP traffic and/or the road maintenance noise for the Operations Area Boundary access road, which would occur along the access roads that these facilities would be located immediately adjacent to. Noise impacts would be negligible to minor, long-term, and localized.

Avalanches

During operations under the 2021 MMP, the same impacts as during construction would be present.

Noise Impacts

Table 4.6-7 provides estimated noise levels at noise receiver locations during the operations phase under the 2021 MMP, followed by a discussion of estimated noise levels and impacts at each NSR.

Table 4.6-7 2021 MMP Noise Levels at NSR Locations During the Operations Phase

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	14	12
Site 3	Meadow Creek Lookout	45	N/A	40	38
Site 5	Forest Service Camp at Landmark	N/A	34	51 / 51[1]	49[2]

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 6	Forest Service Summer Camp/ Warm Lake Recreation Areas	N/A	34	<1	<1
Site 7	Warm Lake Road/ Warm Lake Camp	N/A	47	5	3
Site 8	Granite Excavation Shop in Cascade	N/A	61	46	44
Site 9	Southern Pines Plantation Property	N/A	51	25	23
Site 10	Yellow Pine	N/A	50	0	7
Site 11	Ice Hole Campground/ Boise National Forest	N/A	50	35	33
Site 12	Mule Hill Trailhead	40	N/A	33	31

Source: AECOM 2020d
[1] Long-term, periodic, or intermittent exceedance of the recommended noise level.
[2] Value does not exceed the 55 dBA threshold but does exceed the ambient noise level.

Site 2 Miller Residence adjacent to Johnson Road

Average hourly noise from all SGP-related activities combined, both with and without blasting, at Site 2 would have no effect on background ambient noise levels; therefore, there would be no impact on the noise environment at Site 2 during operations.

Site 3 Meadow Creek Lookout

Average hourly noise from all SGP-related activities combined, both with and without blasting, at Site 3 would have no effect on the background ambient noise levels. Access road maintenance on the Burntlog Route would be the greatest contributor of SGP noise at Site 3 during operations; however, combined noise levels would still be well below the 55-dBA threshold and background ambient noise levels at the site. The 2021 MMP would have a negligible, long-term, and localized impact on the noise environment at Site 3 during the operations phase.

Site 5 Forest Service Camp at Landmark

In the absence of blasting, access road maintenance on the Burntlog Route is the greatest contributor of SGP-related noise at Site 5 during operations. Average hourly noise from all SGP-related activities combined, both with and without blasting, would attenuate to below the 55-dBA threshold, but well above background ambient noise levels at Site 5.

In the absence of access road maintenance activity, SGP-related noise would attenuate to well below background ambient noise levels. Access road maintenance is expected to be temporary in any single location and intermittent throughout the year, though more frequent during the winter.

The 2021 MMP would have negligible to minor, long-term but periodic, and localized impacts at Site 5 during road maintenance activity throughout operations.

Site 6 Forest Service Summer Camp at Warm Lake

Average hourly noise from all SGP-related activities combined, both with and without blasting, would have no effect on background ambient noise levels at Site 6. The 2021 MMP would have a negligible, long-term, and localized impact on the noise environment at Site 6 during operations.

Site 7 Warm Lake Camp

Access road winter maintenance and SGP-related traffic on the Burntlog Route is the only activity that would contribute to the noise environment at Site 7 during operations; however, average hourly noise from all SGP-related activities combined, both with and without blasting, would attenuate to well below the 55-dBA threshold and background ambient noise levels. The portion of the road influencing Site 7 is currently used and plowed under existing conditions; the only additional SGP-related noise source would be up to 50 AADT using the access road. The 2021 MMP would have a negligible, long-term, and localized impact on the noise environment at Site 7 during operations.

Site 8 Granite Excavation Shop in Cascade

Substation noise is the only SGP-related noise that would contribute to the noise environment at Site 8 during operations. The Cascade Switching station would be 1,242 feet away from Site 8; however, average hourly noise from all SGP-related activities combined, both with and without blasting, would have no effect on background ambient noise levels at Site 8 due to distance. The 2021 MMP would have a negligible, long-term, and localized impact on the noise environment at Site 8 during operations.

Site 9 Southern Pine Plantation

Substation noise is the only SGP-related noise that would contribute to the noise environment at Site 9 during operations; however, average hourly noise from all SGP-related activities combined, including blasting, would have no effect on background ambient noise levels at Site 9 due to distance. The 2021 MMP would have a negligible, long-term, and localized impact on the noise environment at Site 9 during operations.

Site 10 Yellow Pine

Average hourly noise from all SGP-related activities combined, including blasting would have no effect on background ambient noise levels at Site 10. The 2021 MMP would have a negligible, long-term, and localized impact on the noise environment at Site 10 during operations.

Site 11 Ice Hole Campground in Boise National Forest

Substation noise is the only SGP-related noise that would contribute to the noise environment at Site 11 during operations; however, average hourly noise from all SGP-related activities combined, including blasting, would have no effect on background ambient noise levels. The 2021 MMP would have a negligible, long-term, and localized impact on the noise environment at Site 11 during operations.

Site 12 Mule Hill Trailhead

Noise from all SGP-related activities combined, including blasting, would attenuate to, below the 55-dBA threshold and background ambient sound levels at Site 12. The 2021 MMP would have a negligible, long-term, and localized impact on the noise environment at Site 12 during operations.

Frank Church-River of No Return Wilderness Areas

Noise levels at a range of distances from the Burntlog Route also were estimated to evaluate SGP-related noise from road maintenance activity in portions of the adjacent FCRNRW east of the Burntlog Route that closely borders the roadway (**Table 4.6-8**). The 5.3-mile Riordan Creek segment of Burntlog Route would be the closest portion to the FCRNRW, resulting in the potential for elevated noise levels to extend further into the FCNRNW area along this segment.

Direct effects on recreationists within approximately 4,000 feet from the roadway could include general annoyance. Indirect effects could include a reduction in the overall quality of the remote wilderness experience. Noise level impacts would be lower farther from the Burntlog Route and would attenuate to a less than perceptible difference at approximately 6,000 feet (1.15 miles). The predicted noise levels in **Table 4.6-8** assume line-of-sight noise transmission and do not take into account obstructions of this path due to terrain which would reduce the noise levels from those predicted.

Table 4.6-8 Estimated Road Maintenance Noise Levels from the Burntlog Route during Operations

Distance from Access Route (feet)	SGP-Related Road Maintenance Noise Level (dBA LEQ, summer-winter)	SGP plus Baseline Noise Level1 (dBA LEQ, summer-winter)	Increase above Baseline Noise Level2 (dBA LEQ, summer-winter)
500	64-66	64-66	24-26
1,000	57-59	57-59	17-19
2,000	49-52	50-52	10-12
3,000	45-47	46-48	6-8
4,000	41-43	44-45	4-5
5,000	38-40	42-43	3-4
6,000	36-38	41-42	1-2

Source: AECOM 2020d

[1]Based on ambient sound levels measured at the Meadow Creek Lookout and along Burnt Log Road, average ambient daytime sound levels within the FCRNRW area are estimated at 40 dBA L_{EQ1h}.

[2]Reported increase over baseline is increase in combined SGP + baseline over baseline.

Overall, the greatest potential noise impacts from road maintenance would occur where the Burntlog Route closely borders the FCRNRW. These potential noise impacts would be minor and long-term, but periodic or intermittent, and localized, only impacting a discrete area of the FCRNRW that is within approximately 4,000 feet of the Burntlog Route.

Noise levels at a range of distances from the Burntlog Route also were estimated to evaluate SGP-related traffic noise in portions of the adjacent FCRNRW that closely border the roadway, summarized here and further detailed in the Noise Specialist Report (Forest Service 2022d). SGP-related traffic noise from the Burntlog Route would attenuate to well below the average ambient daytime sound levels within the FCRNRW 500 feet from the roadway. Overall, aside from the noise impact predicted at Site 5, SGP-related traffic during the operations phase would have negligible to no effect on the ambient sound environment at the NSR locations.

If the borrow areas along the Burntlog Route adjacent to the FCRNRW are utilized during the operations phase, potential impacts to recreationists within approximately 1,000 to 2,000 feet of these borrow areas would be the same as during the construction phase.

Closure and Reclamation

Operations Area Boundary

Major noise-generating activities at the Operations Area Boundary during closure would include the operation of heavy industrial-type earth moving equipment for the placement of materials, grading, contouring, and similar activities associated with reclamation. In the absence of a detailed list of equipment to be used during the closure phase, a conservative assumption was made that equipment and numbers of each equipment type would be the same or similar to the construction phase. The estimated total average hourly noise levels and noise attenuation from the Operations Area Boundary during closure and reclamation would be the same as during construction, as described above and further detailed in the Noise Specialist Report (Forest Service 2022d).

Access Roads

During closure, the Burntlog Route would continue to be in use. Potential noise sources from the access road during closure would include road maintenance, SGP-related traffic, borrow areas, and road decommissioning of the Burnt Log Road-Thunder Mountain Road Connector.

Road Maintenance

Road maintenance activities and equipment are assumed to be the same as during the operation phase described above. Noise impacts from road maintenance during closure and reclamation would be minor, short-term, and localized.

SGP-Related Traffic During the Access Road Closure Phase

During closure, SGP-related traffic would continue to utilize the Burntlog Route. Traffic volumes would be lower than during the operation phase. Total average annual daily traffic is estimated at 27 AADT (versus 50 ADDT during the operation phase), Heavy vehicle volumes are estimated to be 15 AADT

(versus 33 ADDT during the operation phase) and light vehicle volumes are estimated to be 12 AADT (versus 17 AADT during the operation phase) (Perpetua 2021a). Assuming 10 percent of AADT at peak hour and vehicle speeds of 25 mph, traffic noise levels 50 feet from the mine access road would be 43 dBA LEQ, 5 dBA lower than during the operations phase, primarily due to the substantially lower volume of heavy vehicles on the roadway. Noise impacts from SGP-related traffic during access road closure would be minor, short term, and localized from SH 55 to the SGLF and from the SGLF to the SGP on the Burntlog Route.

Borrow Areas

Activity, equipment, and noise levels at borrow areas are expected to be similar to the construction and operations phases. It is unknown which borrow areas would be active within each SGP phase. Noise impacts from borrow areas would be negligible to minor, short-term but intermittent, and localized.

Road Decommissioning

Decommissioning the Burnt Log Road-Thunder Mountain Road Connector section of the Burntlog Route would likely involve the same or similar set of equipment as construction and would generate similar noise levels as described in for road construction under that phase; however, road decommissioning activity would be limited to just this section of the Operations Area Boundary access road. Noise impacts from road decommissioning would be negligible to minor, short term, and localized.

Utilities

Under the 2021 MMP, the new transmission line into the SGP would be decommissioned and reclaimed. In the absence of a detailed schedule of equipment being operated for decommissioning and reclamation at the transmission line during closure, it was assumed that equipment used during this phase would be similar to equipment detailed in environmental documents for other transmission line projects. The estimate of total average hourly noise levels is considered conservative, assuming the simultaneous operation of all the equipment, summarized below and described in further detail in the Noise Specialist Report (Forest Service 2022d).

The estimated total average hourly noise levels generated from the transmission line decommissioning would be 81 dBA L_{EQ} at the reference distance of 50 feet, slightly lower than noise levels generated during construction. Noise from transmission line decommissioning would attenuate to the threshold of 55 dBA approximately 0.19 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from transmission line decommissioning would attenuate to 55 dBA approximately 0.11 mile from the source of activity. Noise impacts from utilities during closure and reclamation would be negligible to minor, long term, and localized.

Off-Site Facilities

The sound sources associated with the closure and reclamation of the Burntlog Maintenance Facility was conservatively assumed to be similar to those associated with construction activities, as described above**.** There would be no reclamation-related noise associated with the SGLF. The facility has a post-mining land use designated as light industry, where it would remain un-reclaimed after mine operations and

transferred to a third-party for light industrial uses. Noise impacts from off-site facilities during closure and reclamation would be minor, short term, and localized.

Avalanches

During closure and reclamation under the 2021 MMP, impacts from avalanches and controls would be the same as described for construction.

Noise Impacts

Estimated noise levels at noise receiver locations during the closure and reclamation phase under the 2021 MMP are included in **Table 4.6-9**.

Table 4.6-9 2021 MMP Noise Levels at NSR Locations During Closure and Reclamation

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	6	4
Site 3	Meadow Creek Lookout	45	N/A	41	39
Site 5	Forest Service Camp at Landmark	N/A	34	47 [1,2]	45
Site 6	Forest Service Summer Camp/ Warm Lake Recreation Areas	N/A	34	18	16
Site 7	Warm Lake Road/ Warm Lake Camp	N/A	47	18	16
Site 8	Granite Excavation Shop in Cascade	N/A	61	<1	<1
Site 9	Southern Pines Plantation Property	N/A	51	<1	<1
Site 10	Yellow Pine	N/A	50	54[2]	52[2]
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	38	36
Site 12	Mule Hill Trailhead	40	N/A	40	38

Source: AECOM 2020d
[1]Temporary short-term exceedance of the recommended noise level.
[2]Value does not exceed the 55 dBA threshold but does exceed the ambient noise level.

Site 5 Forest Service Camp at Landmark

Access road decommissioning work on the Burntlog Route would be the greatest contributor of SGP noise at Site 5 during the closure phase. Noise from all SGP-related activities combined would attenuate to approximately 47 dBA at Site 5, resulting in a temporary increase in noise levels above the 55-dBA threshold. The 2021 MMP would have a minor, temporary, and localized impact on the noise environment at Site 5 during closure while access road decommissioning and facilities decommissioning work is occurring in the immediate vicinity.

4.6.2.3 Johnson Creek Route Alternative

Construction

Avalanches

During construction under the Johnson Creek Route Alternative, there are 94 potential avalanche paths present. Additional details summarizing each avalanche hazard are provided in the Noise Specialist Report (Forest Service 2022d). The number and frequency of use of avalanche control measures are included in **Table 4.6-10**.

Table 4.6-10 Expected Number and Frequency of Use of Avalanche Control for Each Access Route Option

Road Segment	# Targets[1]	# Targets/ Mission[1,2]	# Missions/ Year[2]	# Charges/ Year[3]	Road Total # Charges/Year[3]
Warm Lake Summit (Warm Lake to Landmark)	23	15	4.0	61	61
Johnson Creek Road (Landmark to Yellow Pine)	26	15	0.3	4	85
Stibnite Road South (Yellow Pine to Stibnite Mine)	97	71	1.0	81	85

Source: DAC 2021
[1]Targets (control points) per path that may be used per mission.
[2]Missions are a function of the frequency estimate. Typically, control frequency was assumed to be three times more frequent than the natural return period of avalanches to the road. The relationship between return period and control frequency was adjusted for some paths. For example, even though Stibnite Road has many more control targets, many of these are on the south facing paths with lower frequency (10-30 years typically) and thus would require infrequent avalanche control during major winters (e.g., 10-year or greater).
[3]Charges are the targets per mission multiplied by missions per year, summed over all the paths on a road segment.

The amount of avalanche control needed each winter would vary depending on winter conditions of the year. There are approximately five missions per year, limiting the amount of avalanche abatement measures to a narrow timeframe of the year, with a minor, long-term, and localized impact.

Noise Impacts

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed or used to access the Operations Area Boundary and no road improvements or road construction would take place in that area. The Johnson Creek Route would be improved and used to access the SGP during construction,

operations, and closure and reclamation. Road widening and straightening, along with drainage and bridge improvements would be required for the Johnson Creek Road portion of the Johnson Creek Route. The Stibnite Road portion would be improved by straightening curves, constructing retaining walls, and installing culverts. During the construction phase, SGP-related traffic volumes on the Johnson Creek Route access road is estimated at 65 AADT. Heavy vehicles are estimated at 45 AADT and light vehicles at 20 AADT (Perpetua 2021a). Vehicles per peak hour were assumed to be 10 percent of AADT (Washington State Department of Transportation 2018). Based on the estimated traffic volumes and vehicle mix, and typical vehicle speeds of 25 mph, estimated average hourly noise levels from SGP-related traffic on the mine access route during the construction phase would be 48 dBA L_{EQ} at a distance of 50 feet from the roadway, which is well below the impact threshold level of 55 dBA.

EDFs as presented in **Section 2.4.9** would be implemented and have been considered in the analysis of construction impacts of the Johnson Creek Route Alternative. **Table 4.6-11** provides estimated noise levels at NSRs during the construction phase under the Johnson Creek Route Alternative. The Johnson Creek Route Alternative would have temporary impacts on the noise environment at Site 2, Site 9, Site 10, and Site 11 during transmission line work in the immediate vicinity.

Table 4.6-11 Johnson Creek Route Alternative Noise Levels at NSR Locations During Construction

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	84[1]	82[1]
Site 3	Meadow Creek Lookout	45	N/A	24	22
Site 5	Forest Service Camp at Landmark	N/A	34	48[2]	46[2]
Site 6	Forest Service Summer Camp/ Warm Lake Recreation Areas	N/A	34	21	19
Site 7	Warm Lake Road/ Warm Lake Camp	N/A	47	21	18
Site 8	Granite Excavation Shop in Cascade	N/A	61	48	46
Site 9	Southern Pines Plantation Property	N/A	51	64[1]	62[1]
Site 10	Yellow Pine	N/A	50	64[1]	62[1]
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	63[1]	61[1]
Site 12	Mule Hill Trailhead	40	N/A	20	18

Source: AECOM 2020d

[1]Temporary Short-term exceedance of the recommended noise level, shaded in gray. [2]Value does not exceed the 55 dBA threshold but does exceed the ambient noise level.

Frank Church-River of No Return Wilderness Areas

The potential noise impacts at dispersed recreational resource areas within the FCRNRW would be the same as reported for the 2021 MMP during construction, provided in terms of predicted noise level and noise level increases over existing at distances between 500 and 8,000 feet; however, the primary access road would access the Operations Area Boundary from the north along the existing Stibnite Road and would approach close to the FCRNRW for a very limited distance about midway between the Operations Area Boundary and the village of Yellow Pine, which would represent a much more limited exposure than the Burntlog Route under the 2021 MMP (**Figure 3.6-1**).

Operations

Avalanches

During operations under the Johnson Creek Route Alternative, impacts would be the same as during construction.

Noise Impacts

Under the Johnson Creek Route Alternative, SGP-related traffic and road maintenance activities would occur along the Johnson Creek Route instead of the Burntlog Route. SGP-related traffic would contribute some noise levels during operations; however, road maintenance activities would temporarily increase daytime noise levels at Site 2, Site 5, Site 10, and Site 11 as high as 75 to 84 dBA.

EDFs as presented in **Section 2.4.9** would be implemented and have been considered in the analysis of operations impacts of the Johnson Creek Route Alternative. **Table 4.6-12** provides estimated noise levels at NSRs during construction under the Johnson Creek Route Alternative.

Table 4.6-12 Johnson Creek Route Alternative Noise Levels at NSR Locations During Operations

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	78[1]	76[1]
Site 3	Meadow Creek Lookout	45	N/A	40	38
Site 5	Forest Service Camp at Landmark	N/A	34	75[1]	73[1]
Site 6	Forest Service Summer Camp/ Warm Lake Recreation Areas	N/A	34	<1	<1
Site 7	Warm Lake Road/ Warm Lake Camp	N/A	47	6	4
Site 8	Granite Excavation Shop in Cascade	N/A	61	25	23

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 9	Southern Pines Plantation Property	N/A	51	25	23
Site 10	Yellow Pine	N/A	50	61[1]	59[1]
Site 11	Ice Hole Campground/ Boise National Forest	N/A	50	84[1]	82[1]
Site 12	Mule Hill Trailhead	40	N/A	27	25

Source: AECOM 2020d
[1] Temporary short-term exceedance of the recommended noise level.

The Johnson Creek Route Alternative would have localized, temporary and periodic, and minor impacts on the noise environment at Site 2, Site 5, Site 10 and Site 11 during road maintenance throughout operations. The estimated noise levels and noise impacts at all other noise receivers would be the same as the 2021 MMP during operations.

Closure and Reclamation

Avalanches

During closure and reclamation under the Johnson Creek Route Alternative, impacts would be the same as during construction.

Noise Impacts

Table 4.6-13 provides estimated noise levels at NSRs during closure and reclamation under the Johnson Creek Route Alternative. The Johnson Creek and Stibnite roads would not be decommissioned and would remain as built under the Johnson Creek Route Alternative. SGP-related closure and reclamation noise would be greater than ambient levels at Site 5 and Site 10; however, it would be intermittent or periodic as SGP-related traffic moves through those areas. The sound sources associated with the closure and reclamation of the Landmark Maintenance Facility was conservatively assumed to be similar to those associated with construction activities. Noise impacts under closure and reclamation would be short-term, localized, and negligible to minor.

Table 4.6-13 Johnson Creek Route Alternative Noise Levels at NSRs During Closure and Reclamation

ID	Name	Baseline Ambient Noise Level (dBA L_{EQ})	Baseline Ambient Noise Level (dBA L_{DN})	SGP-Attributed Daytime Noise Level (dBA L_{EQ})	SGP-Attributed Day-Night Noise Level (dBA L_{DN})
Site 2	Miller Residence	N/A	50	37	35
Site 3	Meadow Creek Lookout	45	N/A	21	19
Site 5	Forest Service Camp at Landmark	N/A	34	54[1]	52[1]
Site 6	Forest Service Summer Camp/ Warm Lake Recreation Areas	N/A	34	18	16
Site 7	Warm Lake Road/ Warm Lake Camp	N/A	47	18	16
Site 8	Granite Excavation Shop in Cascade	N/A	61	<1	<1
Site 9	Southern Pines Plantation Property	N/A	51	<1	<1
Site 10	Yellow Pine	N/A	50	54[1]	52[1]
Site 11	Ice Hole Campground/Boise National Forest	N/A	50	42	40
Site 12	Mule Hill Trailhead	40	N/A	20	17

Source: AECOM 2020d
[1] Temporary short-term exceedance of the recommended noise level.

4.6.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Noise impacts.

4.6.4 Irreversible and Irretrievable Commitments of Public Resources

4.6.4.1 No Action Alternative

Under the No Action Alternative, the SGP would not be undertaken. Consequently, there would be no irretrievable and irreversible commitment of public resources as it relates to the ambient noise environment.

4.6.4.2 Action Alternatives

The SGP would not contribute to irretrievable and irreversible commitment of public resources as it relates to the ambient noise environment. All noise sources and noise impacts associated with the SGP would cease upon final closure of the Operations Area Boundary and noise levels would return to ambient conditions without acoustical contribution of SGP-related activities. The future non-SGP ambient sound environment is likely to be similar to the reported baseline, adjusted only by changes in non-SGP acoustical contributors such as roadway traffic flows and the potential for new residential, commercial, and industrial development in the Operations Area Boundary vicinity.

4.6.5 Short-term Uses versus Long-term Productivity

4.6.5.1 No Action Alternative

Under the No Action Alternative, the SGP would not be undertaken. Consequently, there would be no short-term use that would affect the ambient noise environment, and no effect on long-term productivity.

4.6.5.2 Action Alternatives

Modeled noise levels did not rise beyond threshold of concern under most conditions, and the noise related to mining and associated activities would represent a temporary use (during the estimated 20-year life of the mine between construction and reclamation) expected to end with SGP reclamation and would not affect long-term productivity.

4.7 Hazardous Materials

4.7.1 Impacts Definitions and Effects Analysis Indicators and Methodology

The analysis of potential effects from hazardous materials includes the following issue and indicators:

Issue: The SGP may cause accidental releases of hazardous materials or wastes, including diesel fuel, gasoline, lubricants, antifreeze, chemical reagents and reactants (including sodium cyanide and sulfuric acid), antimony concentrate, mercury containing residuals, lime, explosives, and other substances during their transport, use, storage, or disposal.

Indicators:

- Volumes and types of hazardous materials and hazardous wastes transported, used, and stored during site operation;
- Practices for storage and use on site including primary/secondary/tertiary containment types and volumes and material handling practices;
- Amount of vehicular transport of hazardous materials during construction, operations, closure, and reclamation; and
- Travel routes and road conditions (e.g., terrain, proximity to water bodies, geohazard risk, etc.).

The assessment considers the measures to avoid or reduce impacts such as:

- Methods for transporting and safely storing such materials;
- Methods and ability to respond to potential spill events; and
- Methods and plan for waste disposal.

Use and transport of hazardous materials is currently occurring at the site associated with exploration activities as described in **Section 3.7**. The existing conditions are compared to the increased use and transport of hazardous materials anticipated under the proposed mining activities (Perpetua 2021a). In addition, the analysis considers modifications to existing and new access routes and proposed support facilities.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1.**

4.7.2 Direct and Indirect Effects

The following analysis of effects associated with hazardous materials is considered in the overall context of direct impacts caused by accidental releases or spills to localized areas, as well as potential impacts to outlying areas associated with releases to groundwater or nearby drainages/streams/surface waters. Elements of this context include:

- Amount, type, and location of storage, use, or disposal of hazardous materials and the potential for release to the environment;
- Transportation of hazardous materials to or from the mine site, and the potential for accidental release to the environment; and
- Fate and transport (i.e., where the hazardous material may go in the environment) of hazardous materials that have entered the environment.

Impacts associated with the storage, use, and disposal of hazardous materials are measured quantitatively by the amount, type, and location of use. Impacts to the environment in the event of an accidental release are assessed qualitatively, based on the type and amount of hazardous material, handling techniques, location of use and contingency plans, risk of accidental release, and exposure pathway to potential sensitive receptors.

The operation of the SGP would involve the use of various materials in order to mine, process, and extract the metals from the ore and conduct related activities. A release event could range from a minor spill of up to a few gallons (for which on-site cleanup would be readily available) to a large, reportable spill (e.g., over 25 gallons of fuel or any material that has or is likely to affect water). Some hazardous chemicals could have immediate adverse impact on soils and vegetation, and potentially degrade aquatic resources and water quality if they enter surface water. Releases of hazardous materials to the environment outside of secondary containments could potentially seep into the ground and contaminate the groundwater system over the long term. The risk and potential transport to the environment exists for all hazardous materials.

Releases of hazardous materials could adversely affect soils, vegetation, water quality, wildlife, and fish, including lower trophic level aquatic organisms (e.g., bacteria and algae). Impacts could include degraded soil and water quality, fish and wildlife habitat contamination, and toxicity, injury, or mortality to fish and other aquatic organisms, depending on the type and volume of material released, location, proximity to streams, timing, spill response, etc.

Impacts could occur at the Operations Area Boundary, off-site facilities, along access routes, or in downstream watersheds. The geographic extent of any impacts would depend on the location and size of the spill and the effectiveness of the response. For most releases, the extent would likely be limited to the immediate vicinity of the release due to the response and cleanup measures that would be in place, but if a release were to occur into a stream, impacts could extend downstream.

The potential for impacts would persist for the life of the SGP. More details regarding the effects of accidental release of hazardous materials to fish and aquatic resources are addressed in **Section 4.12**.

Local, state, and federal laws regulate the storage, use, recycling, disposal, and transportation of hazardous materials, wastes, and fuels. A SPCC Plan would be developed prior to SGP construction and operations, providing direction for preventing and controlling spills and describing BMPs to minimize the potential for releases of hazardous materials. In the event of a spill or release of hazardous materials or wastes, standard spill response and cleanup practices would be implemented to mitigate potential impacts, as described later in this section.

4.7.2.1 No Action Alternative

Under the No Action Alternative, there would be no large-scale mine operations by Perpetua and use or transportation of certain hazardous materials at the SGP site would continue to be impacted by past mining activities and by currently permitted Perpetua exploration activities.

Perpetua would continue to implement surface exploration and associated activities that have been previously approved on NFS lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project EA (Forest Service 2015b). These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads) and drilling on both NFS and private lands at and in the vicinity of the Operations Area Boundary.

The continuation of approved exploration activities by Perpetua would result in the continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip. Consequently, there would be little change in the current use of hazardous materials at the site including fuel, oils, antifreeze, propane, and equipment maintenance products (**Table 3.7-1**). Small amounts of used oil and waste maintenance materials would continue to be produced and shipped from the site for offsite disposal.

Past mining activities have resulted in long-term impacts to the SGP site. Legacy impacts from these activities include the existing mining disturbances such as surface disposal of development rock, spent heap leach materials, and open pits. On-site processing of these ores has resulted in legacy tailings

deposits. These mining wastes have resulted in documented environmental impacts to topography, soils, vegetation, groundwater, surface water, and biota.

In January 2021, Perpetua entered into an ASAOC with the Forest Service and EPA for removal actions at the Stibnite legacy mining site. Phase 1 of this agreement includes removal of contaminated sediment, mine wastes, and tailings from within and along the banks of Lower Meadow Creek and the East Fork SFSR. It also includes construction of three stream diversions to prevent clean water from infiltrating source areas, and a study of selected adit discharges. The primary objective of these removal actions is to eliminate or reduce potential ecological and human exposure to metals by mitigating sources of contamination from contact with sediment and surface water. Removal actions would include excavating, localized transportation, and disposal of legacy mine wastes. Following these construction activities, the disturbed areas would be reclaimed with growth medium and revegetated to stabilize the sites. This work is planned to occur in 2022 and 2024.

The planned ASAOC activities would temporarily increase the use of fuels and lubricating oils at the SGP site for the duration of the Phase 1 activities. A total of 48 deliveries of fuel to the site has been estimated to be required over the 3 years required to complete the construction. These activities are being completed under CERCLA authority and are not subject to the NEPA analysis for the SGP.

4.7.2.2 2021 MMP

Under the 2021 MMP, the volume and types of hazardous materials transported, stored, and used at the mine site and off-site facilities would increase from the current conditions of the permitted exploration operations. Substantial quantities of fuels, lubricants, and chemicals would be transported annually via large trucks, and would be stored in aboveground storage tanks, bins, totes, and drums, within the required secondary containment designed to prevent spill releases to the environment.

Table 4.7-1 provides a list of the hazardous materials to be used under the 2021 MMP including their annual transport, number of annual deliveries, and on-site storage. Estimates of the wastes likely to be generated can be made based on the volume of materials proposed to be used.

Table 4.7-1 List of Hazardous Materials

Name	Units	Annual Usage/ Transport	Annual Deliveries	On-site storage capacity	Amount of Waste Likely to be Generated
Diesel fuel	Gallons	5,800,000	580	200,000	0 (fully consumed)
Lubricants	Gallons	296,000	99	30,000	148,000 (50% consumed)[1] Off- site disposal.
Gasoline	Gallons	500,000	100	10,000	0 (fully consumed)
Antifreeze	Gallons	40,000	13	4,000	40,000 (assumed fully drained and recycled off site)
Propane-Buildings	Gallons	560,000	93	30,000	0 (fully consumed)
Propane-Lime Plant	Gallons	1,463,000	133	30,000	0 (fully consumed)

Name	Units	Annual Usage/ Transport	Annual Deliveries	On-site storage capacity	Amount of Waste Likely to be Generated
Antimony Concentrate	Tons	Variable 0 to 17,500	Variable 0 to 730	Variable	All concentrate transported off-site with temporary daily staging at SGP
Ammonium nitrate	Tons	7,300	304	200	0 (fully consumed)
Explosives	Tons	100	20	20	0 (fully consumed)
Grinding media (balls for mill)	Tons	8,100	337	600	0 (typically consumed, any residuals recycled offsite)
Mill liners	Tons	650	94	650	200 (70% consumed, residual recycled offsite)
Crusher liners	Tons	160	1	160	80 (50% consumed, residual recycled offsite)
Sodium cyanide	Tons	4,000	167	300	Mostly consumed, residual quantity mixed with tailings, neutralized and discharged to the TSF[3]
Lime (process)	Tons	70,000	(produced on site)	4,000	0 (fully consumed in process, mixed with tailings as calcium carbonate)
Activated carbon	Tons	500	23	50	0 (recycled and re-activated)[2]
Copper sulfate	Tons	1,250	57	100	0 (consumed as a reagent)
Lead nitrate	Tons	800	37	25	0 (consumed as a reagent)
Aerophine 3418A	Gallons	10,500	53	400	0 (consumed as a reagent)
Methyl isobutyl carbonyl	Gallons	120,000	40	6,000	0 (consumed as a reagent)
Flocculant	Tons	300	15	50	0 (consumed as a reagent)
Sodium metabisulfite	Tons	2,000	91	200	0 (consumed as a reagent)
Potassium amyl xanthate	Tons	1,350	68	40	0 (consumed as a reagent)
Sodium hydroxide	Tons	330	15	40	0 (consumed as a reagent)
Nitric acid	Gallons	65,000	22	6,000	0 (consumed as a reagent)
Scale control reagents	Gallons	5,000	5	1,000	0 (consumed as a reagent)
Hydrogen peroxide	Gallons	7,100	2	10,000	0 (consumed as a reagent)
Sodium Hypochlorite	Gallons	2,000	2	1,000	0 (consumed as a reagent)
Sulfuric acid	Gallons	12,000	5	8,000	0 (consumed as a reagent)
Ferric Sulfate	Gallons	23,000	17	6,000	0 (consumed as a reagent)
Sodium Bisulfite	Drums	2	1	2	0 (consumed as a reagent)
Lime (water treatment)	Tons	150	7	30	0 (consumed as a reagent)
Solvents	Gallon	1,000	5	1,000	1,000 (Spent solvent recycled off site)

Name	Units	Annual Usage/ Transport	Annual Deliveries	On-site storage capacity	Amount of Waste Likely to be Generated
Batteries	Variable	Variable	25	500 units	Recycled offsite or disposed offsite as solid waste or special waste depending on characteristics.
Herbicides/Pesticides	Pounds	1,250	1	1,000	0 (fully consumed in use)
Wastes containing mercury from ore processing (carbon canisters, filter packs, gas condensers)	Pounds	Not quantified	Variable	Variable	Not quantified. Waste would be disposed off-site in permitted facilities.

Source: Perpetua 2021a
[1] https://ec.europa.eu/environment/waste/oil_index.htm.
[2] Some amount of carbon per ton of ore leached is likely lost to attrition. This lost material would end up in the tailings.
[3] Waste would be in the form of cyanide mixed with tailings and would be sent to fully contained TSF for disposal. Cyanide levels would be reduced to less than 10 parts per million weak acid dissociable cyanide.

Specific components proposed under the 2021 MMP that would have hazardous materials include the Operations Area Boundary and off-site facilities. Within the Operations Area Boundary, areas with hazardous materials would include the maintenance workshop with truck wash (petroleum products and chemical storage, oil water separator), worker housing facility (with sanitary and solid waste), and the fuel and explosives storage at the mine site.

During the construction phase (approximately 2 to 3 years), the Operations Area Boundary would be accessed via the Johnson Creek Route until the Burntlog Route is completed. The Johnson Creek Route originates at Landmark at the intersection of Warm Lake Road and Johnson Creek Road and extends north on Johnson Creek Road (CR 10-413) for approximately 25 miles along Johnson Creek to the village of Yellow Pine. From there, the Stibnite Road (CR 50-412) continues eastward and southward along the East Fork SFSR entering the Operations Area Boundary from the north. The main watersheds that could be potentially impacted by releases of fuels or hazardous materials to the environment along this route include Johnson Creek and East Fork SFSR.

The largest volume of hazardous material or petroleum transferred to the mine site during construction would be diesel fuel. It is estimated that on average, two daily round trips to deliver fuel and miscellaneous supplies would occur (**Table 2.4-2** provides the projections for all construction traffic to the mine site).

Although transportation of hazardous materials presents the greatest risk of impacts from spills and releases to the environment, all deliveries of fuel and hazardous loads would be escorted by pilot vehicles. The pilot vehicles would regulate the speed of transports for the current road conditions and would advise oncoming traffic to park until the convoy passes. These actions would reduce the potential for vehicle collisions and thus spills resulting from collisions. Hazardous materials would be transported to the mine site in USDOT certified containers and by USDOT registered transporters (Midas Gold 2016a).

During the mining and ore processing operations phase (approximately 15 years), the Operations Area Boundary would be accessed via the Burntlog Route. The Burntlog Route would connect the eastern end of Warm Lake Road at Landmark to the Operations Area Boundary via the existing Burntlog Road (FR 447), Meadow Creek Lookout Road (FR 51290), Thunder Mountain Road (FR 50375), and approximately 15 miles of new road constructed to connect the three. The road would cross through the drainage areas of Burntlog Creek, Trapper Creek, and upper Riordan Creek, all tributaries to Johnson Creek. It would then descend across the upper Meadow Creek and East Fork SFSR drainages entering the Operations Area Boundary from the southeast. The main watersheds that could be affected by releases of fuels or hazardous materials along this route are Burntlog Creek, Trapper Creek, and the upper portions of Riordan Creek, Meadow Creek, and East Fork SFSR.

Hazardous materials such as diesel, gasoline, propane, lubricants, hydraulic oil, antifreeze, explosives, antimony concentrate, and ore processing reagents would be transported, stored, and used at the mine site, and potentially at off-site facilities (**Table 4.7-1**). Shipments would be transported by truck along the Burntlog Route in USDOT approved containers or bulk tanker trucks, depending on the material and vendor. During construction, it is estimated that the truck AADT between SGLF and Operations Area Boundary would be 45 trips per day. It is estimated that on average, 33 daily round trips of trucks to transport ore processing supplies, fuel, concentrate, and other materials would occur between SGLF and Operations Area Boundary during operations, and 15 trips per day during closure and reclamation. **Table 2.4-2** provides the projections for all traffic during mining and ore processing operations to the mine site.

The majority of hazardous materials used on site would be spent or consumed during operations (**Table 4.7-1**). Materials that are not spent or consumed (e.g., lubricants, antifreeze, solvents) would be recycled, to the extent practical, or disposed off-site in an approved depository in accordance with applicable federal and state laws (Perpetua 2021a). Antimony concentrate produced at the mine site would be transported off-site for processing. Descriptions of the handling practices for various materials at the site follow.

Liquid Petroleum Products and Wastes

Aboveground storage tanks would be used for fuels and other petroleum fluids, including gasoline, diesel fuel, lubricants, coolants, hydraulic fluids, and propane at the mine site, as outlined in a SPCC Plan required for the mine site under Section 311(j)(1)(C) of the CWA. The storage tank facility for gasoline, diesel fuel, and propane would be located near the maintenance workshop with additional propane storage at the ore processing facility area, the underground portal area, and the worker housing facility. Approximate fuel and petroleum volumes for diesel, gasoline, and propane that would be stored at the mine site are included in **Table 4.7-1**.

Motor oils, lubricants, antifreeze, and solvents would be shipped to the mine site on trucks. These would be stored in approved containers located within, or directly adjacent to, the maintenance shop and contained within secondary containments to prevent spills into the environment. All used petroleum products, waste antifreeze, and used solvents would be collected in approved containers, transported off site, and disposed or recycled.

All liquid petroleum products would be managed in closed tanks or containers that are located within secondary containment areas such that a complete release of petroleum from the largest tank or container

with the secondary containment area would be retained in the area without release to the environment. The procedures in the SPCC Plan would cover all activities related to receipt, storage, and dispensing petroleum products in a manner that would minimize spills and prevent releases outside of the secondary containment areas. Inspections, security, and maintenance activities of all petroleum storage facilities would minimize the potential for spills from tanks and containers, and prompt cleanup of any such spills.

The 2021 MMP includes the operation of four new substations and upgrades to five existing substations, which would require quantities of dielectric oils (i.e., mineral oils). These oils would be contained within the substation equipment and as per the site-specific SPCC plans, design of the substation yards would prevent discharges out of the yards in the event of a leak from the electrical equipment.

Written spill response procedures and pre-positioned spill response supplies and tools would assist in containing and cleanup of any spills within and outside of secondary containments. SGP personnel would be trained in the execution of the SPCC Plan which would be reviewed and updated as needed through all phases of the SGP from construction through closure. Spills of fuel or oils outside of secondary containments would be responded to in a manner to control the size of the spill. The spilled petroleum and contaminated soil would be cleaned up and placed in steel bins or drums to be shipped off site for treatment or disposal.

Cyanide Handling

The International Cyanide Management Code (ICMC) is a voluntary initiative for the gold and silver mining industries and the producers and transporters of cyanide used in gold and silver mining. It is intended to complement a mine operation's existing regulatory requirements. The ICMC focuses exclusively on the safe management of cyanide that is produced, transported, and used for the recovery of gold and silver, and on mill tailings and leach solutions. Standards of practice specific to cyanide transport, handling, storage, and emergency response under the ICMC include:

- Establish clear lines of responsibility for safety, security, release prevention, training, and emergency response in written agreements with producers, distributors, and transporters.
- Require that cyanide transporters implement appropriate emergency response plans and capabilities and employ adequate measures for cyanide management.
- Design and construct unloading, storage, and mixing facilities consistent with sound, accepted engineering practices and quality control and quality assurance procedures, as well as spill prevention and spill containment measures.
- Operate unloading, storage, and mixing facilities to incorporate inspections, preventive maintenance, and contingency plans to prevent or contain releases and control and respond to worker exposures.
- Prepare detailed emergency response plans for potential cyanide releases.
- Involve site personnel and stakeholders in the planning process.
- Designate appropriate personnel and commit necessary equipment and resources for emergency response.
- Develop procedures for internal and external emergency notification and reporting.

- Incorporate into response plans monitoring elements and remediation measures that account for the additional hazards of using cyanide treatment chemicals.
- Periodically evaluate response procedures and capabilities and revise them as needed.

Perpetua would purchase sodium cyanide from producers that are compliant with the ICMC and utilize ICMC certified and compliant transporters to transport the dry cyanide product from the manufacturer to the mine site. A common method of sodium cyanide transport is via ISO container, which holds dry sodium cyanide in the form of briquettes. ISO containers are heavy-duty steel containers that are air and watertight and are ruggedly designed within a steel framework to withstand rollovers and other accidents. The dry solid sodium cyanide is extracted by connecting the ISO container to the reagent circuit in the mill and circulating process water through the container, dissolving the briquettes and producing a sodium cyanide solution for use in the leach circuit. The ISO containers remain sealed at all times, during transportation and use at the site. The empty ISO containers are rinsed at the processing site and then returned to the supplier for reuse, removing the necessity for container disposal.

Additionally, the cyanide reagent and leach facilities at the processing site would be constructed and operated consistent with the ICMC standards. All pipes and tanks containing cyanide in solution would be located within secondary spill containment such that any spills of water containing cyanide in solution would be retained and recycled back to the process.

Any spill of water with cyanide in solution would be immediately responded to by containing and stopping the spill as soon as possible. The spilled water and any contaminated soil would be recovered and recycled back to the leach process or tailings circuit. Sampling of the remediated spill site would be done to confirm that the cleanup was completed.

Using sodium cyanide in the solid form eliminates the risk of fluid leaks or spills during transportation. Any released cyanide briquettes stay in place at the spill site. The spilled briquettes can be readily recovered with mechanical means placing the briquettes and any contaminated soil in a suitable container by a person equipped with appropriate personal protection equipment. The recovered material can be recycled into the leach process at the mill. Sampling of the remediated spill site would be done to confirm that the cleanup was completed.

During transportation, it is unlikely that any cyanide briquettes spilled on an access road would directly enter a live stream because of the separation of the road travel way from running streams. A more probable contact of the reagent with water could occur if the spill site on the road was wet with snow or rain and there was a concern over dissolved cyanide leaving the spill site. In this case the spilled material and any contaminated water would be contained at or near the spill site with earth berms and spill control materials. The spilled briquettes would be picked up and packaged and the contaminated soil and water treated on site or removed and either recycled at the SGP mill or packaged for offsite disposal as a waste.

Process Reagents

The mill process would require the use of multiple other reagents in different steps of the process (**Table 4.7-1**). Some of these reagents would be dry materials shipped in bags or supersacks. Other reagents would be liquids shipped in drums or totes and a few would be shipped in bulk tanker trucks. All reagents would be stored on site within secondary containment areas such that a leak of the shipping or storage

containers or tanks would be retained in the secondary containments for cleanup without release to the environment. Process reagents would be used up in the process and become combined with the mill tailings and concentrate. Any spills of reagents would be contained and cleaned up by SGP personnel in appropriate personal protective equipment according to their safety data sheets.

Explosives

The main blasting agent to be used in the open pit mining would be ANFO consisting of ammonium nitrate and fuel oil. The dry ammonium nitrate prill would be shipped in bulk trucks and loaded into large bins at the SGP. It would be transported within the Operations Area Boundary in special trucks to the blast holes where it would be mixed with about 6 percent fuel oil and placed in the blast holes. The ANFO in the blast holes would be detonated with high explosive primers, detonating cord, and blasting caps. These other explosives would be delivered in boxes and stored in specially constructed and secured storage buildings (magazines) away from other SGP facilities. All explosives would be carefully managed by specially trained SGP personnel. High explosives are pre-packaged units that are not subject to any spillage. Spilled ammonium nitrate would be contained and cleaned up by mechanical means to be used on site. Any spilled fuel oil would be responded to as described above.

Tailings Neutralization

Sodium cyanide reagent would be dissolved in process water that was treated with lime to elevate the pH to at least 10. This would produce a solution of free cyanide ion in water. The free cyanide ion can dissolve precious metals in the leach circuit to remove the target metals from the solid ore or concentrate particles. The cyanide-metal complexes are then adsorbed from the leach solution by activated carbon removing much of the cyanide but some residual cyanide remains in the tailings slurry leaving the leach circuit. Tailings with high residual cyanide concentrations can be harmful to wildlife exposed to the tailings water. According to the International Cyanide Management Institute and its International Cyanide Management Code, reducing the weak-acid dissociable cyanide concentration in tailings to less than 50 mg/l should not harm terrestrial and avian wildlife. The EPA and IDEQ require a limit of three orders of magnitude lower than this for a discharge to the aquatic environment.

Cyanide leach tailings from the SGP would be neutralized within the ore processing facility before being pumped to the TSF. Tailings from the leaching circuit would first be routed to one or more tailings thickeners where much of the water would be recycled within the ore processing facility. Thickened tailings would then be pumped to the cyanide neutralization facility where the residual cyanide would be treated using sodium metabisulfate and air system (or equivalent) to oxidize cyanide to cyanate. Cyanate is a much less toxic compound and is further naturally degraded through hydrolysis chemical reactions in the tailings impoundment to form carbonate and ammonia. The tailings treatment would reduce the WAD cyanide concentrations to approximately 10 mg/L at the process facility before the tailings are pumped to the TSF.

In addition to the oxidation of cyanide, metals are also removed from solution by precipitation as metal hydroxides. The proposed cyanide neutralization process is capable of removing stable iron-cyanide complexes from solution. Ferricyanides are reduced to insoluble ferricyanide salts and precipitated from solution.

Throughout operations, remnant cyanide levels would be monitored in the treated leach tailings and the TSF supernatant pond to ensure they remain in compliance with issued approvals and permits and remain below concentrations harmful of wildlife.

Tailings Water Management

Tailings would be thickened at the process facility to directly recycle much of the process water back to the process. The thickened tailings slurry would be pumped from the mill process facility to the TSF. Cyanide concentrations in the tailings water would be reduced by treatment at the mill process to approximately 10 mg/L before being transported to the TSF. The tailings pipeline would be laid in a geosynthetic lined trench to contain any potential leaks from the pipeline and convey the leaks to lined containment ponds along the pipeline corridor. The reclaim water pipeline from the TSF back to the mill process would also be laid in the lined trench. Where the pipeline corridor passes under roads, the slurry and reclaim water pipelines would be contained in large pipes connected to the trench liner on either end. The same would be the case where the corridor passes over the East Fork SFSR. The pipeline corridor would be designed and built to prevent release to the environment of any potential spills within the corridor.

In the TSF, the solid fraction of the tailings slurry would settle out and the tailings water would accumulate in the supernatant pool where reclaim pumps would remove the water and pump it back to the mill process for reuse. The TSF is designed to contain the tailings water and prevent leakage to the environment. The entire TSF impoundment would be lined with 60-mil linear low-density polyethylene membrane which would be underlain by secondary liner of GCL. To limit head on the liner system, portions of the liner system would be overlain by either a gravel or geocomposite overliner drain network to allow consolidation-related drainage to be collected and conveyed to a collection sump near the upstream toe of the embankment. The presence of the overliner drains would minimize hydraulic head on the liner system and allow tailings pore pressures to dissipate, facilitating consolidation during operations. Monitoring of the TSF liner would be accomplished with an underdrain system installed below the liner and reporting to a sump where the water flow and quality would be monitored. Downgradient groundwater monitoring wells would also be installed.

The TSF facility design and operation would comply with the Idaho Rules for Ore Processing by Cyanidation (IDAPA 58.01.13).

Following mill operations closure activities would include reducing the tailings water pool within the TSF by forced evaporation and pumping to an onsite wastewater treatment plant. The treatment plant would treat the water to receiving stream standards before discharge to Meadow Creek. After the tailings water was removed and the TSF cover was installed the surface runoff from the TSF would not require treatment.

Contingency Plans

Perpetua would maintain and exercise contingency plans for all possible emergency situations at the SGP including accidents, medical emergencies, fire/explosions, chemical spills, wildfire, extreme weather, geologic hazards, and avalanches. These plans would include responses to spills and releases of any of the hazardous materials used at the site. Response actions would include alarms, calling out trained SGP spill

response personnel, appropriate personal protective equipment, spill containment, cleanup, handling spill response wastes, and proper notifications to government agencies. Adequate spill response personnel and required spill response equipment and materials would be available at all times during construction through reclamation.

Since 2019 and according to a Community Partnership Agreement, Perpetua has discussed its development plans with the Stibnite Advisory Council, representing eight local communities. The Council has met regularly to inform the communities, identify potential impacts from the SGP development, and discuss opportunities to mitigate these impacts. Some of these discussions have included how Perpetua can provide resources to the local first responder agencies to support their training and preparedness for responding to potential spills or accidents involving SGP-related traffic. So far, Perpetua has reached out to all Valley County fire department to provide HAZWOPER training specific to the hazardous materials currently used on site. Perpetua has committed to continue to work closely with local fire, EMS, and law enforcement departments to offer joint safety/emergency training and share information on Perpetua's safety protocols and emergency preparedness plans. Perpetua would also enter into an agreement with Valley County to lessen impacts to county service providers and infrastructure, such as EMS, Sheriff, solid waste, etc.

The water balance between the different circuits in the processing mill and between the mill and the TSF would be maintained by constant pumping of water or slurry through the various parts of the water balance. Electric power for the SGP, including these pumps, would be supplied by the IPCo transmission line and on-site solar power generation. It is desirable to maintain these pumping rates and in the event of a power outage on the transmission line to the SGP, diesel and propane powered generators would automatically start to supplant the solar power generation and maintain electric power for priority uses at the SGP.

Solid Waste Management

All municipal waste and construction and demolition waste generated by the SGP would be collected in wildlife-resistant containers and hauled offsite for disposal in a municipal waste landfill. Concrete foundations and floors would be broken during demolition and covered in place with at least two feet of earth. Small scale composting associated with organic materials generated at the worker housing facility may be conducted at the Fiddle GMS.

Hazardous Waste Management

Material the meets the classification of hazardous waste would be collected and stored according to Idaho regulations implementing federal RCRA regulations on hazardous waste management. Such wastes would be accumulated in approved containers at designated collection locations in the facilities. These containers would be transferred to a 90-day storage site at the facilities prior to shipping to an offsite, permitted hazardous waste disposal facility.

The handling of hazardous waste, from generation through off-site disposal, would be done in concert with written procedures to comply with all applicable parts of the Idaho hazardous waste regulations. This would include written contingency plans identifying response and notifications actions in the event of a spill of hazardous waste at the SGP. The largest quantity of hazardous waste routinely produced by gold

mines is laboratory assay wastes containing lead. These materials are solids like slag, cupels, crucibles, and the like. These wastes are contained in steel bins that are sealed at the mine site before being shipped off site to permitted hazardous waste disposal facilities. In the unlikely event of a spill of these materials the spilled material could be readily recovered with mechanical means appropriate to the spill event placing the material and any contaminated soil in a suitable container by a person equipped with appropriate personal protection equipment. The recovered material would be replaced into the accumulation bins.

Autoclave refractory liner bricks are typically non-hazardous when new. They can become contaminated with metals during use at mine sites such that they must be handled as hazardous wastes when removed during maintenance relining of an autoclave. This would be determined at the SGP through operational experience during maintenance activities when the autoclave liner was rebuilt. Spent refractory material would be properly managed and disposed based on its characteristics when the waste was generated.

Smaller quantities of hazardous waste typically consist of waste maintenance materials such as solvents, paints, batteries, lamps, and electrical equipment. These materials would be accumulated in steel drums positioned near the points of generation of these materials. Any drums of liquid hazardous waste would be placed in secondary containment. Any spills would immediately be contained and remediated according to the site contingency plans.

Antimony Concentrate Handling

An estimated 15 to 20 percent of the total mill feed would contain sufficient antimony mineral grades (> 0.1 percent weight antimony) to warrant production of an antimony concentrate product. Annual production of antimony would be variable with almost all of the antimony being recovered from ore mined in the first 6 years of operations (M3 2021). After then, the antimony recovery circuit in the mill process would be operated infrequently and the gold/silver circuit would be operated alone when the antimony recovery circuit is bypassed. The SGP ore processing circuit would produce an antimony concentrate that would contain approximately 55 to 60 percent antimony by weight. The remaining 40 to 45 percent of the concentrate is predominantly sulfur (as sulfide in the stibnite) and common rock, with trace amounts of gold, silver, and mercury. Antimony concentrate would be produced at a rate of approximately 20 to 50 tons per day.

The antimony concentrate filtration and loading area would be within the flotation building. The concentrate would be a dry, granular material that would be placed in 2-ton supersack containers secured to a bagging machine. The filled supersacks would then be sealed in the building and loaded into 20-foot shipping containers at the process site. The loaded shipping containers would then be closed and affixed with shipping seals before being loaded onto trucks for transportation to the SGLF and then transported to market via highway legal trucks. The dual containment of supersacks within sealed shipping containers makes it unlikely that there would be spills of concentrate during transportation from the SGP. In the unlikely event that a concentrate spill occurred, the spilled concentrate could be recovered with mechanical means appropriate to the spill event, placing the recovered concentrate and any contaminated native material in a suitable container by a person equipped with appropriate personal protection equipment. The recovered material can be recycled into the process at the mill. Sampling of the remediated spill site would be done to confirm that the cleanup was completed.

Mercury and Mercury Containing Materials

In the gold and silver leaching process, small amounts of mercury would also be dissolved from the ore and follow the gold and silver through the rest of the process. During the carbon stripping process, a small amount of mercury may not desorb from the activated carbon. This residual mercury would volatilize in the carbon reactivation kiln and be controlled with a venturi scrubber and sulfur-impregnated carbon columns in the kiln off-gas stream. Solid waste from this process (i.e., the carbon canisters and filter packs) would be disposed offsite in a permitted solid waste or hazardous waste disposal facility depending on the mercury characteristics of the wastes.

Gold and silver would be precipitated from the carbon strip solution onto stainless steel mesh in the electrowinning circuit. The mesh would be removed from the electrowinning cells and washed to produce a metal-bearing sludge that would be filtered and placed into a retort to dry the material and volatilize any remaining impurities, such as mercury. The off gas from the retort would be passed through a chilled condenser, where any mercury would be converted to its liquid metallic state, collected in steel containers called "pigs" and then securely stored prior to shipment to a certified hazardous waste disposal facility. The off gas from the condenser would be passed through a bed of sulfur-impregnated carbon to collect any residual mercury vapor before the cleaned off gas would be released into the atmosphere.

The generation rates for these waste streams would be variable depending on the particular ore streams being processed in any one year but an estimate of average annual, total mercury content in flasks and other waste streams to be disposed offsite is 10.9 tons per year with 10.7 tons consisting of metallic mercury in flasks.

Water Treatment Plant (WTP) Residuals

Groundwater and surface water that has contacted rock involved in the mine operations is called "contact water". The chemistry of this water can be affected by its contact with the ore and development rock. This water would be collected and typically used as makeup water in the mill process. During wet seasons or other times when there may be more contact water than can be used in the mill, the excess contact water would be treated to a quality where it could be discharged to Meadow Creek or East Fork SFSR in compliance with the discharge limitations of an IPDES discharge permit issued by the IDEQ. The WTP would be located at the mill site during operations and near the base of the TSF embankment during closure.

The objective of the water treatment would be to remove dissolved metals by chemical precipitation, flocculation, filtration, and final chemistry adjustment of the treated water prior to discharge. If needed, organic sulfide, reverse osmosis, nanofiltration, or ion exchange steps may be added to the treatment process. During closure activities of the TSF, in addition to metals removal, the WTP would incorporate additional steps to treat TDS and any residual cyanide in the influent water.

The WTP would produce a residuals slurry that would be disposed in the TSF. During operations, this slurry would be mixed with the rest of the mill tailings slurry to be pumped to the TSF for disposal. During closure, the residuals slurry would be filtered at the WTP and hauled to a designated disposal location in the TSF. Current evaluation of the potential chemistry of the WTP residuals indicate the

material would not exhibit hazardous waste characteristics. The design and operation of the WTP would purposely produce residuals that would not have hazardous waste characteristics.

Transportation of Hazardous Materials

All SGP access routes could present occasionally adverse road conditions that are common on remote mountain roads, especially due to ice and snow conditions during winter months. Road conditions on high mountain passes such as Landmark Big Creek Summit, and portions of the Burntlog Route may be particularly challenging in the winter. Both the Burntlog and Johnson Creek routes have segments with steep grades (above 6 percent), and no emergency truck ramps are present or planned on the routes. Switchbacks and reduced turning radius also may be a challenge for large trucks operating on these roads.

Perpetua has prepared a written Transportation Management Plan that describes standard operating procedures for transportation of fuels and hazardous materials (*materials*) that would require adherence to the following:

- All *materials* would be transported to the SGP in USDOT approved containers and by USDOT registered transporters who will comply with applicable USDOT, OSHA, and MSHA regulations. Transportation of *materials* would comply with USDOT requirements for markings, labels, and placards.

- Transporter drivers would be experienced in their specific truck haulage practices on NFS roads including travel routes and safe speeds for all parts of the routes, especially steep slopes.

- Schedules for delivery of *materials* to the SGP would be planned in advance with established dates and times communicated to SGP personnel involved and all deliveries of *materials* would occur during daylight hours.

- All hazardous *material* shipments over the mine access roads would be done with single trailer trucks.

- Transporters of *materials* would be required to check in at the SGLF for: safety inspections of the vehicle; providing documentation of spill response, safety, and resource awareness training; demonstrating presence of spill cleanup kit on the vehicle, coordinating use of GPS vehicle tracking signal with SGP security, receive SGP site-specific safety and safe-driver training, and briefings on the Idaho State EMS, first responder actions, importance of anadromous fisheries, and current Burntlog Route conditions.

- Pilot vehicles would escort all *materials* shipments in and out of the SGP access roads and have radio contact with the site and transport vehicles.

- All pilot and SGP emergency response vehicles would carry spill containment and cleanup equipment and materials, as well as first aid kits.

- Pilot vehicles would advise oncoming traffic to park until the convoy passes and would regulate the speed of the convoy for the current conditions of the road.

- Road signs would be placed at both ends of the route while a convoy of *materials* is operating warning other traffic to use caution.

- Spill response equipment and supplies would be pre-positioned at SGP facilities and along the access routes. SGP personnel would be trained in the use of spill response supplies and equipment including knowledge of where and how to contain and cleanup spills.

Perpetua has prepared a Vehicle Incident Emergency Response Plan that includes best practices for responding to accidents occurring on the access routes. The Perpetua Emergency Response Staff would assume a lead role in these responses and local law enforcement would be contacted to address blockage of the access route. Adequate Perpetua support personnel would be scheduled to be present at all times, including site-specific training and 40-hour HAZWOPER training for spill response.

Perpetua has inventoried the potential locations of earth instability (landslides and rockfalls) and snow avalanches along the potential access routes to the SGP. These are discussed in **Sections 3.2** and **4.2**. Where these hazards might occur during operations, they could impact the ability of traffic using the access routes and in unlikely situations could impact passing vehicles. **Table 3.2-1** compares identified geohazards of the two access routes to the SGP and shows the Johnson Creek Route, that would be used during initial 2021 MMP construction, has 45 locations of landslides and rockfalls and 94 avalanche paths. The Burntlog Route crosses 26 landslide/ rockfall areas and 38 avalanche paths. These geohazards present along the road corridors could increase the potential for truck accidents resulting in spills of hazardous materials. The Johnson Creek Route has increased potential for trucking accidents and greater spill risk from these geohazards compared to the Burntlog Route.

Perpetua has committed to monitoring and control measures to reduce the potential impacts of these hazards. For avalanche hazards, Perpetua would post warning signs along the routes indicating avalanche prone areas and include the locations of these areas in safety information provided to transporters using the routes. This information would be updated annually as needed for changed conditions. During avalanche season Perpetua would:

- Conduct daily region-scale assessment of avalanche parameters using in-house avalanche forecasters.
- Conduct weather conditions assessment daily including snowpack, avalanches, and road conditions.
- Notify SGP staff when avalanche conditions are highly unstable.
- Close access routes during periods of elevated avalanche hazard or blocked roads.
- Control avalanche initiation with explosives or equivalent means.

Earth movements like landslides and rockfalls are exacerbated by periods of heavy precipitation and by diurnal freeze/thaw cycles typical of spring weather. They may also be seismically induced. Protection measures such as rock bolting, netting, and signage would be installed along road segments susceptible to rock falls. Other road design features would be incorporated such as cut slope laybacks, retaining walls, soil nails, and slope dewatering to reduce the potential for slope failures. Removal of earth debris along access routes would be covered in the maintenance agreement with Valley County.

Based on the proposed hazardous materials, supplies, reagents, and wastes being transported to and from the Operations Area Boundary, the greatest concern would be a significant release of a hazardous material from a transportation accident. Data accessed from the Federal Motor Carrier Safety Administration (Federal Motor Carrier Safety Administration [FCSA] 2018) website (www.fmcsa.dot.gov) show very low rates of large truck accidents resulting in spills of hazardous material. Strict regulatory controls and SGP emergency response procedures would be expected to limit the extent of any such incidents.

To evaluate the potential impact of the transport of hazardous materials to and from the mine site, the risk of a transportation accident resulting in the release of hazardous materials was estimated. Accident and incident rates were derived from national statistics for truck accidents that involve hazardous materials as published by the Federal Motor Carrier Safety Administration (2018). Records show that the number of large trucks (gross vehicle weight of more than 10,000 pounds) on national highways from 2013 to 2016 ranged from over 10.59 million to 11.49 million; with large trucks traveling between 275.01 billion miles to 287.89 billion miles annually. Over that same time frame, large truck crashes involving hazardous materials cargo (with no release) ranged from 2,420 to 2,475, while large truck accidents with release of hazardous materials cargo ranged from 385 to 552. The statistical rate of large-truck accidents involving hazardous cargo for miles traveled ranged from approximately 1 accident for every 714 million miles traveled in 2013 to approximately 1 accident for every 522 million miles traveled in 2016. Therefore, statistically, the rate of accidents on the nation's highways involving crashes or spills of hazardous material cargo by large trucks is very low (FMCSA 2018).

Nationwide data from the Federal Motor Carrier Safety Administration website was obtained recently (FMCSA 2022). This information indicated that in 2019 (the latest data available by the FMCSA website) hazardous materials cargo carried by trucks was present in 3,885 total crashes and releases of the hazardous materials from their containers occurred in 671 of the crashes (FMCSA 2022). The most common cargo that was involved in crashes of hazardous materials transport was flammable liquids, accounting for 1,972 of the crashes. Recorded releases of flammable liquids occurred in 311 of the crashes. This category includes gasoline and fuel oils. Corrosives (including acids) were involved in 308 total crashes including 46 crashes where the cargo was released. Poisonous materials (including cyanide) were involved in 24 total crashes and only one of these involved a known release of the poisonous cargo.

This information shows that the most common type of hazardous material being transported is flammable material, which mostly consists of gasoline and fuel oil in bulk tanker trucks, and in about 16 percent of the crashes there was a release of the cargo. Crashes involving corrosives in transportation were six times less common than flammable liquids and about 15 percent of these crashes involved releases of the cargo. Again, these types of materials are commonly transported in bulk tanker trucks. It is notable that poisonous cargos were involved in only 24 total crashes and of these only one crash resulted in the release of the cargo.

Nationwide data from Federal Motor Carrier Safety Administration website (FMCSA 2022) shows that crashes involving large trucks in 2019 included 5,005 fatal crashes, 119,000 injury crashes, and 414,000 property damage crashes. Of these total incidents, about 418,000 of the crashes were the result of collisions with other vehicles, 47,211 crashes were collisions with fixed objects, and 14,287 crashes were rollovers. These data indicate that almost all accidents involving large trucks occur when driving on

public roads, collisions with fixed objects are much less frequent, and rollover accidents are a small percentage of the total (2.7 percent).

In 2019 there were a total of 38 spills of hazardous materials reported in the state of Idaho. None of these spills appear to be associated with a mine site or hauling of materials from a mine site. Most of the spills were from freight haulers and delivery services such as Fed Ex or United Parcel Service (accessed at https://portal.phmsa.dot.gov/analytics/saw.dll?Dashboard).

While national highways would be used to transport materials to the SGP as far as Cascade, Idaho, secondary roads would be used to make delivery into, or transport materials out of, the Operations Area Boundary and to the off-site facilities. Statistics for haul truck accidents on county roads and/or in mountainous terrain are very limited. Transportation of fuels and hazardous materials on the SGP access roads would be controlled with pilot vehicles and at lower speeds and with less traffic than highways and would likely be less prone to vehicle crashes than on the public highways.

However, the use of the SGP access roads do present additional hazards to vehicles such as: mountainous terrain, curves, rockfalls, reduced road widths, reduced sight distances, presence of wildlife, snow accumulations, avalanches, rock falls, falling trees, etc. These conditions could result in accidents related to vehicles encountering these other hazards. Perpetua would monitor conditions along the access roads and control transport of fuels and hazardous materials beyond the SGLF to reduce the effects of these other potential hazards.

Such accidents could cause spills of fuels or hazardous materials the environmental effects of which would depend upon the size of the spill, the material spilled, and proximity to flowing water. Perpetua has proposed spill control and countermeasures to reduce the effects of spills through responses with trained SGP personnel, equipment, and readily available spill response materials.

Spill Responses

Perpetua has prepared written spill response procedures described in their SGP Emergency Response Program (OHS-008) and SPCC Plan (OHSF-008K) that include:

- Emergency Call List and Contact Matrix (OHSF-008-A): Communication protocols for internal contacts for emergency notification and call matrices per incident type (e.g., spill, flood, fire, avalanche, etc.) for appropriate federal, state, and county agency reporting.

- Protection Systems and Response Equipment (OHSF-008-D): Identifies the locations of emergency response equipment and includes an inventory of available emergency response equipment at each location.

- Spill Plan (OHS-008-K): Provides emergency response protocols for employees and contractors in the event of spills. Includes directives for minor and major spill response, emergency contacts, reporting requirements for fuel spills/hazardous materials spills, contact numbers for environmental response contractor (Specialty Environmental Services), muster points, and emergency medical services contact information (i.e., Life Flight and Cascade Ambulance).

- Related plans include:
  - Critical Operations List (OHSR-008-C)
  - Evacuation Plan (OHSF-008-G)
  - HAZWOPER Program (OHSF-008-N)
  - Waste Determinations SOP (ESOP-021)
  - Herbicide Spill Response SOP (ESOP-024)

- For major hydrocarbon spills, areas of "flat water" in any adjacent waterways will be identified prior to material hauls in the event that booms need to be placed to capture major spills.

Spills at Mine Site and Off-Site SGP Facilities

A large volume release to the environment at the mine site or off-site facilities (SGLF, Burntlog Maintenance Facility) is not likely to occur based on the planned infrastructure specifically designed for the storage and management of hazardous materials and use of secondary containment. A copy of the SPCC plan would be kept at an appropriate on-site facility. Staff handling fuel or hazardous materials would be trained to successfully implement the SPCC plan. Inspections of the storage and handling areas would be conducted as specified in the SPCC plan and appropriate warning signs would be placed around storage facilities.

All contractors and company staff involved in handling oil and other chemicals would be made aware of the SPCC plan, spill kit locations, and appropriate emergency response procedures, and would be required to abide by all applicable federal, state, and local laws and regulations pertaining to their respective operations. Annual spill awareness/response training would be required for on-site personnel and suppliers/providers.

In the event a leak or spill was to occur, it would likely be relatively small in volume compared to the container volumes and would be promptly addressed by stopping the source of the spill, using absorbent material or barriers to prevent further migration of the spilled material, and removing, characterizing, and properly handling the cleanup wastes per implementation of the prescribed SPCC Plan and/or Emergency Response Plan recovery efforts.

The bulk petroleum and reagent storage facilities would be constructed with secondary containment systems in place. The tanks would be above ground and located within lined secondary containment facilities that would be capable of holding a minimum of 110 percent of the largest tank volume present within the containment. All process areas that include process liquids in tanks, vessels, or pipes would also include lined spill containment and collection sumps or ponds to retain any leaks or spills of process water or slurries. These materials would be recycled back into the process circuits without discharge to the environment.

Spills from transporters or mine equipment outside of secondary equipment at the site would be immediately responded to in order to limit effects to the immediate area of release and would therefore be local in geographic extent. Containment of any such spills to prevent migration of spilled material to flowing surface waters would be a maximum priority. Timely cleanup of any spilled materials and contaminated soils would reduce potential for longer-term contamination of surface water or groundwater.

A standard marine-type fuel containment boom (which would be of sufficient length for a worst-case discharge), spill prevention kit, and fire kit would be stored at the re-fueling site and would be readily available during off-loading of fuel from the fuel trucks or during re-fueling operations.

For these reasons, the overall direct and indirect effects of hazardous materials and other substances would depend on the location where a spill occurs and the amount and type of material released. For these reasons, possible spill-related impacts of fuels or hazardous materials to surface water, groundwater, and other physical resources from these facilities would be localized and low to negligible. Any effects would be temporary in duration, considering proper spill response measures, but the low risk of spills would be throughout the life of the SGP (long term).

Spills on Access Roads

The most probable release scenario associated with truck transport on the access routes to the SGP would be relatively small amounts of fuel spilled from vehicles themselves and attributed to mechanical failure or human error. Under this scenario, immediate cleanup actions would include deployment of containment and spill recovery materials, and removal of impacted soil. Fuel spilled to soils/roadbed could be readily contained and recovered, while fuel which enters waterways via roadside drainages may be difficult or impossible to fully recover and there would be potential for migration beyond the immediate spill area. Spill response materials on the vehicles and pre-positioned along the access routes and in SGP response vehicle would include materials to contain and recover floating oil. Response actions would include notification to the appropriate regulatory agencies.

Small volume release scenarios would be temporary due to prompt response and cleanup actions; however, higher volume/lower probability spill scenarios could result in longer-term remedial actions and impacts. The risk of spills would last throughout the life of the SGP (long term). Effects would generally be local and in close proximity to the release source in most scenarios; however, if surface or groundwater were to be impacted with fuels or other hazardous materials, the potential for migration beyond the local area could occur.

A low probability release of liquid petroleum or hazardous material from a bulk truckload could potentially occur assuming the puncture of the bulk tanker in the accident. Under this scenario, spilled material would be released to the immediate roadbed area, and potentially impact physical resources and ecological receptors (e.g., vegetation or wildlife) and nearby surface water depending on the topography and location. Spill response and recovery measures such as containment, deployment of absorbent materials, removal of impacted roadbed material and vegetation, and deployment of water-based spill recovery materials and equipment (as needed) would help to limit impacts.

A release of large quantities of solid hazardous materials such as cyanide or antimony concentrate would also be unlikely. Breaches of the shipping containers for these materials in the case of an accident could release the solid materials to the ground where it would reside until response actions are taken to mechanically clean it up, along with any contaminated soil. Migration of these solid materials from the immediate release site would be less likely than for liquid materials but could be possible in wet weather or snowmelt conditions. Again, spill response and recovery measures would help to limit impacts.

The pilot vehicles that would accompany all transports of fuel or hazardous materials between the SGLF and the Operations Area Boundary would carry spill response tools and materials, communications equipment, and drivers trained in spill responses. Thus, response to a small to moderate spill of fuel or hazardous material during transit over the SGP access roads would essentially be immediate.

Spill containment and countermeasures equipment and materials would be pre-positioned at the SGP mine site, Burntlog Maintenance Facility, and SGLF. In the event of a major spill requiring assistance from any of these locations, the radio communications between the pilot vehicles and these facilities would enable a timely response which would take an estimated 45 minutes to mobilize and arrive at the spill site.

Close proximity of access roads to surface water resources increases the potential for spilled material on the roadways to enter water, thus increasing the potential consequences of a spill. The Burntlog Route crosses 37 streams and includes 9 miles of road that are within 0.5 mile of surface water resources. The Johnson Creek Route crosses 43 different streams and includes 27 miles of road that are within 0.5 mile of surface water resources, including several miles that parallel the fish-bearing East Fork SFSR and Johnson Creek waterways. Though the Burntlog Route includes a greater number of stream crossings, the Johnson Creek Route includes significantly greater proximity to water resources. The potential consequences from trucking spills would thus be greater along the Johnson Creek Route that would be utilized during construction of the Burntlog Route.

Closure and Reclamation

Hazardous materials present at the mine site and off-site facilities during closure and reclamation would be similar in comparison to the construction phase of the SGP. However, most of the final closure and reclamation would be concentrated during May through November to avoid winter conditions. It is estimated that on average, one daily round trip to deliver fuel and miscellaneous supplies would occur during closure and reclamation. The risk of spills or releases would diminish throughout the closure and reclamation phase as fuel and other hazardous materials demands progressively diminish.

Spill Impacts Throughout SGP Phases

Mine transport begins on Warm Lake Road (CR 10-579) where the risk of spills would be lower, as it is paved and maintained by Valley County and has overall gentler grades with the exception of Big Creek Summit. At the intersection of Warm Lake Road and Johnson Creek Road (CR 10-413) the two mine access routes begin, with the Johnson Creek Route north along Johnson Creek Road (CR 10-413) and the Burntlog Route east onto Burnt Log Road (FR 447). The location of the spill risk would change as the SGP progresses under the 2021 MMP. Johnson Creek and the portion of the East Fork SFSR between the village of Yellow Pine and the Operations Area Boundary would be at risk of any significant spills of hazardous materials during the first 1 to 2 years of the SGP when the Johnson Creek Route would be used as the access route during the Burntlog Route construction. For the remainder of the mine life, the waterbodies along the Burntlog Route would be at risk from any significant spills.

The combination of the proposed monitoring, planning, and control practices described in the preceding narrative for transport and handling of fuels and hazardous materials and committed design measures would minimize the risk of accidental releases during the transportation, storage, management, and use of

hazardous materials. Nevertheless, the proximity of the access roads to surface water resources increases the potential for a release to enter water which could result in major consequences. The overall environmental impacts from potential releases of hazardous materials under the 2021 MMP would be localized, temporary, and minor to major depending on the type of material released and the location of the spill.

4.7.2.3 Johnson Creek Route Alternative

The Johnson Creek Route Alternative would use Johnson Creek Road for the long-term access route to the Operations Area Boundary and the Burntlog Route would not be constructed. The only differences between the two action alternatives related to hazardous materials would be the location of long-term access to the Operations Area Boundary. All other characteristics of hazardous materials matters would be the same for both alternatives.

The use, storage, and disposal of hazardous materials during the construction, operations, and closure and reclamation phases would be the same as those described for the 2021 MMP. However, the Johnson Creek Route has both a higher spill risk than the Burntlog Route due to increased presence of landslides, rockfalls, and avalanche paths, and higher potential consequences from a spill due to the route's closer proximity to surface water resources, as discussed above. The overall environmental impacts from potential releases of hazardous materials under the Johnson Creek Route Alternative would be localized, temporary, and minor to major depending on the type of material released and the location of the spill with any releases to the creek being a major impact.

4.7.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and project design features (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Hazardous Materials.

4.7.4 Irreversible and Irretrievable Commitments of Public Resources

4.7.4.1 No Action Alternative

Under the No Action Alternative, no irreversible or irretrievable commitment of public resources or impacts are anticipated. However, if a spill were to affect a sensitive resource, an irretrievable impact could occur pending the recovery of the resource (i.e., soil, water, vegetation, or wildlife).

4.7.4.2 Action Alternatives

Under the 2021 MMP and Johnson Creek Route Alternative, no irreversible or irretrievable commitment of public resources or impacts are anticipated. However, if a spill were to affect a sensitive resource, an irretrievable impact could occur pending the recovery of the resource (i.e., soil, water, vegetation, or wildlife). Some impacts from hazardous materials spills and releases, such as any mortality to wildlife from the releases, would be irreversible.

4.7.5 Short-term Uses versus Long-term Productivity

4.7.5.1 No Action Alternative

Continued authorized exploration activities would result in potential short-term impacts to resources from the presence of hazardous materials in the area. Small spills would likely occur but would be cleaned up and managed in accordance with site practices and plans, and state and federal regulations.

4.7.5.2 Action Alternatives

Development of the 2021 MMP or Johnson Creek Route Alternative would result in potential short-term impacts to resources from the presence of hazardous materials in the area. Small spills would likely occur but would be cleaned up and managed in accordance with site practices and plans, and state and federal regulations. Residual contamination from previous mining and exploration efforts in the area would be addressed as they are encountered during the Action Alternative. Potential hazardous materials would be characterized for proper off-site disposal. Long-term positive impacts due to removal and proper disposal of residual and hazardous materials, habitat reclamation, and post- mining reclamation are anticipated to provide an overall long-term environmental benefit and improve the long-term productivity.

4.8 Surface Water and Groundwater Quantity

4.8.1 Impact Definitions and Effects Analysis Indicators and Methodology

The following indicators are applied for the analysis of water quantity:

- Stream flow characteristics (daily, seasonal, annual)
- The extent, magnitude, and duration of changes in groundwater levels

Analysis of surface water and groundwater quantity effects is guided by the following issues and indicators:

Issue: The SGP may cause changes in the quantity of surface water and groundwater in all drainages within the analysis area.

Indicators:

- Stream flow characteristics (daily, seasonal, annual).
- The extent, magnitude, and duration of changes in groundwater levels.

Issue: The SGP may affect water rights.

Indicators:

- Change in water rights availability in the SGP area.
- New water rights needed.
- Impacts to other water rights.

The surface water and groundwater quantity effects analysis primarily used information provided in the modeling reports prepared for the SGP by Perpetua, or their contractors (Brown and Caldwell 2017a, 2018a, 2021a, 2021b, 2021c, 2021d, 2021e; HDR 2017f; SPF 2017) but also included scientific literature. A more detailed description of the effects analysis may be found in the SGP Water Quantity Specialist Report (Forest Service 2022e).

The analysis for water rights was performed by gathering existing pertinent data related to surface water and groundwater resources, and existing and proposed water rights in the analysis area. The analysis then considered the timing, place of use, and impact of the proposed transfer of existing water rights and new water rights. The IDWR would determine if the water rights applications in the analysis area would impact downstream senior rights.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1.**

Surface water resource investigations for the SGP were initiated in 2012 to characterize existing conditions in the analysis area and continued through 2016. Baseline sampling has continued beyond 2016; however, characterization of surface waters' baseline conditions draws from the data collected during a period from 2012 to 2016 and presented by Brown and Caldwell 2017a. The physical hydrologic conditions of the SGP study area are described in **Section 3.8.4**.

Several parties have investigated groundwater resources in the analysis area for the past 35 years. These investigations evaluated general groundwater hydrology and interaction between groundwater and surface water. A 2017 SPF Water Engineering Groundwater Hydrology Baseline Study report summarizes findings of those previous studies and presents the results of the newer hydrogeological investigations (SPF Water Engineering LLC [SPF] 2017).

Additionally, a Water Resources Summary Report summarizes hydrogeology-related work completed up to 2017 (Brown and Caldwell 2017a). The Water Resources Summary Report also provides information regarding IDWR well records for groundwater supply wells constructed in the analysis area.

From 2017 through 2021, Brown and Caldwell completed surface water and groundwater modeling and flow analysis (Brown and Caldwell 2018a, 2018b, 2021b, 2021e). These modeling efforts are summarized in this document with further details available in those references.

4.8.2 Direct and Indirect Effects

4.8.2.1 No Action Alternative

Under the No Action Alternative, there would be no large-scale mine operations by Perpetua, and water resources would continue to be impacted by currently permitted Perpetua drilling activities for exploration. The continuation of approved exploration activities at the SGP by Perpetua would result in the continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip. Local minor withdrawals of surface water and groundwater to sustain the permitted exploration activities would continue. Consequently, there would be little change in the current status of water quantity conditions at the SGP.

In January 2021, Perpetua entered into an ASAOC with the Forest Service and EPA 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 East Fork SFSR 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. Following these construction activities, the disturbed areas would be reclaimed with growth medium and revegetated to stabilize the sites in concert with the Reclamation and Closure Plan developed by Perpetua for the SGP. This work is planned to occur between 2022 and 2024. These activities are not anticipated to have noticeable impacts on water quantity in the SGP area.

4.8.2.2 2021 MMP

Water Resources Conceptualization

This section provides a summary of the methods used to evaluate the potential changes to groundwater elevations (drawdown) and surface water flows resulting from open pit mining, pumping the water supply wells, and utilizing surface water diversion at the proposed Project, predict the development of the West End pit lake projected to develop in the post-mining period, and evaluate potential drawdown impacts to surface water resources and water rights in the affected areas.

Several water models were utilized to predict water flow rates, volumes, quality and temperatures throughout the mine life, closure, and post-closure. These water models are inter-related as output from one model is used as input to another model (**Figure 4.8-1**; Brown and Caldwell 2021e). The meteoric water balance model (MWB) uses monthly meteorological data to provide groundwater recharge and surface water runoff volumes for the site-wide water balance model (SWWB, Brown and Caldwell 2021a) and the Stibnite hydrologic site model (SHSM, Brown and Caldwell 2021e). The SWWB evaluates operational consumptive use (e.g., mill water supply, dust control), TSF water volumes, and contact water volumes generated over the span of the project from construction through closure (**Figure 4.8-2**).

The SHSM simulates groundwater and surface water systems to forecast the pit dewatering rates and water supply diversions required for operations (**Figure 4.8-3**). The SHSM also forecasts the groundwater drawdown, effects on groundwater discharge to surface water and pit lake recharge associated with the dewatering and water supply diversions (Brown and Caldwell 2021e). Both the SWWB and SHSM provide input to the water chemistry and water temperature models described in the companion SGP Water Quality Specialist Report (Forest Service 2022f).

Watershed Drainage Effects

This section describes the direct effects of the SGP on surface water quantities in the analysis area. The indirect effects of groundwater pumping on surface streams are described under **Groundwater Quantity**.

Streams

The SGP is located within the upper reaches of the East Fork SFSR, and several perennial streams flow through the project site (**Figure 3.8-1**). The streams would be temporarily diverted around mine facilities from construction through closure to prevent generation of contact water (Brown and Caldwell 2021b). The stream diversions would divert stream flow and also capture stormwater runoff from areas upslope from mine facilities. These diversions would consist of:

- rock-cut channels along steep slopes in areas with shallow or at-surface bedrock,
- excavated earthen channels and berms constructed of alluvium,
- HDPE or steel pipelines, and
- the East Fork SFSR tunnel.

Pipelines and culverts would be used in areas where open channels are infeasible or ineffective such as steep hill slopes, road crossings, or underneath mine facilities, and for temperature control in the Meadow Creek diversion (Brown and Caldwell 2021b). Open channel diversion designs would incorporate:

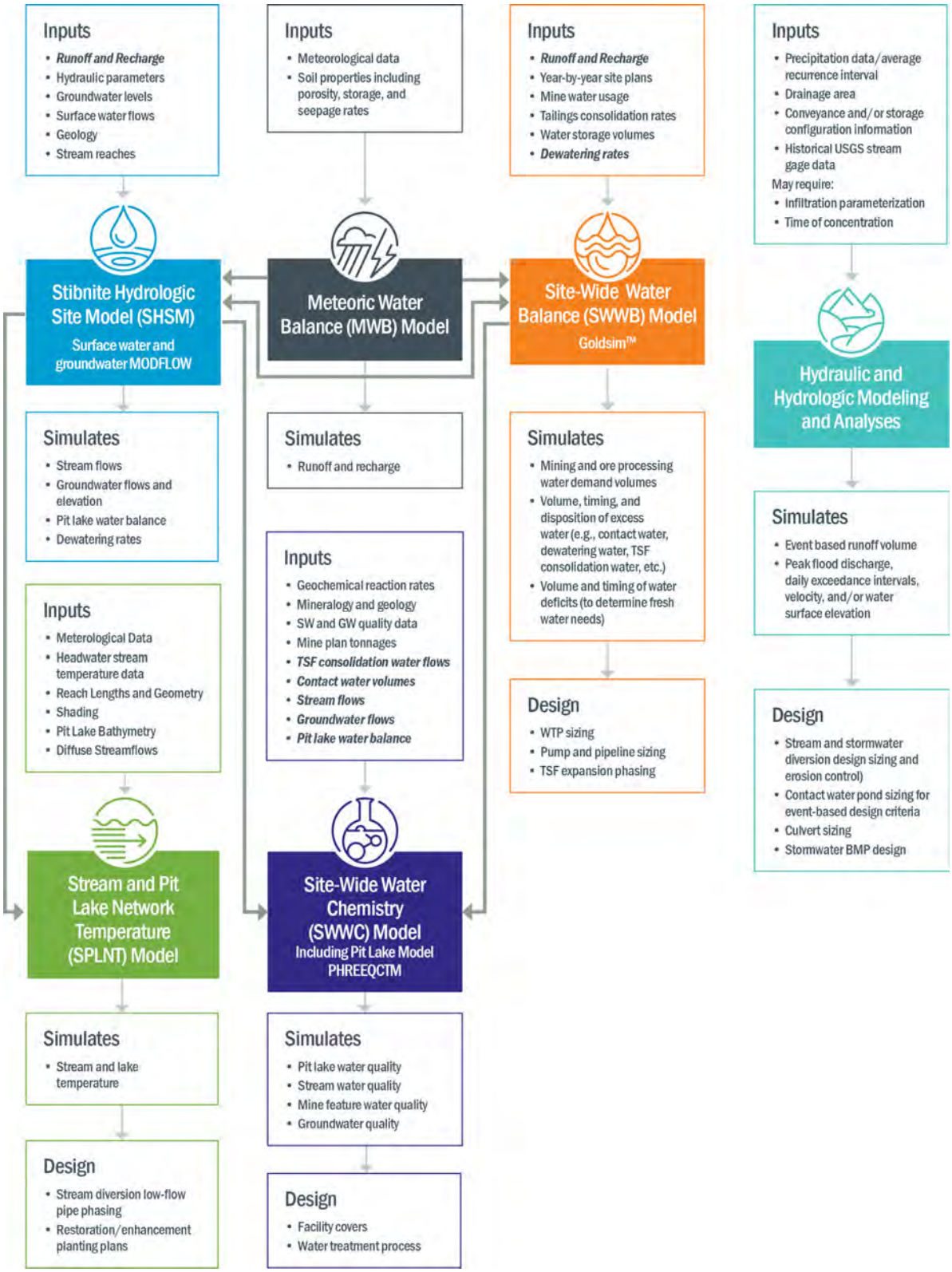
- riprap lining for channels in erodible materials,
- geosynthetic lining for channels across fill or highly permeable materials, and
- gradients sufficient to ensure continuous flow at velocities allowable for the channel lining.

The East Fork SFSR currently flows through the existing Yellow Pine pit. Renewed mining activity would require temporarily diverting the East Fork SFSR to allow expansion, mining, backfilling, and reclamation of the pit. A tunnel would be constructed around the west side of the pit to divert the East Fork SFSR during operations and closure activities.

Properties of the East Fork SFSR tunnel design include:

- rock-cut, concrete-lined tunnel 15 feet wide by 15 feet high,
- sediment trap and debris collection at upstream portal,
- freshwater intake for mine water supply at upstream portal, and
- a transition zone for flow to native channel at the downstream portal.

Additional details regarding stream diversions and the East Fork SFSR tunnel are provided in the SGP Water Management Plan (Brown and Caldwell 2021b).



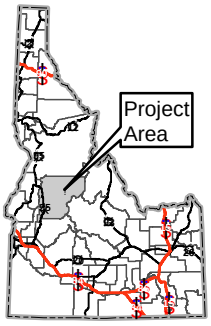
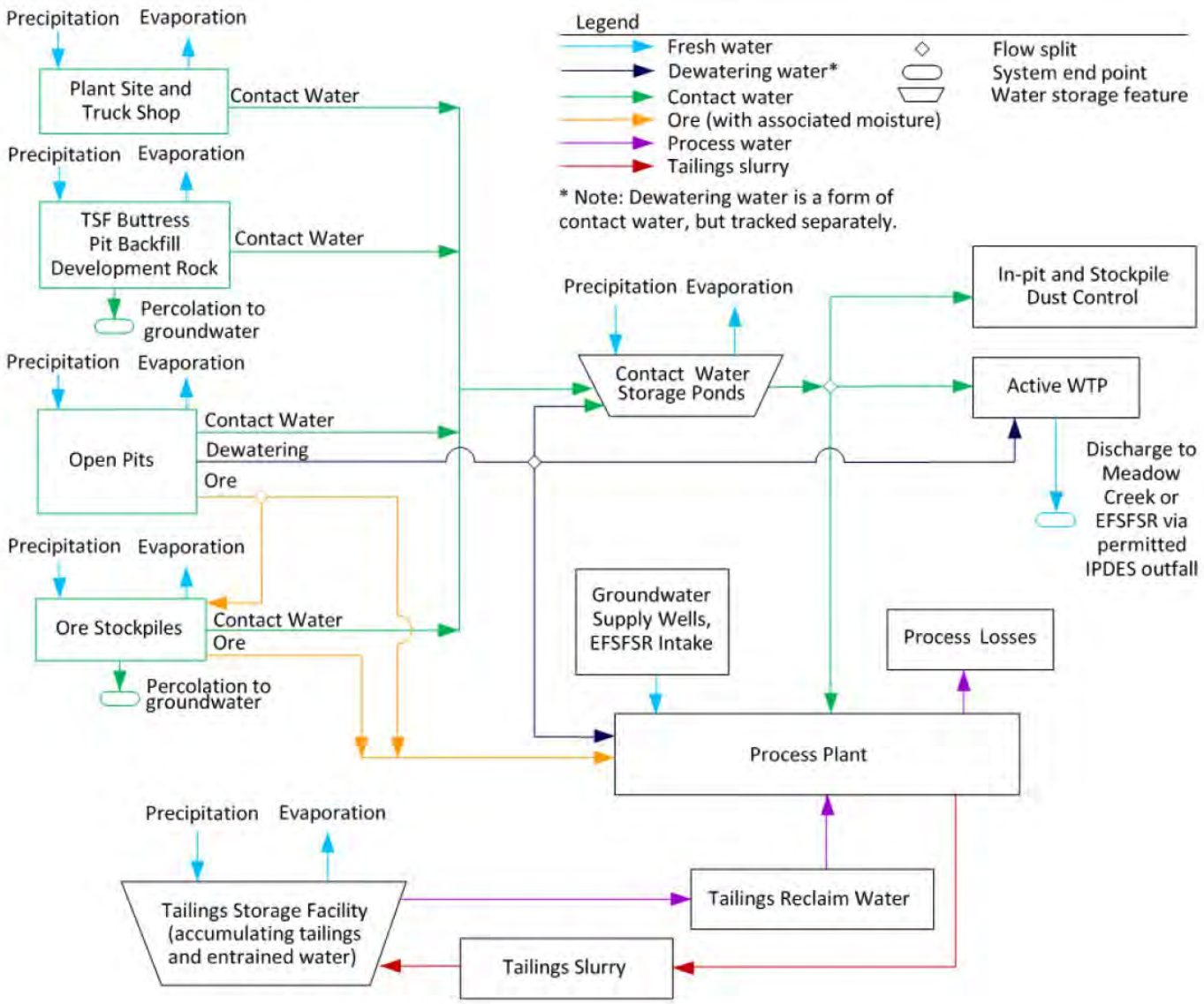


Figure 4.8-1
Water Quantity Conceptual Model

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021b)



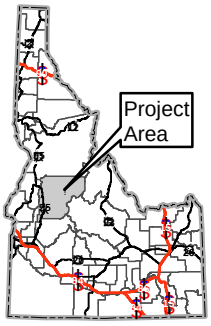
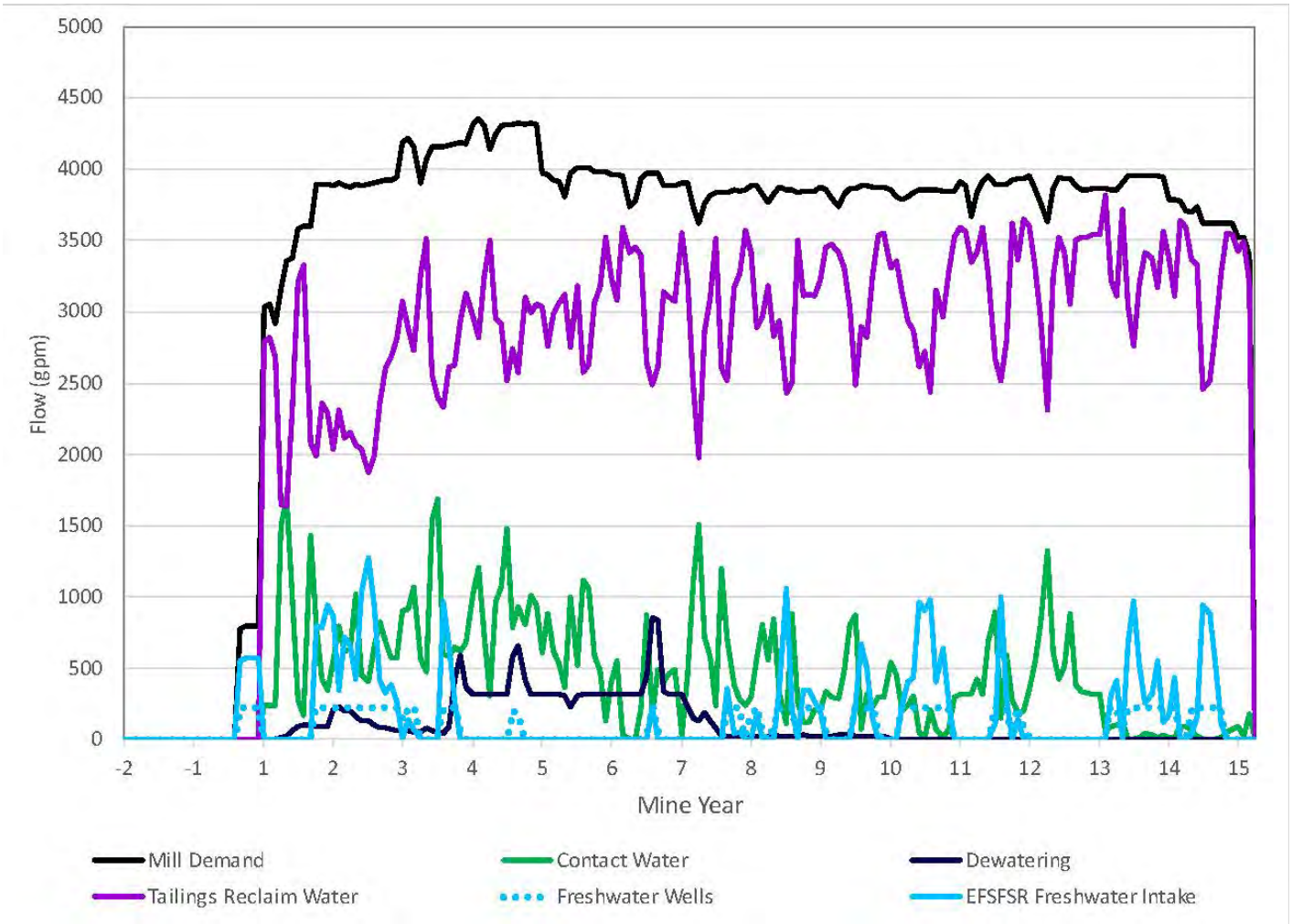


Figure 4.8-2
Project Water Management Schematic Flow Diagram

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021b)



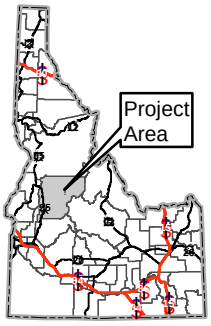


Figure 4.8-3
Mill Processing Water Requirements

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021b)

Stream diversion descriptions for the streams are summarized in **Table 4.8-1**. Unlike other streams, diversion of the East Fork of Meadow Creek (Blowout Creek) is not associated with proposed mining activity. This diversion would be associated with a voluntary restoration effort to create a stable, sustainable solution to the continual erosion and sediment loading resulting from the 1965 failure of a water storage dam in the upper East Fork of Meadow Creek valley.

Table 4.8-1 SGP Stream Diversions

Stream	Diversion Length (miles)	Diversion Type	Discharge Location	Post-Closure
East Fork SFSR	0.9	Tunnel	East Fork SFSR below Yellow Pine pit	Restored stream channel
Hennessy Creek	0.7	Pipeline	Fiddle Creek	Restored stream channel
Midnight Creek	0.3	Open channel with culverts	East Fork SFSR above the East Fork SFSR tunnel	Restored stream channel
West End Creek	1.5	Open channel	West End Creek below West End pit	Within West End pit
Fiddle Creek	0.2	Pipeline	Fiddle Creek below the GMS	Restored stream channel
Garnet Creek	0.2	Open channel with culverts	East Fork SFSR below plant site	Restored stream channel
Meadow Creek	2.0	Open channel	SODA diversion channel	Restored stream channel
EFMC (Blowout Creek)	-	Open channel	Lower Meadow Creek	Restored stream channel with water retention structures in meadow area

Source: Brown and Caldwell 2021b

Streams would be routed into the diversions by temporary flow barriers, such as berms or cofferdams that redirect flows from the existing stream channel into the diversion channel. During closure, stream channels would be restored near their pre-mining locations using designed stream channels to cross reclaimed mine facilities. The East Fork SFSR tunnel openings would be sealed and the East Fork SFSR flow returned to a restored stream channel crossing the Yellow Pine pit backfill.

Designs for restored stream channels would incorporate as needed:

- open channels for surface water flow,
- meadow reaches,
- step pool reaches
- cascade reaches,
- energy dissipation pools,
- reach transitions,
- small and larger woody debris structures, and
- riparian planting.

The portion of the restored stream channel across the backfilled Yellow Pine pit would incorporate an in-stream lacustrine feature (Stibnite Lake) analogous to the existing Yellow Pine pit lake, with the

exception that it is lined, to assist in emulating current flow and water temperature conditions (see Forest Service 2022f for more discussion of residence time and temperature conditions).

Therefore, use of stream diversions and subsequent stream restoration would modify the location of surface water flows. Flow rates would be affected by contact water capture, groundwater pumping, and surface water diversion as described below under **Surface Water Quantity**. The effects of stream diversions on water quantity would be moderate, long-term, and localized.

Seeps and Springs

Certain seeps and springs in the vicinity of proposed facilities have already been covered or disturbed by historical mining activities. Therefore, new direct impacts to these springs and seeps associated with surface disturbance from the proposed Project would not occur. Seeps and springs covered by facilities would be intercepted by facility underdrains that would collect flows and route them to pipelines for conveyance back to the ground surface. Indirect impacts to springs and seeps associated with groundwater pumping are described under **Groundwater Quantity**.

Stormwater

Stormwater diversions would be used to divert non-contact stormwater runoff around mine facilities and disturbed areas and would remain in place from facility constructure through closure. Stormwater diversion designs would generally be the same as surface water diversions except pipelines would not be used and the need for geosynthetic liners would be less frequent.

Stormwater diversion outfalls would discharge to existing drainages and would incorporate BMPs such as sediment ponds, energy dissipation structures, or other erosion and sediment control measures.

Contact Water

Contact water is mine-impacted water that contacts disturbed areas and/or mine facilities with the potential to contribute sediment and dissolved constituents to surface water and groundwater without proper management. SGP contact water sources would include stormwater runoff and seepage from:

- legacy materials (e.g., Bradley tailings, Hecla heap, SODA),
- SGP haul roads,
- open pits,
- plant site and truck shop,
- TSF Buttress, and
- ore stockpiles.

In addition, groundwater produced by the dewatering system would be managed as contact water (Brown and Caldwell 2021b).

Runoff from haul roads and access roads outside the mine area is also considered contact water to be managed via BMPs applicable to those specific locations.

Contact water storage ponds would be used to provide temporary storage of contact water flows. The location of these storage ponds is constrained by topography, other proposed mine facilities, legacy materials, and near-surface groundwater levels. The ponds are also located to manage runoff in proximity to the water-generating areas.

Contact water ponds would be geomembrane-lined earthen facilities, equipped with emergency spillways and designed to contain runoff volumes associated with design storm runoff events (**Table 4.8-2**).

Table 4.8-2 SGP Contact Water Ponds

Pond	Pond Capacity (excluding freeboard; acre-feet)	Design Storm Runoff (acre-feet)	Freeboard (feet)	Embankment Height (feet)
Hangar Flats Pond	201.8	33.9	3	35.0
Soda Pond	147.7	24.6	3	29.4
West End Pond	28.7	39.3[1]	3	60.5
Midnight Pond	83.9	16.8	3	72.7
North Truck Shop Pond	3.2	3.2	2	n/a
South Truck Shop Pond	18.3	17.9	2	n/a
North Plant Pond	7.5	7.3	2	n/a
Central Plant Pond	4.3	4.3	2	n/a
Scout Pond	9.0	9.0	2	n/a

Source: Brown and Caldwell 2021b, Table 6-2
[1]West End Pond can contain the 100-year, 24-hour storm volume (25.8 acre-feet). Additional potential volume from snowmelt would be managed using in-pit sumps or pumping stored water from West End Pond to Midnight Pond or Yellow Pine pit.
n/a = not available

Additional details regarding the management of contact water are available in the SGP Water Management Plan (Brown and Caldwell 2021b).

Capture of contact water for consumptive use would reduce the volume of runoff and hence, stream flow by between 0 and 1,600 gpm with typical average capture rates of approximately 800 gpm during the first 6 years of processing as the site water inventory is built (**Figure 4.8-3**). Average capture rates for consumptive use decrease after year six as recycled water from the tailings facility fulfills a greater proportion of the process needs. This volume of capture represents a relatively small portion of overall flow rates in the East Fork SFSR which range annually between 20 cfs and more than 120 cfs (approximately 9,000 gpm to more than 54,000 gpm) near Yellow Pine, Idaho.

Contact water that is not used consumptively would be routed to the water treatment plant to achieve a water chemistry suitable for discharge to surface water in accordance with Idaho IPDES permit requirements. The effects of contact water management on surface water quantity would be moderate, long-term, and localized.

Groundwater Quantity

This section provides a summary of the methods used to evaluate the potential changes to groundwater elevations (drawdown) resulting from mine dewatering and pumping the water supply wells at the proposed Project, predicted development of a pit lake in the West End pit in the post-closure period, and evaluate potential drawdown impacts to surface water resources and water rights in the affected areas.

Water Quantity Modeling of the Proposed Project

The three proposed open pits and exploration decline would extend below the water table and, therefore, require systems to capture and remove groundwater that flows toward or into them as mining progresses. In addition, while not below the local water table, the East Fork SFSR tunnel would intercept inflows of groundwater in its vicinity. Water demands for ore processing would necessitate the installation of production wells and a surface water diversion from the East Fork SFSR, in addition to the dewatering system.

A calibrated three-dimensional numerical groundwater flow model was developed to estimate effects to groundwater and surface water resources from the proposed activity. Specifically, the groundwater flow model estimates: 1) dewatering rates for the open pit mines; 2) drawdown and groundwater levels resulting from dewatering and water supply pumping; 3) potential for pit lake development in the post-mining period; and 4) changes in groundwater discharge to stream flows.

The numerical groundwater model used the modeling code MODFLOW 6 and utilized Newton-Raphson numerical solver to simulate drying and wetting of model cells representing the groundwater system in response to dewatering and production well pumping plus seasonal recharge (Brown and Caldwell 2021e). The groundwater model domain encompassed approximately 48 square miles (six miles by eight miles), which included the analysis area (**Figure 4.8-4**). A detailed explanation of the conceptual hydrogeologic model, modeling approach and setup, steady-state and transient calibration, sensitivity analysis, water budget, and model predictions are presented in the groundwater model technical report (Brown and Caldwell 2021e).

The groundwater modeling included the development of a conceptual model of the groundwater flow systems. The conceptual model of the study consisted of three hydrogeologic categories based on groupings of geologic and stratigraphic units with similar hydraulic characteristics plus faults and fracture zones that act to inhibit or enable groundwater flow. In the analysis area, groundwater flows downhill from the mountainous areas toward the valley areas including the Meadow Creek Valley where most of the historical and proposed mining activities are located. Groundwater flow encounters the high angle MCFZ that inhibits bedrock flow from east to west creating local upward groundwater gradients on the eastern, uphill, side of the fault. After slowly migrating through the bedrock units and intervening fault structures, groundwater eventually discharges into the alluvial valley fill and subsequently into streams, departing the analysis area predominantly as surface flow.

No flow conditions were set around the perimeter of the model to represent inferred hydrologic divides associated with the mountain ridgetop topography. Modelled meteoric recharge to the groundwater system (**Figure 4.8-5**) was applied based on a water balance calculation that partitioned precipitation into recharge, runoff, and evaporation (Brown and Caldwell 2021e). Runoff and recharge estimates were

partitioned in unconsolidated dominated areas and bedrock dominated areas to allow differentiation between areas prone to recharge versus areas prone to runoff. This calculation resulted in relatively higher recharge rates in the alluvial valley bottoms as they received runoff from the surrounding mountainous areas.

Flows in surface streams were simulated using the MODFLOW 6 Surface Flow Routing (SFR) package. The SFR package models inflow or outflow from the stream grid cells depending on the cell's modelled groundwater elevations at a rate associated with the cell's stream bed conductance.

Model calibration was accomplished using a process that included simulation of pre-mining steady state conditions and then transient conditions associated with the pumping tests. The model was calibrated to water levels measured between 2011 and 2019 in 55 wells and piezometers plus flow rates at five stream locations by allowing the hydraulic conductivity values to vary within the range of the aquifer test results for each unit. The calibrated parameter values utilized for modeled hydrologic units are summarized in **Table 4.8-3**.

Table 4.8-3 Parameter Values for Modeled Hydrologic Units

Hydrogeologic Unit	Hydraulic Conductivity (feet/day)	Vertical Anisotropy Ratio	Specific Yield	Specific Storage (1/feet)
Alluvium	12	10:1	0.20	1.0E-07
Alluvium-Bedrock Transition	0.2	1:1	0.04	1.0E-07
Shallow Idaho Batholith Bedrock	0.1	1:1	0.006	1.0E-07
Deep Idaho Batholith Bedrock	0.03	1:1	0.002	1.0E-07
Shallow Metasedimentary Bedrock	0.5	1:1	0.006	1.0E-07
Deep Metasedimentary Bedrock	0.15	1:1	0.002	1.0E-07
Meadow Creek Fault Zone	0.0001	1:1	0.025	1.0E-04

Source: Brown and Caldwell 2021e

The calibrated model was used to estimate dewatering requirements to achieve dry mining conditions in the open pits, the magnitude and areal extent of drawdown resulting from dewatering and additional groundwater production required for process needs. The groundwater inflow into the pit areas would be pumped out for dewatering purposes by dewatering wells in the vicinity of the open pits and/or collection sumps within the pits.

The model predicts that dewatering requirements for the open pits would range from less than 0.2 cfs, approximately 100 gpm, in Mine Year 1 to approximately 5 cfs, approximately 2,200 gpm, in Mine Year 6 with an average rate of 2.75 cfs, approximately 1,250 gpm, over that six-year period. **Figure 4.8-6** shows the estimated dewatering requirements over the active mining period for the Hangar Flats pit, Yellow Pine pit, and West End pit. Total dewatering rates would be the sum of the overlapping rates for these three pits. Total dewatering pumping rates would decrease to less than 1 cfs, approximately 450 gpm, during Mine Year 7 through the end of dewatering in the West End pit. These dewatering rates were based on the calibrated model's hydraulic parameter values. A sensitivity analyses examining order of

magnitude changes in hydraulic parameter values was used to examine the range of likely dewatering rates (**Section 4.8.2.4**; Forest Service 2022e, Brown and Caldwell 2021h).

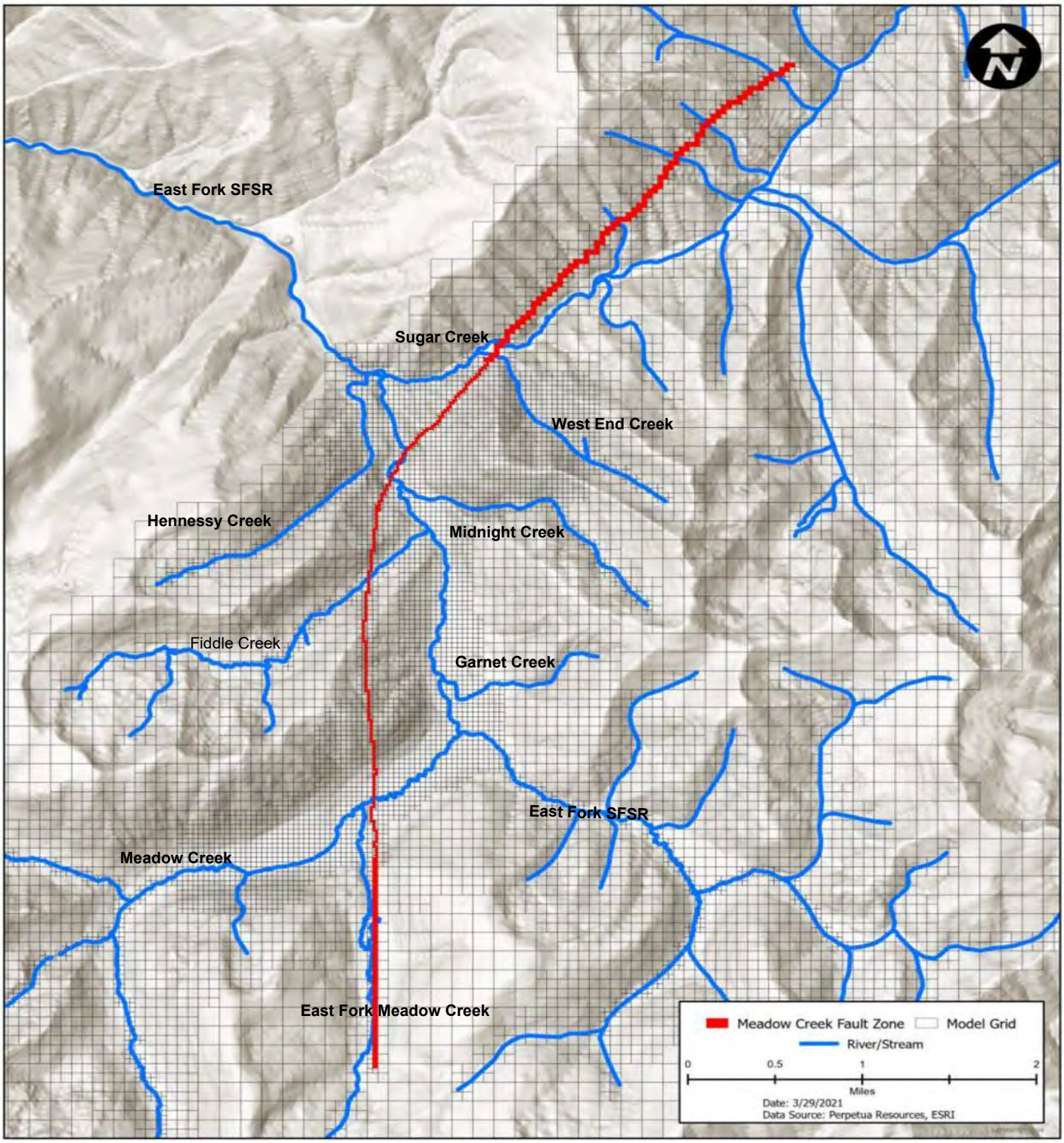
The calibrated model was used to estimate dewatering requirements to achieve dry mining conditions in the open pits, the magnitude and areal extent of drawdown resulting from dewatering and additional groundwater production required for process needs. The groundwater inflow into the pit areas would be pumped out for dewatering purposes by dewatering wells in the vicinity of the open pits and/or collection sumps within the pits.

The model predicts that dewatering requirements for the open pits would range from less than 0.2 cfs, approximately 100 gpm, in Mine Year 1 to approximately 5 cfs, approximately 2,200 gpm, in Mine Year 6 with an average rate of 2.75 cfs, approximately 1,250 gpm, over that six-year period. **Figure 4.8-6** shows the estimated dewatering requirements over the active mining period for the Hangar Flats pit, Yellow Pine pit, and West End pit. Total dewatering rates would be the sum of the overlapping rates for these three pits. Total dewatering pumping rates would decrease to less than 1 cfs, approximately 450 gpm, during Mine Year 7 through the end of dewatering in the West End pit. These dewatering rates were based on the calibrated model's hydraulic parameter values. A sensitivity analyses examining order of magnitude changes in hydraulic parameter values was used to examine the range of likely dewatering rates (Forest Service 2022e; Brown and Caldwell 2021h).

Impacts to Groundwater Levels

For this impact analysis, the area that is predicted to experience a change in groundwater elevation of ten feet or more is used for quantification and comparison of project effects and baseline conditions. The numerical groundwater flow model was not used to quantify changes in groundwater elevation of less than ten feet due to the scale of the model and unavoidable uncertainty associated with regional groundwater flow models. In addition, within the Analysis Area, changes in groundwater levels of less than ten feet can be difficult to distinguish from natural seasonal or annual fluctuations in groundwater levels.

Predicted dewatering rates and underdrain flows were combined with estimated volumes of mine-impacted waters from the SWWB to forecast the volume requirements for water treatment during operations and closure. Water treatment is required whenever the volume of produced groundwater plus mine-impacted waters exceeded the consumptive use demands for the project. Hence, the water treatment volume estimate represents the sum of predicted mine-impacted water values (e.g., dewatering production, contact water) less the consumptive use by the project (i.e., process water). These volumes ranged from 2,000 gpm during the years of highest dewatering production down to 150 gpm from the collection of mine-impacted waters post-closure (**Figure 4.8-7**). Estimates also included potential variability associated with meteoric conditions on the generation of contact water to develop potential contact water volumes associated with the range between the 5th and 95th percentiles of meteoric inputs based on historic measurements. The project water management system is designed with storage capacity for meteoric water events so that water destined for treatment can be contained until it can be transferred to the water treatment plant for constituent removal at the plant's 2,000 gpm design rate. The installation of geosynthetic liner systems on the top surface of the TSF, TSF Buttress, Yellow Pine pit backfill, and Hangar Flats backfill inhibits the generation of contact water in the post-closure period plus drainage of



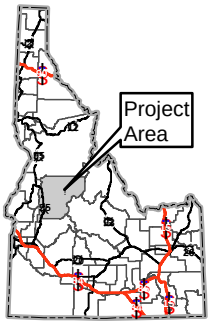
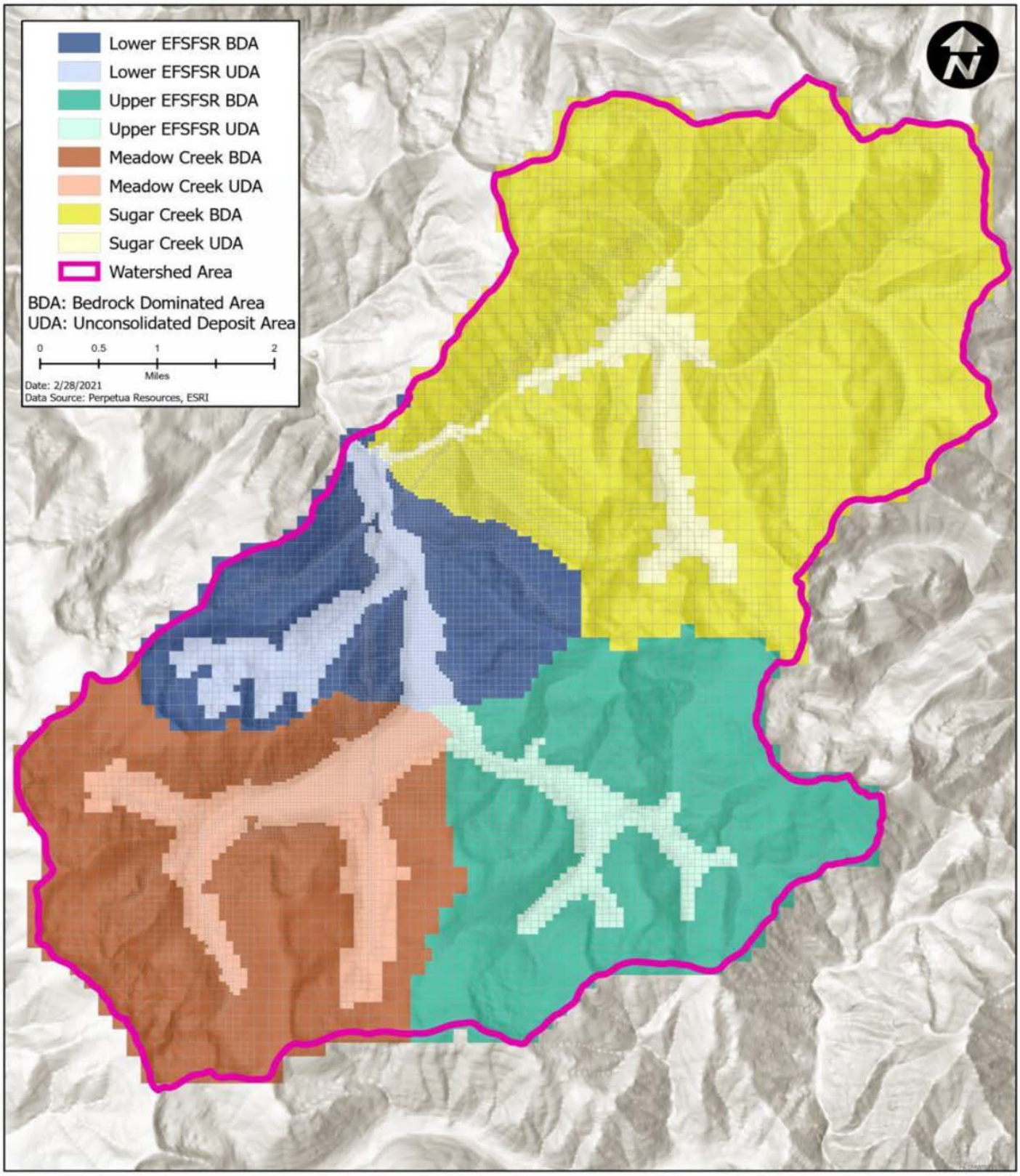


Figure 4.8-4 Groundwater Flow Model Domain and Model Grid

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a) Figure shows model cells in mine area but does not show entire model domain.



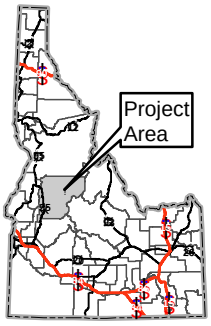
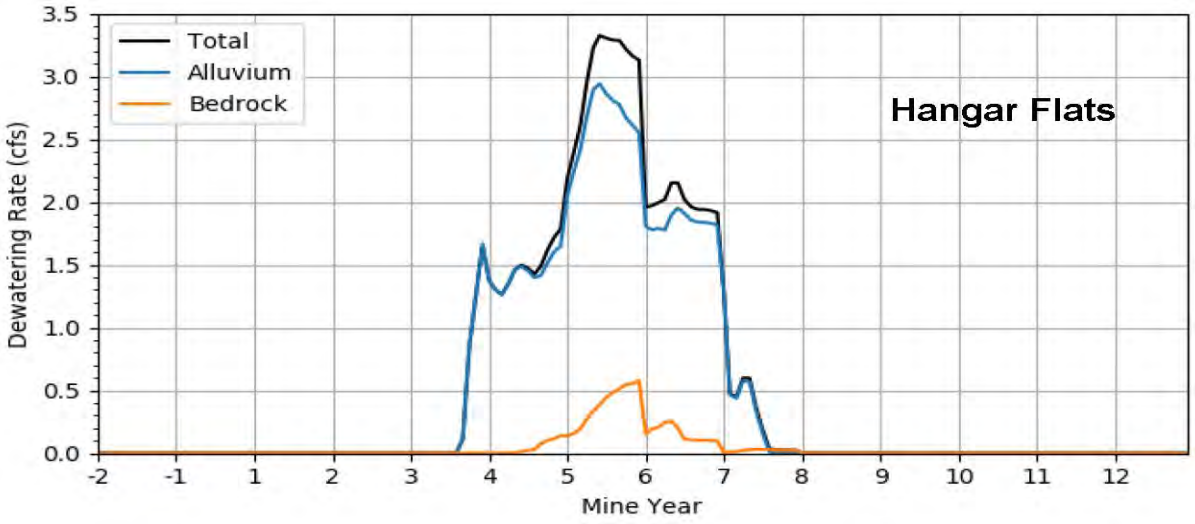
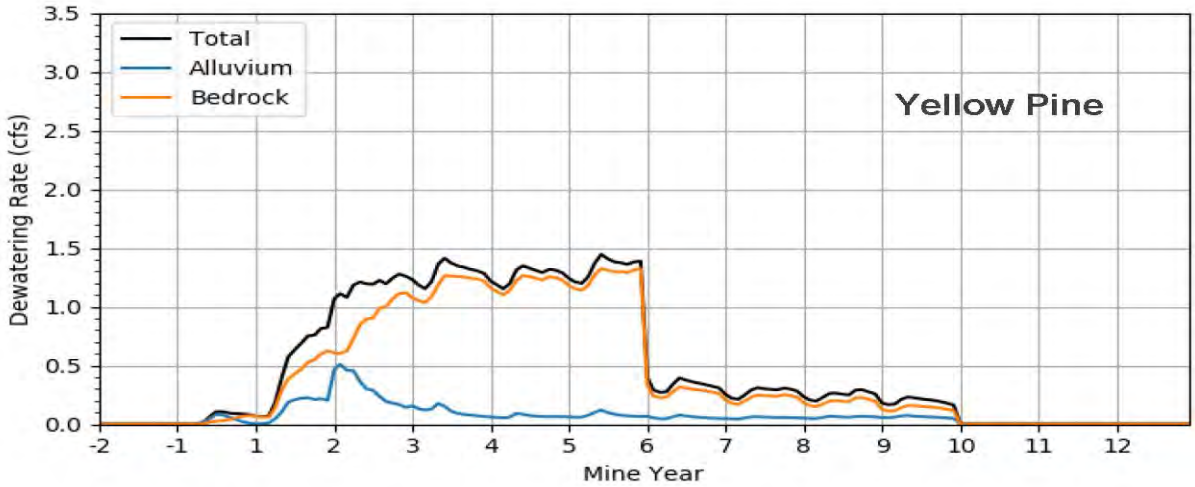


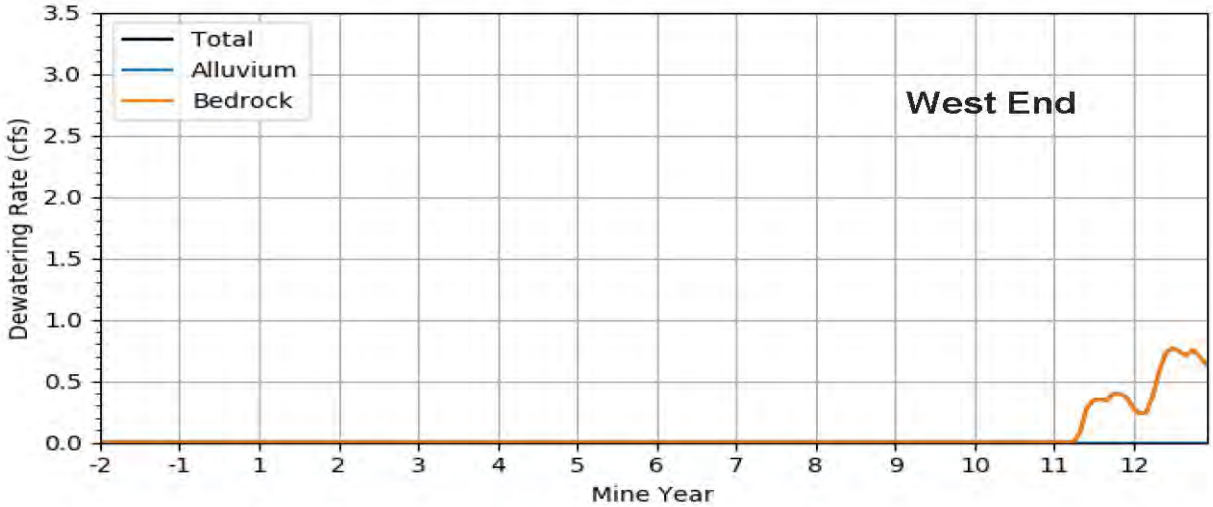
Figure 4.8-5
Groundwater Flow Model Recharge Zones

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)







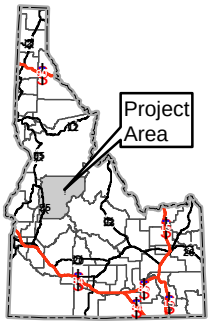
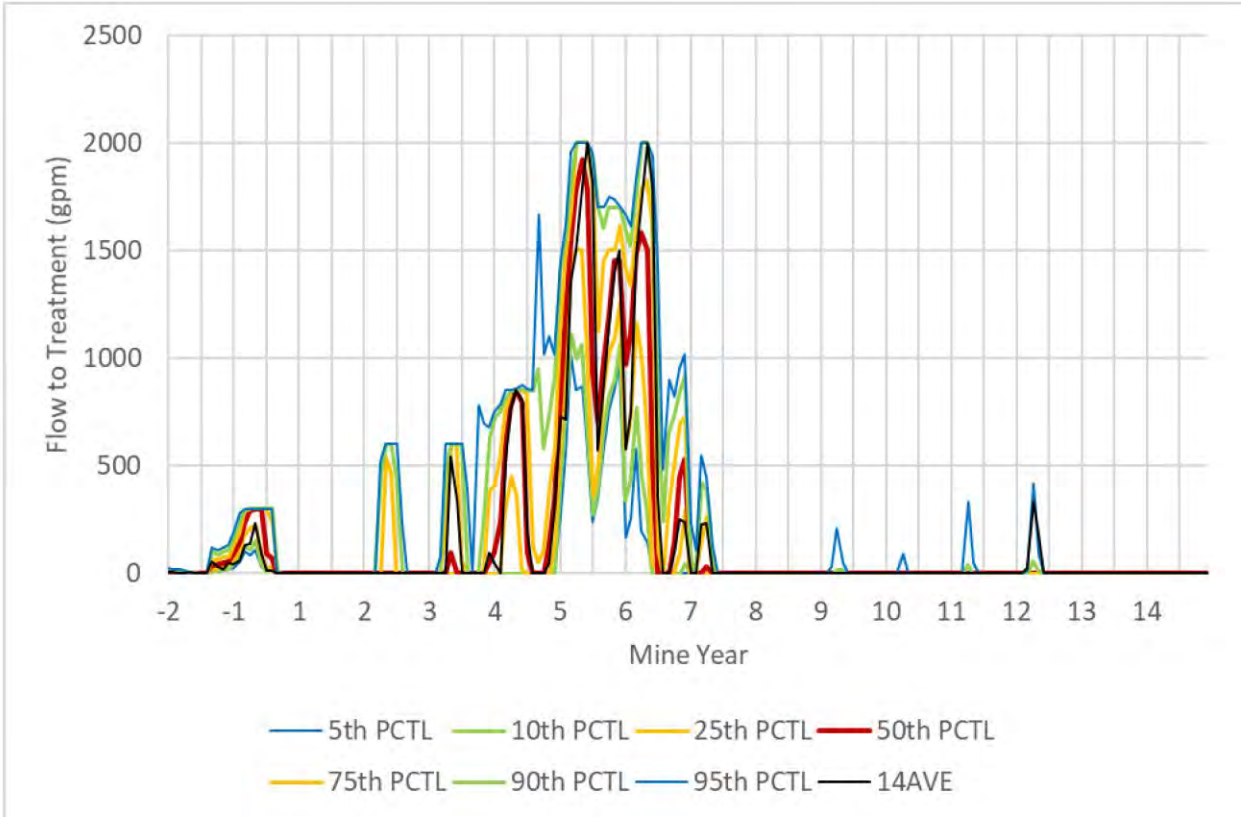
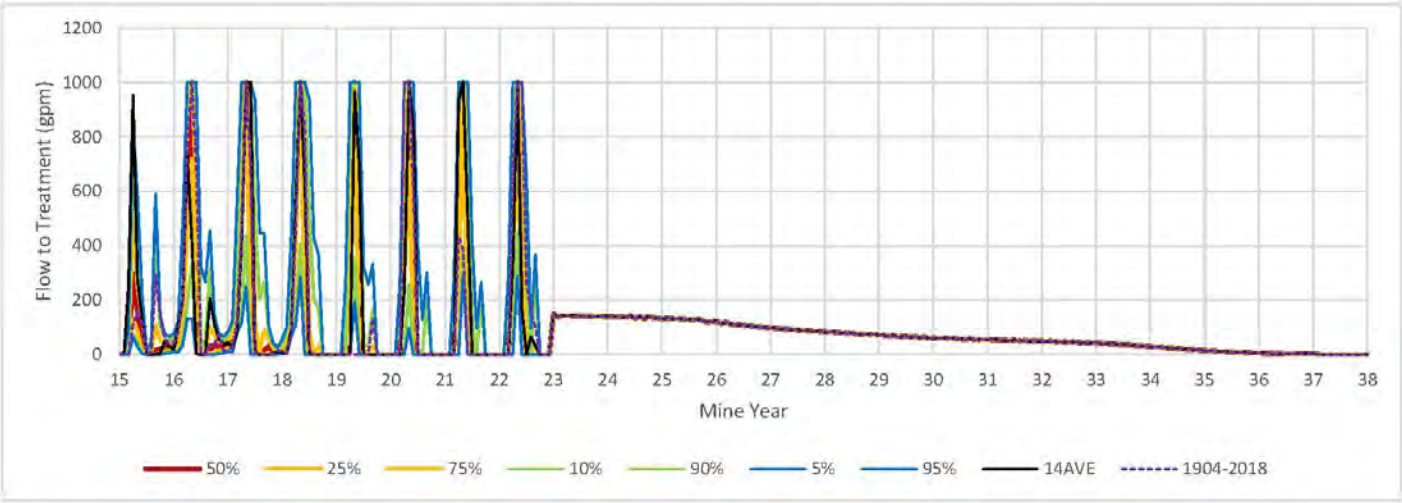


Figure 4.8-6 Predicted Dewatering Pumping Rates

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)





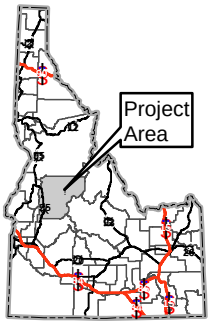


Figure 4.8-7
Predicted Water Treatment Rate Requirements

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021b)

the water entrained in the TSF results in the abatement of contact water flows after approximately 40 years. Further details on the collection of waters for water treatment are located in the companion Water Quality Report (Forest Service 2022f).

Drawdown effects were predicted based on the net effect of pumping from pit dewatering wells and industrial supply wells. The maximum extent of alluvial groundwater drawdown in the Yellow Pine pit area is predicted to occur at the end of Mine Year 5 (**Figure 4.8-8**, Brown and Caldwell 2021e, 2021h). The cone of depression induced by dewatering of the Yellow Pine pit (and defined by drawdown greater than or equal to 10 feet) would extend to the Sugar Creek drainage to the north, to the topographic basin divide to the west, and approximately a half mile south of the pit. Maximum drawdown during operations is coincident with the pit bottom elevation (740 feet bgs). Water levels start recovering at the end of dewatering and re-inundate the pit area after around Mine Year 12. The extent of predicted drawdown cones was generally insensitive to variation in hydraulic parameters.

Alluvial drawdown near the West End pit along West End Creek would result from dewatering production and rerouting the creek around the pit. The maximum extent of drawdown from the West End pit activities would occur at the end of Mine Year 12, with a cone of depression extending approximately one mile to the north, east and south of the West End pit (**Figure 4.8-8**). The cone of depression also extended to the northeast into the Sugar Creek drainage. Maximum drawdown during operations is coincident with the pit bottom elevation (approximately 6200 feet amsl). Water levels start recovering at the end of dewatering and re-inundate the pit area after approximately 50 years.

The maximum alluvial drawdown near the Hangar Flats pit would occur at the end of Mine Year 5, after which dewatering production rates would decrease. The cone of depression is predicted to extend up to approximately three-quarters of a mile from the pit area within the Meadow Creek Valley (**Figure 4.8-8**). Maximum drawdown during operations is coincident with the pit bottom elevation (460 feet bgs). Water levels start recovering at the end of dewatering and re-inundate the pit area around approximately Mine Year 8.

Lowered groundwater levels in the vicinity of the TSF and TSF Buttress are predicted to slightly reduce flows in underdrain systems constructed below the facilities and their liners to collect groundwater discharge from below the facilities. Predicted flows averaging approximately 1,400 gpm would reduce to approximately 1,200 gpm in response to Hangar Flats dewatering and water supply activities that result in lowered groundwater levels in that vicinity (**Figure 4.8-8**, Brown and Caldwell 2018a, 2018b, 2021b). The effects of the SGP on groundwater levels would be minor to major, long-term, and localized to the analysis area. Groundwater levels away from the pit dewatering focus areas would observe measurable reductions in water levels constituting a minor or moderate effect while groundwater levels in the dewatering focus areas would observe drawdown of several hundred feet, constituting a major effect.

Pit Lake Development

The numerical groundwater flow model developed for the proposed Project was used to predict the rate of recovery and pit lake development for the final West End pit configuration. Predicted lake filling would commence within the first year after the cessation of dewatering activities and would continue for approximately 40 years until the lake stage reaches near steady-state at an elevation of approximately 6600 feet amsl (Brown and Caldwell 2021e), resulting in a maximum pit lake depth of approximately 300

feet (**Figure 4.8-9**) with a ponded surface area of approximately 150 acres. The pit lake is not expected to overflow to the surface. Outflow from the pit lake would be in the form of subsurface outflow to groundwater. This effect is described in more detail in the companion SGP Water Quality Specialist Report (Forest Service 2022f).

Because they would be backfilled with development rock, pit lakes would not form in the Hangar Flats or Yellow Pine pits. Recovering water levels would inundate the portions of the backfill below the pre-dewatering water levels around approximately Mine Years 8 and 12 years, respectively.

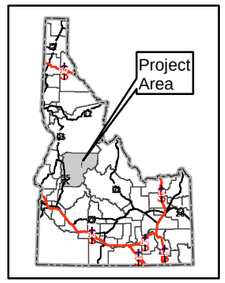
Impacts to Groundwater Flow

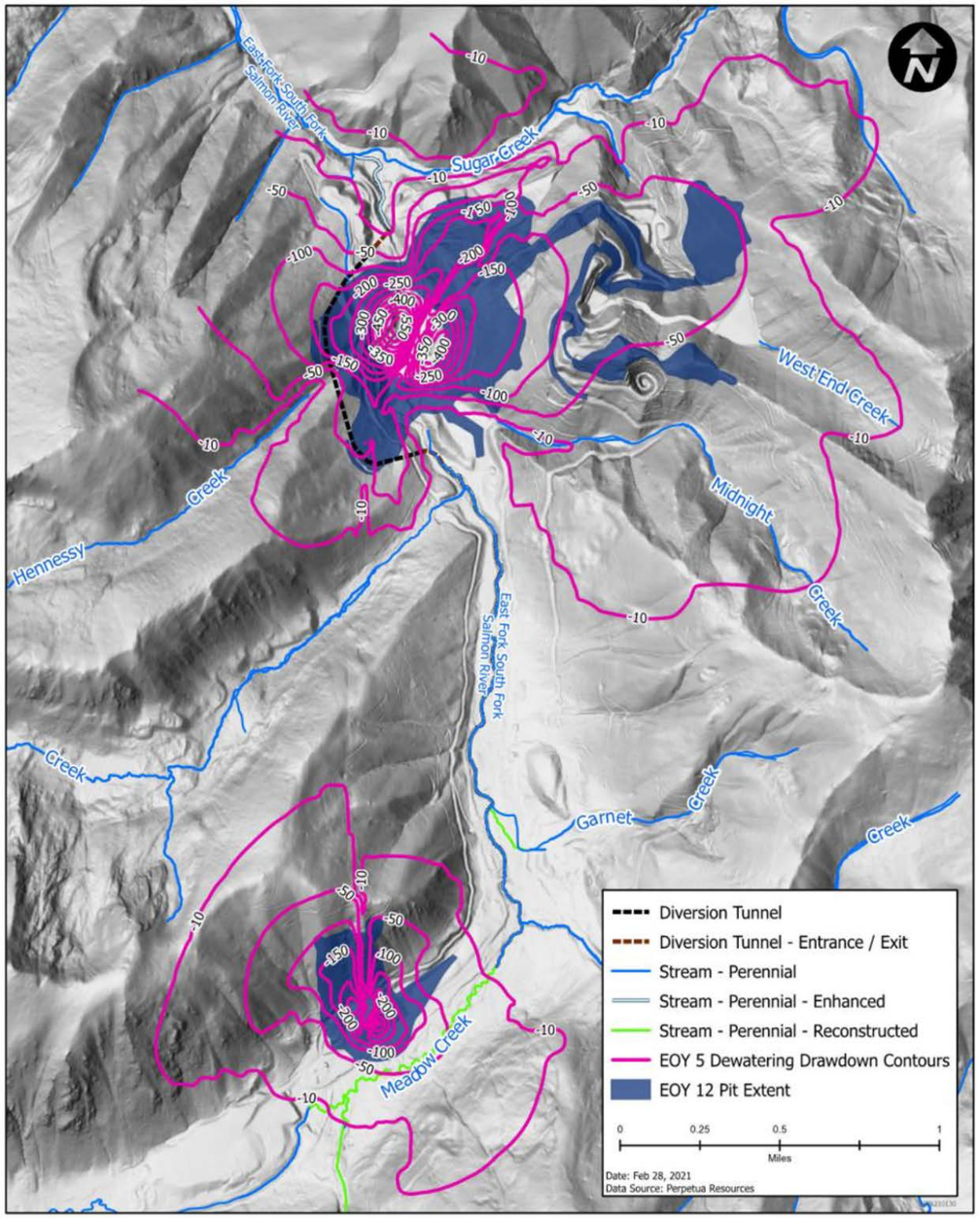
The presence of the fully lined TSF and TSF Buttress along with the lined Yellow Pine pit and Hangar Flats pit backfills would alter local groundwater recharge and flow permanently, as these liners would inhibit groundwater recharge across the areas of their footprints and thereby, increase surface water runoff from these areas while potentially lowering groundwater levels locally. The total covered area would be approximately 430 acres (Perpetua 2021a, Table 3-4) of a total basin area of 25 square miles (16,000 acres).

In addition, the underdrains for the TSF and TSF Buttress facilities would continue to function and locally lower groundwater levels beneath these facilities to the elevation of the drains. Therefore, groundwater flow away from this location would be reduced compared to baseline conditions because groundwater flow to the area would be partially converted to underdrain discharge.

Away from the TSF area, groundwater levels would rebound during the post closure period, with most recovery occurring within 3 years following the cessation of groundwater pumping (Brown and Caldwell 2021e). The groundwater flow pattern and flow directions are predicted to be only minimally affected by the presence of the West End pit lake, where the presence of the lake would result in a flat hydrologic gradient across the ponded area. Groundwater in areas away from the pit lake would return to stable conditions, with seasonal responses to recharge followed by lower winter water levels. The simulated groundwater levels and seasonal changes are similar to pre-mining conditions simulated by the existing conditions model.

Impacts to groundwater flow would be minor, permanent, and localized, as when mining and reclamation are completed, there would be minor reductions in groundwater flows due to local reductions in recharge in the vicinities of the TSF, TSF Embankment and Buttress, Hanger Flats pit backfill, and Yellow Pine pit backfill.





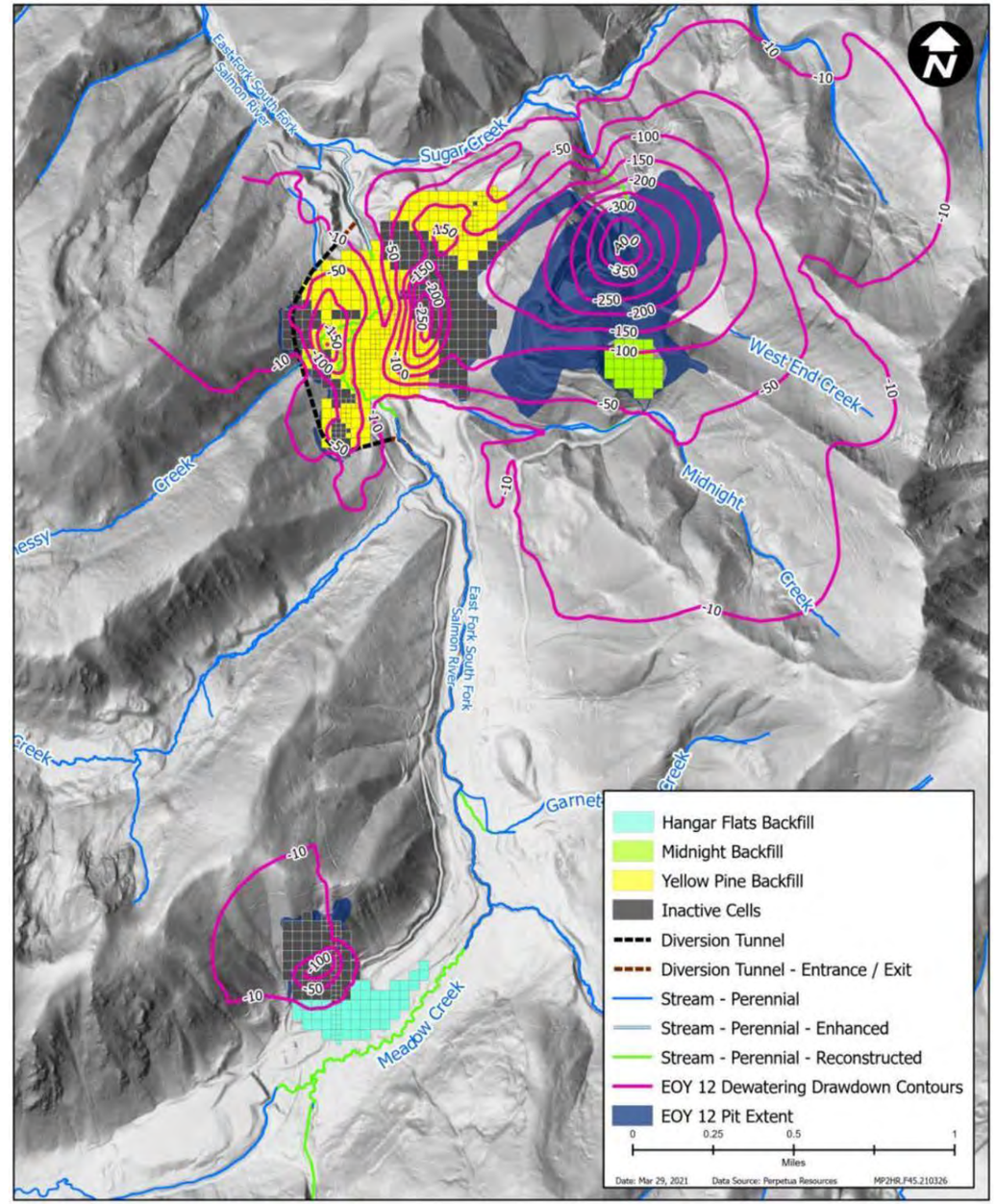
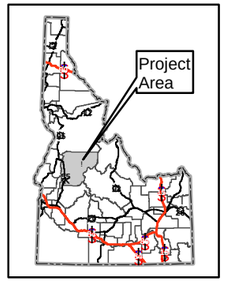
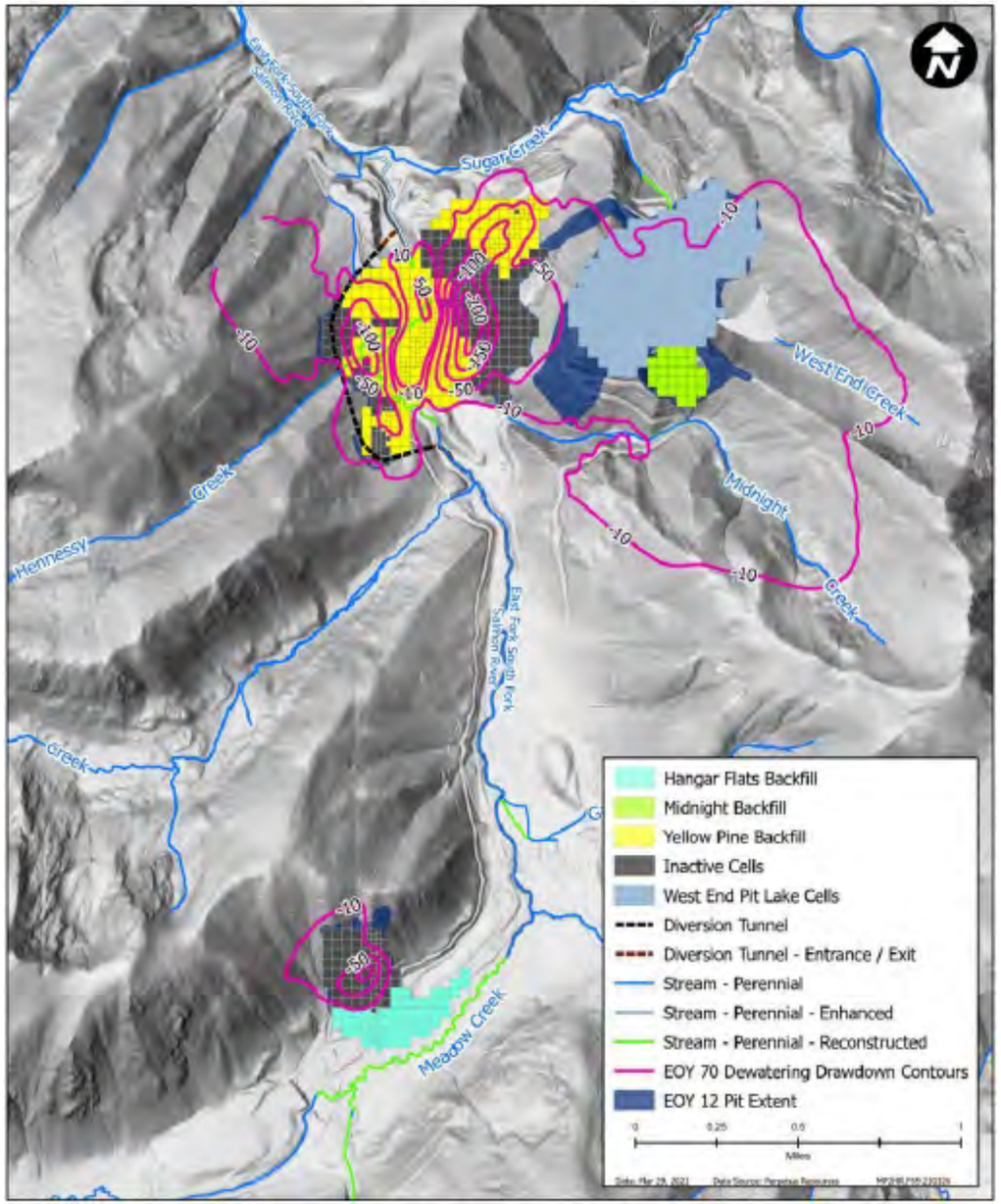


Figure 4.8-8
Predicted Dewatering Drawdown

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)





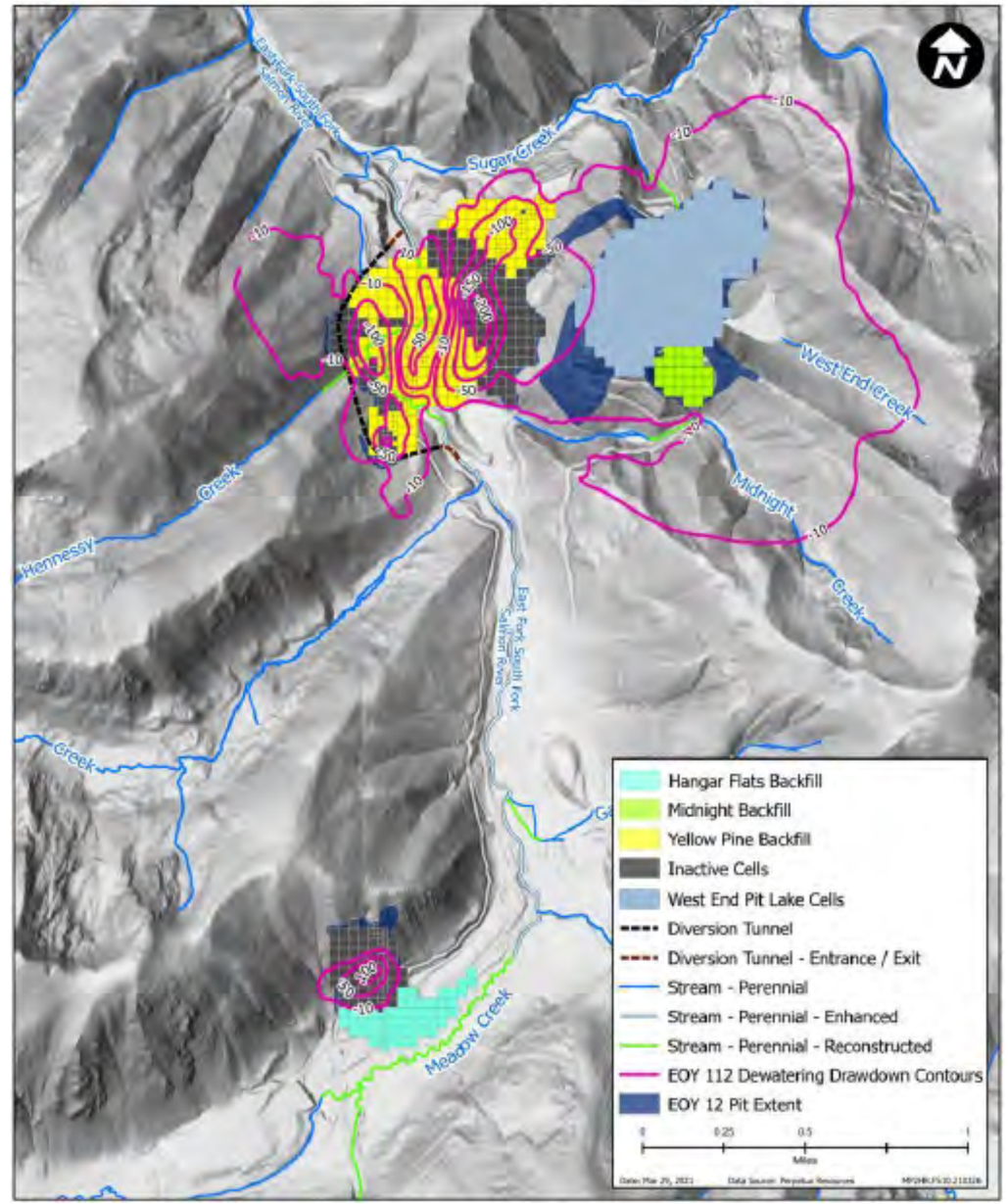


Figure 4.8-9 Predicted Dewatering Drawdown

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)

Impacts to Groundwater Dependent Ecosystems

As described above, mine-induced drawdown resulting from proposed dewatering and water production activities is predicted to cause a reduction in groundwater levels within the analysis area. These reductions are predicted to occur in the vicinity of existing seeps and springs plus the GDEs they support (**Figure 4.8-10**). These seep and spring locations can be characterized as either ephemeral or perennial. Ephemeral locations flow only during or after wet periods primarily in response to precipitation or runoff events. Thereby, these surface water features are not controlled by discharge from the regional groundwater system. During low precipitation periods of the year, ephemeral locations typically would be dry. In contrast, perennial seeps and springs generally flow throughout the year. Flows observed during wet periods include a combination of surface runoff and groundwater discharge, whereas flows during dry periods are sustained primarily by groundwater discharge. This groundwater discharge may emanate from a local system or from the regional groundwater system. If the flow from these seeps and springs relies on groundwater from an aquifer experiencing drawdown, that reduction in groundwater levels could reduce the surface water discharge resulting in potential reductions to the length of flow reach, rate of flow, and corresponding reduction in the associated riparian vegetation area.

Potential impacts to seeps, springs, and GDEs were evaluated by comparing surface water locations to the predicted ten-foot drawdown contour resulting from mine dewatering and water production. **Figure 4.8-10** illustrates that there are 45 GDEs catalogued to be present within the analysis area potentially affected by dewatering drawdown of groundwater levels at the end of mining. During mining there are also 48 locations potentially affected by drawdown from the Hangar Flats pit dewatering and industrial well supply pumping. Such impacts would occur only in cases where the hydrology of the seeps, springs, and wetlands affected is dominated, or largely influenced by groundwater discharge from the aquifer where water levels are subject to drawdown. The actual impact to each specific seep or spring would depend on the degree of interconnection between that perennial surface water and the aquifer affected by mine-related pumping. Considering the complexity of hydrogeologic conditions and the inherent uncertainty in numerical modeling predictions relative to the exact areal extent of groundwater drawdown, conclusive *a priori* identification of specific seep and spring impacts is not possible. Therefore, a precautionary principle is applied where seep and spring locations within the vicinity of the predicted drawdown would be subject to monitoring and mitigation requirements (see **Section 4.8.3**).

Impacts to GDEs would be negligible to potentially major, long-term, and localized.

Impacts to Groundwater Rights

There are no groundwater rights located within the predicted ten-foot drawdown contour associated with the drawdown prediction for mining activity. Current Perpetua groundwater rights are located outside of the predicted dewatering impact areas.

Additional groundwater rights would be needed for the SGP and would be secured through direct permit application for approval of such rights from the IDWR. Perpetua plans to apply for a maximum total diversion rate of 9.6 cfs to maintain ore processing and mine operations. This rate would be for combined groundwater and surface water diversion in addition to existing water rights. Perpetua is currently in the process of applying for these additional rights.

Groundwater use for potable water supply would require drilling wells at the Landmark Maintenance Facility and SGLF. At each facility, a well with a capacity of 18 gpm (0.04 cfs) is proposed. Separate water rights applications would be submitted for each well, seeking a permit to authorize diversion of 0.04 cfs for domestic and industrial purposes at the Landmark Maintenance Facility, and a permit authorizing diversion of 0.04 cfs for domestic and commercial purposes at the SGLF.

Domestic water use at the truck shop and mill facilities also would be supplied from a potable water system. Perpetua anticipates submitting an application for permit seeking 0.06 cfs of groundwater for this use.

Domestic use at the Worker Housing Facility also would be supplied by groundwater. The authorized point of diversion for water right 77-7141 (0.20 cfs) would be modified for this purpose through an application for transfer. In addition, Perpetua anticipates submitting an application for permit to appropriate and additional 0.20 cfs of groundwater to supplement the currently authorized 0.2 cfs volume authorized under 77-7141.

The effects of groundwater diversion at these rates were incorporated into the impact analyses above.

Surface Water Quantity

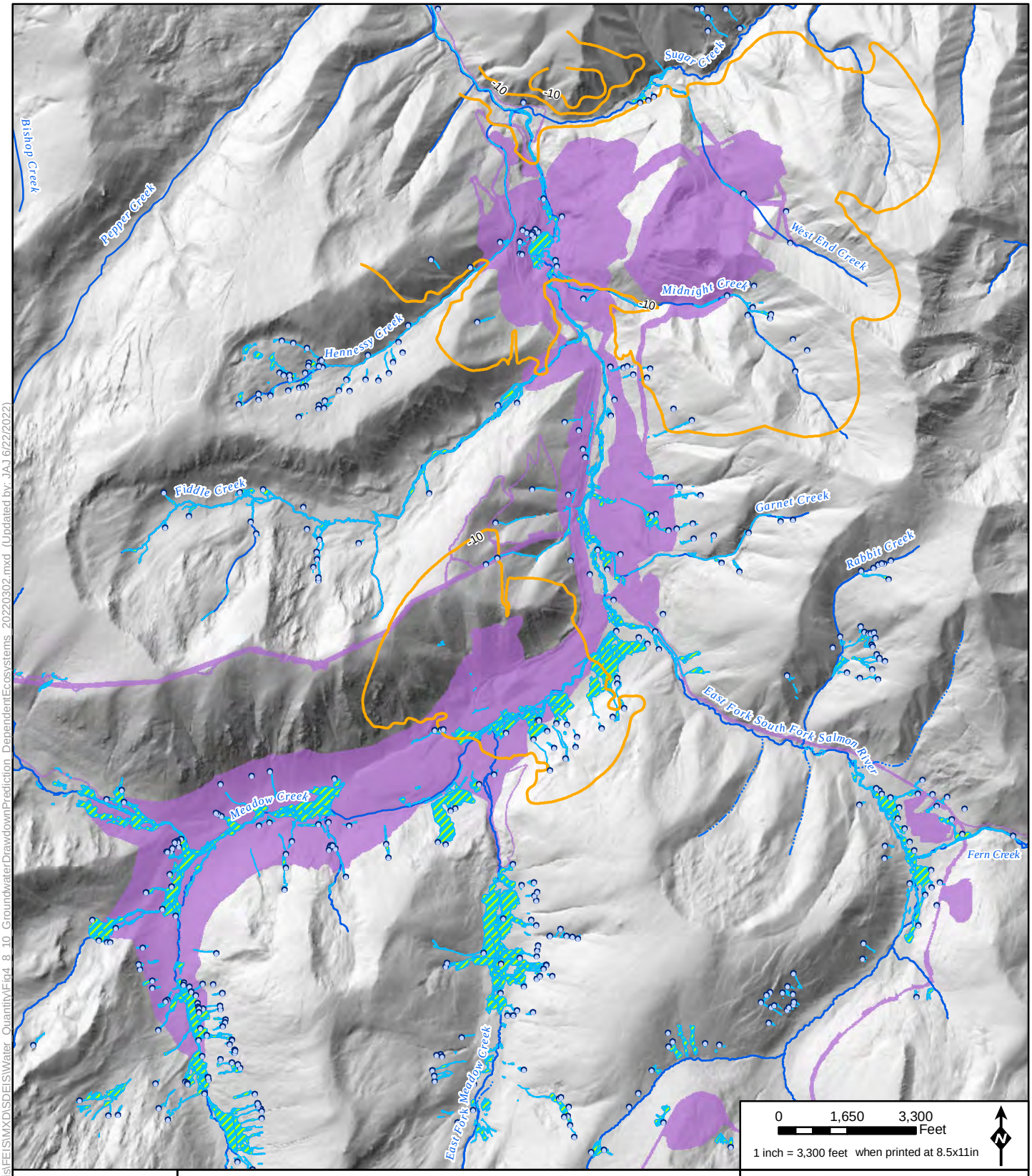
This section provides a summary of the methods used to evaluate the potential changes to stream flows and surface water rights in the affected areas. The primary focus of the effects analysis is on predicted stream flows in Meadow Creek between the TSF and Hangar Flats pit; Meadow Creek downstream of the Hangar Flats diversion but upstream of the confluence with the East Fork SFSR; the East Fork SFSR at USGS Gaging Stations 13310800, 13311000, and 13311250; the East Fork SFSR downstream of Sugar Creek; and Sugar Creek at the USGS Gaging Station 13311450.

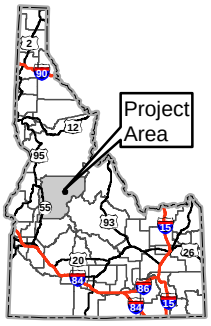
Changes in Stream Flow Characteristics

The changes in surface water flow described in this section are compared to those of the simulated existing conditions. Changes in surface water flows in the analysis area are expected to result primarily from:

- Stream diversion around mine facilities,
- Interception of contact water and other mine-impacted water prior to runoff,
- Development and dewatering of three open pits,
- Groundwater production for consumptive use,
- Stream water diversion above the East Fork SFSR tunnel for consumptive use, and
- Discharge of treated water.

These activities have the potential to modify the location and flow rate of stream flows in the analysis area.





LEGEND

- Seep/Spring
- SHSM Drawdown Maximum Contour
- Intermittent Stream
- Perennial Stream
- Delineated Wetland

Project Components *

- Mine Footprint (Mine Year 12)

*Mine Site components are associated with 2021 MMP

Figure 4.8-10
Predicted Groundwater Drawdown in the Vicinity of Groundwater Dependent Ecosystems
Stibnite Gold Project
Stibnite, ID

Base Layer: Midas Hillshade Raster 10m
Other Data Sources: Perpetua; Boise National Forest; Payette National Forest

Document Path: U:\2037\21981\03_data\gis_cad\gis\FEIS\MXD\SDEIS\Water_Quantity\Fig4_8_10_GroundwaterDrawdownPrediction_DependentEcosystems_20220302.mxd (Updated by: JAJ 6/22/2022)

Streamflow simulations were performed for various locations potentially affected by mine operations, including locations of the USGS gaging stations in the analysis area (**Figure 3.8-3**). Stream flows arepresented graphically in this report with numerical tabulations of the predicted stream flows available in the appendices to Brown and Caldwell 2021e.

Stream flows in Meadow Creek and East Fork SFSR upgradient of the mine activities would not be affected by the operations because these areas are outside the influence of mine disturbance and dewatering. Predicted monthly changes in stream flows are summarized in **Table 4.8-4**.

The model predicts reductions in Meadow Creek flows between the TSF and Hangar Flats pit compared to baseline flows of up to approximately 40 percent during low flow periods (**Figure 4.8-11**) which depicts the predicted monthly surface flows for the project compared to No Action case during the construction and operational period for the SGP. This point of comparison is not associated with a stream gauge location because the current Meadow Creek gauge location would be displaced by construction of the TSF. This section of Meadow Creek is simulated as lined, preventing groundwater from discharging to the creek. However, baseflow depletion is largely offset by the addition of treated water in this portion of Meadow Creek via an IPDES permitted outfall. This offset is anticipated to be substantially effective because the predicted impact is primarily associated with dewatering of the Hangar Flats pit. Therefore, that dewatering is contemporary with the greatest availability of treated water around Mine Years 5 and 6, as dewatering production is a contributing source to the water treatment requirement for that time.

Table 4.8-4 Average Monthly Percent Predicted Reductions in Stream Flows during the Mine Operations Period

Month	East Fork SFSR above Meadow Creek (13310800)	East Fork SFSR below Meadow Creek (13311000)	East Fork SFSR above Sugar Creek (13311250)	Sugar Creek above East Fork SFSR (13311450)	East Fork SFSR below Sugar Creek (13311500)
January	-	7%	13%	3%	9%
February	1%	6%	13%	3%	9%
March	-	5%	12%	3%	8%
April	-	6%	8%	2%	6%
May	-	4%	4%	1%	4%
June	-	3%	3%	1%	3%
July	-	7%	14%	3%	10%
August	-	9%	18%	3%	12%
September	-	7%	15%	3%	11%
October	-	7%	15%	3%	10%
November	-	7%	15%	3%	10%
December	-	6%	13%	3%	10%
Maximum Monthly Reduction	3% (end of Mine Year 6)	26% (start of Mine Year 7)	30% (end of Mine Year 1, start of Mine Year 7)	3% (Mine Year 12)	3% (end of Mine Year 1, start of Mine Year 7)

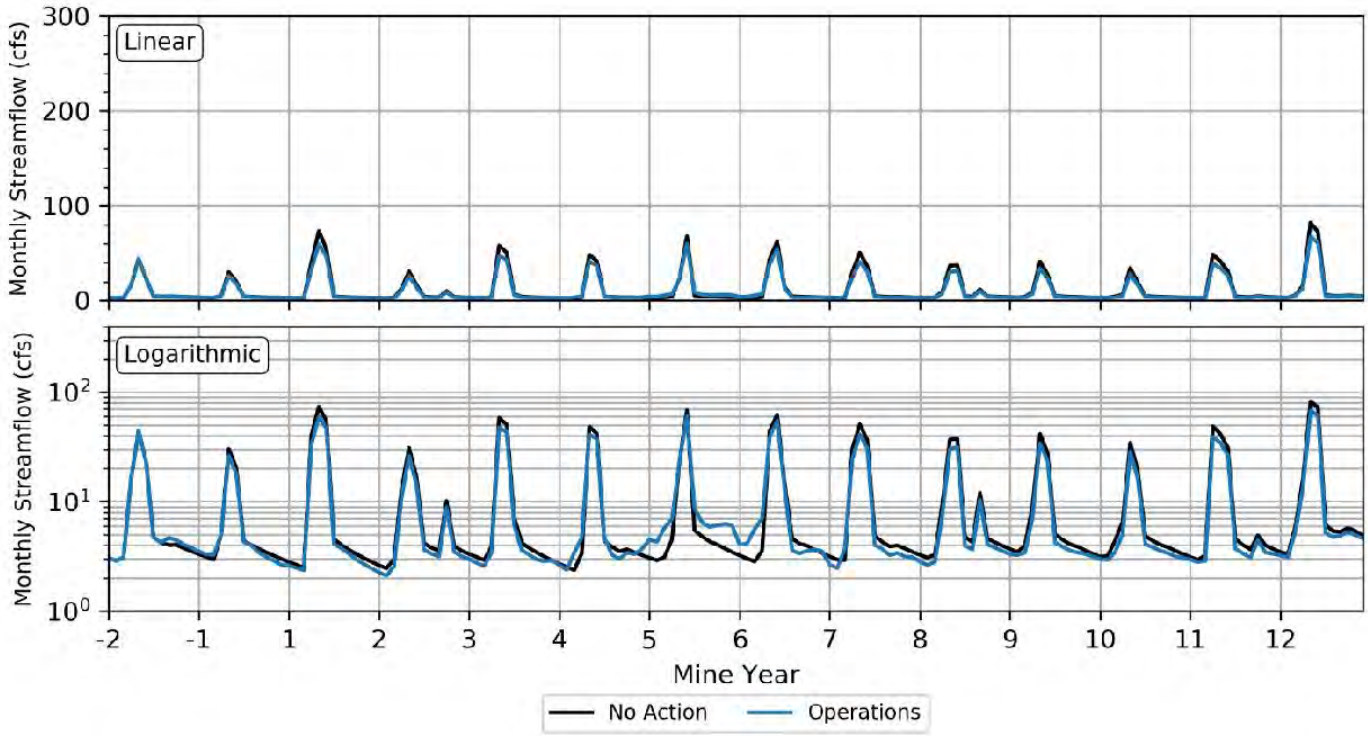
Source: Brown and Caldwell 2021e, Appendix B (predicted flows in CFS and relative percentage differences)
- indicates a less than 1% change

Effects to both seasonal peak and low flows are noted for Meadow Creek below the Hangar Flats diversion, but above the East Fork SFSR (**Figure 4.8-12**). Minimum flows under the No Action Alternative are approximately 4.9 cfs, compared to 2.9 cfs for the action alternatives (a 40 percent reduction) related to Hangar Flats dewatering interception of groundwater as simulated by the mine operational period model (Brown and Caldwell 2021e). Flow reductions are predicted during the project's operational period with the largest flow reductions (i.e., on the order of 40 percent) occurring during Mine Years 4 through 8 as Hangar Flats pit is being dewatered. Flows recover toward the No Action Alternative condition following the cessation of Hanger Flats dewatering and are near equivalent to the No Action Alternative conditions by Mine Year 12.

Below the confluence of Meadow Creek and East Fork SFSR and in the East Fork SFSR above the confluence with Sugar Creek, late-season stream flow decreases would occur under average climate conditions during the mine operational period (**Figures 4.8-13** and **4.8-14**). Upstream of the Yellow Pine pit area, minimum baseflows based on comparison of model results to the existing conditions model for the action alternatives would be approximately 6.6 cfs compared to 8.9 cfs (26 percent reduction) for the No Action Alternative attributable to the diversion and capture (contact water) of surface water as well as mine dewatering. Downstream of the Yellow Pine pit area prior to the confluence with Sugar Creek, minimum baseflows for the action alternatives are predicted to be 7.9 cfs compared to 11.3 cfs under the No Action (30 percent reduction) under the proposed water management scenario and its associated water balance (Brown and Caldwell 2021e). These reductions are predicted to occur during the project operational period with the largest reductions occurring during the Mine Years 2 through 8 when dewatering product at Yellow Pine pit and then Hangar Flats pit are at their peak rates. Flows recover toward the No Action Alternative condition at the end of mine operations and are near equivalent to the No Action Alternative conditions by Mine Year 12.

Predicted Sugar Creek flows for the action alternatives are approximately 3 percent less than the No Action Alternative during the operational period (**Figure 4.8-15**). During the post-closure period when the West End pit lake is forming, predicted Sugar Creek flows decrease by up to 9 percent primarily. Predicted flow reductions of this size persist for approximately 50 years post-closure before decreasing to an approximately 1 percent difference indefinitely compared to the No Action Alternative. Downstream of the East Fork SFSR and Sugar Creek confluence, the average seasonal low flows for the action alternatives are 20.1 cfs compared to 22.1 cfs under the No Action Alternative (9 percent reduction), while the minimum predicted low flow is 15.7 cfs compared to 18.2 cfs (14 percent reduction, **Figures 4.8-16** and **4.8-17**). These reductions are attributable to the total of upstream capture of surface water, groundwater dewatering, and water abstraction for consumptive use partially offset by discharge of treated water. Flows fully recover within 10 years from cessation of operations (Brown and Caldwell 2021e).

It appears that the predicted reduction in stream flows due to the SGP are most pronounced within lower Meadow Creek above East Fork SFSR and East Fork SFSR above Sugar Creek. The percentage decrease in base flows is moderated by the flow from Sugar Creek. Farther downstream of the confluence of East Fork SFSR and Sugar Creek, flow reductions are expected to decrease due to incremental inflows of surface water and groundwater along the downstream run of the river that are not impacted by the SGP (e.g., Salt Creek, Profile Creek, Johnson Creek, and others) with predicted flow reductions in the project area equivalent to less than one percent of mean flows downstream of the confluence with Johnson Creek.



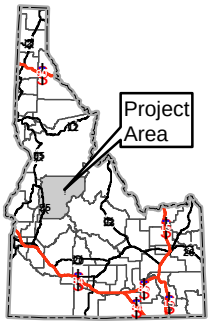
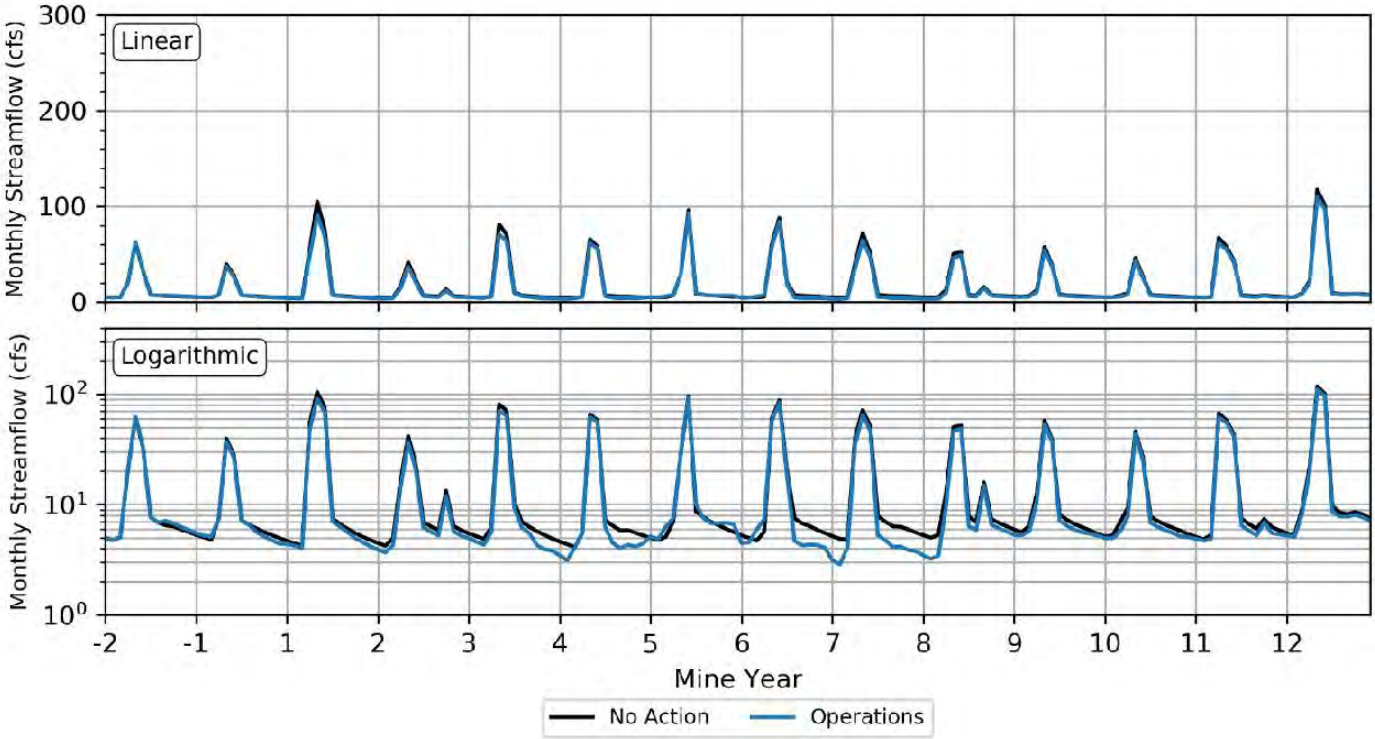


Figure 4.8-11
Comparison of No Action and Action Alternatives Predicted Meadow Creek Flow between the TSF Buttress and Hangar Flats Pit

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021b)



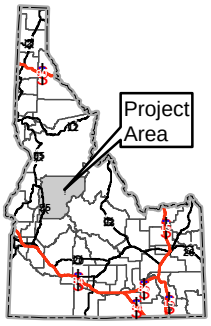
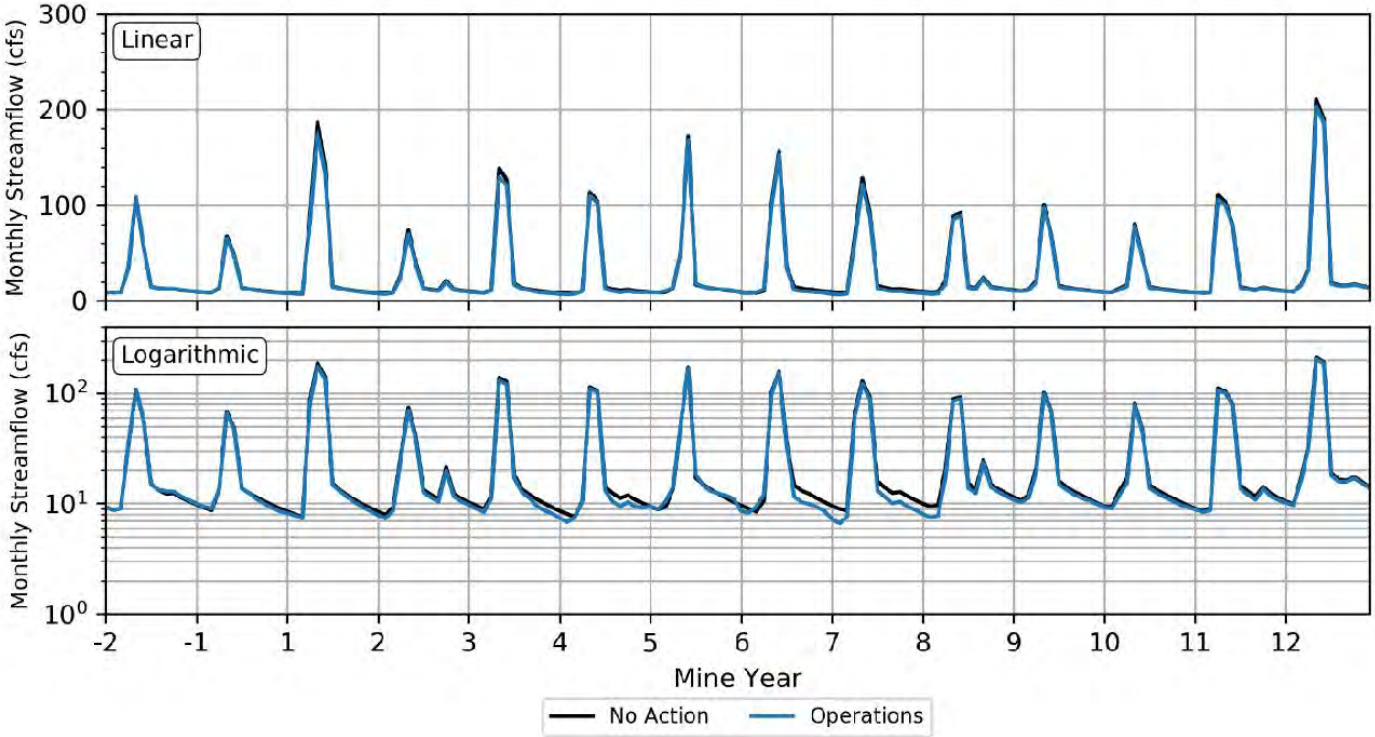


Figure 4.8-12
Comparison of No Action and Action Alternatives Predicted Meadow Creek Flow above EFSFSR Confluence

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021b)



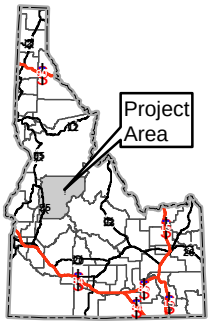
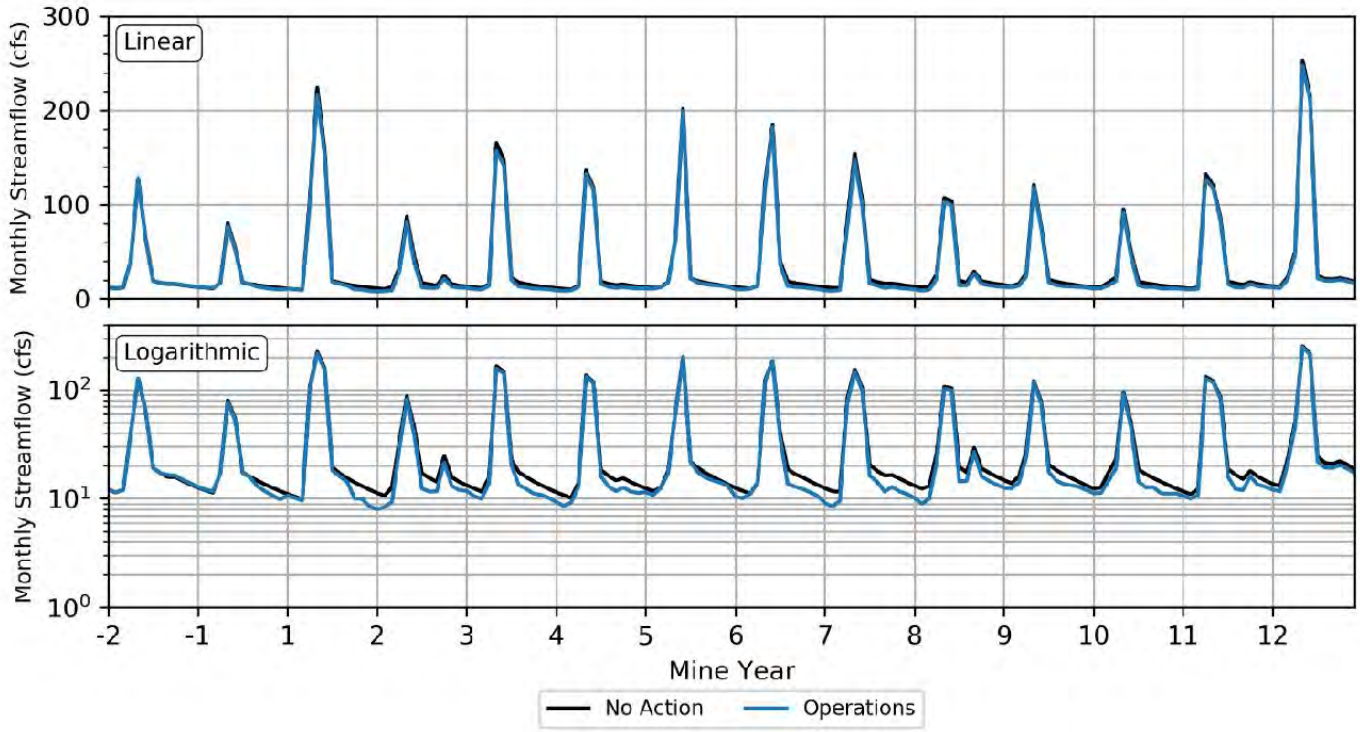


Figure 4.8-13
Comparison of No Action and Action Alternatives Predicted EFSFSR Flow below Meadow Creek Confluence

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021b)



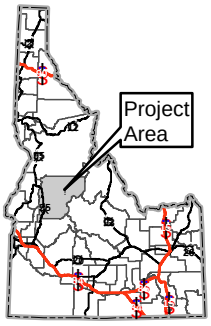
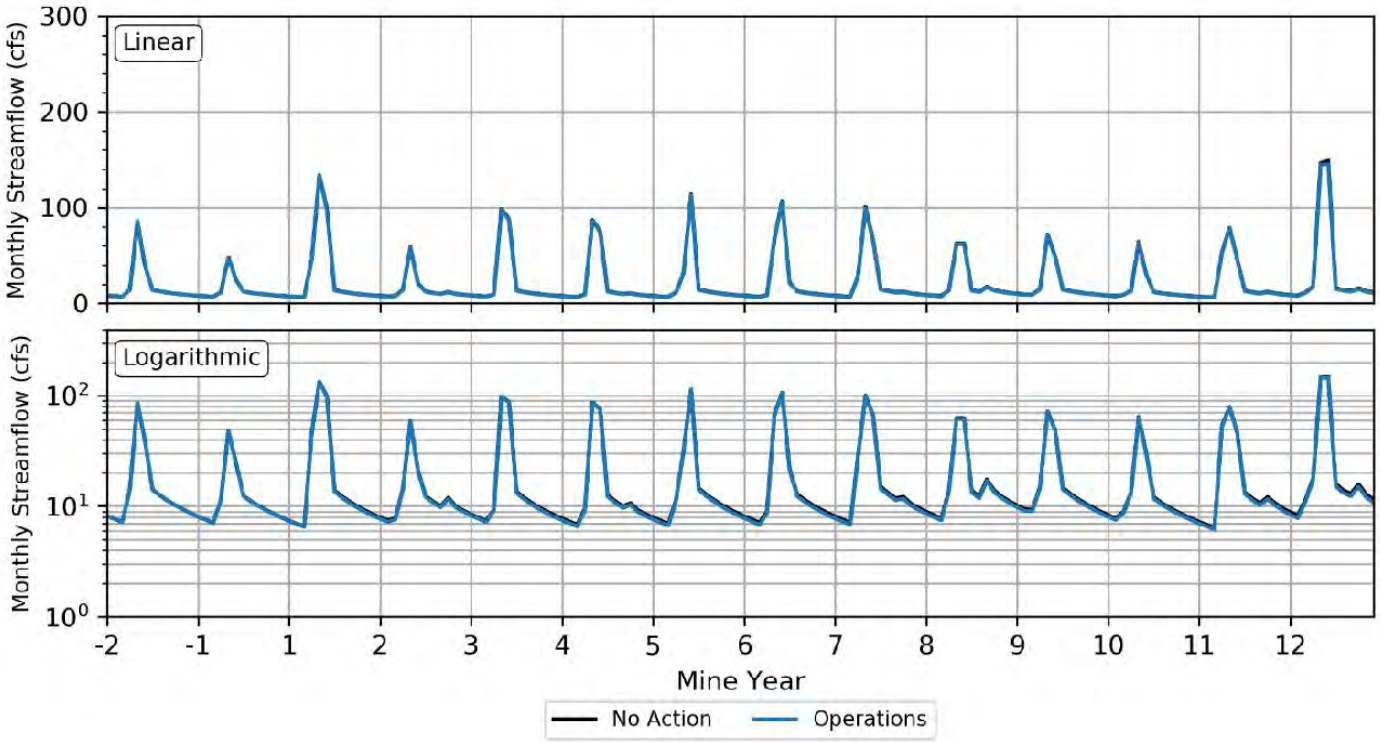


Figure 4.8-14
Comparison of No Action and Action Alternatives Predicted EFSFSR Flow above Sugar Creek Confluence

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021b)



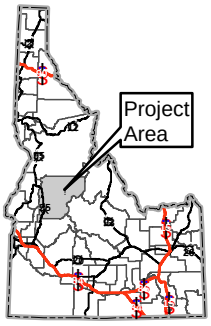
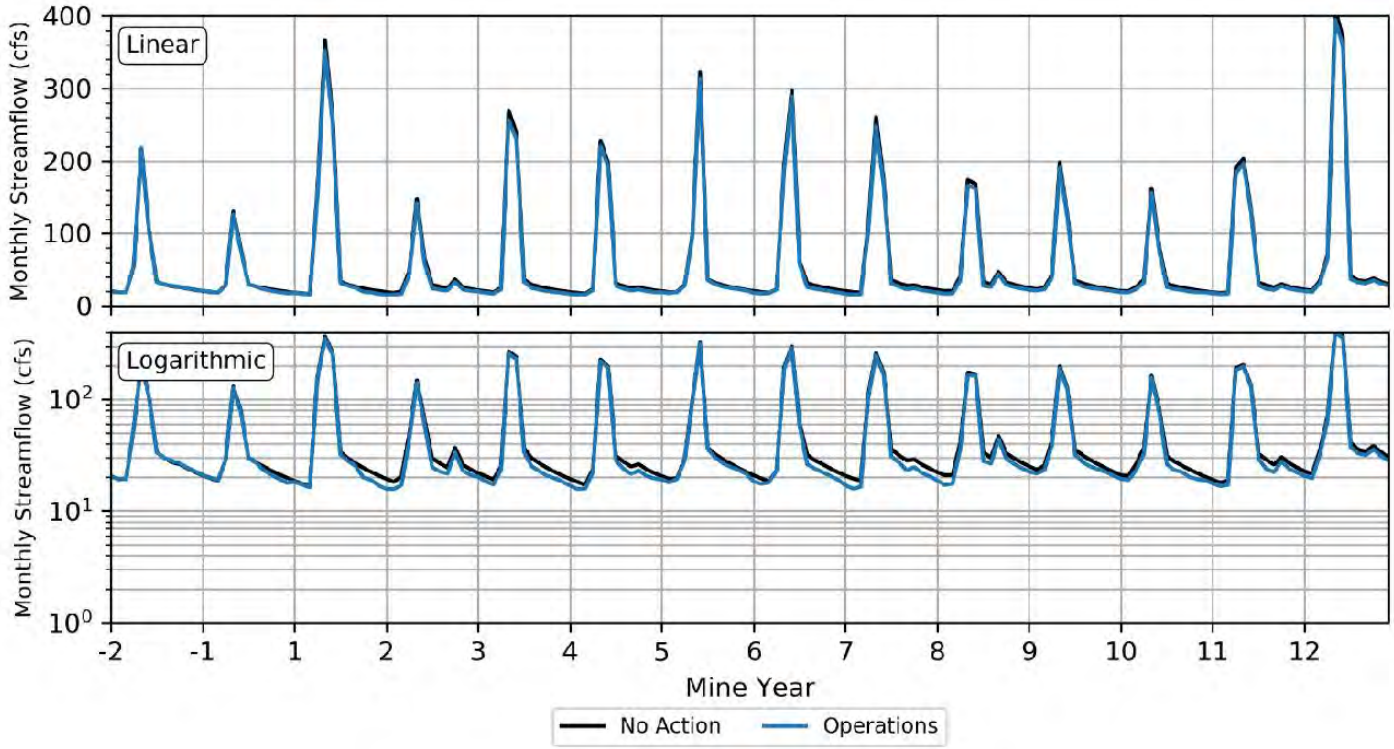


Figure 4.8-15
Comparison of No Action and Action Alternatives Predicted EFSFSR Flow above Sugar Creek Confluence

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)



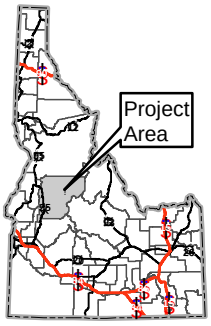
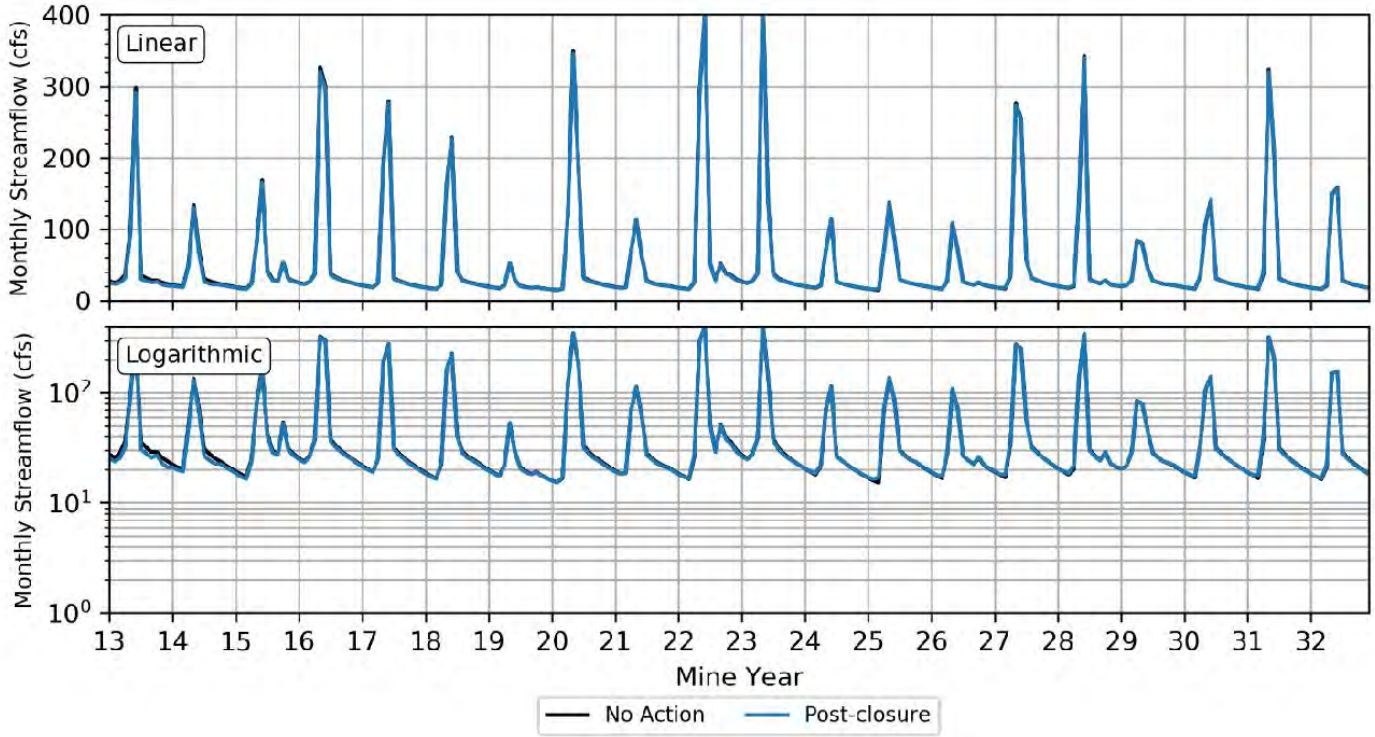


Figure 4.8-16
Comparison of No Action and Action Alternatives Predicted EFSFSR Flow below Sugar Creek Confluence

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)



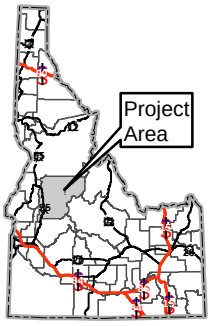


Figure 4.8-17
Comparison of No Action and Action Alternatives Predicted EFSFSR Flow below Sugar Creek Confluence in the Post-Closure Period

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)

The effects of changes in stream flow characteristics on ecological receptors are described in **Sections 4.12.2** and **4.13.2** plus companion specialists reports for Wildlife (Forest Service 2022j) and Fish and Aquatic Resources (Forest Service 2022i).

Impacts to stream flow characteristics would be moderate, long-term, and localized.

Impacts to Surface Water Rights

There are no surface water rights located within the analysis area other than Perpetua's.

Additional surface water rights would be needed for the SGP and would be secured through direct permit application for approval of such rights from the IDWR. Perpetua plans to apply for a maximum total diversion rate of 9.6 cfs to maintain ore processing and mine operations. This rate would be for combined groundwater and surface water diversion in addition to existing water rights. Actual production at the maximum rate would be uncommon and limited in duration. Typical rates of surface water diversion during the build-up of project water inventory would be approximately 4 cfs.

It should be noted that no water right with a junior priority date can deplete the water needed to maintain the IWRB maintained minimum streamflow water right on the East Fork SFSR (Water Right 77-14190), unless allowed as a condition of approval of the proposed junior water right. All the existing water rights at the SGP predate the priority date of April 1, 2005, associated with Water Right 77-14190. Any new water rights permits would have a junior priority date, but the minimum stream right (77-14190) on the East Fork SFSR is subordinate to all future domestic, commercial, municipal, and industrial uses, and up to 8.2 cfs of new non-domestic, commercial, municipal, and industrial uses. This would allow authorization of up to 8.2 cfs of new non-domestic, commercial, municipal and industrial water rights to which Water Right 77-14190 would be subordinate.

Base flows in the East Fork SFSR below Sugar Creek are approximately 20 cfs and 60 cfs in Johnson Creek (at gauge location 13313000). The maximum diversion rate under existing and proposed surface water rights is 4.05 cfs, which is approximately 20 percent of the base flow in the East Fork SFSR and five percent of the combined flows of the East Fork SFSR and Johnson Creek.

After a water right application has been filed, IDWR would perform an analysis to determine if the application is made in good faith with sufficient financial resources to complete the project, would reduce the quantity of water under existing rights (including Minimum Stream Flow and Wild & Scenic water rights on the South Fork Salmon River and the Salmon River), would be insufficient for the proposed use, and would not conflict with the local public interest. Instream rights on the SFSR are subordinate to 20.6 cfs; maximum diversions proposed by Perpetua from all sources and uses would be 9.68 cfs, within the allowance of the SFSR instream rights.

Minimum instream flow in the Federal Reserve Water Rights for the Salmon WSR (75-13316 and 77-11941) at their designated location approximately 64 miles downstream from the SGP area range from 1,200 cfs in early September to 9,450 cfs in early June. IDWR would be responsible for determining the impacts of the water right application. The current seasonal low baseflow in the Salmon River is approximately 4,150 cfs near Shoup gage.

Impacts to surface water rights would be addressed by the water rights authorizations as determined by IDWR via mitigation measures associated with those authorizations. Pending application of the IDWR mitigation measures, effects on surface water rights would be moderate, long-term, and localized.

4.8.2.3 Johnson Creek Route Alternative

The water quantity related impacts associated with the 2021 MMP and Johnson Creek Route alternatives are identical. Water for dust control on access roads would be obtained from permitted freshwater sources. The relative sourcing of dust control water from permitted diversion locations would vary depending on access route but would remain within the authorized diversions (e.g., off-site maintenance facilities, on-site freshwater sources).

4.8.2.4 Uncertainty Associated with Model Predictions

Predictions generated by groundwater and hydrologic models are associated with a degree of uncertainty. General sources of model uncertainty are attributed to a variety of factors, including:

- data characterizing hydraulic properties (over a large enough area), or the hydrologic system's response to changes or stressors on which the model predictions depend;
- conceptual models or model assumptions;
- geometrical representation of a complex system and its heterogeneities;
- variation in the drawdown associated with specific dewatering well and dewatering sump locations and designs as represented in the numerical model by drains;
- impreciseness of spatial interpolations;
- field measurement inaccuracies;
- inadequate interpretation of the collected data;
- misinterpretation of relevant processes that affect the hydrologic system;
- general limitations of the models and numerical methods used; and
- unpredictable natural and human factors.

Uncertainties associated with model predictions can be evaluated and assessed using a variety of approaches, including:

- Sensitivity analysis;
- "Bayesian model averaging" applied to multiple conceptual models and multiple parameter estimation methods;
- Parallel testing of several viable conceptual models, combined with parametric uncertainty analysis carried out for each conceptual model;
- The use of "pilot points" in conjunction with nonlinear parameter estimation software that incorporates advanced regularization functionality;
- "Calibration-Constrained Monte-Carlo," also called "Null Space Monte Carlo;" and/or
- "Subspace Monte Carlo" that allows calibration-constrained random heterogeneity.

Sensitivity analysis is deemed an important part of model uncertainty analysis. Most often such analysis is limited to varying model parameters and noting how such changes affect the model calibration.

However, sensitivity analysis alone is not always adequate if the altered model is used for making predictions. This is because varying the values of model parameters often results in a significant model "de-calibration," and de-calibrated models should not be used for predictive simulations.

ASTM International Standard Guide for Conducting Sensitivity Analysis for a Groundwater Flow Model Application (ASTM International 2008) provides the following clear instructions: "For each value of each group of inputs, rerun the calibration and prediction runs [emphasis added] of the model with the new value of the calibrated value" – this means that after varying the value of a given parameter, one needs to calibrate the altered model, before using it for making predictions. This is seldom accomplished with the models developed for industrial applications – completing such systematic analysis would require large budgets and a significant level of effort that many projects cannot support.

Many of the other, more sophisticated approaches listed above for evaluating model uncertainty can be quite involved and, due to limitations of software and hardware, combined with the budgetary and time constraints of most projects, are still not practical outside of the realm of research (Rzepecki 2012).

Parameter value selection for the hydraulic characteristics simulated in the SGP hydrologic model is the primary source of uncertainty in predicting pumping rates associated with open pit dewatering and the nature and extent of potential impacts from project pumping and water management. In particular, the selection of parameter values to represent the bedrock aquifer hydraulic characteristics are important because bedrock-hosted groundwater is extensively present throughout the Analysis Area.

To address this source of predictive uncertainty for groundwater pumping and its impacts, a sensitivity analysis was performed on the parameter values selected for bedrock hydraulic properties. Model parameter values for hydraulic conductivity and specific storage were evaluated over a range of numerical values within the range of measurements observed during borehole testing. A range of bedrock hydraulic conductivity values between 0.02 and 50 times the model selected values and bedrock specific storage values between 0.5 and 2 times the model selected values were examined. Additional details of the sensitivity analysis are described in Brown and Caldwell 2021e. Parameter value changes by more than a factor of 10 produced a model that did not calibrate to observed conditions. Therefore, the following discussion of sensitivity results relates to a range of bedrock hydraulic conductivity values between 0.02 and 10 times the model selected values.

Dewatering pumping rate predictions were sensitive to increases in bedrock hydraulic conductivity but were insensitive to decreases in bedrock hydraulic conductivity or changes in specific storage. For the Yellow Pine pit dewatering, peak pumping rates associated with the sensitivity analysis ranged up to approximately 2,000 gpm compared to the model predicted rate of approximately 650 gpm. For Hangar Flats pit and West End pit dewatering, the sensitivity analysis peak pumping rate ranged up to approximately 2,400 gpm compared to a predicted value of approximately 1,500 gpm, and approximately 400 gpm compared to 300 gpm, respectively.

If higher than predicted dewatering pumping rates within the sensitivity range were in fact realized, the project would be less reliant on surface water abstraction from the intake above the EFSFSR tunnel or production from groundwater industrial supply wells to meet its consumptive use needs. Therefore, increases in dewatering pumping would be less than the increase in total groundwater pumping by the

project because dewatering production could be used to source more of the consumptive use, offsetting pumping from industrial supply wells. However, the increase in total pumping due to increased bedrock hydraulic conductivity only slightly affected the lateral extent of the 10-foot drawdown cone compared to model predictions because that extent is more closely related to drawdown in the more permeable alluvial materials (Brown and Caldwell 2018a, 2021b, 2021e).

With regard to surface waters, the effects of increased groundwater pumping would be largely offset by the associated reduction in surface water abstraction from the intake above the East Fork SFSR tunnel for consumptive use. Therefore, surface water flow rates would be within 0.5 cfs of those predicted by the model, representing the difference between predicted surface flow rate reductions and removing the rate of forecasted withdrawal from the intake above the EFSFSR tunnel, which would no longer be needed. Conversely, decreased dewatering pumping would create a need for more industrial well production or surface water abstraction.

Groundwater modeling requires simplifying assumptions to represent a complex subsurface hydrologic regime. As a result of data limitations and simplifying assumptions, all predictive models, no matter how well constructed and calibrated, contain uncertainty. The main sources of uncertainty for the Brown and Caldwell model are:

- Typical limitations of data derived from localized, short-term hydraulic tests to characterize an aquifer at a field-scale;
- Predictive sensitivity to various possible degrees of hydraulic transmissivity of the fault zones, only one of which has been explicitly represented in the model; and
- Putative inability to directly observe the effects of long-term hydraulic stresses on the bedrock aquifer as attempted deep bedrock pumping tests have not been completed due to the inability to sustain groundwater production from a pumping well.

Although alternative conceptual and numerical models likely could be developed, an undertaking of this magnitude is not realistic, and in any case, would have been unlikely to produce significantly different predictive results or to significantly reduce the uncertainties associated with the model predictions.

4.8.3 Mitigation Measures

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. The mitigation measures described below in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) have been accounted for in the preceding impact analysis.

Issue: Mine-induced drawdown of water levels could impact flows in springs that were hydrologically connected with the aquifer.

Monitoring Measure - Water Resource Monitoring Plan Implementation: Because construction, operation, and closure of the SGP has the potential to impact surface or groundwater resources. A focused water resources monitoring plan for the proposed operations would be implemented by the proponent. The mine owner/operator would be responsible for the implementation of a Water Resources Monitoring

Plan focused on confirming the predicted groundwater drawdown within allowance for model uncertainty and its relationship to discharges at proximal surface water resources. The plan would include surface water, groundwater, and meteorological monitoring requirements for the approved project. Water quantity measurements would include diversion rates from groundwater pumping, water levels in groundwater monitoring wells and piezometers located within the Operations Area Boundary, and flow rates of streams and springs at USGS monitoring stations as well as spring locations characterized in the baseline program within the predicted 10-foot drawdown contour. Monitoring results would be provided to the Forest Service on a quarterly basis and summarized in an annual report. The mine owner/operator would be responsible for continued monitoring and reporting of changes in groundwater levels and surface water flows prior to, and during, operation and for a period of time in the post-reclamation period. The plan would be reviewed and approved by Forest Service and implemented prior to the commencement of mining. State authorizations may also have monitoring requirements and these requirements along with monitoring already conducted or proposed could be applied to satisfy the needs of this mitigation measure.

Effectiveness: This monitoring measure would provide for identification of potential flow-related impacts that deviate outside uncertainty of model forecasts to groundwater and surface water resources as a result of mine-related water management activities. Implementation of this monitoring measure in conjunction with associated mitigation measures is anticipated to mitigate potential adverse impacts to surface water resources resulting from mine-related drawdown during the mining and post-mining period. If such deviation is observed, actions may consist of additional investigation and evaluation, including additional monitoring as necessary, to determine effective management practices and prevent adverse impacts.

Issue: Despite the best efforts at calibration and validation, predictive modeling of groundwater flow and stream flow entails uncertainty and future field conditions may vary from predictions.

Monitoring Measure - Groundwater Modeling Validation and Update: Since there is uncertainty in the numerical groundwater model developed for the project, a work plan would be developed to revise the model and update it as necessary 1 year after mining intercepts the groundwater table and then again whenever monitoring data demonstrates a change in conditions that would significantly influence prediction and recognition of potential mine impacts. The model update would be based on the actual observed changes in groundwater elevations and additional hydrogeologic or groundwater-related data collected during operation. The Forest Service’s annual review of monitoring results combined with the updated groundwater modeling, if necessary, would provide early warning of potentially unanticipated, undesirable impacts to water resources to allow for implementation of appropriate mitigation measures.

Effectiveness: Implementation of this monitoring measure is expected to be effective in sustaining predictive models as usable evaluation tools that reflect site conditions and monitoring data for the purpose of predicting impacts and developing effective management practices.

4.8.4 Irreversible and Irretrievable Commitments of Public Resources

4.8.4.1 No Action Alternative

Under the No Action Alternative, the current mine plan would not be approved and the mining activities proposed under it would not take place. Perpetua could still propose to exercise its mining rights in the future. Under the No Action Alternative, no change would occur in the current surface water and groundwater flow conditions in the analysis area, and no change to the current commitment of these resources would occur. Therefore, there would be no irreversible or irretrievable commitments of water resources beyond those already realized as a consequence of historical mining activities conducted within the analysis area.

4.8.4.2 Action Alternatives

Surface water, in terms of its flow rate characteristics, is a renewable resource, and therefore the action alternatives are not expected to have permanent flow impacts. The duration of the predicted impacts on streamflow includes the mine construction and operational period, and up to another 10 years through the post closure period, before returning to a stable, long-term seasonal pattern under natural conditions. Impacts to surface stream flow rates from the SGP would be irretrievable commitments of these resources.

However, the SGP would irreversibly alter the terrain of the analysis area by the development of the TSF, by eliminating the existing Yellow Pine pit lake (and reconstructing the East Fork SFSR through its present location), while creating a pit lake at West End and the Stibnite Lake feature atop the backfilled and reclaimed Yellow Pine pit.

Meadow Creek would be routed over the reclaimed TSF with its natural flow rate but its gradient would be permanently altered over the TSF. The seeps and springs under the TSF that would be collected and routed out from under the site within pipes would be permanently carried by these systems. These would be irreversible commitments of these resources.

Mining of ore would result in the formation of mine pits, which would fill during a post closure period, forming inundated pit backfills in the Yellow Pine and Hangar Flat pits and a pit lake in the West End pit. The Yellow Pine, Hangar Flats, and existing Midnight pits would be backfilled with development rock to reduce the amount of development rock placed in surface DRSFs and facilitate reclamation of the East Fork SFSR. Mining of the pits and filling them with rock would result in the groundwater system achieving a new flow regime through the rock backfill instead of the baseline aquifer conditions but the groundwater levels in the backfills are expected to reach approximate baseline elevations as influenced by the revised groundwater flow in the backfills. These would be irreversible commitments of the groundwater system in these locations.

The West End pit lake would be situated primarily in bedrock and therefore would not receive substantial groundwater inflows. Model simulations show that the primary sources of water for filling the lake are direct precipitation and surface water runoff. The lake is predicted to fill slowly over 41 years, with a seasonal pattern of increased lake stage from spring runoff followed by seasonal declines as water

evaporates and flows from the lake back into local bedrock groundwater (Brown and Caldwell 2018b, 2021a, 2021b).

Long-term, groundwater levels would be locally affected by the geosynthetic covers that would be placed over the TSF and TSF Buttress during closure activities plus the geosynthetic covers placed over the Yellow Pine pit and Hangar Flats pit backfills. These covers are intended to significantly reduce infiltration of recharge from precipitation which would permanently limit groundwater recharge rates over the areas covered by these liners. In these areas, precipitation would not recharge groundwater but instead would remain in the shallow subsurface where it would be available for evapotranspiration and discharge to surface water in the East Fork SFSR. This would be an irreversible commitment of the groundwater resource in these locations.

4.8.5 Short-term Uses versus Long-term Productivity

4.8.5.1 No Action Alternative

Under the No Action Alternative, SGP activities would not be implemented. Consequently, no short-term use would occur that would affect surface water or groundwater quantity, and no change in long-term productivity would occur.

4.8.5.2 Action Alternatives

Implementation of the SGP would result in long-term impacts to surface water quantity at the SGP through groundwater withdrawal and stream diversions. The duration of predicted impacts on streamflow includes the mine operational period, and the early post-closure period. After that period, the system would return to a stable seasonal pattern similar to existing conditions.

Apart from triggering some changes in groundwater quality characteristics (Forest Service 2022f), implementation of the action alternatives would potentially have indirect effects on surface water discharges associated with changes in groundwater levels. Post-mining, groundwater wells could still be installed within the SGP area and used to produce groundwater at rates similar to those under existing conditions. Saturated thickness of alluvial deposits and their groundwater transmissive properties would remain similar to baseline conditions except in the three open pit areas where the alluvial deposits were removed during the mining period.

4.9 Surface Water and Groundwater Quality

4.9.1 Impact Definitions and Effects Analysis Indicators and Methodology

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1.** Analysis of water quality impacts utilizes a comparison of predicted analyte concentrations to regulatory standards (**Table 3.9-1**). These standards are developed to be protective human and wildlife water users. Human health and wildlife implications of the predicted analyte concentrations relative to regulatory standards and existing conditions are included in analyses of public health & safety and the Fisheries and Aquatic Habitat Special Report (Forest Service 2022i).

Issue: The SGP may affect water resources through acid rock drainage and/or metals leaching from mineralized rock in the mine pits, development rock, and the TSF.

Indicators:

- Volume and disposition of mineralized waste generated.
- Lithologic composition of final pit walls and exposure of potentially acid-generating material.
- Removal of legacy mine tailings and waste rock.
- Predicted and observed leachate chemistry of development rock and tailings.

Issue: The SGP may cause changes in surface water and groundwater quality.

Indicators:

- Surface water quality parameters (e.g., pH, temperature, major ions, TDS, metals, sediment content, and organic carbon).
- Groundwater quality parameters (e.g., pH, major ions, TDS, and dissolved metals).

Issue: The SGP may cause increased mercury methylation in adjacent waterbodies through SGP-related activities and discharges.

Indicator:

- Predicted impact on methylmercury production.

Surface water and groundwater quality were primarily analyzed using baseline water quality data, geochemical characteristics of development rock and tailings produced by mining, water quality predictions from modeling studies completed by Perpetua and their consultants for the SGP, and the SGP Water Management Plan (Brown and Caldwell 2021b). Other sources consulted include scientific literature and governmental agency documents that identify impaired stream segments and applicable water quality standards.

Several models were developed by Perpetua to support the water quality analysis, including a site-wide water balance model (SWWB), a hydrologic model, a site-wide water chemistry (SWWC) model, and the Stream and Pit Lake Network Temperature (SPLNT) model. Summaries of the SWWB model, SWWC model, and the SPLNT model are provided below. The hydrologic modeling is summarized in the companion SGP Water Quantity Specialist Report (Forest Service 2022e) and additional modeling details can be located in the modeling reports provided by Perpetua (Brown and Caldwell 2021a, 2021e, 2021i, SRK 2021a).

4.9.1.1 Geochemical Characterization of Mined Materials

The leachate chemistry of the mine waste material was characterized through static and kinetic test work (SRK 2017, 2020). The kinetic tests were used to define potential acid generating (PAG) and non-PAG development rock source terms for geochemical modeling (SRK 2018a). The summary description of this characterization is found in **Section 3.9.4.2**.

The HCT program was conducted in two different phases with the first phase focused on anticipated project mined materials and the second phase supplementing mined material samples as well as testing of synthesized and legacy tailings samples. Steady-state constituent release rates from the HCTs were used to develop leachate source terms for each development rock and wall rock lithology. The source terms were assigned by correlating each rock type to a representative HCT based on the lithology, location, and geochemistry of the HCT sample. The test cell HC-14 from the Phase I testing program was selected to represent PAG development rock and wall rock because this cell had the highest total sulfur and highest sulfate leaching rate, which corresponds to maximum sulfide oxidation and acid rock drainage potential. The source terms were then scaled to field conditions to account for differences in reaction rates, temperatures, and liquid-to-solid ratios between laboratory tests and field conditions. For a more detailed discussion of source term development and the site- specific scaling factors used, the reader is referred to SRK 2018a and SRK 2021a. The development rock and wall rock source terms were used as inputs in a geochemical model to predict operational, closure, and post-closure groundwater and surface water quality resulting from the mine pits and/or development rock as activities change over time. Specific water quality predictions are discussed in subsequent sections.

4.9.1.2 Water Balance Model

A site-wide water balance model was performed by Brown & Caldwell to assess:

- meteoric precipitation contributions (i.e., rainfall and snowmelt) to surface water and groundwater,
- volumes of water requiring storage and management due to contact with mine facilities (i.e., contact water),
- consumptive use needs and water sourcing for mining and ore processing,
- volume of water requiring water treatment during operations and post-closure following the installation of geosynthetic covers over reclaimed mine facilities, and
- runoff, infiltration, and seepage of meteoric waters incident on stockpiles, the TSF Buttress, and other mined materials.

The modeling was conducted using the commercial GoldSIM software which is widely used in the mining industry for site and facility water balances.

4.9.1.3 Hydrologic Model

The effects of mine dewatering and production of water for consumptive use were simulated using a groundwater numerical MODFLOW model (Brown and Caldwell 2021e). This modeling effort is described in **Section 4.8.2.2** and the companion SGP Water Quantity Specialist Report (Forest Service 2022e).

With regard to water quality, the hydrologic model provides predictions to assess:

- groundwater inflows to open pits during operations and pit backfill during closure,
- groundwater discharge volume to surface waters, and
- groundwater flow paths from materials in the TSF Buttress, the West End pit Lake and pit backfills that eventually emerge as a surface water flow.

4.9.1.4 Groundwater Chemistry Model

Geochemical modeling was performed by SRK to assess future water quality resulting from the SGP (SRK 2021a). The objective of the modeling was to determine the potential for groundwater (and surface water impacts) from the proposed open pits, the TSF, the TSF Buttress, ore stockpiles, and pit backfill material. The adopted methodology included development of conceptual models for operational and post-closure phases of the SGP, and numerical geochemical modeling. The numerical modeling was completed for: (1) Yellow Pine pit and backfill, (2) Hangar Flats pit and backfill, (3) West End pit lake, (4) Midnight pit and backfill, and (5) the TSF and TSF embankment. These models assumed leakage rates for proposed liners to account for small volumes of infiltration through tailings and development rock and their effects on water chemistry.

The general modeling approach was to quantify the solute concentrations in water that would potentially seep from the base of those facilities during operations and post closure, and to predict the likely solute concentrations in the underlying groundwater.

Data used as input to the geochemical models included:

- Geological and mine planning information, including development rock production schedule and mine design;
- Hydrogeologic and hydrologic water balance information;
- Geochemical data from laboratory static and kinetic tests performed on representative materials, scaled to field conditions; and
- Precipitation chemistry data from long-term monitoring at the Smiths Ferry meteorological station, Idaho.

4.9.1.5 Surface Water Chemistry Model

The data sources and groundwater chemistry plus pit lake water chemistry forecasts were combined with surface water chemistry data from the Surface Water Quality Baseline Study (HDR 2017f) to predict future surface water chemistry associated with project activities.

The surface water assessment nodes were established at or near surface water sampling locations monitored during the Surface Water Quality Baseline Study (HDR 2017f). The main sources contributing to flow and constituent loading at each of the assessment nodes were identified from the baseline study, the Water Resources Summary Report (Brown and Caldwell 2017a), and from an inventory of legacy mining features provided by Perpetua (SRK 2018b). These sources include upgradient stream flow, flow from seeps and adits in the watershed, loading from legacy mine features, plus any potential sources of groundwater inflow identified from the gain-loss analysis conducted as part of the Water Resources Summary Report (Brown and Caldwell 2017a).

Predictive water quality modeling utilizes the USGS's PHREEQC software (Parkhurst and Appelo 1999) to forecast water chemistry associated with

- infiltration and seepage from the TSF Buttress,
- the influence of the TSF on groundwater chemistry,

- inundated backfill in the Yellow Pine pit, Hangar Flats pit, and Midnight pit,
- the West End pit lake, and
- water treatment influent and effluent.

Results from the facility water chemistry models describing the source terms were then incorporated into the calibrated SWWC model to assess surface water chemistry at a series of prediction nodes downstream of the facilities (in Meadow Creek, West End Creek, Sugar Creek, and the East Fork SFSR) under high flow and low flow conditions, during both the mine operational and post-closure periods. Examples of loading sources that affect concentrations during the mine operational period include upstream surface water flows, seep flows, and groundwater discharge. During the post closure period, additional mass loading from the TSF, the TSF Buttress, pit lakes, and pit backfills were incorporated into the SWWC model. Ammonia concentrations in surface waters were not explicitly modeled. Of the 109 baseline sample analyses where ammonia was detected above a 0.05 mg/L analytical detection limit, the maximum detected concentrations was 0.57 mg/L, a concentration below the strictest potentially applicable water chemistry standard of 2.1 mg/L.

4.9.1.6 Surface Water Temperature Model

The SPLNT water temperature model was developed by Brown and Caldwell (2019c, 2021f) using two separate software packages: QUAL2K for stream temperature modeling, and the General Lake Model for simulating pit lake temperatures. After the existing conditions SPLNT model had been appropriately calibrated, it was used to generate future temperature predictions for the 2021 MMP in Meadow Creek, West End Creek, Sugar Creek, and the East Fork SFSR. A post closure timeline also was simulated to represent how the site would function after the mine facilities and permitted discharges have been removed, dewatering and mining have been discontinued, and the channels and vegetation have been fully reclaimed.

The SPLNT model results were integrated with other modeling efforts for the SGP. Outputs from the hydrologic model and the site-wide water balance model became SPLNT inputs to simulate streams and pit lakes. Output from the General Lake Model component of the SPLNT model supported development of the SWWC model by providing temperature and dissolved oxygen profiles for the pit lakes.

4.9.2 Direct and Indirect Effects

4.9.2.1 No Action Alternative

Under the No Action Alternative, the Forest Service would not approve the SGP, and therefore no activities proposed on Forest Service lands would be approved as part of the EIS.

This alternative would not include any surface (open-pit) mining or ore processing to extract gold, silver, and antimony, and no underground exploration or related operations included in the proposed 2021 MMP on Forest Service lands would occur. Perpetua would continue to implement surface exploration and associated activities that have been previously approved on Forest Service lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project EA (Forest Service 2015c). These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites

(total of 28 drill sites), drill pad construction (total of 182 drill pads) and drilling on both Forest Service and private lands at and in the vicinity of the SGP. The continuation of approved exploration activities at the SGP by Perpetua would result in the continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip (located primarily on patented land), which would require the continued use of diesel, gasoline, and jet fuel (approximately 141,000 gallons per calendar year) that is stored in aboveground tanks.

Perpetua would be required to continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and EA, which include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using standard reclamation practices, and monitoring to ensure that sediment and stormwater BMPs are in place and effective so that soil erosion and other potential resource impacts are avoided or minimized. Additionally, Perpetua could, pursuant to development of another plan of operations, continue information collecting activities at the SGP and vicinity such as groundwater and surface water monitoring and reporting beyond which is required as part of the Golden Meadows Exploration EA, care and maintenance of stormwater BMPs at over 140 historical mining impact locations, and monitoring stream flow measurements from stream gages installed within creeks.

The legacy mining wastes at the SGP site have contributed to elevated metals concentrations in surface water. These effects are described in **Section 3.9.4.3**. Overall, the elevated metals concentrations found in surface water would only improve with additional source removal. This removal is part of the planned Phase I scope for the ASAOC signed in 2021 with implementation anticipated in 2022 and 2024. As such, the effects of the ASAOC are reasonably foreseeable future improvements in analyte concentrations in Meadow Creek and the EFSRSR associated with stream flow interaction with the historical mine waste. To the extent that surface waters recharge groundwater in these areas, there would also be a potential improvement in groundwater analyte concentrations.

Soil sampling and analysis indicate that legacy mining wastes have influenced concentrations of arsenic, antimony, and mercury in soil within the SGP. The elevated soil concentrations and continued presence of the waste material provide a pathway for these constituents to leach into groundwater. These effects are described in **Section 3.9.4.3**. The elevated antimony and arsenic concentrations in groundwater are unlikely to improve in the future under the No Action Alternative.

Under the No Action Alternative, there would be no new or upgraded access roads per the 2021 MMP. Current access to the area, via Johnson Creek Road and Stibnite Road, would continue to be used and would be expected to have traffic levels similar to current conditions. There would be no change to the existing condition of surface water quality related to roads.

Under the No Action Alternative, there would be no changes to the existing transmission lines and no new segment of transmission line constructed. No new communication towers would be established. As such, there would be no change to the existing condition of surface water quality related to utilities.

The 2021 MMP offsite facilities would not be constructed under this alternative. Existing facilities would likely continue to be used in a similar manner. As such, there would be no change to the existing condition of surface water quality related to off-site facilities.

4.9.2.2 2021 MMP

Water Chemistry Conceptualization

The conceptual development and modeling details associated with the quantitative forecast of water chemistry associated with the 2021 MMP are described in the Site-Wide Water Chemistry Modeling Report (SWWC, SRK 2021a). This section summarized that description as context for the ensuing effects analysis.

In summary, many water chemistry effects of the SGP originate with the mobilization of solutes from mined materials that would otherwise remain stable and in place in their native rock under the No Action scenario. Solutes generated from mined materials are expected to be partially to substantively controlled by water management practices that are part of the SGP.

Mined materials under the 2021 MMP appear in the following mine facilities:

- as mined ore in stockpiles,
- as finely ground tailings in the TSF,
- as mined development rock in the TSF Embankment and Buttress,
- as in situ rock exposed in pit walls of the Yellow Pine, Hangar Flats, and West End open pits, and
- as mined development rock placed as backfill in the Yellow Pine, Hangar Flats and Midnight open pits.
- The net effect of the solute mobilization and control measures is reflected in water chemistry associated with specific mine facilities, namely:
- seepage emerging at the ground surface from mine facilities (stockpiles, TSF, TSF Embankment, TSF Buttress),
- seepage infiltrating into the local alluvium from mine facilities (stockpiles, TSF, TSF Embankment, TSF Buttress),
- pit lake water (West End pit lake),
- interstitial water within the backfill material placed in proposed open pits (Yellow Pine pit, Hangar Flats pit, Midnight pit),
- groundwater affected by contact with mine-related solute mobilization, and
- surface water affected by contact with mine-related solute mobilization.

In addition to solute mobilization, the temperatures of surface waters would be affected by the proposed project as it modifies the flow and shading characteristics of the mine area which affect stream temperatures.

Water management practices proposed in the 2021 MMP are incorporated into their associated individual source conceptualizations described below.

Water Management and Water Treatment

According to the 2021 MMP (Perpetua 2021a) three water types would require management over the life of the Project: contact water from mine facilities, which includes dewatering water (construction through closure); consolidation water from the TSF (construction through closure which includes process water); and sanitary wastewater (construction through early closure). **Figure 4.9-1** is flow diagram showing the main process water components.

Specific sources of mining impacted water that could be expected to require treatment during operations include:

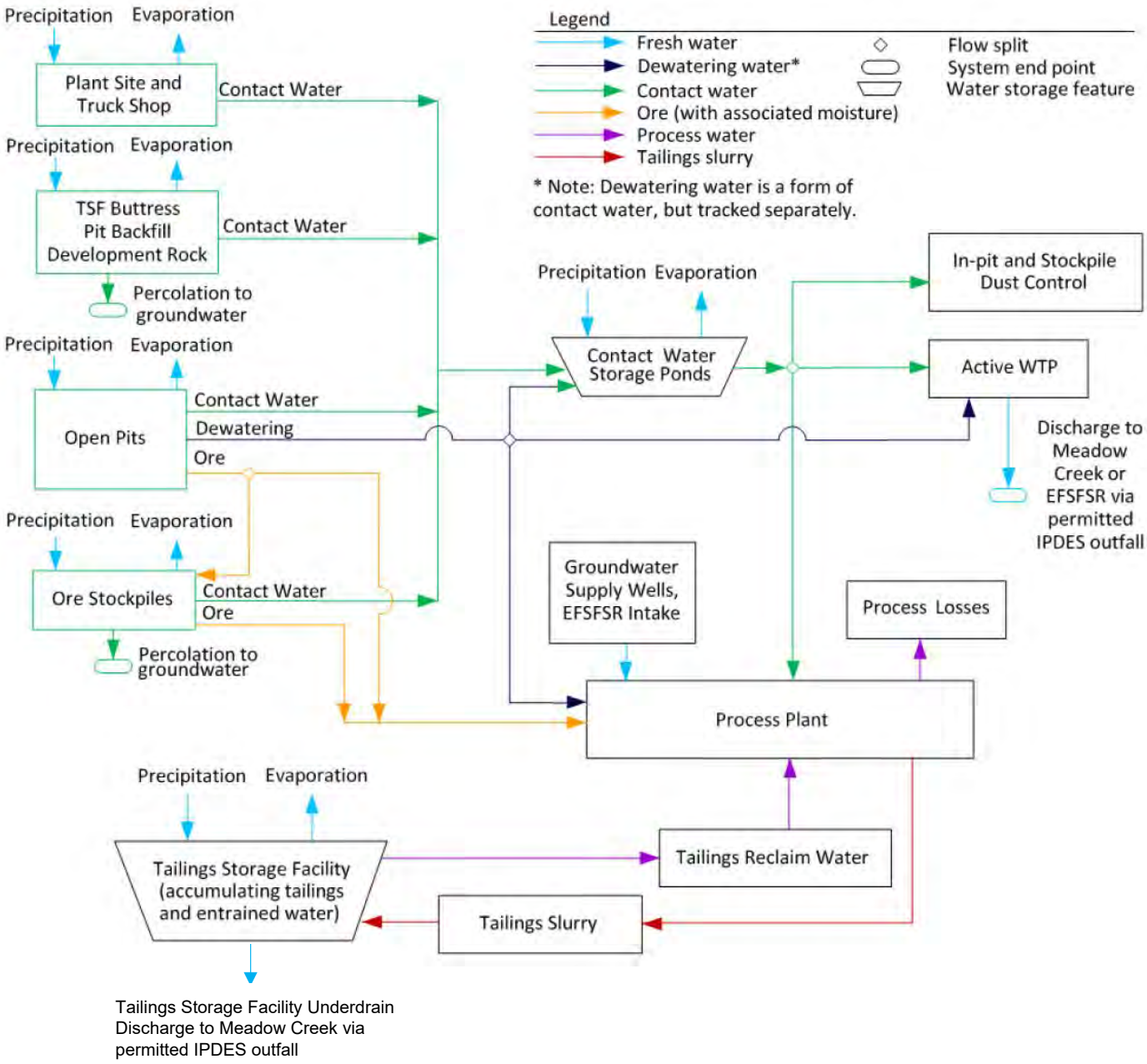
- Contact water from the dewatering of the Hangar Flats, Yellow Pine, and West End pits.
- Contact stormwater runoff from the pits, TSF buttress, Bradley Tailings, SODA, Hecla Heap, ore stockpiles, truck shop, and ore processing facility.
- Toe seepage and pop-out seepage from the TSF buttress and ore stockpiles.
- Sanitary wastewater from the worker housing facility, truck shop, ore processing facility, administrative buildings, and offsite facilities.

After mine closure and final reclamation of the TSF Buttress and pit backfill surfaces which incorporate geosynthetic liners to inhibit interaction between water resources and mined materials, contact water treatment would no longer be required; but process water treatment for the TSF would continue longer, through approximately year 40 to account primarily for consolidation water from the TSF which would exhibit a diminishing flow rate over that period.

Contact Water Pond Chemistry

During operations, contact water from SGP facilities, and occasionally pit dewatering water, would be directed to site contact water collection ponds and subsequently directed to the water treatment plant (WTP). Inflow sources to each collection pond, and predicted analytes of concern, are provided in **Table 4.9-1**. Open pit dewatering water that is not directed to site contact water collection ponds would be pumped directly to the WTP.

The WTP influent water quality was predicted based on water chemistries associated with each of the inflow sources listed in **Table 4.9-1**, mixed in their relative proportions based on the site wide water balance model, to estimate the mixed influent chemistry to the water treatment plant on a monthly timestep (SRK 2021a, Appendix D). Predicted water chemistries for individual water sources reporting to the contact water ponds are described below.



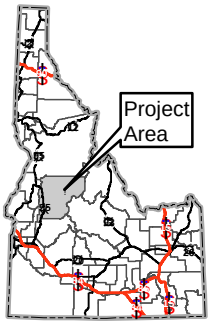


Figure 4.9-1
Project Water Management Components

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)

Table 4.9-1 Contact Water Collection Pond Inflow Sources included in Model

Contact Water Pond	Inflow Sources	Predicted Analytes with Concentrations above the Strictest Potentially Applied Standards
Hangar Flats Pond	• Hangar Flats pit contact water • TSF Buttress toe seepage and runoff • Bradley Tailings contact water	Antimony, Arsenic, Cadmium, Copper, Fluoride, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Sulfate, Thallium, and Zinc
SODA Pond	• Hangar Flats pit contact water • TSF Buttress toe seepage and runoff • Bradley Tailings contact water	Antimony, Arsenic, Cadmium, Copper, Fluoride, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Sulfate, Thallium, and Zinc
Plant Ponds	• Pit Dewatering • Stockpiles	Antimony, Arsenic, Cadmium, Chromium, Copper, Lead, Manganese, Mercury, Selenium, and Zinc
West End Pond	• West End pit contact water • West End In-Pit backfill and stockpile Seepage and runoff	Antimony, Arsenic, Cadmium, Chloride, Copper, Fluoride, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Sulfate, and Zinc
Midnight Pond	• West End pond • Yellow Pine pit contact water	Antimony, Arsenic, Copper, Mercury, and Lead

Source: SRK 2021a, Appendices D1-D5

Dewatering Water Chemistry

Forecasts for the water chemistries of the dewatering production for the Yellow Pine, Hangar Flats, and West End pits were developed based on the water in alluvial and bedrock monitoring wells in proximity to those locations. The relative dewatering components from the alluvium and bedrock groundwater were based on the groundwater flow model dewatering simulations (Brown and Caldwell 2021e).

An aggregate dewatering chemistry was calculated from the individual source terms on an annual basis (SRK 2021a, Appendix D6). Predicted dewatering chemistry has consistently circumneutral pH with antimony and arsenic concentrations above the strictest potentially applied water quality standards. In some instances, maximum monthly predicted concentrations of manganese (Mine Years 3, 4, and 5) and mercury (Mine Year 3) were also above the strictest potentially applied water quality standards.

In early years, average predicted arsenic concentrations were between 0.12 mg/L and 0.14 mg/L before decreasing to 0.012 mg/L in Mine Year 6. In the mid-years, dewatering is encountering unimpacted groundwater in the Hangar Flats pit area. Later year predicted arsenic concentrations returned to their initial levels after Mine Year 8. Predicted antimony concentrations exhibited a similar trend with early time dewatering concentrations between 0.014 mg/L and 0.016 mg/L. In Mine Years 4 through 6, average antimony concentrations decreased below the 0.006 mg/L standard before returning to their initial concentrations after Mine Year 8.

Ore Stockpiles

Stockpiles would be used to manage mined ore awaiting processing during project operations. There would be three short-term ore stockpiles located in the processing area near the crushing facility plus five long-term ore stockpiles located on the footprints of the TSF Buttress or the Hangar Flats pit backfill. Stormwater runoff and seepage from the ore stockpiles would be collected in runoff channels and managed as contact water.

Stockpile runoff, toe seepage, and sub-surface infiltration was evaluated by the Site-Wide Water Balance Model (Brown and Caldwell 2021a). The model utilized the volume of meteoric water incident on each stockpile to develop estimates for surface runoff, toe seepage, and sub-surface infiltration over time. Details of this modeling are provided in Brown and Caldwell 2021a and SRK 2021b.

Contributions of analytes leached from stockpiles to water chemistry were estimated based on a weighted-average of humidity cell test results for the lithologies expected to be present in each stockpile. The weights utilized for the calculation were based on the relative percentage of each lithologic unit. Details of the calculations are available in SRK 2021a, Appendix A.

Predicted water chemistries for the stockpiles exhibited circum-neutral pH values with antimony concentrations (0.008 mg/L to 0.016 mg/L) and arsenic concentrations (0.069 mg/L to 0.25 mg/L), both above the strictest potentially applied water quality standards. Other metal leaching concentrations were predicted to be below surface water standards with mercury concentrations between 7 ng/L and 11 ng/L (SRK 2021a, Appendix A), but above the 2 ng/L concentration calculated by the EPA.

TSF Embankment and Buttress

During the construction and early operations phases, Hangar Flats Pond would be located near the northeast toe of the TSF Buttress to provide contact water storage. Runoff and toe seepage from the TSF Buttress and remaining legacy materials in SODA would be conveyed to the Hangar Flats Pond using a series of runoff collection channels or berms, internal collections sumps, pumps, and pipelines as needed. The SODA Pond would be constructed south of the TSF Buttress to provide contact water storage for the remaining years of operations and closure, as the Hangar Flats Pond would be deconstructed as the Hangar Flats pit is mined below the valley bottom.

Operational and post-closure water quality predictions were developed for the TSF Buttress and adjacent TSF Embankment. The general modeling approach was to quantify:

- Solute concentrations in contact waters that would run off the surface of the facility or emerge from the base and intermediate lifts of the facility, either as toe seepage, pop-out seepage or as recharge to groundwater.
- Solute concentrations in groundwater underlying the facility.

Conceptual models for the TSF Buttress and Embankment during operations and closure are shown in **Figure 4.9-2**. Further details regarding the TSF Buttress design and modeling can be found in Perpetua 2021a and SRK 2021a, respectively. A summary of the information follows.

At final buildout, the TSF Buttress and adjacent TSF Embankment would contain 142 million tons of material, comprising 85.5 million tons (60%) of non-PAG development rock from the Yellow Pine pit, 22 million tons (16%) of non-PAG development rock from the West End pit, 14.3 million tons (10%) of non-PAG development rock from the Hangar Flats pit, 6.4 million tons (4%) of PAG development rock, 11.7 million tons (8%) of borrow material, 1.25 million tons (0.9%) of spent ore from the Hecla Heap, 0.85 million tons (0.6%) of spent ore from the SODA, and 0.2 million tons (0.1%) mine waste placed on the former SMI on/off leach pads during the ASAOC action. Active 'blending' of the development rock during operations is not proposed. During operations, ore stockpiles 1, 2, 3 and 4 would be located on top of the TSF Buttress and are assumed to contribute to solute loading from the facility during the operational period only. These stockpiles are assumed to have been completely removed and processed prior to closure.

Representative leachate chemistries for the lithologies within the TSF Buttress and Embankment were obtained from humidity cell effluent data, scaled to field conditions. The details for the leachate chemistry calculation are described in SRK 2021a.

The primary source of contact water for material within the TSF Buttress and Embankment would be rainwater and snowmelt. Any precipitation that falls on the TSF Buttress and Embankment would either run off or infiltrate the facility. Runoff waters are assumed to contact the outermost 0.3 meters (1 foot) of material within the facility. Any precipitation that infiltrates the facility would either recharge groundwater or report as toe seepage or pop-out seepage on the face of the facility (Brown and Caldwell 2021a, 2021c).

Precipitation that infiltrates the facility has the potential to recharge to groundwater. This water was assumed to interact with groundwater in the uppermost 32.8 feet (10 meters) of the aquifer beneath the footprint of the facility (SRK 2021a). The aquifer below the facility consists entirely of alluvium. Any infiltration recharging to groundwater would migrate directly to the water table and no allowance for solute attenuation has been accounted for along the flow path. The residence time in the aquifer of any precipitation that infiltrates the TSF Buttress and Embankment and recharges groundwater, was assumed to be short and on the order of one month to a few months at most (SRK 2021a). The direction of groundwater flow beneath the TSF buttress and Embankment is toward the Hangar Flats pit area.

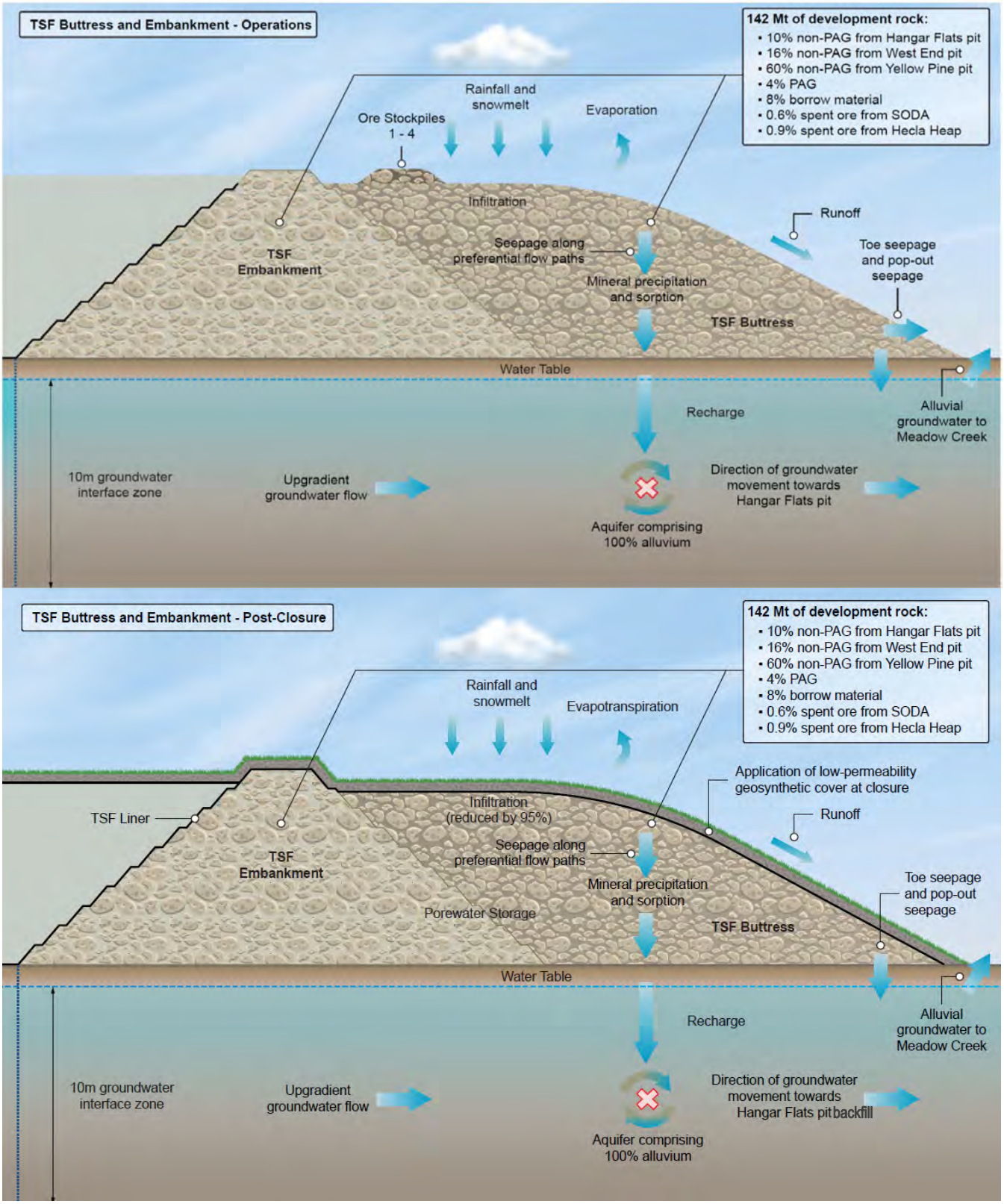
At closure, the TSF Embankment and Buttress would be regraded to promote positive drainage and a low permeability geosynthetic cover would be placed over the entire facility, which would be designed to limit infiltration through the underlying development rock (Perpetua 2021a). The geosynthetic cover would be overlain by an inert soil/rock layer and growth media and revegetated. Following cover placement, any toe/pop-out seepage from the facility would occur under the liner and is assumed to recharge groundwater.

Under this design and conceptualization, the predicted seepage volume from the TSF Buttress increases during the operations phase until closure of the facility and installation of the geosynthetic liner (**Figure 4.9-3**). Following closure there is no longer any runoff or toe seepage from contact with the buttress materials. In the post-closure period, residual solution from the buttress materials continues to infiltration into the sub-surface and alluvial groundwater.

Predicted water chemistry associated with runoff from the TSF Buttress and Embankment has circum-neutral pH with concentrations of antimony, arsenic, copper, manganese, mercury, and thallium above the strictest potentially applied water quality standards (**Table 4.9-2**).

Predicted water chemistry associated with toe seepage from the TSF Buttress and Embankment has circum-neutral pH with concentrations of antimony, arsenic, cadmium, chromium, copper, fluoride, manganese, mercury, nickel, lead, selenium, silver, sulfate, thallium, zinc, and TDS above the strictest potentially applied water quality standards (**Table 4.9-3**).

Both the runoff and the toe seepage from the TSF Embankment and Buttress report to a contact water pond and then to the water treatment plant. Sub-surface infiltration from the TSF Embankment and Buttress was modeled to mix with the alluvial groundwater under the facility footprint, resulting in a groundwater chemistry that has circum-neutral pH with antimony and arsenic concentrations above the strictest potentially applied water quality standards (**Table 4.9-4** and **Figure 4.9-4**). After the end of operations, predicted groundwater analyte concentrations decrease slightly as TSF Embankment and Buttress seepage is collected on surface. Upon placement of the geosynthetic cover, seepage to the ground surface is inhibited and residual water within the TSF Embankment and Buttress infiltrates, contributing to slightly higher groundwater concentrations. Other constituent concentrations are below standards for groundwater. However, because the alluvial groundwater in the system contributes discharge to surface water flows, it is worth noting that predicted long-term mercury (10 ng/L) and copper concentrations (0.002 mg/L) are increased relative to existing conditions but remain below the most stringent potentially applicable criteria.



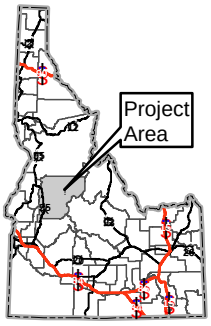
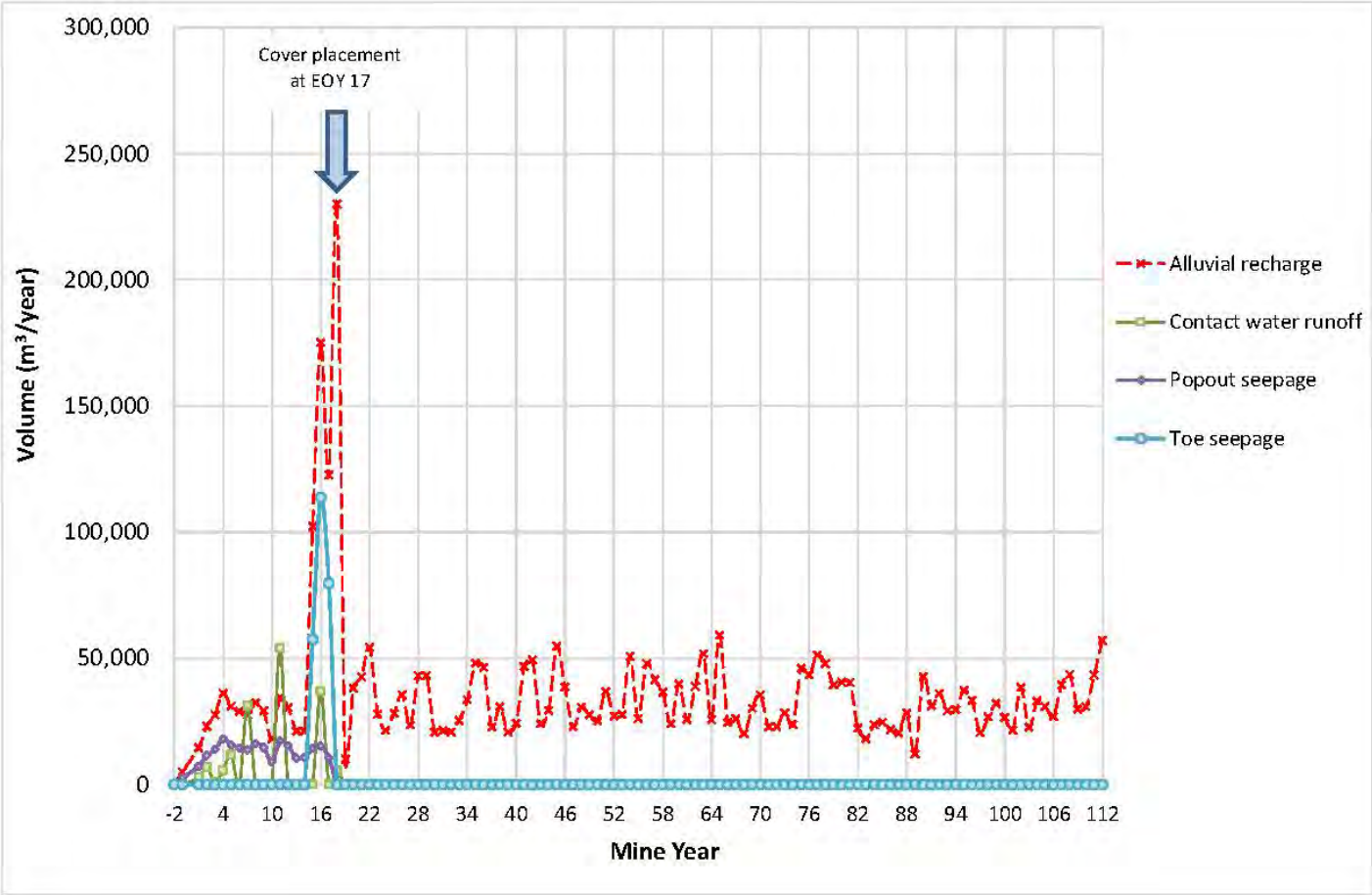


Figure 4.9-2
Conceptual Model for Tailings Storage Facility Buttress

Stibnite Gold Project
Stibnite, ID

Data Sources: (SRK 2021)



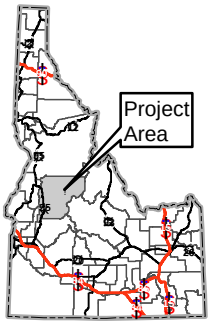


Figure 4.9-3
Tailings Storage Facility
Buttress Seepage Volume

Stibnite Gold Project
Stibnite, ID

Data Sources: (SRK 2021)

Table 4.9-2 Predicted Runoff Chemistry for the TSF Buttress and Embankment

Parameter	Units	Strictest Potentially Applicable Surface Water Quality Criteria*	Operations Mine Year -2 to 12			Post-Mining Prior to Cover Placement Mine Year 13 to 18*	Post-Mining after Cover Placement Mine Year 19 to 112
			Average	Minimum	Maximum	Average*	Average
pH	s.u.	6.5 - 9	7.45	6.94	7.96	7.65	No contact water runoff from TSF Buttress and Embankment post-mining
Alkalinity	mg/L as $CaCO_3$	>20	13.2	3.04	32.7	15.7	
Ag	mg/L	0.0007†	0.00002	5.9E-06	0.00004	0.00002	
Al	mg/L	0.05	0.0027	0.0025	0.0031	0.0025	
As	mg/L	0.01	0.14	0.029	0.34	0.14	
B	mg/L	-	0.048	0.0075	0.12	0.0557	
Ba	mg/L	2.0	0.021	0.0032	0.053	0.0251	
Be	mg/L	-	<0.001	<0.001	<0.001	<0.001	
Ca	mg/L	-	4.92	1.22	11.6	5.55	
Cd	mg/L	0.00033†	0.00002	4.7E-06	0.00005	0.00003	
Cl	mg/L	230	0.69	0.20	1.59	0.83	
Co	mg/L	-	0.0002	0.000046	0.00048	0.00023	
Cr	mg/L	0.0106†††	0.00057	0.00009	0.0013	0.00043	
Cu	mg/L	0.002††	0.0017	0.00009	0.0041	0.0019	
F	mg/L	2.0	0.069	0.0085	0.18	0.087	
Fe	mg/L	0.3	<0.005	<0.005	<0.005	<0.005	
Hg	mg/L	0.000012	0.000013	1.6E-06	0.000032	0.000015	
K	mg/L	-	0.94	0.26	2.18	1.05	
Mg	mg/L	-	1.78	0.60	4.09	2.08	
Mn	mg/L	0.05	0.017	0.0033	0.039	0.018	
Mo	mg/L	-	0.0031	0.00025	0.0081	0.0033	
Na	mg/L	-	1.86	0.33	4.79	2.36	
Ni	mg/L	0.024†	0.0015	0.00025	0.0035	0.0013	

Parameter	Units	Strictest Potentially Applicable Surface Water Quality Criteria*	Operations Mine Year -2 to 12			Post-Mining Prior to Cover Placement Mine Year 13 to 18*	Post-Mining after Cover Placement Mine Year 19 to 112
			Average	Minimum	Maximum	Average*	Average
P	mg/L	-	0.024	0.0075	0.055	0.027	
Pb	mg/L	0.0009†	0.00041	0.00009	0.00098	0.00045	
Sb	mg/L	0.0052	0.065	0.018	0.15	0.071	
Se	mg/L	0.0031	0.00007	0.00002	0.00014	0.00007	
SO4	mg/L	250	7.34	1.77	17.3	8.41	
Tl	mg/L	0.000017	2.5E-06	5.4E-07	5.6E-06	2.7E-06	
V	mg/L	-	<0.01	<0.01	<0.01	<0.01	
Zn	mg/L	0.054†	0.0051	0.00087	0.013	0.0057	
TDS	mg/L	500	31.8	7.89	80.0	30.1	
NO3 + NO2	mg/L as N	-	8.43	1.64	17.8	<0.01	

Source: SRK 2021a
All values are for the dissolved fraction unless otherwise noted
< Indicates parameter was consistently below analytical detection limits in the HCT effluents, and is thus not expected at detectable concentrations in the buttress toe/pop-out seepage waters
- Indicates no guideline for parameter
†Indicates hardness-dependent parameter. The values listed are based on the East Fork SFSR hardness of 40 mg/L as calcium carbonate, which represents the 5th percentile hardness during the driest four months at node YP-SR-10 (East Fork SFSR below Meadow Creek) between April 2012 and May 2019.
†† Estimated criterion based on DEQ guidance on Biotic Ligand Model and limited site-specific SGP data
†††† Standard is for chromium VI and is based on Water Effect Ratio
* During this period, runoff would only be generated in Mine Year 16 according to the SWWB (Brown and Caldwell 2021a). Therefore, only a single prediction (rather than a range) is provided for each parameter
Shading indicates value is greater than Strictest Potentially Applicable Surface Water Quality Criteria

Table 4.9-3 Predicted Toe/Pop-out Seepage Chemistry for the TSF Buttress and Embankment

Parameter	Units	Strictest Potentially Applicable Surface Water Quality Criteria*	Operations Mine Year -2 to 12			Post-Mining Prior to Cover Placement Mine Year 13 to 18			Post-Mining after Cover Placement Mine Year 19 to 112
			Average	Minimum	Maximum	Average	Minimum	Maximum	Average
pH	s.u.	6.5 - 9	8.39	8.35	8.61	8.42	8.41	8.44	Post-mining the application of a low permeability geosynthetic cover to the TSF Buttress and Embankment means any toe/pop-out seepage would report to groundwater
Alkalinity	mg/L as $CaCO_3$	>20	107	92.2	192	114	110	117	
Ag	mg/L	0.0007†	0.00098	0.00071	0.0037	0.00077	0.00074	0.00079	
Al	mg/L	0.05	0.0044	0.0041	0.0059	0.0045	0.0044	0.0046	
As	mg/L	0.01	6.23	3.37	22.4	6.09	5.98	6.21	
B	mg/L	-	1.71	0.83	3.64	2.12	2.03	2.21	
Ba	mg/L	2.0	0.0081	0.0067	0.011	0.0066	0.0065	0.0068	
Be	mg/L	-	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	
Ca	mg/L	-	26.8	10.2	29.9	24.3	23.3	25.4	
Cd	mg/L	0.00033†	0.00092	0.00054	0.0024	0.00094	0.00093	0.00095	
Cl	mg/L	230	21.1	11.2	30.1	27.6	26.2	29.1	
Co	mg/L	-	0.0072	0.0047	0.010	0.0088	0.0084	0.0092	
Cr	mg/L	0.0106†††	0.017	0.0050	0.024	0.023	0.023	0.024	
Cu	mg/L	0.002††	0.004	0.004	0.004	0.004	0.004	0.004	
F	mg/L	2.0	2.27	0.97	3.60	3.18	3.02	3.34	
Fe	mg/L	0.3	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	
Hg	mg/L	0.000012	0.00041	<0.0000006	0.00055	0.00057	0.00055	0.00059	
K	mg/L	-	36.4	24.6	76.3	39.3	37.8	41.0	
Mg	mg/L	-	57.2	39.5	91.3	69.4	65.6	73.3	
Mn	mg/L	0.05	0.24	0.094	0.27	0.22	0.21	0.23	
Mo	mg/L	-	0.091	0.029	0.14	0.14	0.14	0.14	
Na	mg/L	-	54.3	22.6	75.9	82.0	77.7	86.5	

Parameter	Units	Strictest Potentially Applicable Surface Water Quality Criteria*	Operations Mine Year -2 to 12			Post-Mining Prior to Cover Placement Mine Year 13 to 18			Post-Mining after Cover Placement Mine Year 19 to 112
			Average	Minimum	Maximum	Average	Minimum	Maximum	Average
Ni	mg/L	0.024†	0.047	0.012	0.065	0.063	0.062	0.064	
P	mg/L	-	1.17	0.89	3.05	1.04	1.01	1.08	
Pb	mg/L	0.0009†	0.015	0.0091	0.028	0.017	0.017	0.018	
Sb	mg/L	0.0052	2.83	1.89	7.19	2.78	2.69	2.89	
Se	mg/L	0.0031	0.0046	0.0026	0.024	0.0028	0.0027	0.0029	
SO_4	mg/L	250	240	143	296	309	296	322	
Tl	mg/L	0.000017	0.00009	0.00005	0.00010	0.00010	0.00010	0.00011	
V	mg/L	-	0.0100	0.010	0.010	0.010	0.010	0.010	
Zn	mg/L	0.054†	0.16	0.082	0.21	0.22	0.21	0.23	
TDS	mg/L	500	573	414	943	639	617	663	
$NO_3 + NO_2$	mg/L as N	-	70.7	20.8	298	16.3	13.5	19.4	

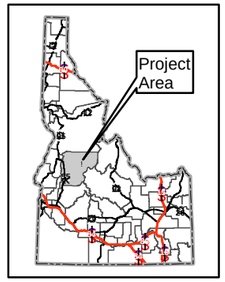
Source: SRK 2021a
All values are for the dissolved fraction unless otherwise noted
< Indicates parameter was consistently below analytical detection limits in the HCT effluents, and is thus not expected at detectable concentrations in the buttress toe/pop-out seepage waters
- Indicates no guideline for parameter
†Indicates hardness-dependent parameter. The values listed are based on the East Fork SFSR hardness of 40 mg/L as calcium carbonate, which represents the 5th percentile hardness during the driest four months at node YP-SR-10 (East Fork SFSR below Meadow Creek) between April 2012 and May 2019.
†† Estimated criterion based on DEQ guidance on Biotic Ligand Model and limited site-specific SGP data
†††† Standard is for chromium VI and is based on Water Effect Ratio
Shading indicates value is greater than Strictest Potentially Applicable Surface Water Quality Criteria

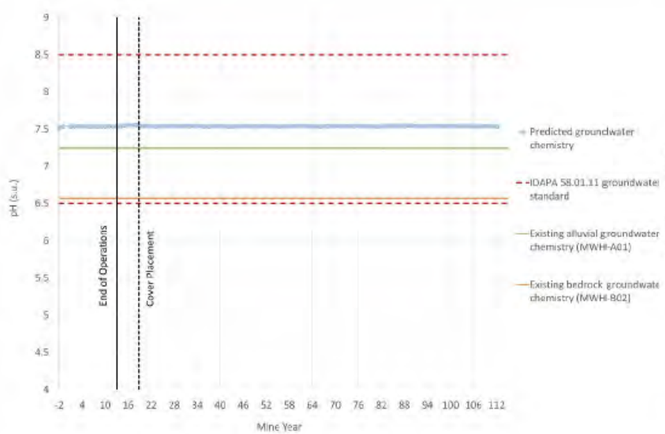
Table 4.9-4 Predicted Groundwater Chemistry under the TSF Buttress and Embankment

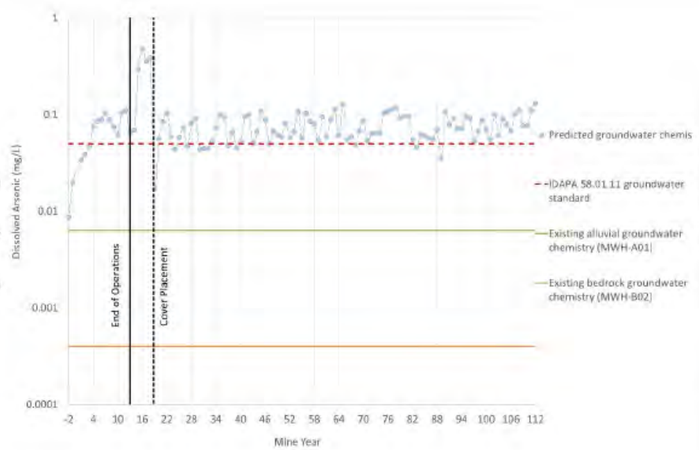
Parameter	Units	Idaho Groundwater Quality Standard (IDAPA 58.01.11)	Existing alluvial groundwater chemistry under facility (MWH-A01)	Existing bedrock groundwater chemistry under facility (MWH-B02)	Operations Mine Year -2 to 12			Post-Mining Prior to Cover Placement Mine Year 13 to 18			Post-Mining after Cover Placement Mine Year 19 to 112		
					Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum
pH	mg/L	6.5 - 8.5*	7.24	6.57	7.53	7.52	7.54	7.55	7.53	7.56	7.54	7.53	7.55
Total Alkalinity	mg/L as $CaCO_3$	-	59.5	38.7	55.9	54.1	56.6	58.2	55.7	59.9	56.7	55.7	57.4
Ag	mg/L	0.1*	9.6E-06	9.4E-06	0.00002	0.00001	0.00002	0.00004	0.00002	0.00007	0.00002	0.00001	0.00003
Al	mg/L	0.2*	0.0065	0.051	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
As	mg/L	0.05	0.0063	0.00040	0.067	0.0087	0.11	0.28	0.066	0.48	0.075	0.017	0.131
B	mg/L	-	0.0072	0.0074	0.027	0.0080	0.043	0.10	0.028	0.17	0.033	0.011	0.054
Ba	mg/L	2	0.0020	0.0028	0.0022	0.0022	0.0023	0.0023	0.0022	0.0025	0.0022	0.0021	0.0022
Be	mg/L	0.004	9.2E-06	0.00002	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Ca	mg/L	-	17.8	10.2	16.4	15.8	16.6	16.7	16.3	16.9	16.6	16.2	16.9
Cd	mg/L	0.005	9.6E-06	0.00002	0.00002	0.00001	0.00003	0.00005	0.00002	0.00008	0.00002	0.00001	0.00003
Cl	mg/L	250*	0.30	0.27	0.55	0.30	0.75	1.52	0.55	2.43	0.66	0.35	1.02
Co	mg/L	-	0.00010	0.00026	0.00022	0.00015	0.00028	0.0005	0.0002	0.0008	0.0002	0.0001	0.0003
Cr	mg/L	0.1	0.00029	0.00020	0.00051	0.00027	0.00069	0.0013	0.00051	0.0020	0.00051	0.00032	0.0007
Cu	mg/L	1.3	0.00048	0.00038	0.0005	0.0005	0.0005	0.0006	0.0005	0.0007	0.0005	0.0005	0.0005
F	mg/L	4	0.076	0.074	0.11	0.083	0.13	0.22	0.11	0.32	0.12	0.08	0.15
Fe	mg/L	0.3*	0.012	0.055	0.00163	0.00159	0.0018	0.00154	0.00149	0.00165	0.00158	0.00151	0.0017
Hg	mg/L	0.002	5.5E-07	1.4E-06	6.1E-06	1.0E-06	0.00001	0.00003	6.0E-06	0.00005	7.6E-06	2.0E-06	1.3E-05
K	mg/L	-	0.77	0.57	1.13	0.72	1.37	2.46	1.10	3.73	1.21	0.81	1.62
Mg	mg/L	-	1.47	1.16	2.08	1.42	2.53	4.48	2.06	6.72	2.34	1.57	3.19
Mn	mg/L	0.05*	0.00080	0.011	0.0059	0.0035	0.0076	0.012	0.0050	0.020	0.0044	0.0027	0.0061
Mo	mg/L	-	0.0012	0.00029	0.0023	0.0012	0.0035	0.0074	0.0025	0.012	0.0027	0.0014	0.0040
Na	mg/L	-	2.66	3.87	3.65	3.12	4.30	6.51	3.74	9.14	3.96	3.06	4.95
Ni	mg/L	-	0.00019	0.00035	0.00084	0.00023	0.0013	0.0	0.0	0.0	0.0	0.0	0.0
P	mg/L	-	0.017	0.014	0.028	0.017	0.034	0.1	0.0	0.1	0.0	0.0	0.0
Pb	mg/L	0.015	2.4E-05	5.2E-05	0.00021	3.7E-05	0.00033	0.00081	0.00020	0.0014	0.00024	0.00006	0.00041
Sb	mg/L	0.006	0.0020	0.0016	0.033	0.0032	0.050	0.126	0.029	0.22	0.035	0.007	0.063
Se	mg/L	0.05	0.00050	0.00049	0.00053	0.00050	0.00054	0.00054	0.00053	0.00054	0.00054	0.00050	0.00068
SO4	mg/L	250*	3.86	2.62	6.70	3.76	8.81	17.4	6.65	27.4	7.55	4.35	10.85
Tl	mg/L	0.002	0.00001	9.3E-06	0.00001	0.00001	0.00001	0.00001	0.00001	0.00002	0.00001	0.00001	0.00001

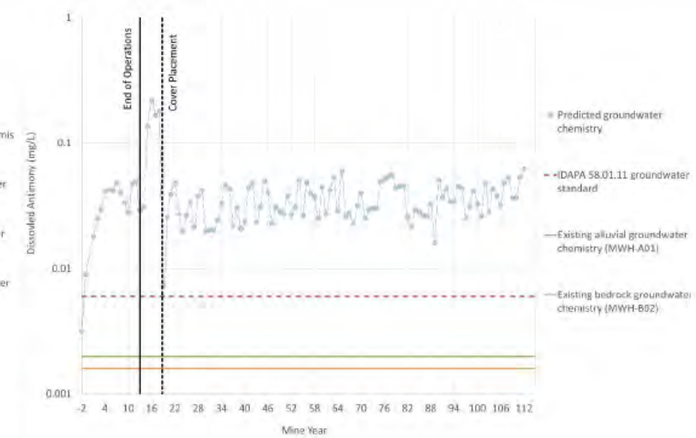
Parameter	Units	Idaho Groundwater Quality Standard (IDAPA 58.01.11)	Existing alluvial groundwater chemistry under facility (MWH-A01)	Existing bedrock groundwater chemistry under facility (MWH-B02)	Operations Mine Year -2 to 12			Post-Mining Prior to Cover Placement Mine Year 13 to 18			Post-Mining after Cover Placement Mine Year 19 to 112		
					Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum
V	mg/L	-	0.00031	0.00019	0.00028	0.00028	0.00029	0.00028	0.00027	0.00029	0.00029	0.00028	0.00030
Zn	mg/L	5*	0.00087	0.0014	0.0031	0.0011	0.0047	0.011	0.0032	0.018	0.0036	0.0014	0.0059
TDS	mg/L	500*	63.1	42.6	65.2	58.3	68.8	85.4	64.7	104	67.0	61.3	72.5
$NO_2 + NO_3$	mg/L as N	10	0.49	0.62	1.07	0.59	1.56	1.17	0.70	1.68	0.61	0.54	0.71

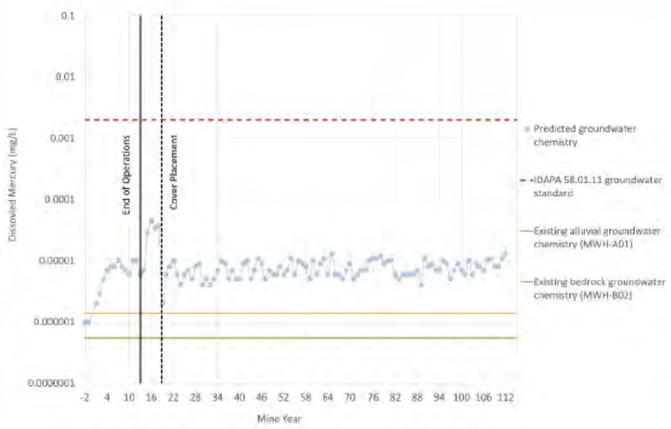
All values are for the dissolved fraction unless otherwise noted
- Indicates no guideline for parameter; * Indicates secondary groundwater standard
Shading indicates value is greater than Idaho Groundwater Quality Standard (IDAPA 58.01.11)

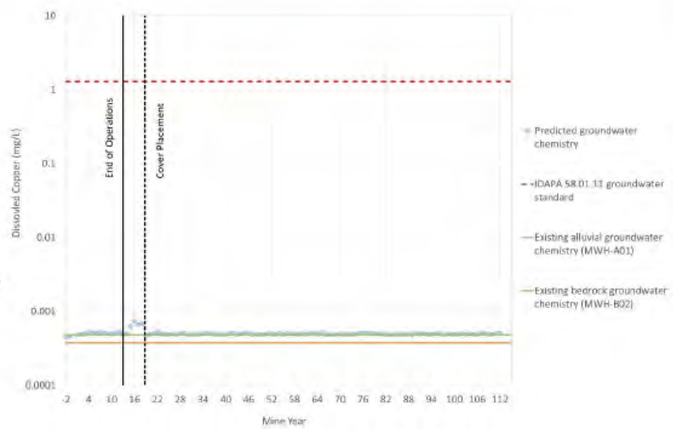












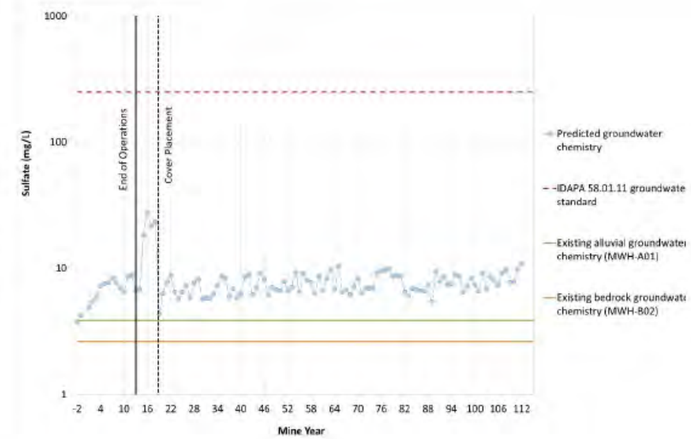


Figure 4.9-4
Predicted Tailings Storage Facility Buttress Seepage Chemistry

Stibnite Gold Project
Stibnite, ID
Data Sources: (SRK 2021)

Tailings Storage Facility

Operational and post-closure water quality predictions have been developed for the TSF (SRK 2021a). The general modeling approach was to quantify:

- Solute concentrations in waters that could potentially seep through defects in the liner, both during operations and post-closure.
- Solute concentrations in groundwater underlying the TSF.
- Solute concentrations in consolidation water emerging at the surface of the TSF after operations end.
- Post-closure solute concentrations in commingled surface water runoff from the covered TSF surface. The model assumes this water consists of a mixture of run-on to the TSF, runoff, consolidation water and minor seepage through the TSF cover that may contact the upper surface of the tailings.

The conceptual model for the TSF is presented in **Figure 4.9-5**, illustrating the TSF water chemistry conditions during operations, closure prior to cover placement, and post-closure following cover placement (SRK 2021a). This conceptual model is based on Perpetua 2021a and is summarized below.

Tailings generated by the Project would be deposited in a fully-lined facility with an engineered rockfill dam and supporting development rock buttress. The composite liner system inhibits tailings water from exiting the facility and mixing with surface water and groundwater. A system of perforated pipes would be installed in the basin before the liner was constructed to collect and drain groundwater out from under the liner. Another drainage system of perforated pipes would be installed on top of the liner before tailings were discharged into the TSF. These upper drains are intended to reduce the hydraulic head of tailings water on top of the liner system.

During operations, the TSF would store tailings solids, water entrained within the tailings, and free water atop the tailings (supernatant pool). Approximately 120 million tons of tailings solids would be stored in the TSF at full buildout, including approximately 115 million tons of ground ore, plus approximately 5 million tons of lime, ground limestone and gypsum resulting from the neutralization of oxidized sulfides. Water collected in or falling on the surface of the TSF would drain to the supernatant pool on top of the tailings and be recycled, along with tailings consolidation water, for use in ore processing. There would be no runoff from the TSF discharged to Meadow Creek during operations, as any precipitation that falls within the TSF would be contained within the facility and managed within the process circuit.

During operations, pore water released from the tailings during consolidation would report to the supernatant pool or to the over-liner drains, and from there be collected and pumped either to the supernatant pool or directly to the reclaim system.

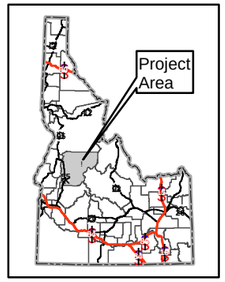
At closure, the TSF facility would be graded and contoured, and a low permeability geosynthetic cover would be placed on top of the tailings. The reclamation would require approximately nine years after ore processing operations cease to allow sufficient tailings consolidation, drainage, and drying to reclaim the facility surface and install the restored Meadow Creek stream channel across the facility (Perpetua 2021a). The application of a low permeability geosynthetic cover would reduce infiltration into the TSF solids by at least 95 percent. Minor infiltration through the cover may contact the upper portion of the underlying tailings, and this contact water would mix with consolidation water.

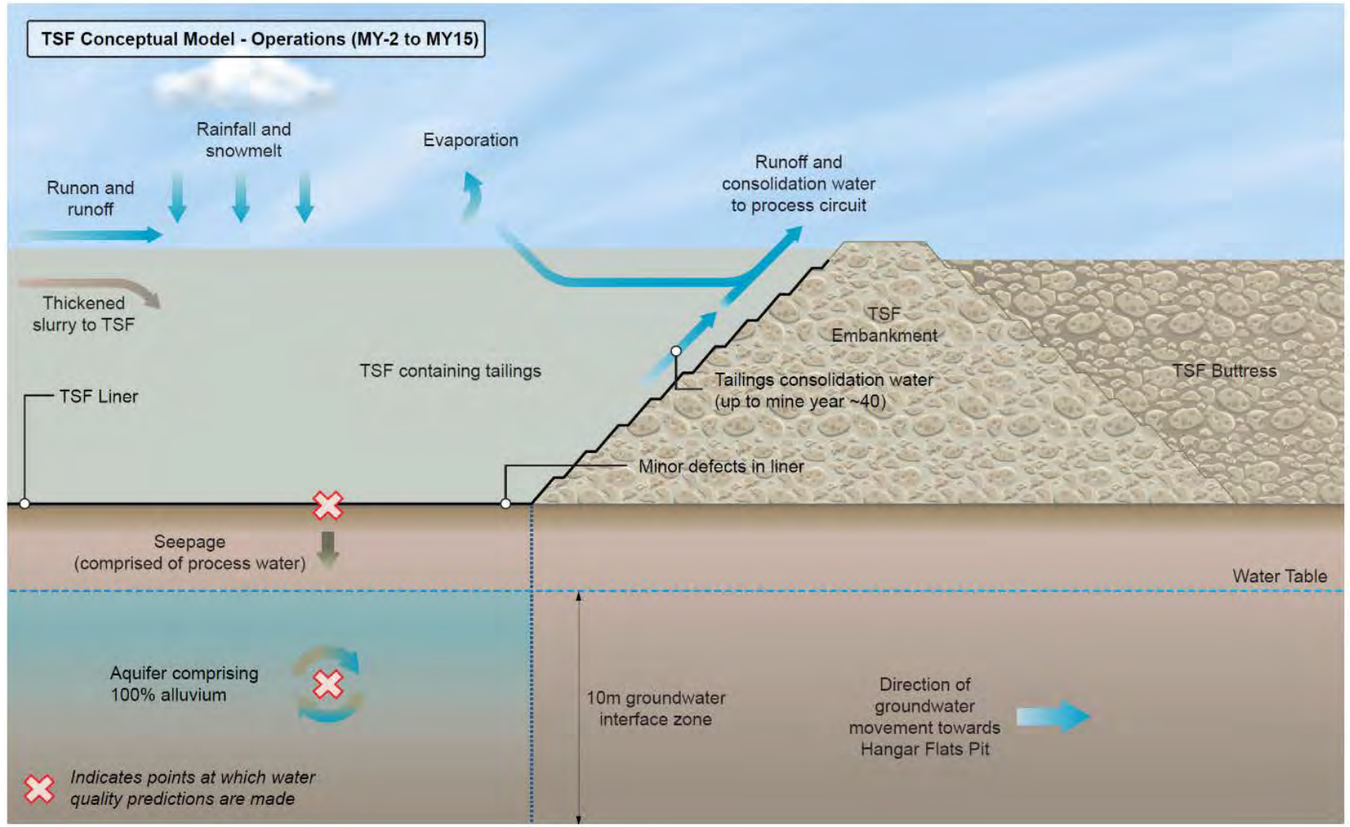
Consolidation of the tailings would continue after cover placement and surface reclamation, at gradually declining rates, and this consolidation water would be withdrawn from beneath the geosynthetic cover using a combination of wells, wicks, and/or gravel drains (that would convey water to a sump with an extraction well) and routed to water treatment. The rates of consolidation water withdrawal along with cover infiltration and runoff were predicted as part of the Site-Wide Water Balance modeling effort (Brown and Caldwell 2021a) and are depicted in **Figure 4.9-6**. The predicted time for tailings consolidation and collection of consolidation water is expected to be until year 40.

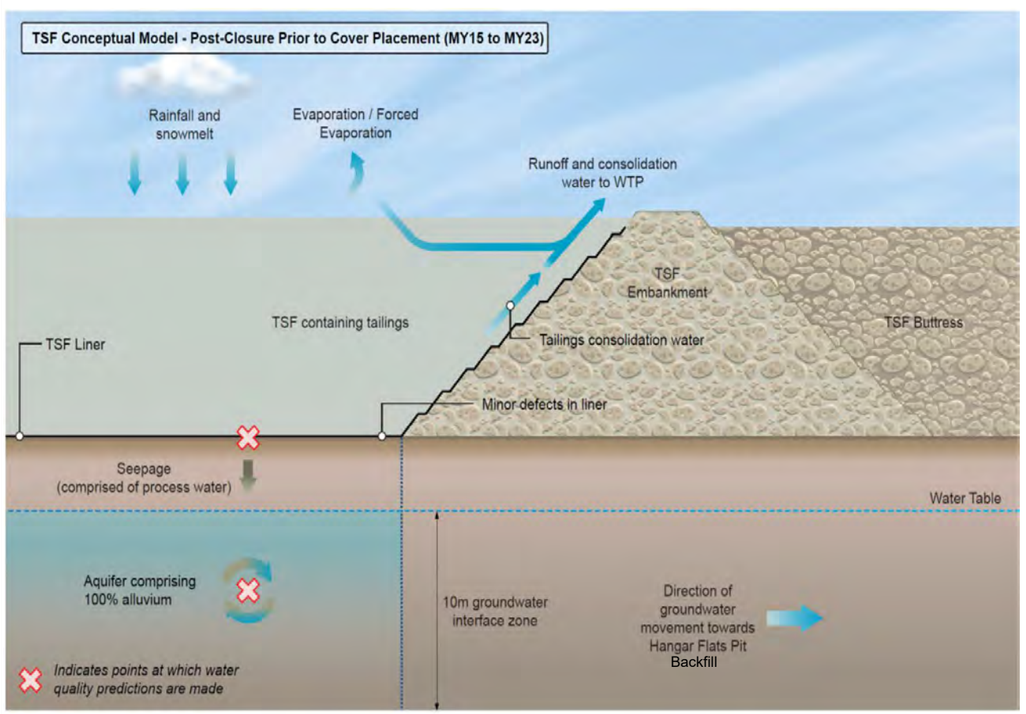
Despite the best practice design, there could be minor seepage from manufacturing defects and other openings in the basal TSF liner, which would ultimately infiltrate to groundwater. This minor seepage would interact with groundwater in the uppermost 32.8 feet (10 meters) of the alluvial aquifer beneath the footprint of the facility. Groundwater below the facility would flow toward the backfilled Hangar Flats pit.

Details of the tailings water chemistry prediction are included in SRK 2021a and summarized below.

Metallurgical testing provided an opportunity to collect samples representative of tailings solids and water that were used in the assessment of operational and post-closure tailings geochemistry (**Table 4.9-5**).







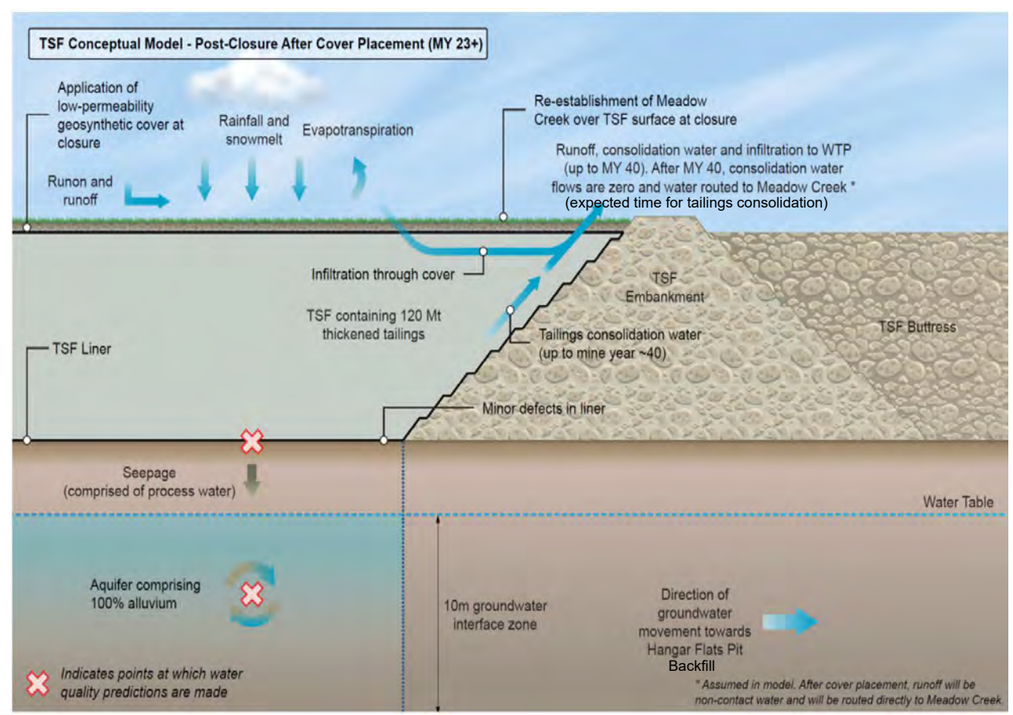
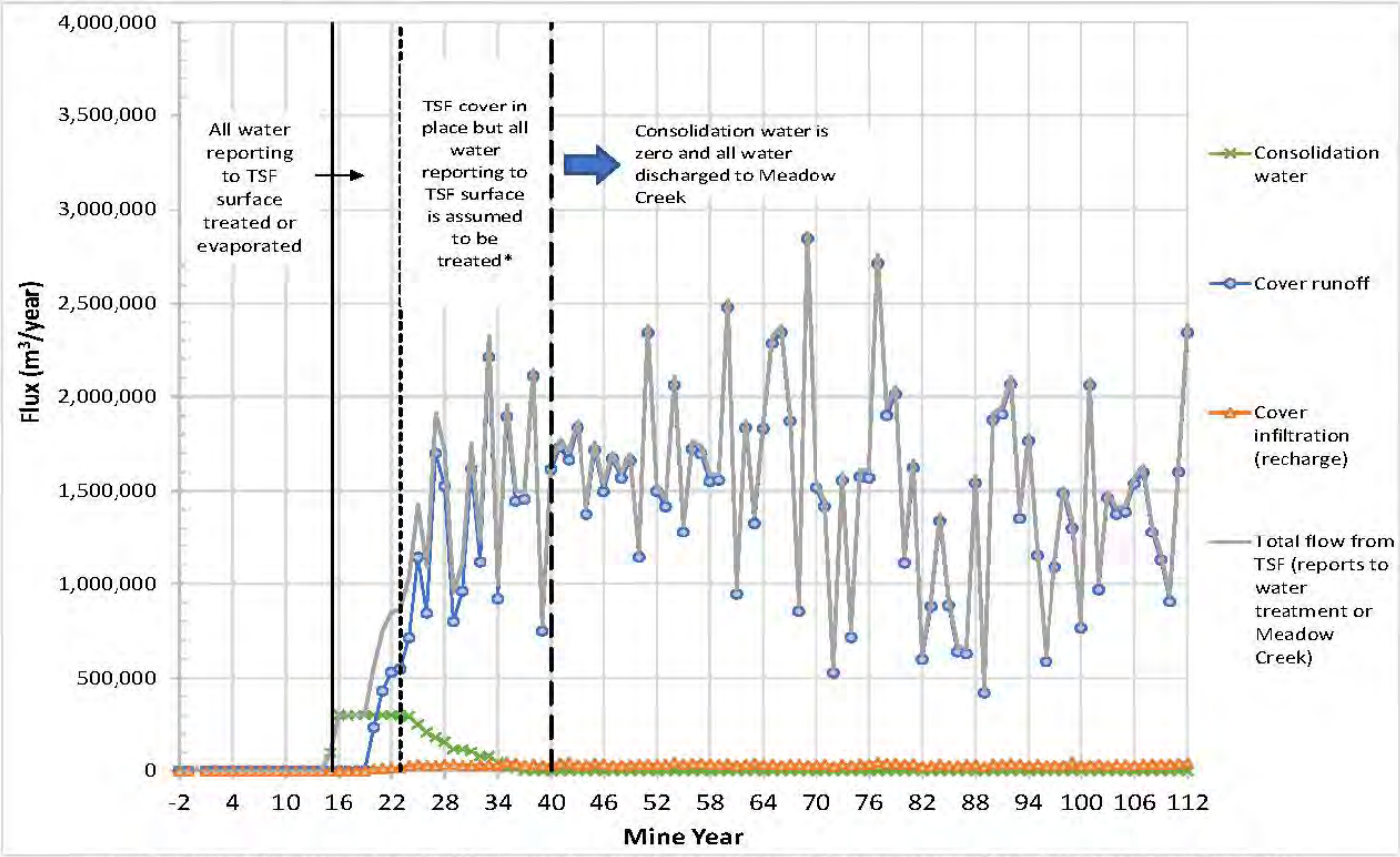


Figure 4.9-5
Conceptual Model
Tailings Storage Facility

Stibnite Gold Project
Stibnite, ID
Data Sources: (SRK 2021)



Note: Treatment of all water reporting to the TSF following placement of the cover is a simplifying assumption used in the SWWC model. In reality, only the consolidation water will be treated and all other TSF surface water will be routed to Meadow Creek after cover placement

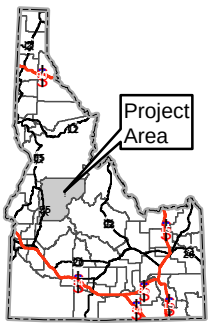


Figure 4.9-6
Tailings Storage Facility Seepage Volume

Stibnite Gold Project
Stibnite, ID

Data Sources: (SRK 2021)

Table 4.9-5 Details of Tailings Composite Samples

Composite ID	Material	Time Period (Mine Year)	Proportion of Total Tailings[1]	Proportion of Last 3 Years Production[1]	HCT Test Duration used in Source Term	Total S (%)[2]	Sulfide S (%)[2]	NPR[2]	As (mg/kg)[2]	Sb (mg/kg)[2]
HCT-4331 SB100 CON 10 PP HCT	Concurrent Mining of Yellow Pine (85%) and Hangar Flats (15%)	1 - 7	32%	0%	77	1.25	0.060	19	3,150	0.026
HCT-4331 CON 5 COMBINED TAILS	Late YP Production	4 - 7	21%	18%	77	0.66	0.090	8.9	2,280	0.0027
HCT-4331 CON 11 COMBINED TAILS	West End Sulfide	11 - 12	11%	12%	77	1.84	0.69	9.9	2,870	0.017
HCT-4331 CON 12 COMBINED TAILS	Concurrent Mining of West End (50%) and Hangar Flats (50%)	6 - 10	6%	3%	77	1.04	0.11	38	1,580	0.026
HCT-4331 5197 CN-170/D1 HCT	West End Oxide	-1 - 12	30%	67%	77	0.29	0.090	58	1,040	0.0063

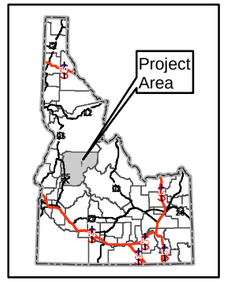
[1] AECOM 2020b
[2] SRK 2021a

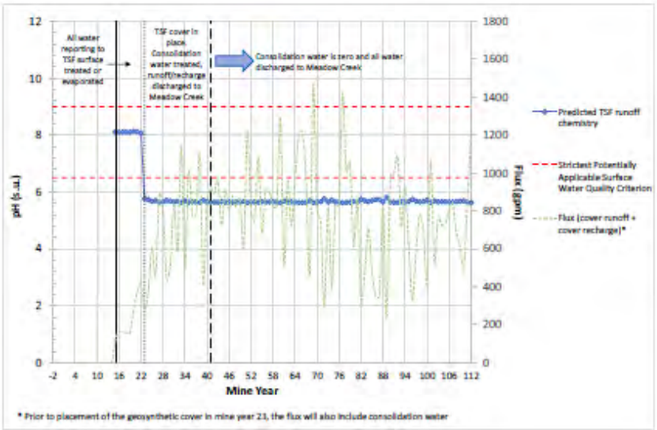
For the purpose of the TSF geochemical model, it is assumed that pore water within the TSF primarily comprises process water chemistry. Representative process water chemistry data were obtained from HCT tailings decant solution collected as part of the metallurgical test work program (**Table 3.9-6**).

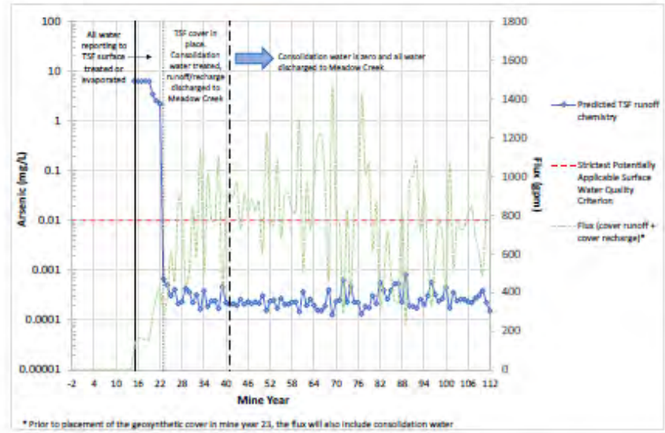
The predicted post-closure TSF consolidation water chemistry is presented in **Table 4.9-6** and is summarized in **Figure 4.9-7** for key constituents of concern (arsenic, antimony, mercury, sulfate, pH, and copper). During the early closure period and prior to cover placement (between Mine Years 15 and 23), TSF surface water chemistry would be dominated by tailings consolidation water expelled from the tailings solids. During this period, several constituent concentrations are predicted to be above the strictest potentially applicable water quality standards, including arsenic, antimony, fluoride, mercury, manganese, silver, sulfate, thallium, total cyanide, and WAD cyanide. These waters would be collected and routed to the treatment plant and would not be discharged to Meadow Creek prior to treatment.

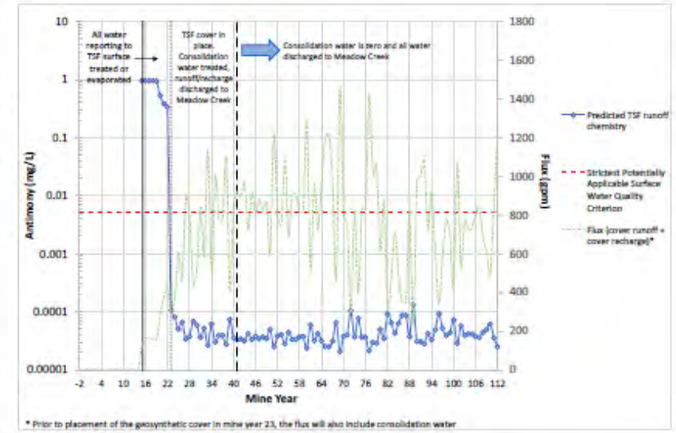
When tailings are sufficiently consolidated to allow equipment to access the TSF surface around Mine Year 23, a geosynthetic cover would be placed over the tailings to reduce meteoric water contact with tailings material and infiltration into the TSF. During and following cover placement, tailings would continue to consolidate and produce water. Constituent concentrations in TSF surface waters decrease between Mine Years 15 and 40 as the volume of consolidation water declines (**Figure 4.9-7**). Through this period (approximately 40 years), TSF surface water would be routed to the water treatment plant before discharge to Meadow Creek.

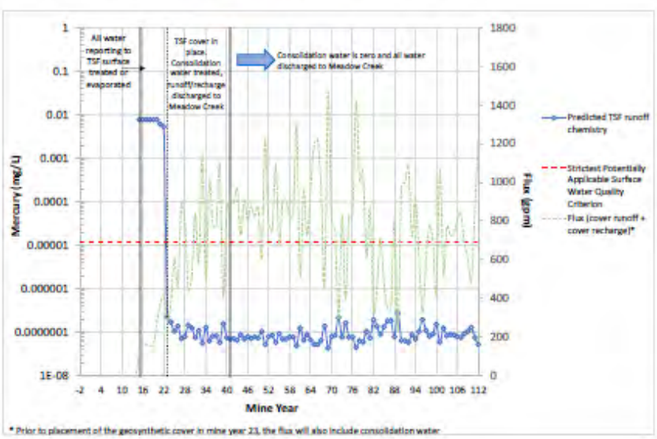
From Mine Year 41 onwards, it is expected that consolidation would be complete and pore water drainage from the tailings would cease (Brown and Caldwell 2021b). Thereafter, TSF surface waters would then be comprised of a mixture of runon and runoff from the TSF cover, in addition to infiltration through defects in the cover that would contact the uppermost surface of the tailings then mix with other interstitial waters within the cover. During this period, TSF surface waters are predicted to be slightly acidic (pH 5.7 to 5.8) and pH and alkalinity are below the strictest potentially applicable surface water quality standard. This reflects the naturally acidic pH of rainwater rather than the tailings geochemistry. The tailings geochemical characterization test work demonstrates that the tailings material is non-acid generating (SRK 2021a). Annual average concentrations of all other parameters in TSF surface waters are predicted to be below the strictest potentially applicable surface water quality standards from Mine Year 41 onwards.

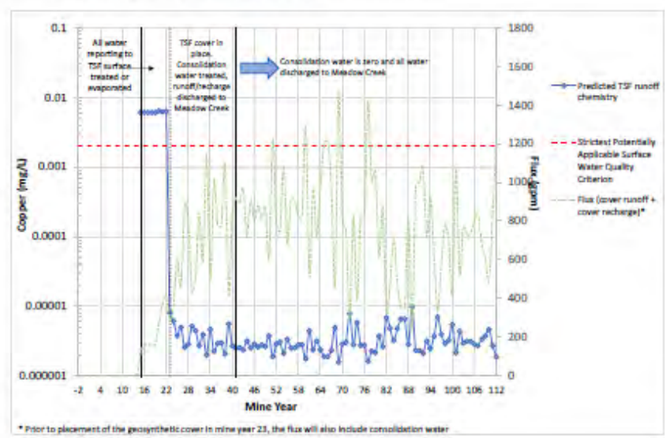












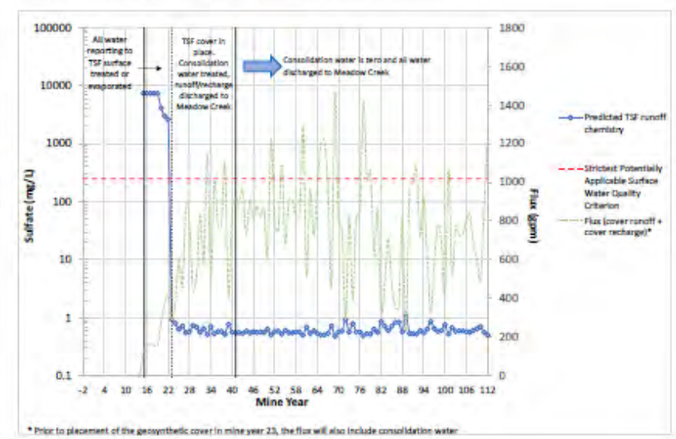


Figure 4.9-7
Predicted Tailings Storage Facility Seepage Chemistry

Stibnite Gold Project
Stibnite, ID
Data Sources: (SRK 2021)

Table 4.9-6 Predicted TSF Surface Water Chemistry

Parameter	Units	*Strictest Potentially Applicable Surface Water Quality Criteria*	Operations Mine Year -2 to 12			Post-Mining during Active Treatment and Prior to Cover Placement* Mine Year 15** to 22			Post-Mining during Active Treatment and After Cover Placement Mine Year 23 to 40			Post-Mining no Water Treatment Mine Year 41 to 112		
			Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum
pH	mg/L	*6.5 - 9*	No surface water runoff from TSF during operations			8.11	8.07	8.14	5.68***	5.63***	5.77***	5.66***	5.62***	5.81***
Total Alkalinity	mg/L as $CaCO_3$	*>20*				66.9	53.9	70.2	0.056***	0.029***	0.11***	0.048***	0.022***	0.14***
Ag	mg/L	*0.0007*†				0.0043	0.0019	0.0055	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Al	mg/L	*0.05*				0.00014	0.00003	0.00022	0.00009	0.00005	0.00014	0.00008	0.00004	0.00017
As	mg/L	*0.01*				4.99	2.21	6.35	0.00032	0.00016	0.00066	0.00027	0.00013	0.00081
B	mg/L	-				0.00006	0.00004	0.00010	0.00003	0.00001	0.00005	0.00002	0.00001	0.00007
Ba	mg/L	*2*				0.0014	0.0012	0.0018	0.00001	0.00001	0.00003	0.00001	5.1E-06	0.00003
Be	mg/L	-				<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008	<0.00008
Ca	mg/L	-				281	147	341	0.24	0.20	0.32	0.23	0.19	0.36
Cd	mg/L	*0.00033*†				0.00027	0.00012	0.00034	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Cl	mg/L	*230*				45.3	20.0	57.6	0.10	0.100	0.10	0.10	0.10	0.10
Co	mg/L	-				0.00003	0.00002	0.00005	0.00001	0.00001	0.00003	0.00001	5.4E-06	0.00003
Cr	mg/L	*0.0106*†††				1.7E-06	1.1E-06	2.9E-06	7.7E-07	4.0E-07	1.6E-06	6.6E-07	3.1E-07	2.0E-06
Cu	mg/L	*0.002*††				0.0061	0.0060	0.0064	3.9E-06	2.0E-06	8.1E-06	3.3E-06	1.6E-06	0.00001
F	mg/L	*2*				3.40	1.95	3.98	0.00024	0.00012	0.00049	0.00020	9.5E-05	0.00061
Fe	mg/L	*0.3*				1.4E-06	6.8E-09	1.9E-06	1.9E-07	1.0E-07	3.1E-07	1.8E-07	7.3E-08	3.2E-07
Hg	mg/L	*0.000012*				0.0072	0.0053	0.0077	1.1E-07	5.6E-08	2.3E-07	9.4E-08	4.4E-08	2.8E-07
K	mg/L	-				88.9	39.4	113	0.040	0.038	0.045	0.039	0.037	0.048
Mg	mg/L	-				182	80.6	232	0.22	0.21	0.23	0.22	0.21	0.23
Mn	mg/L	*0.05*				0.22	0.099	0.29	0.00002	0.00001	0.00005	0.00002	9.7E-06	0.00006
Mo	mg/L	-				0.15	0.064	0.19	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Na	mg/L	-				2499	1100	3181	0.16	0.15	0.20	0.16	0.14	0.22
Ni	mg/L	*0.024*†				<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
P	mg/L	-				<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pb	mg/L	*0.0009*†				2.9E-07	1.8E-07	4.9E-07	1.3E-07	6.7E-08	2.7E-07	1.1E-07	5.2E-08	3.3E-07
Sb	mg/L	*0.0052*				0.75	0.33	0.96	0.00005	0.00003	0.00011	0.00004	0.00002	0.00013
Se	mg/L	*0.0031*				7.4E-07	7.4E-07	7.4E-07	3.5E-07	1.9E-07	7.4E-07	1.6E-07	1.0E-07	2.8E-07
SO4	mg/L	*250*				5830	2607	7392	0.65	0.52	0.94	0.61	0.49	1.08
Tl	mg/L	*0.000017*				0.0020	0.00086	0.0025	1.2E-07	6.2E-08	2.5E-07	1.0E-07	4.8E-08	3.1E-07
V	mg/L	-				0.00002	0.00001	0.00003	7.3E-06	3.8E-06	0.00002	6.3E-06	2.9E-06	0.00002
Zn	mg/L	*0.054*†				6.9E-06	4.3E-06	0.00001	3.1E-06	1.6E-06	6.4E-06	2.7E-06	1.3E-06	8.0E-06
NO2 + NO3	mg/L as N	-				6.96	3.07	8.85	0.00004	0.00002	0.00008	0.00003	0.00001	0.00009
TDS	mg/L	*500*				8976	4032	11371	1.44	1.23	1.91	1.38	1.18	2.12

All values are for the dissolved fraction unless otherwise noted
* TSF surface water is assumed to report to water treatment in Mine Years 15 (when processing of stockpiled ore ends) through 40
** During Mine Years 13 and 14, open pit mining would have ended, but stockpiled ore would be processed with water reporting to the TSF surface being recycled
*** The pH and alkalinity reflect the naturally acidity of rainwater (pH 5.2) rather than the tailings geochemistry which is non-acid-generating
< Indicates parameter was consistently below analytical detection limits in the geochemical testing, and is thus not expected at detectable concentrations in the TSF surface waters
- Indicates no guideline for parameter
†Indicates hardness-dependent parameter. Calculated based on 100 mg/L total hardness and water effect ratio of 1
†† Estimated criterion based on DEQ guidance on Biotic Ligand Model and limited site-specific SGP data
†††Standard is for chromium VI and is based on Water Effect Ratio
Shading indicates value is greater than Strictest Potentially Applicable Surface Water Quality Criteria

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As described above, despite application of best practices, there is a potential for the tailings facility basal liner to develop small-scale leaks through which tailings solution could enter the subsurface and infiltrate to local alluvial groundwater. Leakage estimates have been developed for each year of operations based on the water elevation and maximum head for each year. The calculated liner leakage estimates are provided in **Table 4.9-7**.

Table 4.9-7 TSF Liner Leakage Estimates (Tierra Group 2020)

Mine Year	Tailings Elevation (m)	Area (m^2)	Maximum Head on Liner (m)	Liner Leakage (m^3/year)
1	2,063	292,076	42	34.3
2	2,080	433,328	59	64.8
3	2,092	532,579	71	96.5
4	2,102	608,787	82	130
5	2,110	691,655	89	158
6	2,116	749,533	96	186
7	2,122	830,742	101	212
8	2,127	874,224	106	241
9	2,132	955,724	111	267
10	2,136	1,000,833	115	294
11	2,140	1,105,979	119	320
12	2,144	1,152,603	123	345
13	2,147	1,202,752	127	372
14	2,151	1,255,297	130	402

Source: Tierra Group 2020

Following operations and into closure, liner leakage decreasing from the Mine Year 14 rate down to near zero is assumed to occur until Mine Year 41 when tailing consolidation is expected to be complete and very minor pore water would drain from the tailings.

The predicted groundwater chemistry underlying the TSF after the TSF leakage is mixed with the upper portion of the alluvial aquifer is presented in **Table 4.9-8** and time series plots for the key constituents of interest are presented on **Figure 4.9-8**. This information shows predicted groundwater quality for the operational and post-closure period compared to IDAPA 58.01.11 groundwater quality standards and existing alluvial aquifer groundwater quality in the TSF area (MWH-A01 and MWH-B01).

The results demonstrate that all constituents are predicted to be below IDAPA 58.01.11 groundwater quality standards in groundwater underlying the future TSF. Predicted groundwater quality under the facility is very similar to existing groundwater chemistry for both operational and post-closure conditions. Furthermore, no significant increases in concentration are predicted as a result of the TSF, which relates to the very low expected seepage volumes from the facility (Tierra Group 2020).

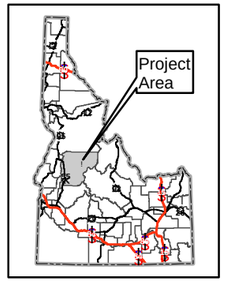
Water Treatment

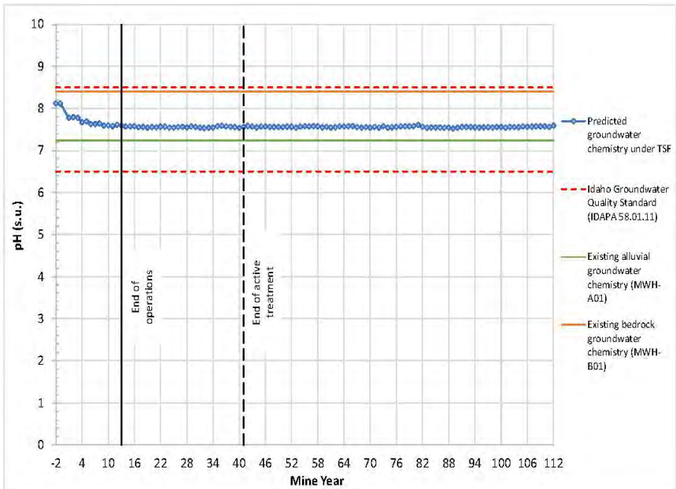
The mine-affected waters described above that report to the ground surface would be subject to consumptive use in ore processing with any water production above consumptive use subject to water treatment and discharge. To summarize, these mine-affected waters include: dewatering production, waters collected in contact water ponds, stockpile runoff and toe seepage, TSF Buttress runoff and toe seepage, and post-closure TSF facility solutions.

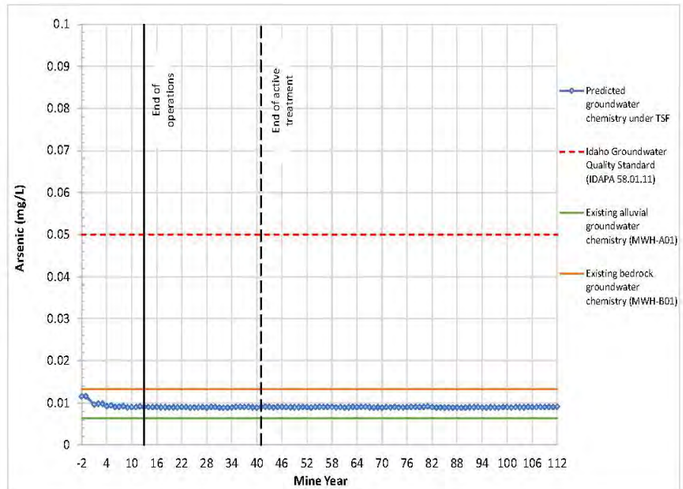
Waters infiltrating into the subsurface under the mine facilities would mix with alluvial groundwater and are not subject to water treatment except in instances where alluvial groundwater is subsequently pumped for mine dewatering.

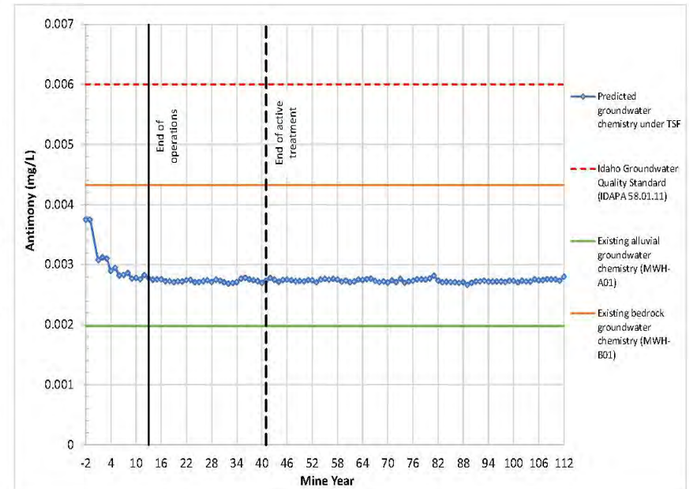
The Site-Wide Water Balance model (Brown and Caldwell 2021a) provides a forecast for the volumes of water that would require water treatment for the operating and post closure time-periods (**Figure 4.9-9**). A principal driver for predicting water treatment rates would be uncertainty in future precipitation rates and their effect on contact water. A 120-year precipitation record was utilized to develop percentile estimates for meteoric inputs to the water balance (5th through 95th percentile ranges) which are displayed on **Figure 4.9-9**. Initially, the volumes of water destined for water treatment would be less than 500 gpm because dewatering and seepage rates from newly constructed facilities would be ramping up at the same time that consumptive use demand for processing needs would be at its largest and consuming contact water as a supply. Over time, water treatment volumes would increase through about Mine Year 6 to approximately 2,000 gpm as dewatering production and seepage rates would constitute a higher percentage of diversion for process water in those years, displacing contact water as a source. Differences in actual versus predicted dewatering rates would have limited effect on water treatment needs because diversion from industrial supply wells or surface waters would be reduced to offset any increase dewatering production (Forest Service 2022e). Following Mine Year 6, predicted dewatering rates would decline removing most of the need for water treatment as water recycling would be needed to meet consumptive use demands, except during seasonal runoff periods when contact water volumes would increase. Any short-term volumes in excess of the water treatment capacity (i.e., following a large storm event) would result in water storage within the TSF and/or contact water ponds.

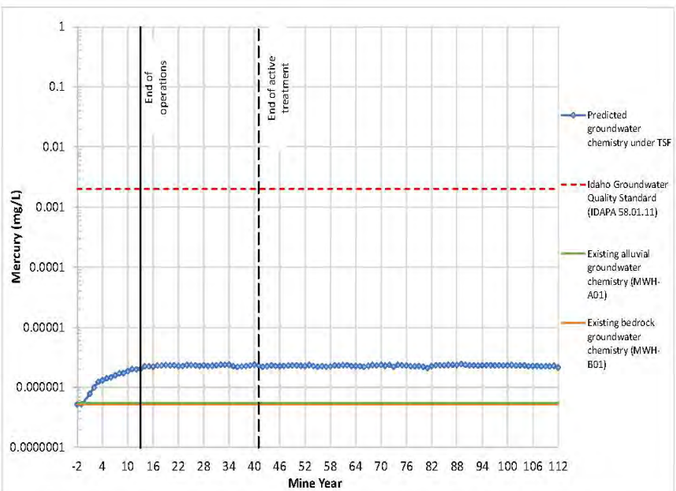
In the closure and post-closure periods, beginning in Mine Year 15, volume of mine-affected waters requiring water treatment would range seasonally up to approximately 1,000 gpm until geosynthetic cover installations (planned to commence in Mine Year 19) could be completed in Mine Year 23 to prevent mixing of surface water runoff and contact waters with consolidation water. Once the cover installations are in effect, volumes consisting of residual seepage and TSF consolidation water would continue to be treated but would decrease from approximately 200 gpm down to very minor, unmeasurable flow as the tailings solids consolidate and stop emitting water (**Figure 4.9-9**).

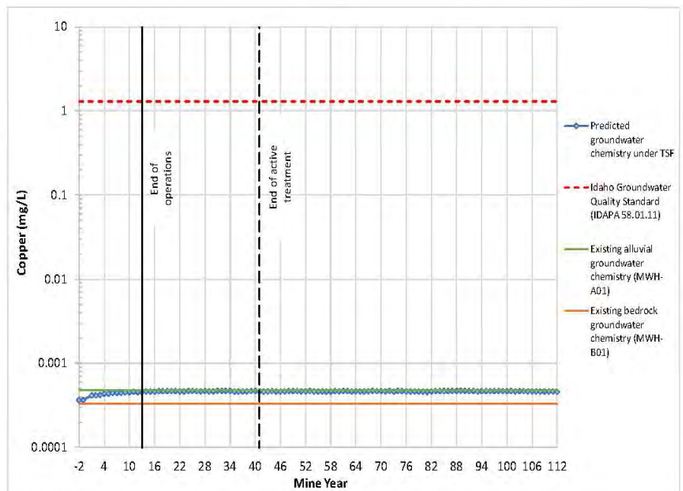












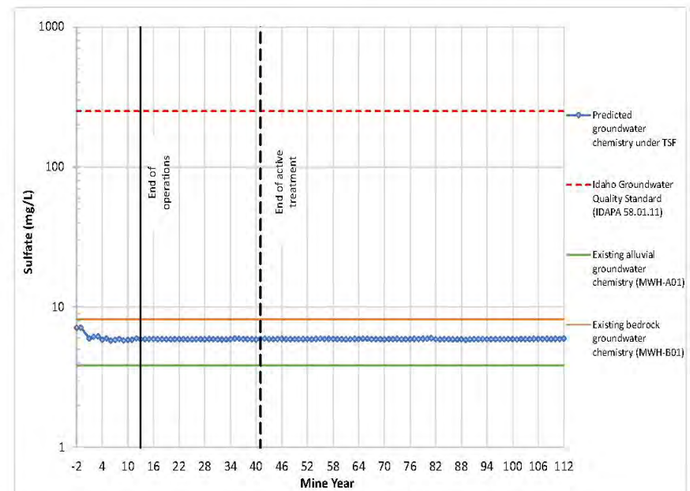


Figure 4.9-8
Predicted Groundwater Chemistry Underlying the Tailings Storage Facility

Stibnite Gold Project
Stibnite, ID

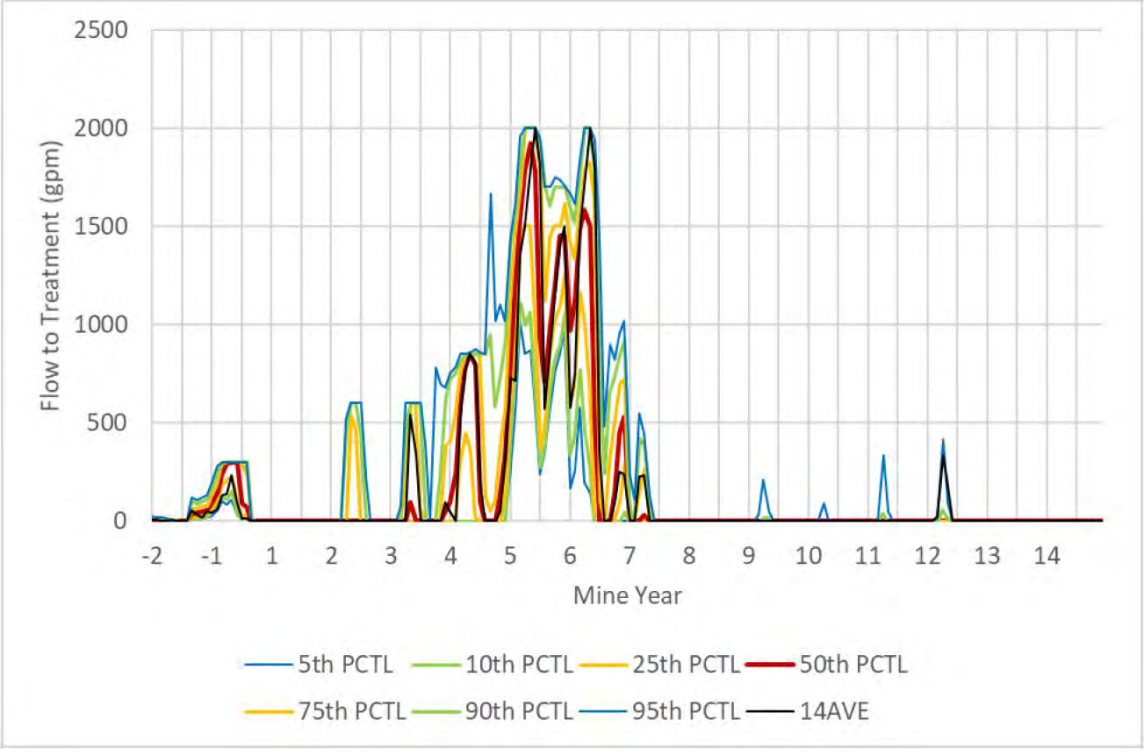
Data Sources: (SRK 2021)

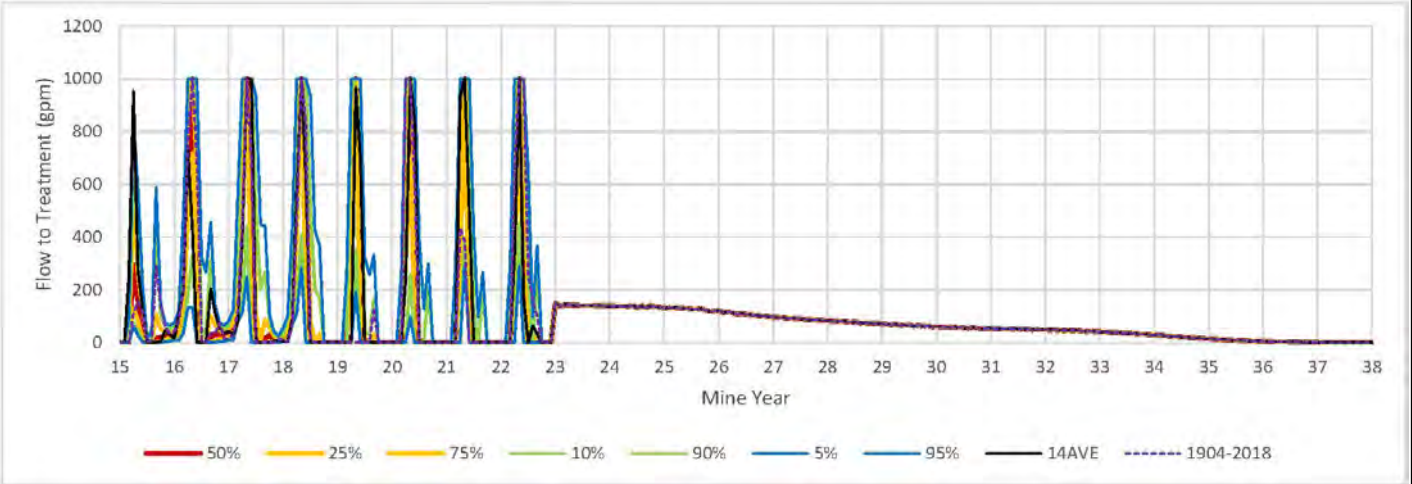
Table 4.9-8 Predicted Groundwater Chemistry Underlying the TSF

Parameter	Units	Idaho Groundwater Quality Standard (IDAPA 58.01.11)	Existing alluvial groundwater chemistry under facility (MWH-A01)	Existing bedrock groundwater chemistry under facility (MWH-B01)	Operations Mine Year -2 to 12			Post-Mining during Active Treatment Mine Year 13 to 40			Post-Mining no Water Treatment Mine Year 41 to 112		
					Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum
pH	mg/L	6.5 - 8.5*	7.24	8.40	7.73	7.58	8.12	7.56	7.53	7.59	7.56	7.52	7.61
Total Alkalinity	mg/L as $CaCO_3$	-	59.5	66.1	62.3	61.4	64.5	61.3	61.2	61.5	61.3	61.1	61.6
Ag	mg/L	0.1*	9.6E-06	9.8E-06	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Al	mg/L	0.2*	0.0065	0.017	0.011	0.0096	0.014	0.0094	0.0092	0.0096	0.0094	0.0090	0.0098
As	mg/L	0.05	0.0063	0.013	0.0096	0.0089	0.012	0.0090	0.0088	0.0091	0.0090	0.0088	0.0092
B	mg/L	-	0.0072	0.0088	0.0079	0.0077	0.0084	0.0077	0.0076	0.0077	0.0077	0.0076	0.0077
Ba	mg/L	2	0.0020	0.0036	0.0027	0.0025	0.0032	0.0024	0.0024	0.0025	0.0024	0.0024	0.0025
Be	mg/L	0.004	0.000009	0.000012	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Ca	mg/L	-	17.8	18.9	18.3	18.2	18.7	18.2	18.1	18.2	18.2	18.1	18.2
Cd	mg/L	0.005	0.000010	0.000012	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
Cl	mg/L	250*	0.30	0.39	0.34	0.33	0.37	0.33	0.33	0.33	0.33	0.33	0.33
Co	mg/L	-	0.00010	0.00013	0.00011	0.00011	0.00012	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011
Cr	mg/L	0.1	0.00029	0.00026	0.00028	0.00027	0.00028	0.00028	0.00028	0.00029	0.00028	0.00028	0.00029
Cu	mg/L	1.3	0.00048	0.00033	0.00043	0.00037	0.00046	0.00047	0.00046	0.00047	0.00046	0.00046	0.00047
F	mg/L	4	0.076	0.22	0.14	0.12	0.19	0.12	0.11	0.12	0.12	0.11	0.12
Fe	mg/L	0.3*	0.012	0.024	0.017	0.015	0.021	0.015	0.015	0.015	0.015	0.015	0.016
Hg	mg/L	0.002	0.0000005	0.0000005	0.0000014	0.0000005	0.0000020	0.0000023	0.0000020	0.0000024	0.0000023	0.0000021	0.0000024
K	mg/L	-	0.77	0.67	0.73	0.69	0.75	0.75	0.75	0.76	0.75	0.75	0.76
Mg	mg/L	-	1.47	1.89	1.66	1.62	1.79	1.61	1.61	1.62	1.61	1.60	1.63
Mn	mg/L	0.05*	0.00080	0.0011	0.00094	0.00091	0.0010	0.00091	0.00091	0.00092	0.00092	0.00091	0.00092
Mo	mg/L	-	0.0012	0.0060	0.0033	0.0027	0.0049	0.0026	0.0025	0.0027	0.0026	0.0024	0.0028
Na	mg/L	-	2.66	6.88	4.61	4.20	5.84	4.18	4.11	4.26	4.19	4.07	4.32
Ni	mg/L	-	0.00019	0.00022	0.00020	0.00020	0.00021	0.00020	0.00020	0.00020	0.00020	0.00020	0.00020
P	mg/L	-	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.017
Pb	mg/L	0.015	0.00002	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
Sb	mg/L	0.006	0.0020	0.0043	0.0030	0.0028	0.0037	0.0027	0.0027	0.0028	0.0027	0.0027	0.0028
Se	mg/L	0.05	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050	0.00050
SO_4	mg/L	250*	3.86	8.23	6.12	5.78	7.16	5.93	5.88	5.98	5.93	5.85	6.01
Tl	mg/L	0.002	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
V	mg/L	-	0.00031	0.00032	0.00032	0.00032	0.00032	0.00032	0.00032	0.00032	0.00032	0.00032	0.00032

Parameter	Units	Idaho Groundwater Quality Standard (IDAPA 58.01.11)	Existing alluvial groundwater chemistry under facility (MWH-A01)	Existing bedrock groundwater chemistry under facility (MWH-B01)	Operations Mine Year -2 to 12			Post-Mining during Active Treatment Mine Year 13 to 40			Post-Mining no Water Treatment Mine Year 41 to 112		
					Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum
Zn	mg/L	5*	0.00087	0.0014	0.0011	0.0010	0.0013	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
$NO_2 + NO_3$	mg/L as N	10	0.49	0.81	0.62	0.58	0.73	0.58	0.57	0.59	0.58	0.57	0.59
TDS	mg/L	500*	63.1	76.9	69.4	68.1	73.5	68.0	67.8	68.3	68.0	67.6	68.4

All values are for the dissolved fraction unless otherwise noted
- Indicates no guideline for parameter
* Indicates secondary groundwater standard





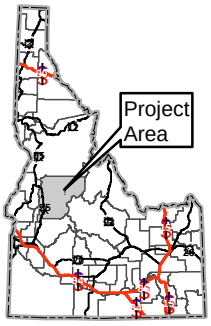


Figure 4.9-9
Predicted Water Treatment Volumes

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)

Predicted maximum analyte concentrations were developed for water treatment plant influent on an annual basis for the construction, operations, and post-closure periods (Brown and Caldwell 2021b and SRK 2021a). In addition to influent flow rates, the maximum influent concentrations are relevant to the selection and design of the water treatment system and are summarized in **Table 4.9-9**.

Table 4.9-9 Predicted Maximum Concentrations in Water Treatment Plant Influent

Parameter	Units	Construction	Operations	Post-Closure
pH (range)	s.u.	6.9 – 7.6	8.1 – 8.5	8.0 – 8.4
Alkalinity	mg/L as $CaCO_3$	233	159	155
Silver	mg/L	0.005	0.0012	0.0055
Aluminum	mg/L	0.01	0.01	<0.01
Arsenic	mg/L	30.08	6.43	6.35
Boron	mg/L	4.89	2.34	0.53
Barium	mg/L	0.01	0.04	0.11
Beryllium	mg/L	0.001	0.001	0.001
Calcium	mg/L	14	22	422
Cadmium	mg/L	0.0032	0.0015	0.00035
Chloride	mg/L	40	34	58
Cobalt	mg/L	0.01	0.01	<0.01
Chromium	mg/L	0.01	0.03	<0.01
Fluoride	mg/L	4.8	4.0	5.6
Iron	mg/L	<0.01	0.12	<0.01
Mercury	mg/L	0.0003	0.0006	0.0151
Potassium	mg/L	103	41	113
Magnesium	mg/L	123	76	232
Manganese	mg/L	0.11	0.27	0.29
Molybdenum	mg/L	0.02	0.21	0.019
Sodium	mg/L	96	131	3,181
Nickel	mg/L	0.01	0.1	0.01
Phosphorus	mg/L	4.1	1.7	0.25
Lead	mg/L	0.037	0.019	0.004
Antimony	mg/L	8.51	2.37	0.96
Selenium	mg/L	0.004	0.003	0.001
Sulfate	mg/L	331	323	7,508
Thallium	mg/L	0.0003	0.0001	0.0025
Vanadium	mg/L	0.01	0.01	0.01

Parameter	Units	Construction	Operations	Post-Closure
Zinc	mg/L	0.198	0.241	0.055
Nitrate/Nitrite	mg/L as N	401	38	9
Ammonia	mg/L as N	<0.3	<0.3	<0.3
Cyanide, Total	mg/L	-	-	0.119
Cyanide, WAD	mg/L	-	-	0.073
TDS	mg/L	-	-	11,371

Source: Brown and Caldwell 2021b

The differences in major ion composition of water treatment influent in the post-closure period are due to the routing of TSF water inventory and tailings consolidation water from the facility for treatment.

To meet applicable discharge standards, the target post-treatment concentrations for analytes were identified for the water treatment plant design (**Table 4.9-10**).

Table 4.9-10 Target Post-Water Treatment Plant Effluent Analyte Concentrations

Parameter	Units	Treatment Objective[1]
pH (range)	s.u.	6.9 – 9.0
Silver	mg/L	0.0007
Arsenic	mg/L	0.01
Cadmium	mg/L	0.00033
Chromium (III)	mg/L	0.035
Chromium (IV)	mg/L	0.0106
Mercury	mg/L	0.000012
Nickel	mg/L	0.024
Lead	mg/L	0.0009
Antimony	mg/L	0.0052
Sulfate	mg/L	250
Thallium	mg/L	0.005
Zinc	mg/L	0.054
Nitrate/Nitrite	mg/L as N	10
Ammonia	mg/L as N	2.1
Cyanide, Total	mg/L	0.0052
Cyanide, WAD	mg/L	0.0039
TDS	mg/L	500

Source: Brown and Caldwell 2021b
[1]Treatment objectives are equivalent to the strictest potentially applied water quality standard

During colder months (October through April), the temperature of treated water is estimated to be 7.3ºC (Brown and Caldwell 2021b). During the operational period Mine Years 4 through 6 when water treatment plant discharge is between seven and 55 percent of the Meadow Creek flow, the discharge would increase stream temperature in Meadow Creek by one to three degrees Celsius. During warmer months, retention times for contact water in ponds would be up to 34 days resulting in warmer water treatment plant feeds with the potential to increase Meadow Creek temperatures downstream of the treatment plant outfall by up to 2.5ºC. However, warmer water treatment plant discharge temperatures would be offset by the cooling effect of the piped diversion of Meadow Creek around the TSF with the net effect of water treatment on temperature of Meadow Creek expected to be less than 0.25ºC (Brown and Caldwell 2021b).

Brown and Caldwell (2021c) performed an assessment of the viability of potentially applicable water treatment technologies to the predicted maximum influent water chemistry and identified the following technologies to incorporate into the proposed project design for the construction, operational, and post-closure periods.

Temporary treatment systems would be employed during the construction period until the project's water treatment plant would be constructed and commissioned. These temporary systems would utilize trailer-mounted or skid-mounted equipment packages containing membrane treatment and/or iron coprecipitation systems that can be set up with limited lead time. **Figure 4.9-10** illustrates the construction period water treatment flowsheet.

Figure 4.9-11 illustrates the operational period water treatment plan flowsheet with a design capacity of 2,000 gpm. For the operational period water chemistry, a treatment process consisting of sodium hypochlorite oxidation, two-stage iron coprecipitation with ferric sulfate, and solids separation with contingent mercury precipitation via organic sulfide precipitant addition between iron precipitation stages was selected. Influent waters would be stored in lined storage ponds for flow equalization and pumped into the water treatment plant. This operational water treatment generally targets dissolved nitrate, metals, and oxyanions in influent solution, primarily arsenic and antimony. Addition of the mercury-sequestering precipitant is included as a contingency for the design to account for uncertainties regarding the effectiveness of iron coprecipitation in reducing dissolved mercury and methylmercury concentrations to levels below applicable receiving stream standards. Residual solids from the treatment plant would be placed in the TSF.

Under an IPDES permit, the water treatment plant effluent would be directed to Meadow Creek at a location upstream of the Hangar Flats pit when flow augmentation is required and otherwise to the East Fork SFSR for the remainder of operations (i.e., when Hangar Flats groundwater pumping results in decreased Meadow Creek baseflow). For predicting surface water chemistry incorporating the effects of treated effluent, the minimum of the predicted water treatment plant influent analyte concentrations or the target effluent concentrations was used. Constituents that do not have a target effluent concentration were assumed to be unaffected by the treatment process.

For the post-closure period, the water treatment process would need to be augmented to treat cyanide, sulfate, and TDS concentrations that would be derived from the remaining inventory of TSF process water and tailings consolidation seepage (**Figure 4.9-12**). The first-stage iron coprecipitation would be

modified to include gypsum precipitation to reduce sulfate concentrations. The second-stage iron coprecipitation would then be converted to ettringite precipitation which would reduce sulfate and TDS concentrations to the target levels for treatment plan effluent. Cyanide would be treated using a two-stage alkaline oxidation process that converts cyanide to carbon dioxide, nitrogen gas, and water. Treatment plant residual solids would be placed in the TSF until its cover was completed, and thereafter dewatered and disposed of in a location constructed in the TSF above the cover.

At the start of closure, water treatment plant effluent would be discharged to the East Fork SFSR until the cover of the TSF is completed (approximately nine years to allow for tailings consolidation, cover installation, and stream channel restoration). Once the TSF cover is completed, the treatment plant and discharge would be relocated to Meadow Creek, nearer the TSF, for the duration of its operation (to approximately Mine Year 40).

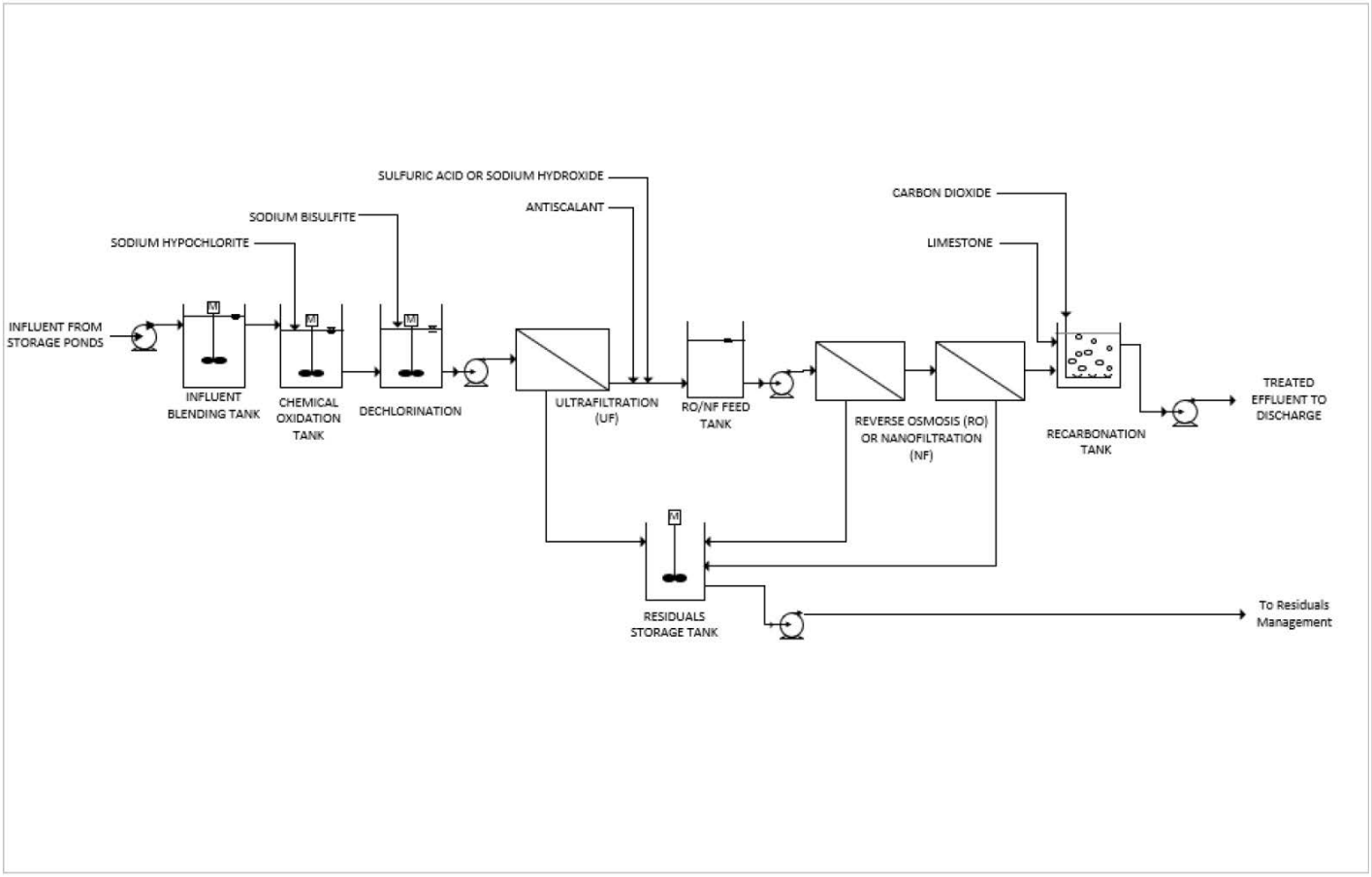
The effects of capture, treatment, and discharge of mine-impacted waters on surface water chemistry would be minor, long-term, and localized.

Sanitary Wastewater Treatment

The worker housing, administration building, warehouse, maintenance shops, and underground exploration surface facilities would produce sanitary wastewater. Wastewater from the administration building, warehouse, maintenance shops, and underground facility would be collected in tanks for transport to a sanitary wastewater treatment plant equipped with a septage receiving system located near the worker housing facility. The sanitary wastewater treatment plant would consist of a package plant containing a membrane bioreactor or equivalent system to treat wastewater to applicable discharge permit requirements. The volume of wastewater influent would depend on the number of personnel working on site and is expected to be approximately 50,000 gallons per day (gpd) during the construction period and 25,000 gpd during operations (Brown and Caldwell 2021b).

Sanitary wastewater treatment plant effluent would be discharged to the East Fork SFSR at an IPDES permitted location near the worker housing facility. Treatment residuals would be dewatered and transported to a permitted, off-site landfill for disposal.

The effects of sanitary wastewater treatment and discharge would be minor, long-term, and localized.



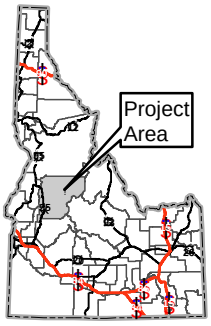
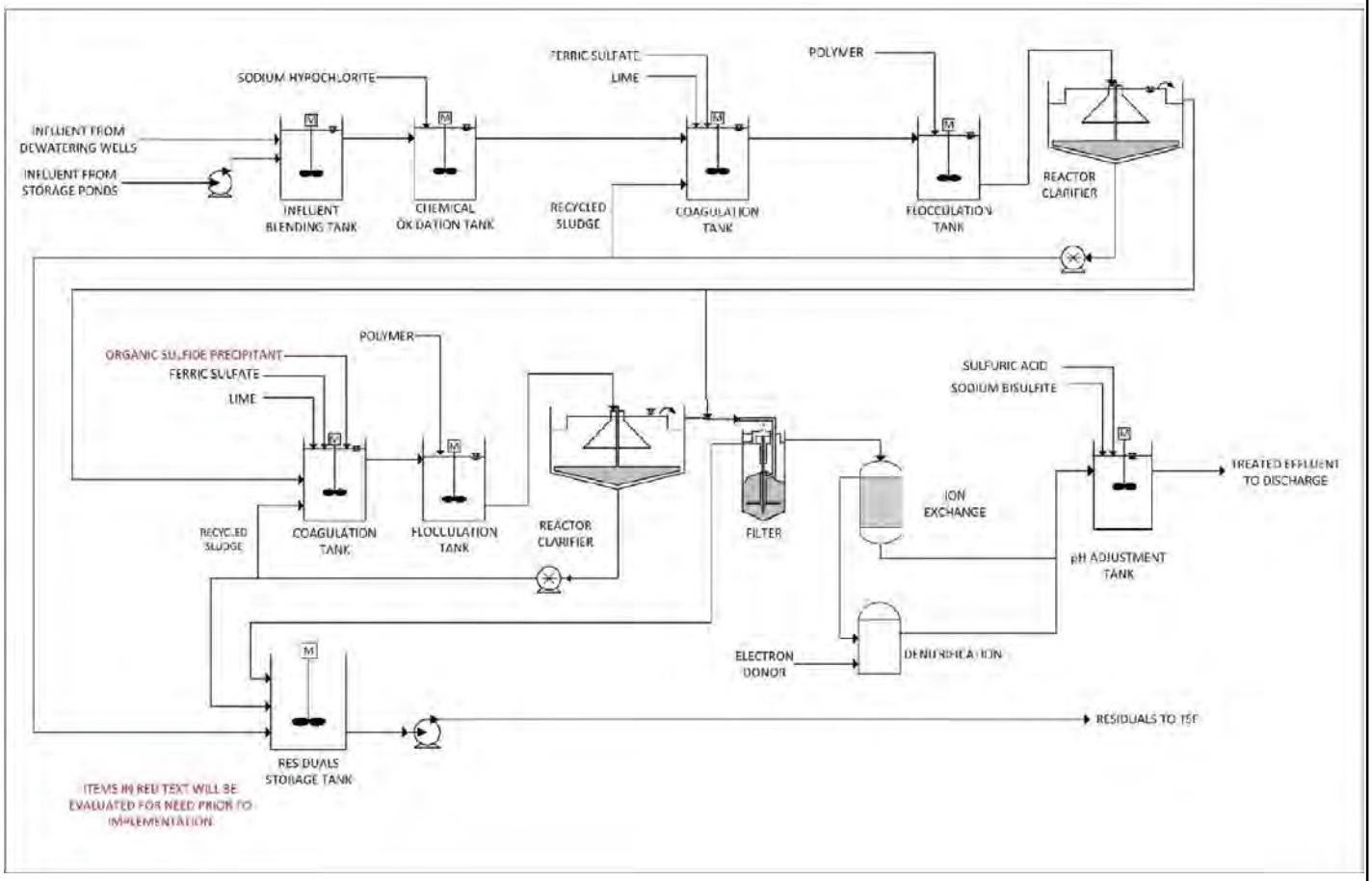


Figure 4.9-10
Construction Period Water Treatment Plant Flowsheet

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)



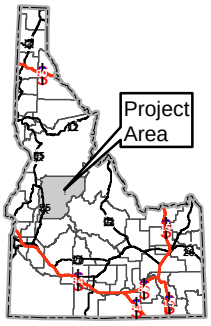
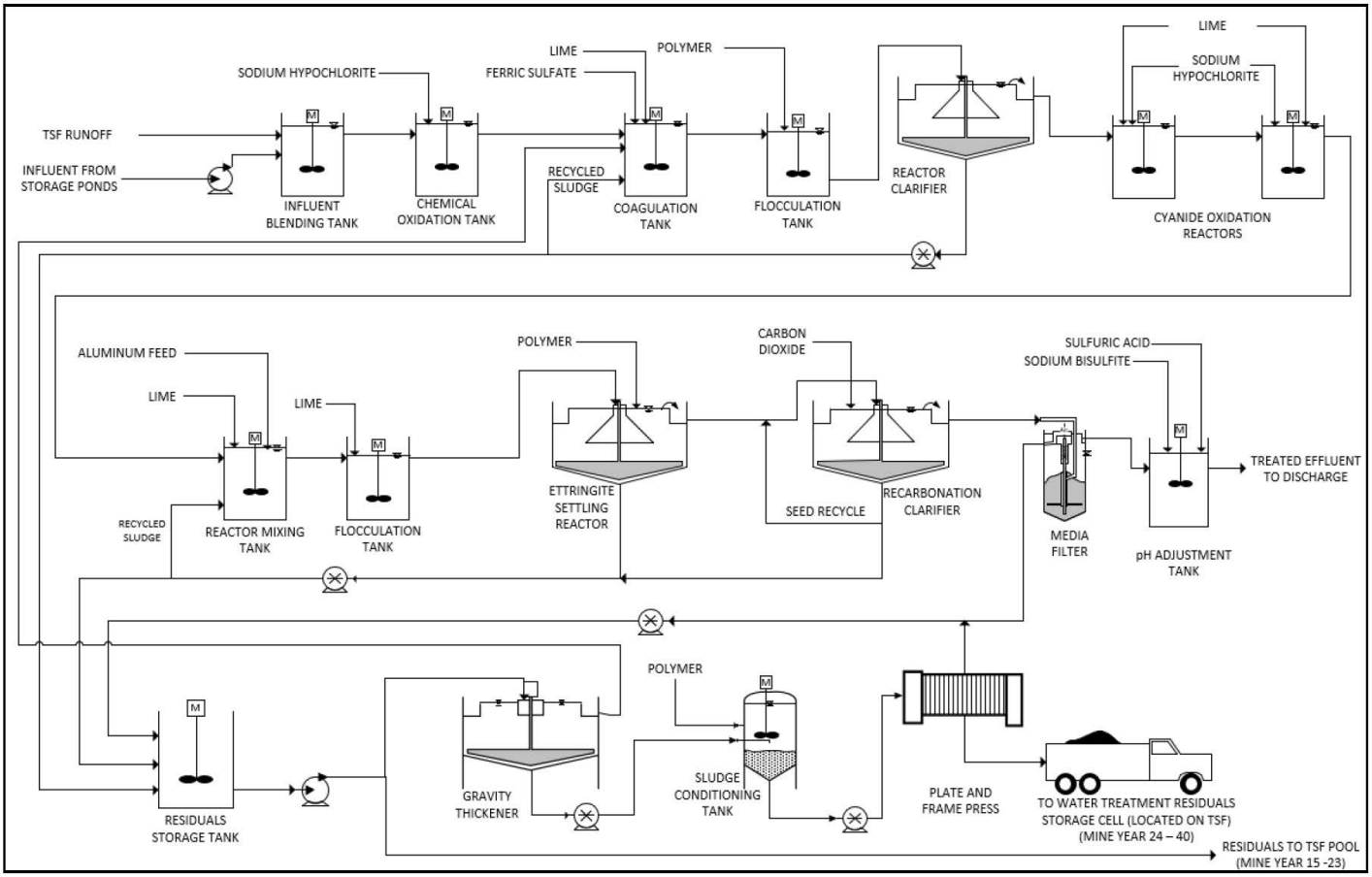


Figure 4.9-11
Operational Water Treatment Plant Flowsheet

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)



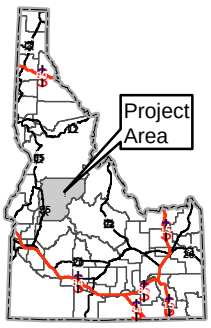


Figure 4.9-12
Closure Period Water Treatment Plant Flowsheet

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021a)

IPDES Permits and Cyanidation Permit

The State of Idaho has regulatory authority over its IPDES process. The SGP would need permits issued by the IDEQ to discharge treated water from its water treatment plant and sanitary wastewater treatment plant. Under the IPDES program, IDEQ would establish specific discharge limits for constituents of interest plus monitoring and reporting requirements for the system based on its regulatory criteria.

The SGP would also need a Cyanidation Permit issued by IDEQ to allow the use of cyanide in its ore processing. Under this permit, IDEQ would institute permit obligations regarding the handling and containment of process solutions as well as responses to upset conditions. In addition, the permit would also contain requirements for the ultimate treatment and disposal of process water. The descriptions of handling TSF water in this specialist report are consistent with the requirements of the Cyanidation Permit regulations.

This analysis of water quality utilizes the predicted water chemistries for water treatment plant discharges as developed by SRK (2021a) and Brown and Caldwell (2021c). Additional limits and requirements associated with the IPDES and Cyanidation Permit have not been determined at the time of this analysis and are therefore not incorporated.

West End Pit Lake Chemistry

During mine operations, the West End pit is expected to be relatively dry, and limited water from stormwater runoff and passive groundwater inflows would pond within the pit sump and be removed. At the end of open pit mine operations, dewatering would cease, diversions would be breached, and a pit lake would ultimately form in the pit. A conceptual geochemical model (**Figure 4.9-13**) has been developed for the West End pit lake from a review of the hydrologic model (Brown and Caldwell 2021e).

During the operational period, highwall runoff, bedrock seepage and run on from undisturbed ground would report to the pit sump as part of the pit dewatering system. Once dewatering ceases, the West End pit lake would begin to fill slowly until attaining a maximum volume of approximately 2,700 acre-feet and a surface elevation of 6,663 feet amsl approximately 57 years from the start of filling. Thereafter, the lake volume and surface elevation would vary at slightly lower levels as meteoric inflows varied in relation to outflows to bedrock groundwater. The final pit lake surface elevations are predicted to be more than six feet below the level where outflow from the pit lake to surface water would be anticipated.

Bedrock groundwater inflow and pit wall runoff are the main contributors to early pit lake filling. After infilling for approximately 11 years, direct precipitation on the pit lake surface would become equivalent to pit wall runoff, while groundwater inflow declines.

Solute loading into the pit lake would come from groundwater and pit wall runoff. These waters would pick up additional solute loading from fractures in the pit walls and talus remaining on pit benches. Representative leachate chemistry for the pit wall rock and talus were obtained from humidity cell tests of West End pit samples, scaled to field conditions.

The USGS code PHREEQC was used to perform a quantitative prediction of future West End pit lake water chemistry based on equilibrium of influent precipitation, groundwater, and rock leachate

chemistries in equilibrium with solid phase minerals that act as solubility controls for dissolved constituents in aqueous systems (**Table 4.9-11**).

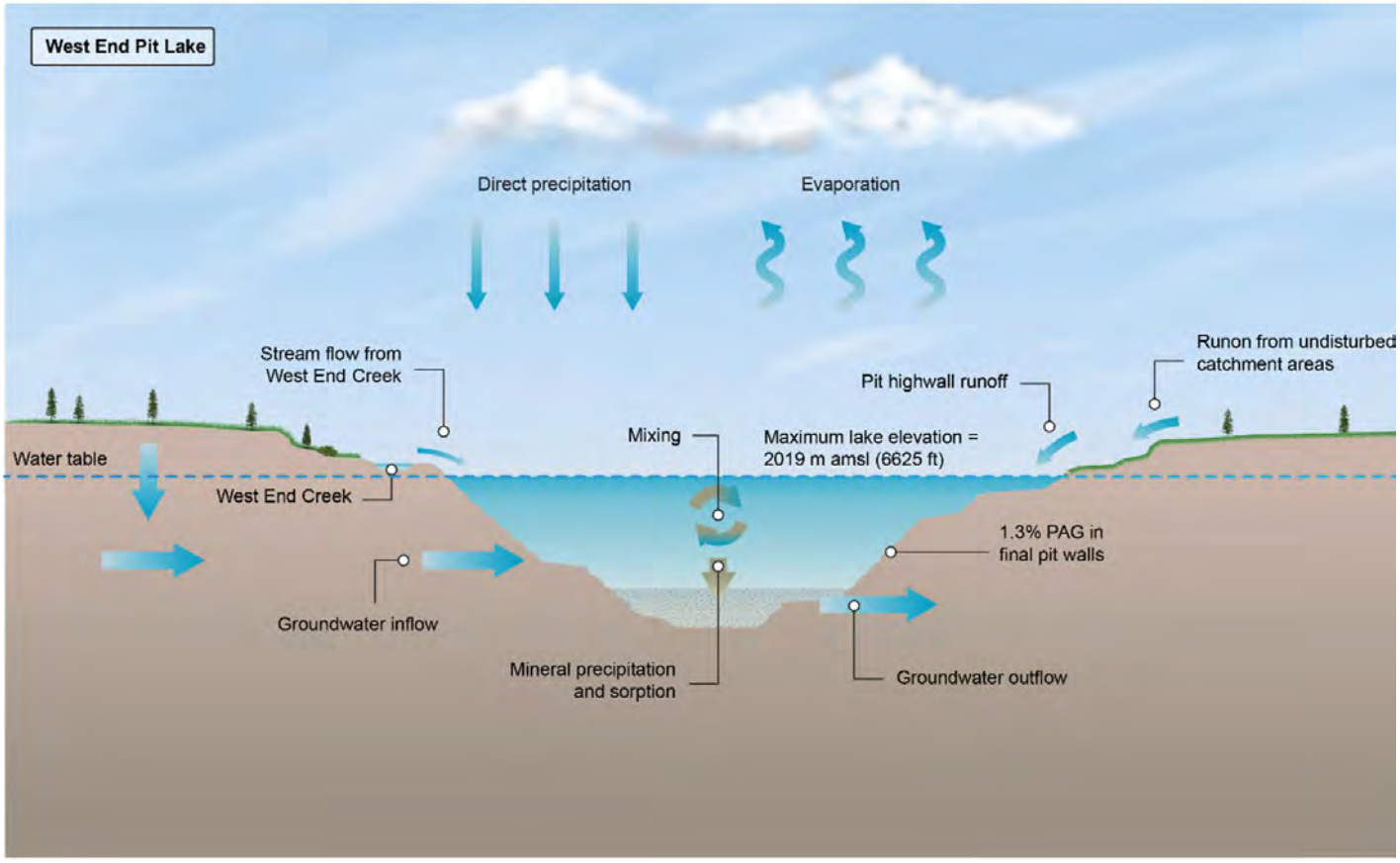
Table 4.9-11 Equilibrium Phases Used for PHREEQC Water Chemistry Models

Mineral Phases Allowed to Form in PHREEQC	Ideal Mineral Formula	Rationale for Inclusion in Facility Models
Barite	$BaSO_4$	Primary mineralogic control on barium (Eary 1999). Close to saturation in initial model runs.
Calcite	$CaCO_3$	Mineral observed in Project area (M3 2020; SRK 2021a). Primary mineralogic control on calcium at alkaline pH (Eary 1999).
Goethite	FeOOH	Primary mineralogic control on iron chemistry and on the sorption of trace elements. Thermodynamic properties well defined (Dzombak and Morel 1990). Mineral observed in the Project area (SRK 2021a).
Fluorite	CaF_2	Primary mineralogic control on fluoride at neutral to alkaline pH (Eary 1999).
Gibbsite	$Al(OH)_3$	Primary mineralogic control on aluminum at neutral to alkaline pH (Eary 1999).
Gypsum	$CaSO_4.2H_2O$	Mineral observed in Project area (SRK 2021a). Primary mineralogic control on sulfate (Eary 1999).
Hgmetal(l)	Hg_2	Close to saturation in initial model runs.
Malachite	$Cu_2(CO_3)(OH)_2$	Primary mineralogic control on copper at alkaline pH (Eary 1999).
Rhodochrosite	$MnCO_3$	Primary mineralogic control on manganese at alkaline pH (Eary 1999). Close to saturation in initial model runs.
Senarmontite	Sb_2O_3	Mineral observed in the Project area (SRK 2021a).

Source: SRK 2021a

The pit lake is expected to turn over seasonally and remain in an oxidizing redox condition. Further details for the pit lake chemistry prediction are available in Site-Wide Water Chemistry Report (SRK 2021a).

Predicted West End pit lake water chemistry exhibits circumneutral pH conditions with TDS concentrations below 130 mg/L. Constituent concentrations are generally below the strictest potentially applied water quality standards except for antimony, arsenic, and mercury concentrations that exceed those values throughout the operating and closure period (**Figure 4.9-14** and **Table 4.9-12**). Concentrations of copper and lead are predicted to exceed the strictest potentially applied water quality standards during pit dewatering operations, when produced water is routed for consumptive use and water treatment but decrease below those levels during as the lake fills.



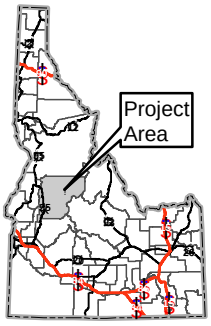
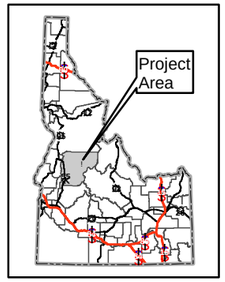
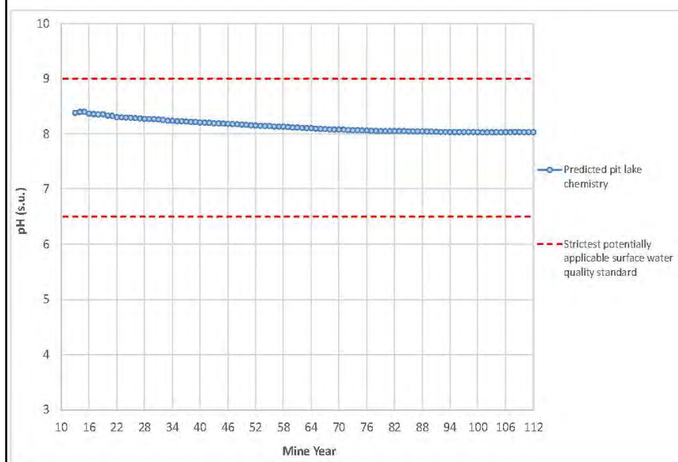


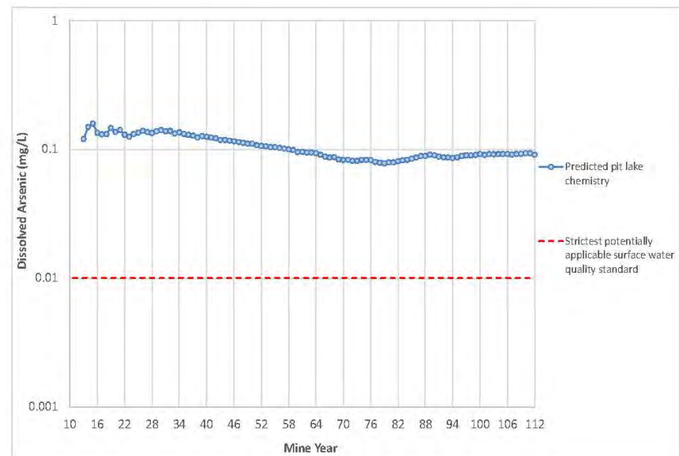
Figure 4.9-13
Conceptual Model - West End Pit Lake

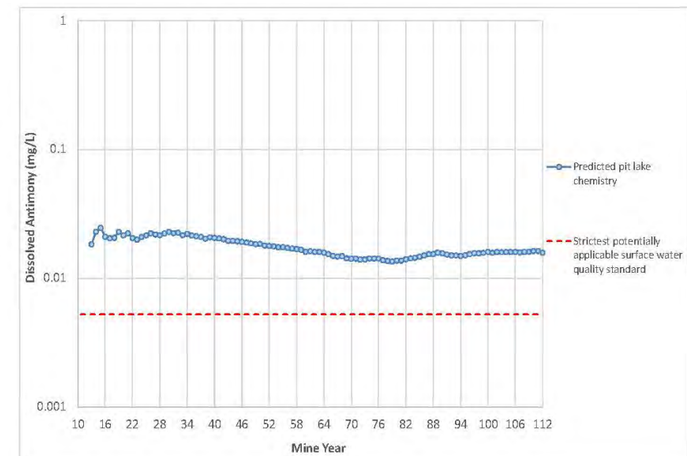
Stibnite Gold Project
Stibnite, ID

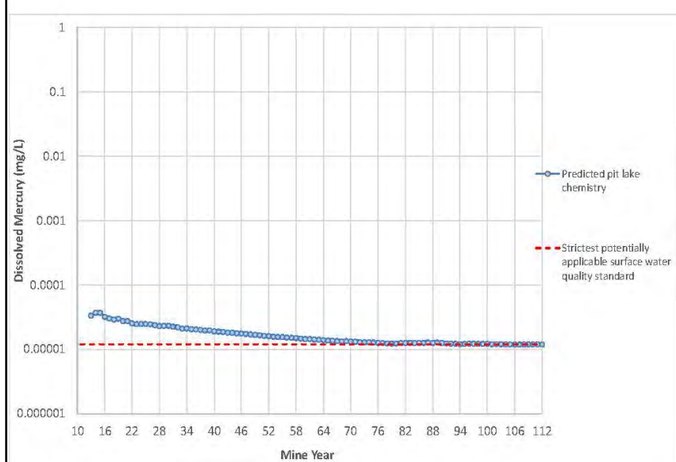
Data Sources: (SRK 2021)

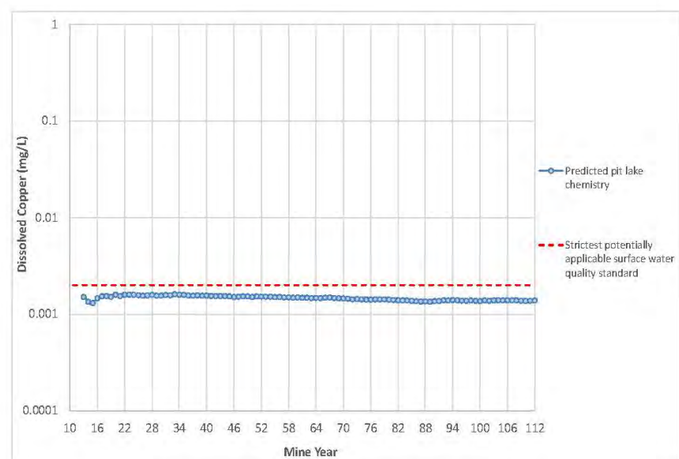












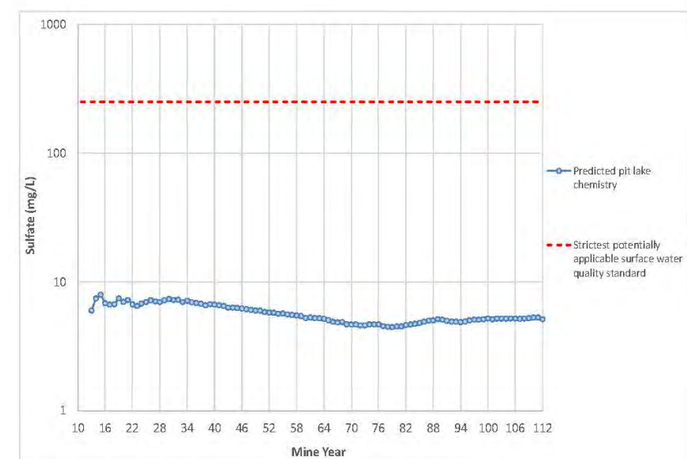


Figure 4.9-14
Predicted West End Pit Lake Chemistry

Stibnite Gold Project
Stibnite, ID

Data Sources: (SRK 2021)

Table 4.9-12 Summary of Results for West End Pit Sump and Pit Lake Geochemical Model

Parameter	Units	Strictest Potentially Applicable Surface Water Quality Standard*	Mine Year 4 (Pit Sump)	Mine Year 6 (Pit Sump)	Mine Year 10 (Pit Sump)	Mine Year 13 (Pit Lake)	Mine Year 25 (Pit Lake)	Mine Year 50 (Pit Lake)	Mine Year 100 (Pit Lake)
pH	s.u.	6.5 to 9.0	7.95	8.33	8.57	8.4	8.3	8.2	8.0
Alkalinity	mg/L as $CaCO_3$	>20	16.5	40.4	74	89	71	53	40
Ag	mg/L	0.0007 †	<0.00002	<0.00002	0.0000208	<0.00002	<0.00002	<0.00002	<0.00002
Al	mg/L	0.05	<0.002	0.0032	0.0051	0.0037	0.0033	0.0028	0.0023
As	mg/L	0.01	0.050	0.12	0.31	0.11	0.13	0.11	0.09
B	mg/L	--	0.044	0.11	0.27	0.1	0.12	0.1	0.088
Ba	mg/L	2	0.006	0.016	0.040	0.024	0.019	0.017	0.013
Be	mg/L	--	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Ca	mg/L	--	3.87	9.16	11.3	19	15	12	8.4
Cd	mg/L	0.00033 †	<0.00002	0.000035	0.00009	0.000036	0.00004	0.000032	0.000026
Cl	mg/L	230	<0.4	0.44	0.97	0.45	0.51	0.46	0.43
Co	mg/L	--	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Cr	mg/L	0.0106 †††	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Cu	mg/L	0.002 ††	0.00074	0.0020	0.0027	0.0014	0.0015	0.0015	0.0013
F	mg/L	2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fe	mg/L	0.3	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	mg/L	0.000012	3.62E-06	8.77E-06	0.000022	0.000033	0.000025	0.000017	0.000013
K	mg/L	--	0.56	1.31	3.30	1.8	1.8	1.5	1.3
Mg	mg/L	--	2.25	5.41	13.8	10	9.2	6.8	5.4
Mn	mg/L	0.05	0.0019	0.0046	0.012	0.0047	0.0053	0.0048	0.004
Mo	mg/L	--	<0.00005	<0.00005	<0.00005	0.000058	<0.00005	<0.00005	<0.00005
Na	mg/L	--	0.44	0.883	2.06	0.93	1.1	0.95	0.86

Parameter	Units	Strictest Potentially Applicable Surface Water Quality Standard*	Mine Year 4 (Pit Sump)	Mine Year 6 (Pit Sump)	Mine Year 10 (Pit Sump)	Mine Year 13 (Pit Lake)	Mine Year 25 (Pit Lake)	Mine Year 50 (Pit Lake)	Mine Year 100 (Pit Lake)
Ni	mg/L	0.024 †	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
P	mg/L	--	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Pb	mg/L	0.0009 †	0.00033	0.00081	0.0021	0.00073	0.00091	0.00077	0.00066
Sb	mg/L	0.0052	0.0075	0.0182	0.047	0.018	0.021	0.018	0.016
Se	mg/L	0.0031	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SO_4	mg/L	250	2.73	6.09	15	5.8	6.9	5.9	5.1
Tl	mg/L	0.000017	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
V	mg/L	--	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Zn	mg/L	0.054 †	0.0023	0.0056	0.0143	0.0053	0.0064	0.0054	0.0046
TDS	mg/L	500	26.7	64.0	121	130	110	81	61
$NO_3 + NO_2$	mg/L as N	--	0.239	0.445	0.354	0.23	0.13	0.075	<0.05

All values are for the dissolved fraction unless otherwise noted
-- Indicates no guideline for parameter
† Indicates hardness-dependent parameter. The values listed are based on the East Fork SFSR hardness of 40 mg/L as calcium carbonate, which represents the 5th percentile hardness during the driest four months at node YP-SR-10 (East Fork SFSR below Meadow Creek) between April 2012 and May 2019.
†† Estimated criterion based on DEQ guidance on Biotic Ligand Model and limited site-specific SGP data
††† Standard is for chromium VI and is based on Water Effect Ratio
Shading indicates value is greater than the strictest potentially applicable surface water quality standard

Midnight, Yellow Pine, and Hanger Flats Backfill

Operational and post-closure water quality predictions have been developed for the Midnight, Yellow Pine, and Hangar Flats pits, which would be backfilled with development rock once the active mining phase is concluded in each pit. Predictions have been developed for sump chemistry for their mining periods and backfill porewater chemistry once backfill placement begins. During mine operations, active dewatering would keep the Yellow Pine and Hangar Flats and Yellow Pine pits dry and limited water would pond within pit sumps. The Midnight area pit is located above groundwater level, so would not require dewatering. The development rock backfill for the Midnight pit is to be sourced mostly from West End pit, with quantities from the West End pit and Yellow Pine pit in the Hangar Flats backfill, and from the Yellow Pine and Hangar Flats pits in the Yellow Pine backfill (**Table 3.9-2**). At the end of open pit mining and backfilling operations, dewatering would cease and the water table would rebound, partially flooding the backfill material within the Hangar Flats and Yellow Pine pits. Midnight pit backfill would be mounded at closure to promote runoff and the highwall and backfill material would be unsaturated.

In order to develop estimates of future porewater chemistry within the three pit backfills, conceptual geochemical models have been developed (**Figure 4.9-15**). Solute loading within the backfilled pits would come from the development rock backfill and from any talus remaining on the pit benches. There would be additional solute loading from groundwater (in the cases of Hangar Flats pit and Yellow Pine pit) and direct precipitation that contacts exposed pit walls and backfill. These waters would pick up additional solute loading from fractures in the pit walls.

Representative leachate chemistry for the non-PAG and PAG pit wall rock, talus and backfill material were obtained from humidity cell data associated with the backfill material and scaled to field conditions. The anticipated lithologies represented in the backfill material are summarized in **Figure 4.9-16**. The Yellow Pine pit would be backfilled from Mine Year 5 through Mine Year 11, with the Hangar Flats pit backfilled in Mine Years 6 and 7, and the Midnight pit backfilled in Mine Year 8. The conceptual models developed for each backfilled pit provide the basis for the development of quantitative predictive calculations using the USGS code PHREEQC.

A low permeability geosynthetic cover would be placed over the Hangar Flats and Yellow Pine pit backfills at closure and covered with earth. These covers are assumed to be 95 percent effective for inhibiting infiltration of meteoric waters from the ground surface into the backfill. A geosynthetic cover would not be placed on the Midnight Area pit backfill. Following installation of the covers, the Hangar Flats pit area would be revegetated and the diversion of Meadow Creek around the area would remain permanently. The East Fork SFSR stream channel would be restored above the Yellow Pine backfill cover along with the development of the Stibnite Lake feature. The restored streams, vegetation, and any wetland/riparian areas formed above the backfill covers would not interact with the development rock or groundwater below the covers. Influent water would inundate approximately 84 percent of backfill material in the Hangar Flats pit and 62 percent of backfill material in the Yellow Pine pit with recovered water levels more than 50 feet below the covers and local surface water.

Further details of the modeling are available in Brown and Caldwell 2021e and SRK 2021a.

Porewater in an unsaturated condition within the Midnight pit backfill is predicted to have alkaline pH with concentrations of antimony, arsenic, manganese, lead, sulfate, and TDS above groundwater standards (**Table 4.9-13** and **Figure 4.9-17**). Surface grading and revegetation of the backfill would limit the potential for porewater within the Midnight pit backfill to infiltrate to local bedrock groundwater.

Table 4.9-13 Predicted Porewater Chemistry for Midnight Pit Backfill

Parameter	Units	Idaho Groundwater Quality Standard (IDAPA 58.01.11)	Mine Year 10	Mine Year 12	Mine Year 25	Mine Year 50	Mine Year 100
pH	s.u.	6.5 - 8.5*	8.4	8.4	8.4	8.4	8.4
Alkalinity	mg/L as $CaCO_3$	-	110	110	110	110	110
Ag	mg/L	0.1*	0.00009	0.00006	0.00009	0.00011	0.00009
Al	mg/L	0.2*	0.004	0.005	0.004	0.004	0.004
As	mg/L	0.05	6.5	4.3	6.3	7.5	6.5
B	mg/L	-	4.0	2.7	3.9	4.6	4.0
Ba	mg/L	2	0.007	0.010	0.007	0.007	0.007
Be	mg/L	0.004	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Ca	mg/L	-	24	19	24	27	25
Cd	mg/L	0.005	0.0014	0.00093	0.0014	0.0016	0.0014
Cl	mg/L	250*	6.4	4.3	6.2	7.3	6.4
Co	mg/L	-	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Cr	mg/L	0.1	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Cu	mg/L	1.3	0.004	0.004	0.004	0.004	0.004
F	mg/L	4	<0.2	<0.2	<0.2	<0.2	<0.2
Fe	mg/L	0.3*	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	mg/L	0.002	0.00034	0.00022	0.00033	0.00038	0.00034
K	mg/L	-	59	39	57	68	59
Mg	mg/L	-	61	49	60	66	61
Mn	mg/L	0.05*	0.22	0.17	0.22	0.24	0.22
Mo	mg/L	-	<0.00005	<0.00005	<0.00005	<0.00005	<0.00005
Na	mg/L	-	32	22	31	37	32
Ni	mg/L	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
P	mg/L	-	0.13	0.089	0.13	0.15	0.13
Pb	mg/L	0.015	0.043	0.029	0.042	0.050	0.044
Sb	mg/L	0.006	1.1	0.7	1.1	1.2	1.1
Se	mg/L	0.05	<0.001	<0.001	<0.001	<0.001	<0.001
SO_4	mg/L	250*	270	180	270	310	280
Tl	mg/L	0.002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002

Parameter	Units	Idaho Groundwater Quality Standard (IDAPA 58.01.11)	Mine Year 10	Mine Year 12	Mine Year 25	Mine Year 50	Mine Year 100
V	mg/L	-	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Zn	mg/L	5*	0.33	0.22	0.32	0.38	0.33
TDS	mg/L	500*	580	440	570	640	580
$NO_3 + NO_2$	mg/L as N	10	<0.05	<0.05	<0.05	<0.05	<0.05

All values are for the dissolved fraction unless stated otherwise
Shading indicates greater than Idaho Groundwater Quality Standard (IDAPA 58.01.11)
* Indicates secondary guideline
- Indicates no standard for parameter

The water chemistry in the inundated backfill within the Yellow Pine pit is predicted to have circumneutral pH with TDS below 180 mg/L. Antimony and arsenic concentrations are predicted to be above groundwater quality standards (**Table 4.9-14** and **Figure 4.9-18**). Predicted mercury concentrations range from 30 ng/L in early years following inundation down to 9 ng/L after approximately 40 years. These mercury concentrations are below groundwater standards but notable because of the potential for groundwater discharge to surface waters.

The water chemistry in the inundated backfill within the Hangar Flats pit is predicted to have circumneutral pH with TDS below 120 mg/L. Antimony and arsenic concentrations are predicted to be above groundwater quality standards (**Figure 4.9-19** and **Table 4.9-15**). Predicted mercury concentrations range from 5 ng/L in early years following inundation down to 2 ng/L after approximately 20 years. These mercury concentrations are less than groundwater standards but notable because of the potential for groundwater discharge and contribute constituents to surface waters.

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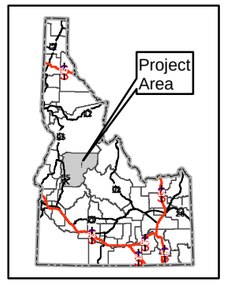
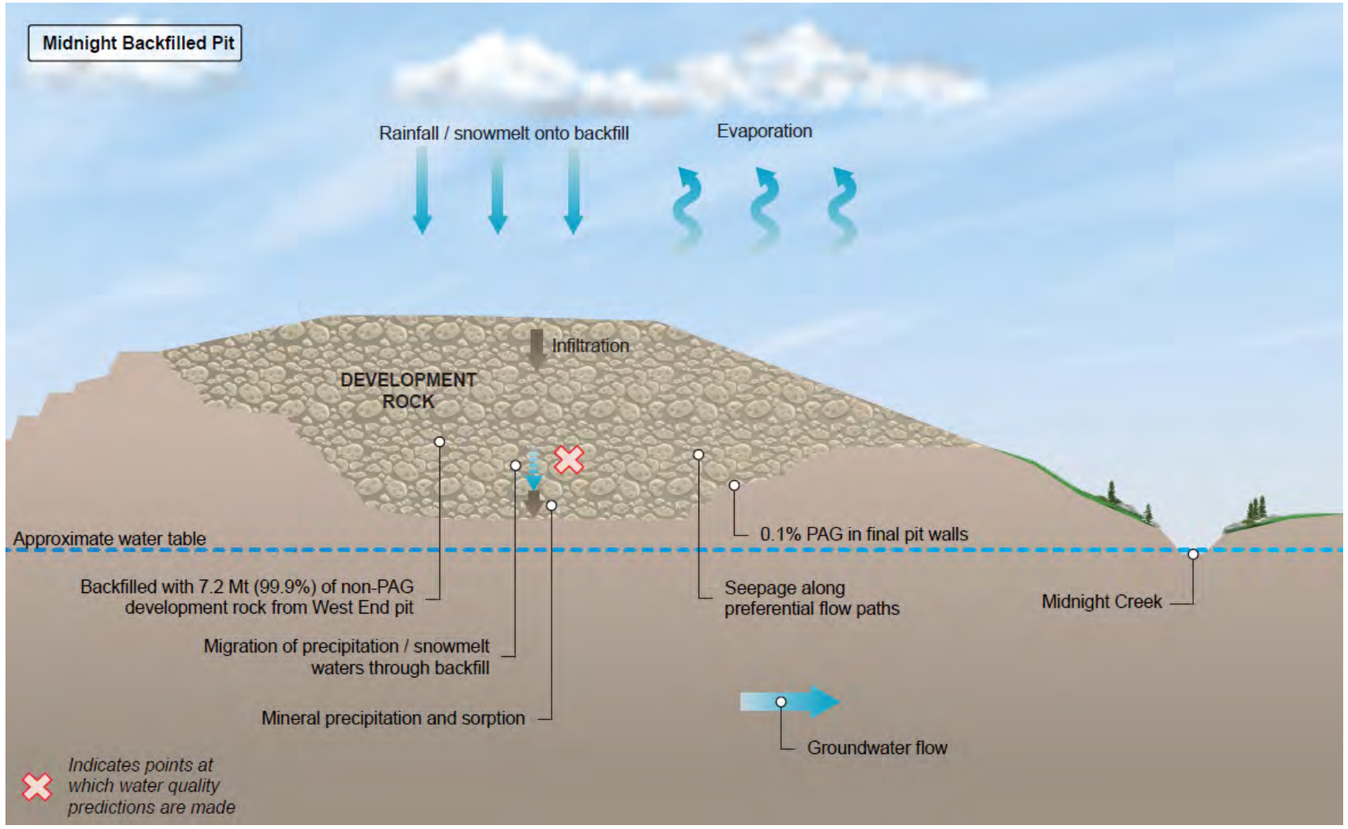
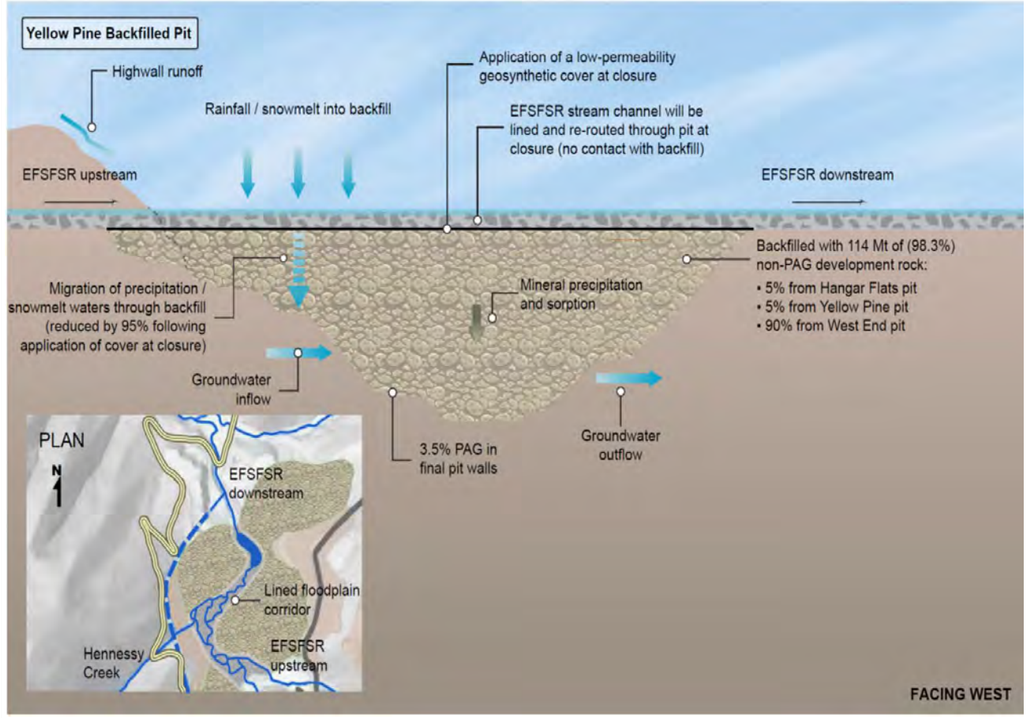






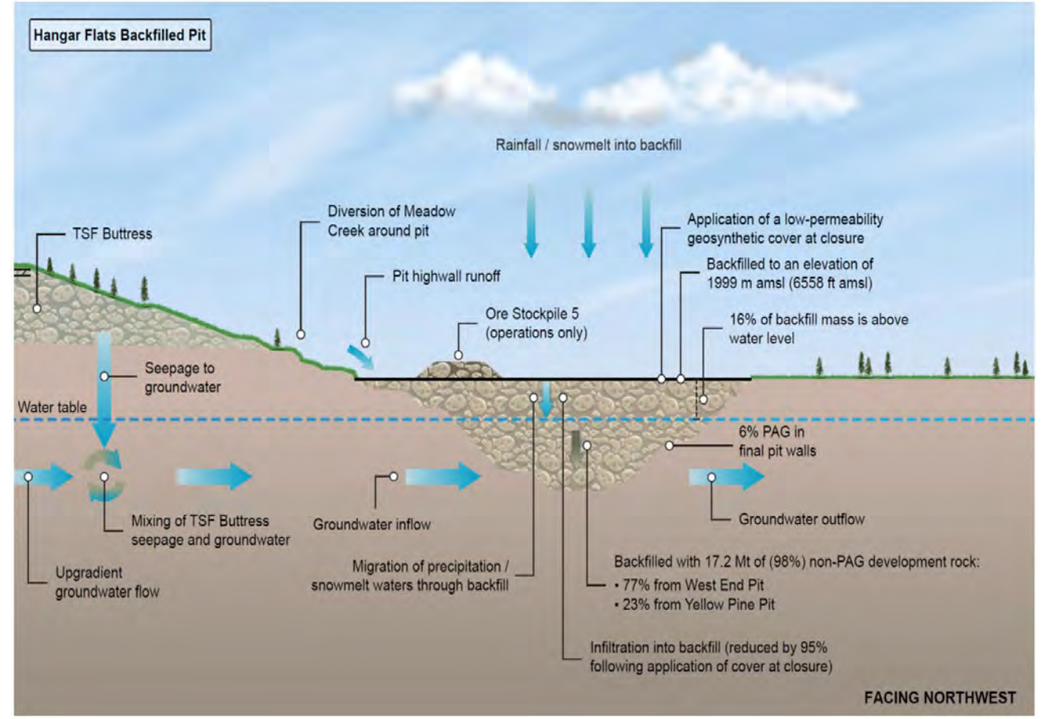
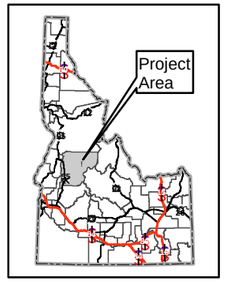
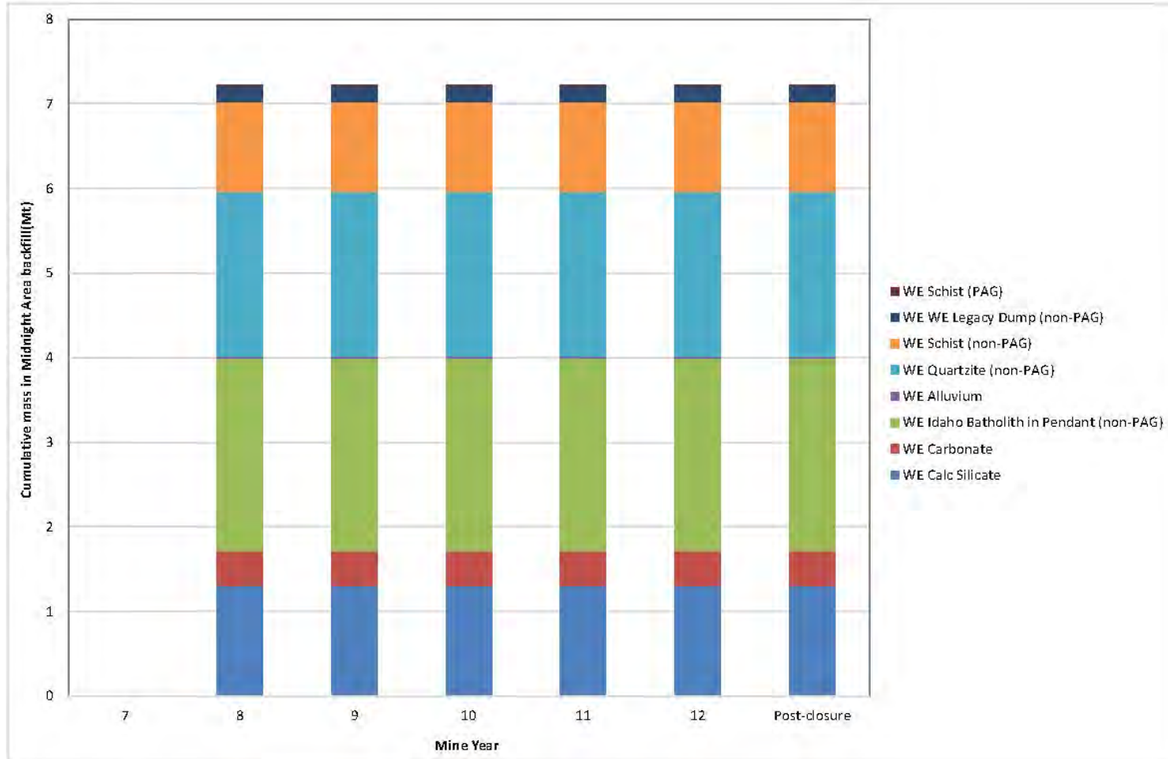


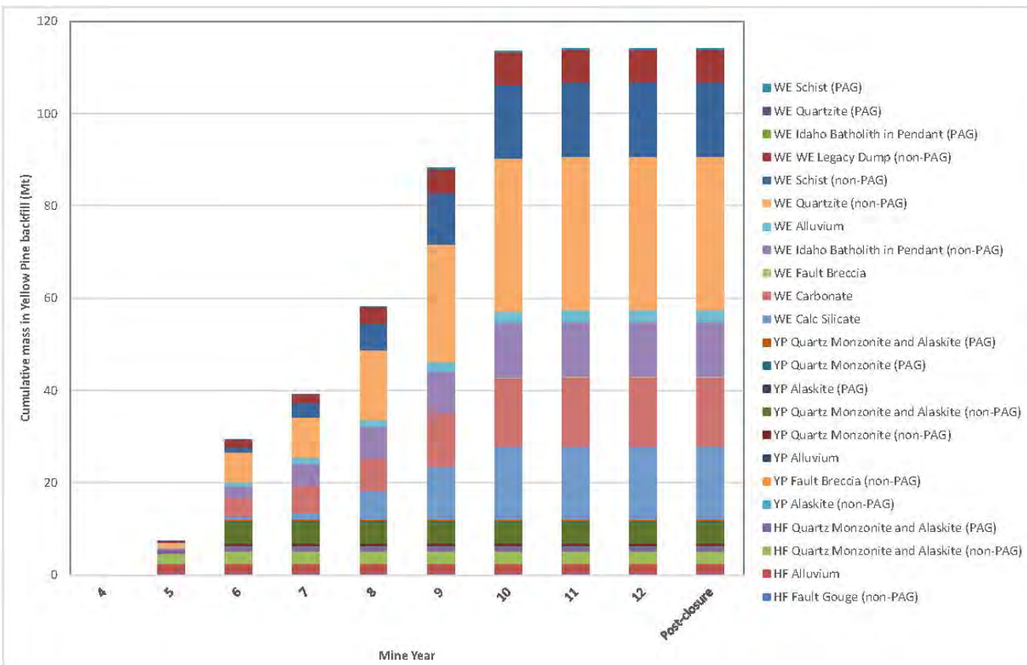
Figure 4.9-15
Conceptual Model - Pit Backfills

Stibnite Gold Project
Stibnite, ID

Data Sources: (SRK 2021)







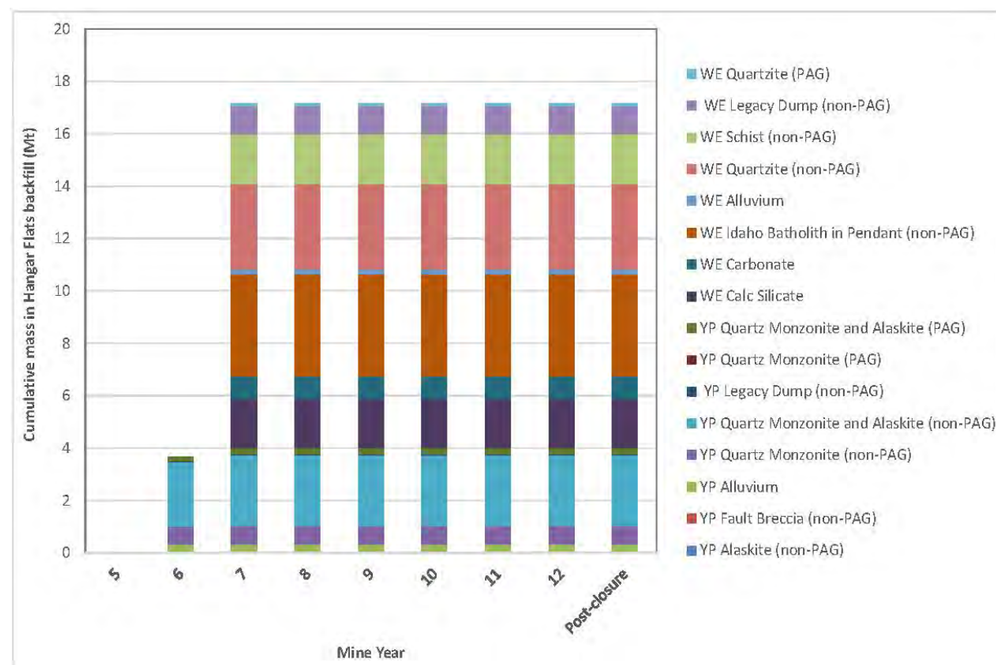
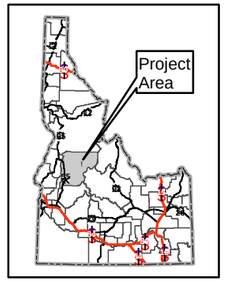
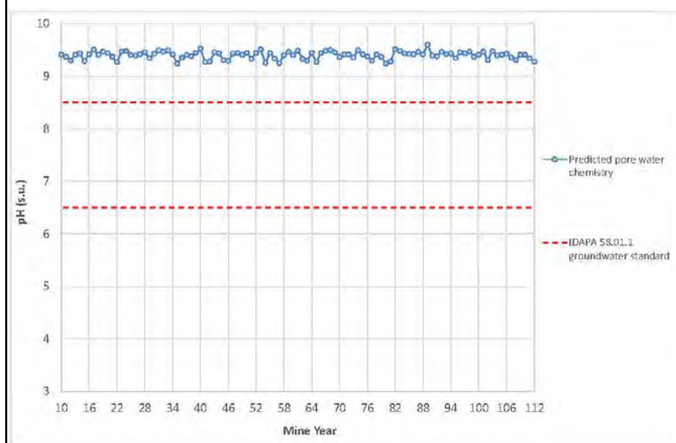


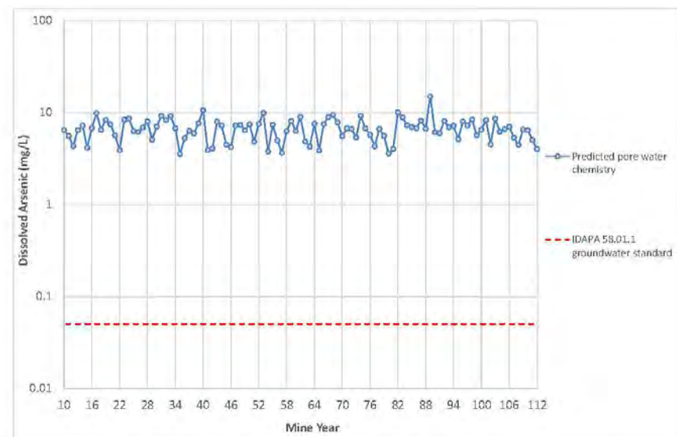
Figure 4.9-16
Pit Backfill Composition

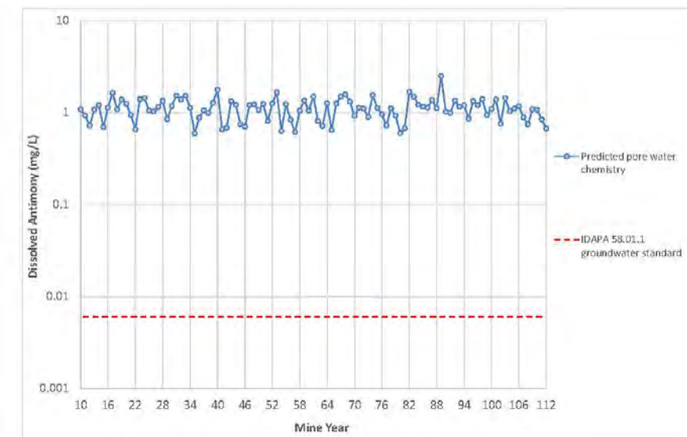
Stibnite Gold Project
Stibnite, ID

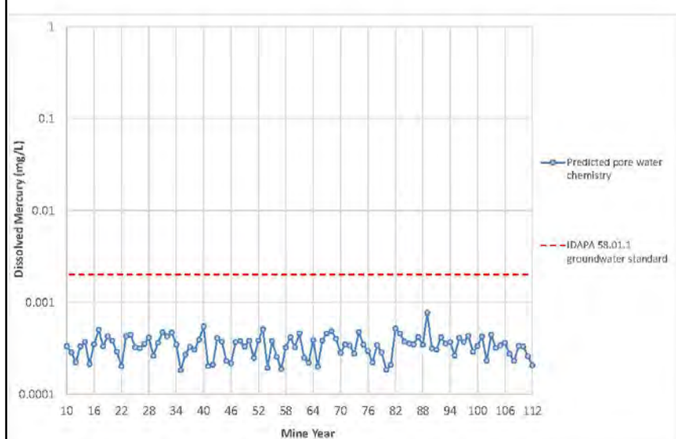
Data Sources: (SRK 2021)

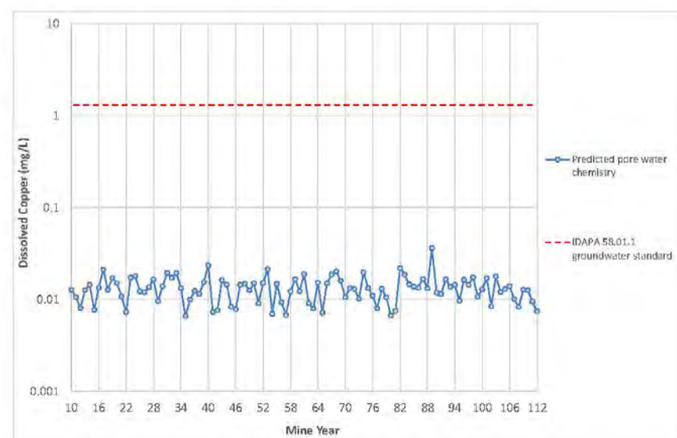












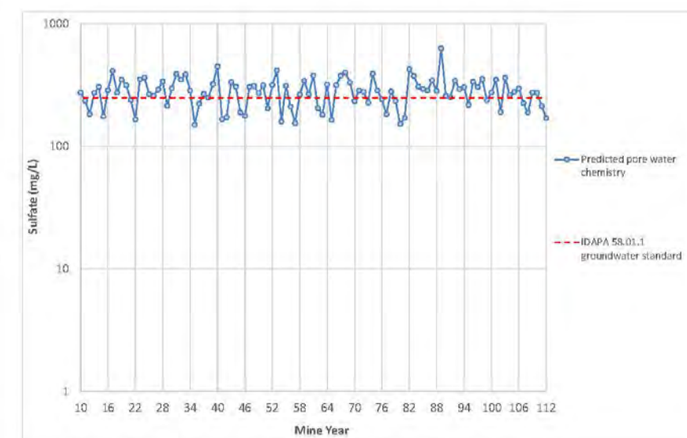


Figure 4.9-17
Predicted Midnight Pit Backfill Porewater Chemisty

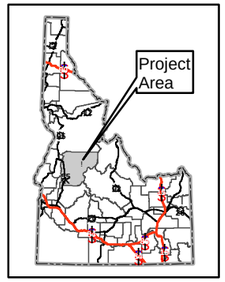
Stibnite Gold Project
Stibnite, ID
Data Sources: (SRK 2021)

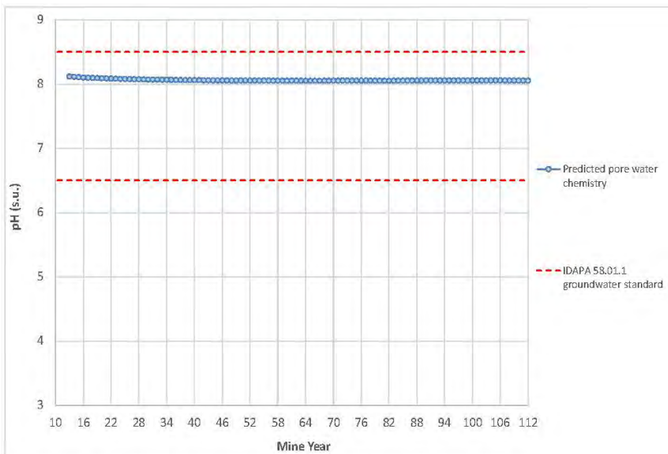
Table 4.9-14 Predicted Post-Closure Porewater Chemistry for Yellow Pine Pit Backfill

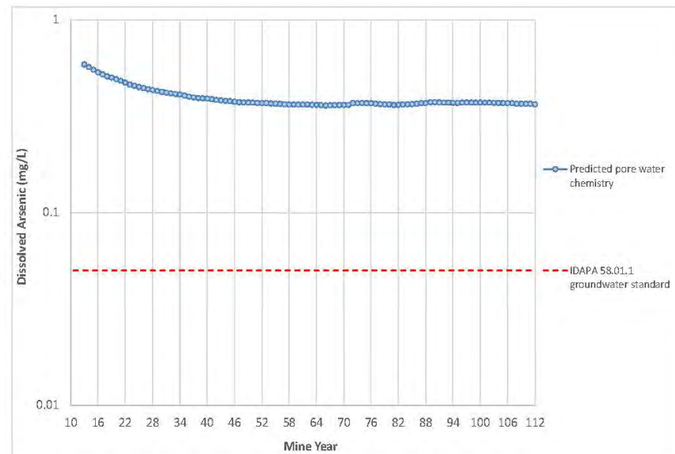
Parameter	Units	Idaho Groundwater Quality Standard (IDAPA 58.01.11)	Mine Year 13	Mine Year 14	Mine Year 15	Mine Year 20	Mine Year 25	Mine Year 50	Mine Year 100
pH	s.u.	6.5 - 8.5*	8.1	8.1	8.1	8.1	8.1	8.0	8.0
Alkalinity	mg/L as $CaCO_3$	-	96	94	93	88	84	79	79
Ag	mg/L	0.1*	0.000027	0.000026	0.000025	0.000021	<0.00002	<0.00002	<0.00002
Al	mg/L	0.2*	0.0032	0.0031	0.0031	0.0031	0.003	0.003	0.003
As	mg/L	0.05	0.58	0.56	0.54	0.47	0.42	0.34	0.34
B	mg/L	-	0.24	0.22	0.21	0.16	0.13	0.076	0.075
Ba	mg/L	2	0.032	0.033	0.033	0.033	0.033	0.034	0.034
Be	mg/L	0.004	0.000031	0.000032	0.000032	0.000033	0.000033	0.000034	0.000035
Ca	mg/L	-	13	13	14	14	14	15	15
Cd	mg/L	0.005	0.000099	0.000093	0.000087	0.000068	0.000056	0.000036	0.000036
Cl	mg/L	250*	1.9	1.8	1.8	1.5	1.3	1.1	1.1
Co	mg/L	-	0.00056	0.00055	0.00055	0.00054	0.00053	0.00051	0.00053
Cr	mg/L	0.1	0.00093	0.00088	0.00084	0.00069	0.00059	0.00042	0.00043
Cu	mg/L	1.3	0.00087	0.00084	0.00081	0.0007	0.00064	0.00053	0.00052
F	mg/L	4	0.53	0.52	0.51	0.49	0.47	0.45	0.46
Fe	mg/L	0.3*	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	mg/L	0.002	0.00003	0.000028	0.000026	0.00002	0.000016	0.0000094	0.0000095
K	mg/L	-	3.5	3.3	3.2	2.6	2.3	1.7	1.7
Mg	mg/L	-	12	12	11	8.9	7.5	5.4	5.3
Mn	mg/L	0.05*	0.018	0.018	0.018	0.017	0.017	0.017	0.017
Mo	mg/L	-	0.0097	0.0093	0.0088	0.0074	0.0064	0.005	0.005
Na	mg/L	-	23	23	23	22	22	21	21

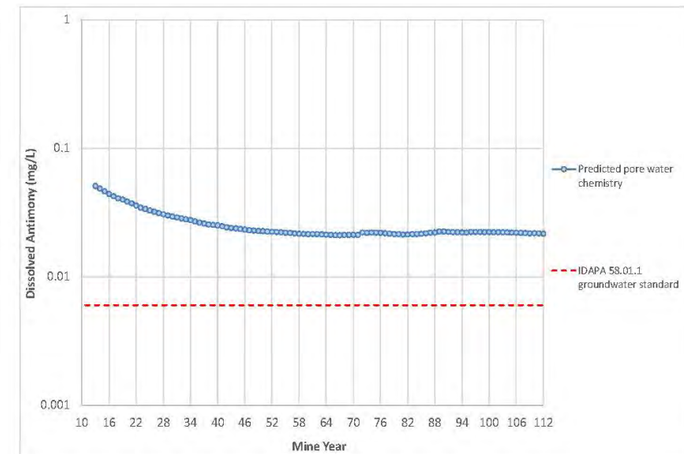
Parameter	Units	Idaho Groundwater Quality Standard (IDAPA 58.01.11)	Mine Year 13	Mine Year 14	Mine Year 15	Mine Year 20	Mine Year 25	Mine Year 50	Mine Year 100
Ni	mg/L	-	0.0025	0.0024	0.0022	0.0018	0.0014	0.00088	0.0009
P	mg/L	-	0.046	0.045	0.043	<0.04	<0.04	<0.04	<0.04
Pb	mg/L	0.015	0.0018	0.0017	0.0016	0.0012	0.00098	0.00059	0.00059
Sb	mg/L	0.006	0.05	0.048	0.045	0.037	0.031	0.021	0.021
Se	mg/L	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SO_4	mg/L	250*	33	32	31	28	26	24	24
Tl	mg/L	0.002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
V	mg/L	-	0.00059	0.0006	0.0006	0.00062	0.00063	0.00065	0.00066
Zn	mg/L	5*	0.017	0.016	0.015	0.011	0.0089	0.0053	0.0053
TDS	mg/L	500*	180	180	180	170	160	150	150
$NO_3 + NO_2$	mg/L as N	10	0.18	0.18	0.19	0.2	0.21	0.21	0.21

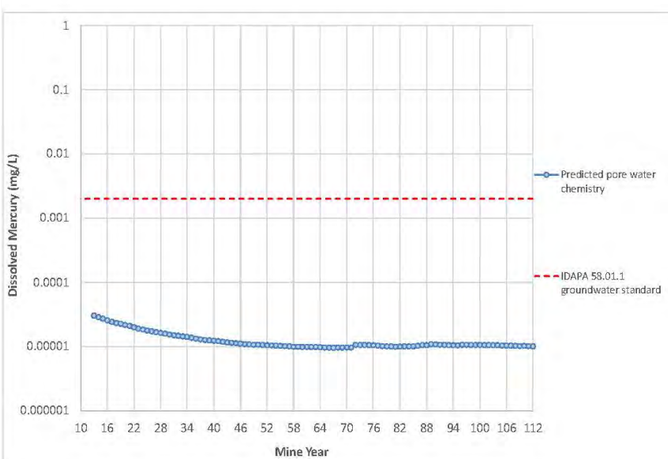
All values are for the dissolved fraction unless stated otherwise
Shading indicates greater than Idaho Groundwater Quality Standard (IDAPA 58.01.11)
* Indicates secondary guideline
- Indicates no standard for parameter

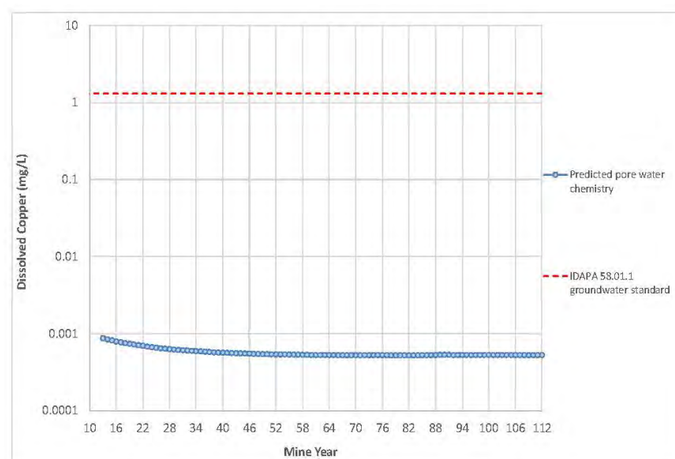












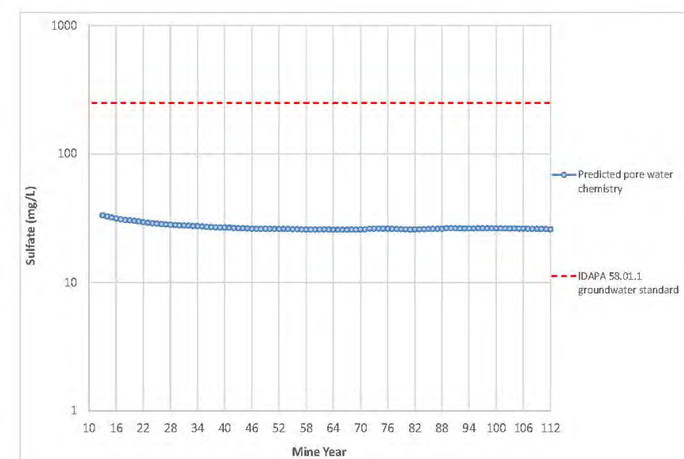
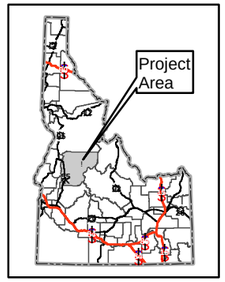
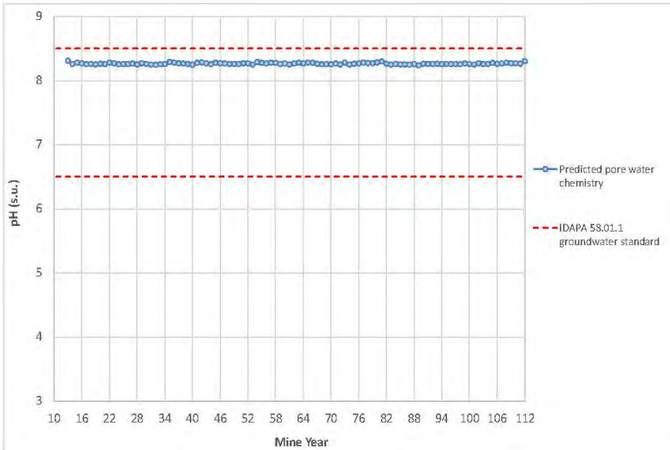


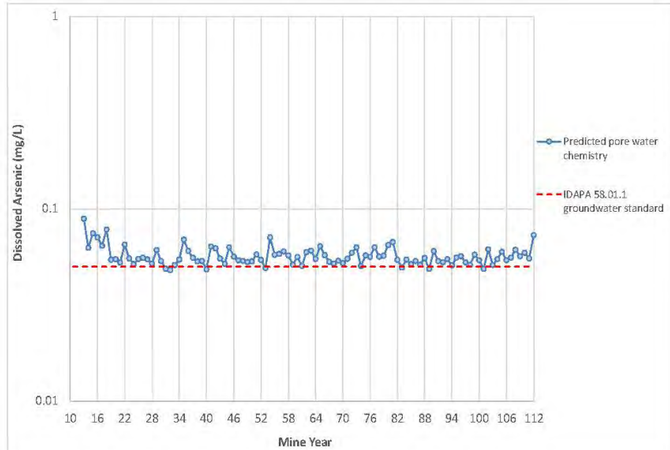
Figure 4.9-18
Predicted Yellow Pine Pit Backfill Porewater Chemistry

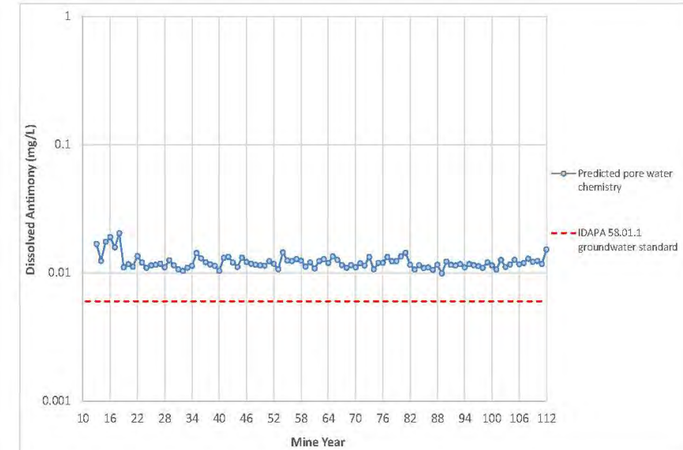
Stibnite Gold Project
Stibnite, ID

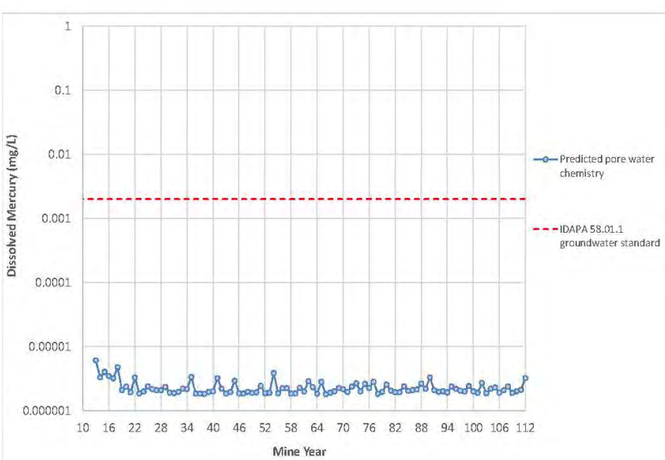
Data Sources: (SRK 2021)

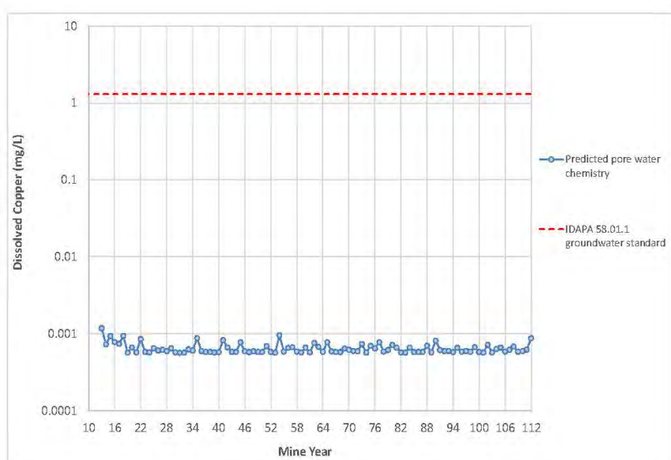












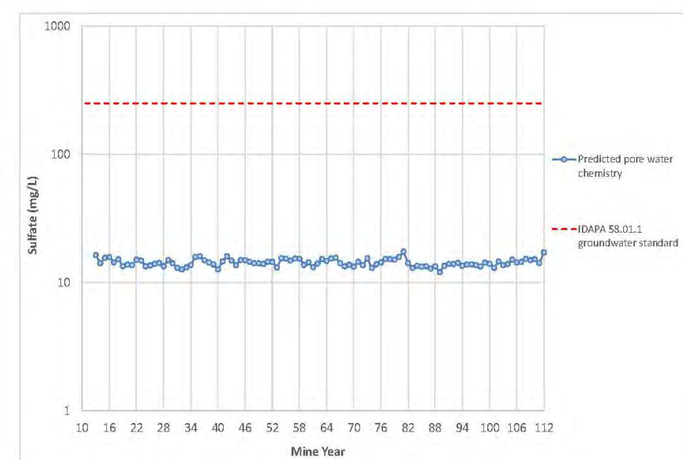


Figure 4.9-19
Predicted Hangar Flats Pit Backfill Porewater Chemistry

Stibnite Gold Project
Stibnite, ID

Data Sources: (SRK 2021)

Table 4.9-15 Predicted Post-Closure Porewater Chemistry for Hangar Flats Pit Backfill

Parameter	Units	Idaho Groundwater Quality Standard (IDAPA 58.01.11)	Mine Year 13	Mine Year 14	Mine Year 15	Mine Year 20	Mine Year 25	Mine Year 50	Mine Year 100
pH	s.u.	6.5 - 8.5*	8.3	8.2	8.3	8.2	8.2	8.2	8.2
Alkalinity	mg/L as $CaCO_3$	-	69	63	66	63	63	63	63
Ag	mg/L	0.1*	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Al	mg/L	0.2*	0.0037	0.0035	0.0036	0.0035	0.0035	0.0035	0.0035
As	mg/L	0.05	0.072	0.051	0.095	0.045	0.045	0.043	0.044
B	mg/L	-	0.031	<0.02	0.034	<0.02	<0.02	<0.02	<0.02
Ba	mg/L	2	0.0050	0.0045	0.0043	0.0039	0.0038	0.0039	0.0038
Be	mg/L	0.004	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Ca	mg/L	-	21	19	20	20	20	20	20
Cd	mg/L	0.005	0.000023	<0.00002	0.00002	<0.00002	<0.00002	<0.00002	<0.00002
Cl	mg/L	250*	0.51	0.45	0.62	0.41	0.42	0.41	0.41
Co	mg/L	-	0.00015	0.00014	0.00021	0.00014	0.00014	0.00014	0.00015
Cr	mg/L	0.1	0.0006	0.00057	0.00050	0.00033	0.00034	0.00033	0.00033
Cu	mg/L	1.3	0.0010	0.00068	0.00080	0.00063	0.00062	0.00056	0.00055
F	mg/L	4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Fe	mg/L	0.3*	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Hg	mg/L	0.002	0.0000050	0.0000028	0.0000066	0.0000020	0.0000020	0.0000016	0.0000017
K	mg/L	-	1.1	0.95	1.3	0.96	0.95	0.93	0.94
Mg	mg/L	-	3.30	2.6	3.2	2.5	2.5	2.4	2.4
Mn	mg/L	0.05*	0.0093	0.0072	0.010	0.0069	0.0068	0.0070	0.0069
Mo	mg/L	-	0.0017	0.0016	0.0026	0.0016	0.0016	0.0016	0.0016

Parameter	Units	Idaho Groundwater Quality Standard (IDAPA 58.01.11)	Mine Year 13	Mine Year 14	Mine Year 15	Mine Year 20	Mine Year 25	Mine Year 50	Mine Year 100
Na	mg/L	-	9.9	8.8	9.9	8.7	8.6	8.9	8.9
Ni	mg/L	-	0.00043	0.00033	0.00083	0.00032	0.00035	0.00033	0.00034
P	mg/L	-	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Pb	mg/L	0.015	0.00022	0.00012	0.00025	0.000097	0.000096	0.000079	0.000080
Sb	mg/L	0.006	0.014	0.010	0.030	0.0097	0.0097	0.0095	0.0095
Se	mg/L	0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
SO_4	mg/L	250*	14	12	15	12	12	12	12
Tl	mg/L	0.002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002
V	mg/L	-	0.00031	0.00030	0.00031	0.00032	0.00032	0.00032	0.00032
Zn	mg/L	5*	0.0033	0.0023	0.0038	0.0019	0.0019	0.0018	0.0018
TDS	mg/L	500*	120	110	120	110	110	110	110
$NO_3 + NO_2$	mg/L as N	10	0.43	0.42	0.55	0.45	0.45	0.45	0.45

All values are for the dissolved fraction unless stated otherwise
Shading indicates greater than Idaho Groundwater Quality Standard (IDAPA 58.01.11)
* Indicates secondary guideline
- Indicates no standard for parameter

Groundwater Chemistry

Project effects on groundwater chemistry would be related to infiltration of leachate from the TSF, TSF Embankment and Buttress, stockpiles, and the Midnight pit backfill plus groundwater interaction with the inundated backfill within the Yellow Pine and Hangar Flats pits and groundwater outflow from the West End pit lake. In addition, accidental releases of fuels, lubricants, coolants, hydraulic fluid, and other chemicals could impact groundwater quality if not effectively addressed via designed containments and spill responses.

Effects of TSF, TSF Embankment and Buttress, and stockpiles leachate infiltration on receiving alluvial groundwater were summarized in **Figures 4.9-4** and **4.9-8**. Limited infiltration from the lined TSF results in minor changes to groundwater analyte concentrations under the TSF that do not result in exceedances of groundwater quality standards. Infiltration from the unlined TSF Buttress is predicted to have a more notable effect on groundwater analyte concentrations. Specifically, mixing of infiltrated leachate with previously unimpacted alluvial groundwater is predicted to increase antimony and arsenic groundwater concentrations above existing conditions and groundwater standards. However, infiltrating leachate would result in little change to the antimony and arsenic concentrations in currently impacted alluvial groundwater.

Where the local groundwater has not been previously impacted, the groundwater interactions with inundated backfill pore water and the West End pit lake would have the potential to increase groundwater concentrations for antimony and arsenic to levels above groundwater standards. Where the local groundwater is previously impacted, these groundwater interactions would have little influence on antimony and arsenic concentrations.

To assess the mixing and movement of dissolved constituents in groundwater, a particle tracking analysis was conducted using the site hydrogeologic model (Brown and Caldwell 2021e). Flow paths from origin locations within the TSF Buttress footprint and pit backfills were tracked over a period simulating 100 years following the end of dewatering operations and the particles were mapped at their final destinations over this time frame (**Figure 4.9-20**). The tracking analyses indicated that these destinations were typically surface stream segments in Meadow Creek, the East Fork SFSR, or Sugar Creek. Flow from the TSF Buttress footprint and the Hangar Flats backfill is predicted to be in an easterly to northeasterly direction toward the Meadow Creek area. The presence of a lined diversion channel for Meadow Creek inhibited discharge of groundwater to surface water along the length of the diversion. Groundwater discharge was predicted to occur primarily in Meadow Creek past the end of the lined diversion and prior to its confluence with the East Fork SFSR. Discharge of groundwater from these origin areas to the East Fork SFSR below the Meadow Creek confluence is predicted to occur to lesser extent than above the confluence. The effects of groundwater discharge on surface water chemistry are incorporated into the predicted analyte concentrations in surface water below.

Most of the groundwater movement from origin locations within the Yellow Pine pit backfill concludes as surface water discharge to the East Fork SFSR below the Yellow Pine pit area. However, approximately 10 percent of the groundwater flow discharges to surface water in Sugar Creek (**Figure 4.9-20**). Twenty-five percent of groundwater outflow from the West End pit lake discharges as surface water in West End Creek with the remainder discharging as surface water in Sugar Creek.

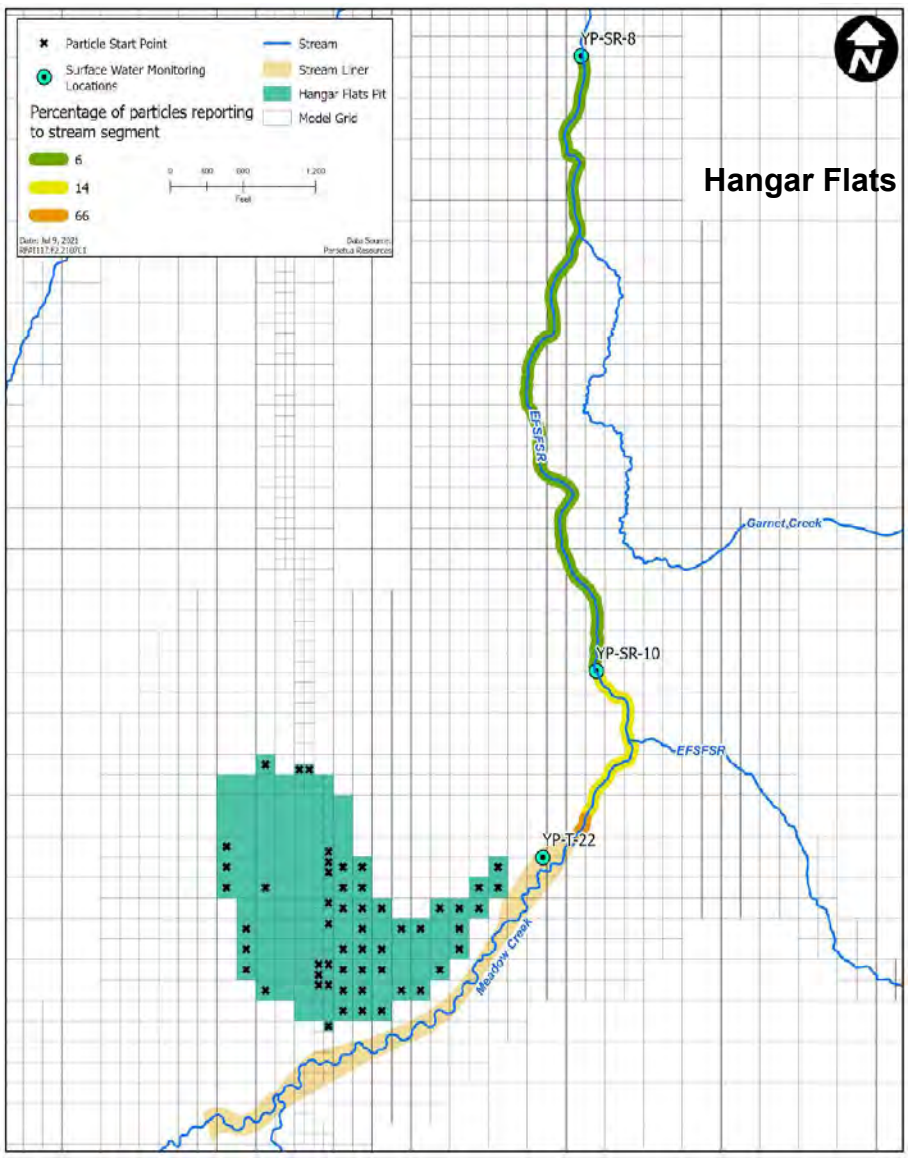
Existing groundwater monitoring data near the confluence of Meadow Creek and the East Fork SFSR exhibit antimony and arsenic concentrations above groundwater standards (**Figures 3.9-8** and **3.9-9**), indicating the mixture of leachate with these waters would result in little change to groundwater concentrations relative to standards. This is also the case with groundwater concentrations with the Sugar Creek drainage. Groundwater monitoring below the existing Yellow Pine pit indicates that there are zones of groundwater to the west of the East Fork SFSR channel (e.g., around MWH-A17 and SRK-GM-04S) where antimony and arsenic concentrations are below groundwater standards. Approximately two percent of the groundwater particles originating from the Yellow Pine pit backfill are predicted to reach those groundwater areas which could observe an associated increase in groundwater antimony and arsenic concentrations.

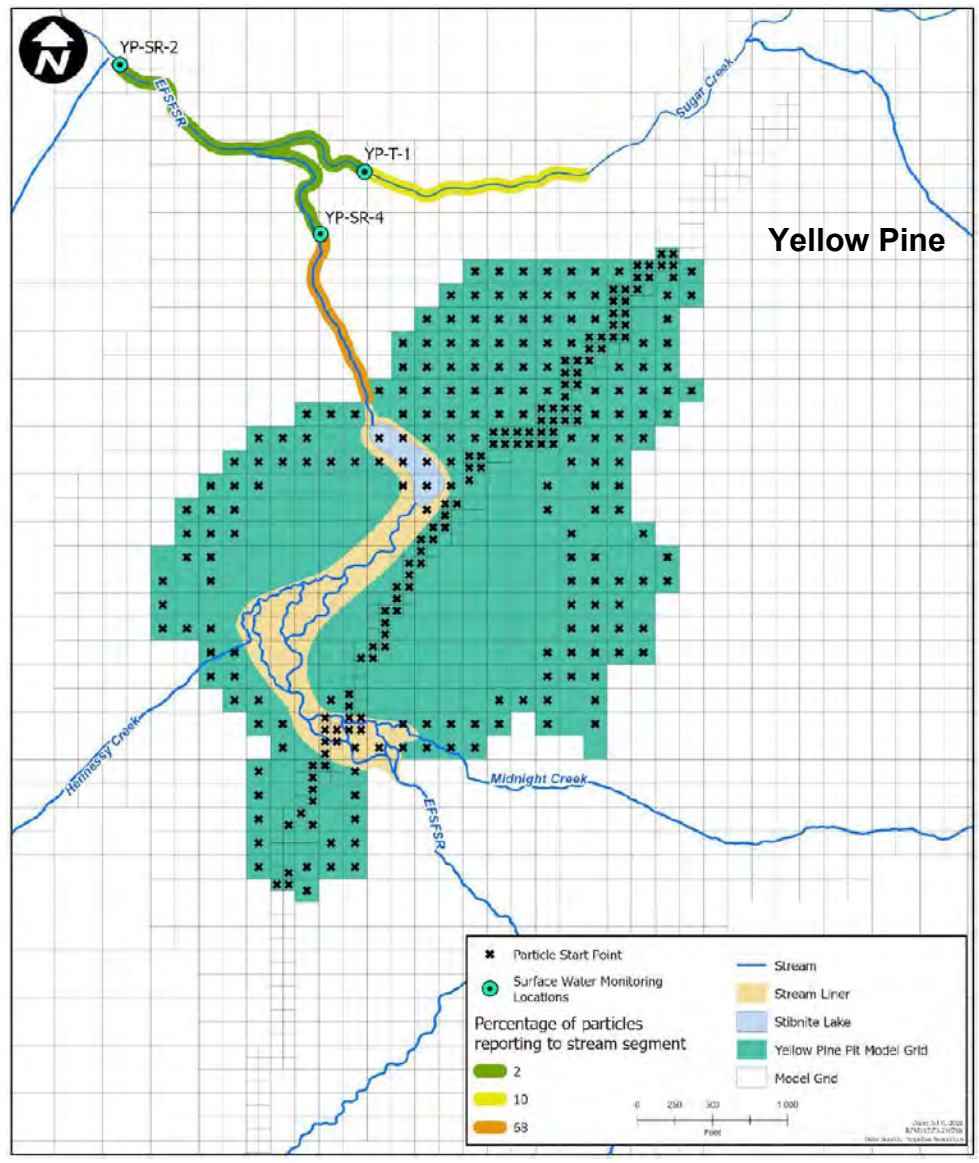
The effects of the infiltration of leachate from the TSF, TSF Buttress, stockpiles and Midnight pit backfill, groundwater interaction with the Yellow Pine and Hangar Flats pit backfills, and West End pit lake on groundwater chemistry would be minor to major depending on the existing condition of receiving groundwater, permanent, and localized. Major effects would be limited to the groundwater area (i.e., around MWH-A17 and SRK-GM-04S) where antimony and arsenic concentrations are below groundwater standards. The effects of groundwater discharge on surface water chemistry are incorporated into the predicted analyte concentrations in surface water in the following section.

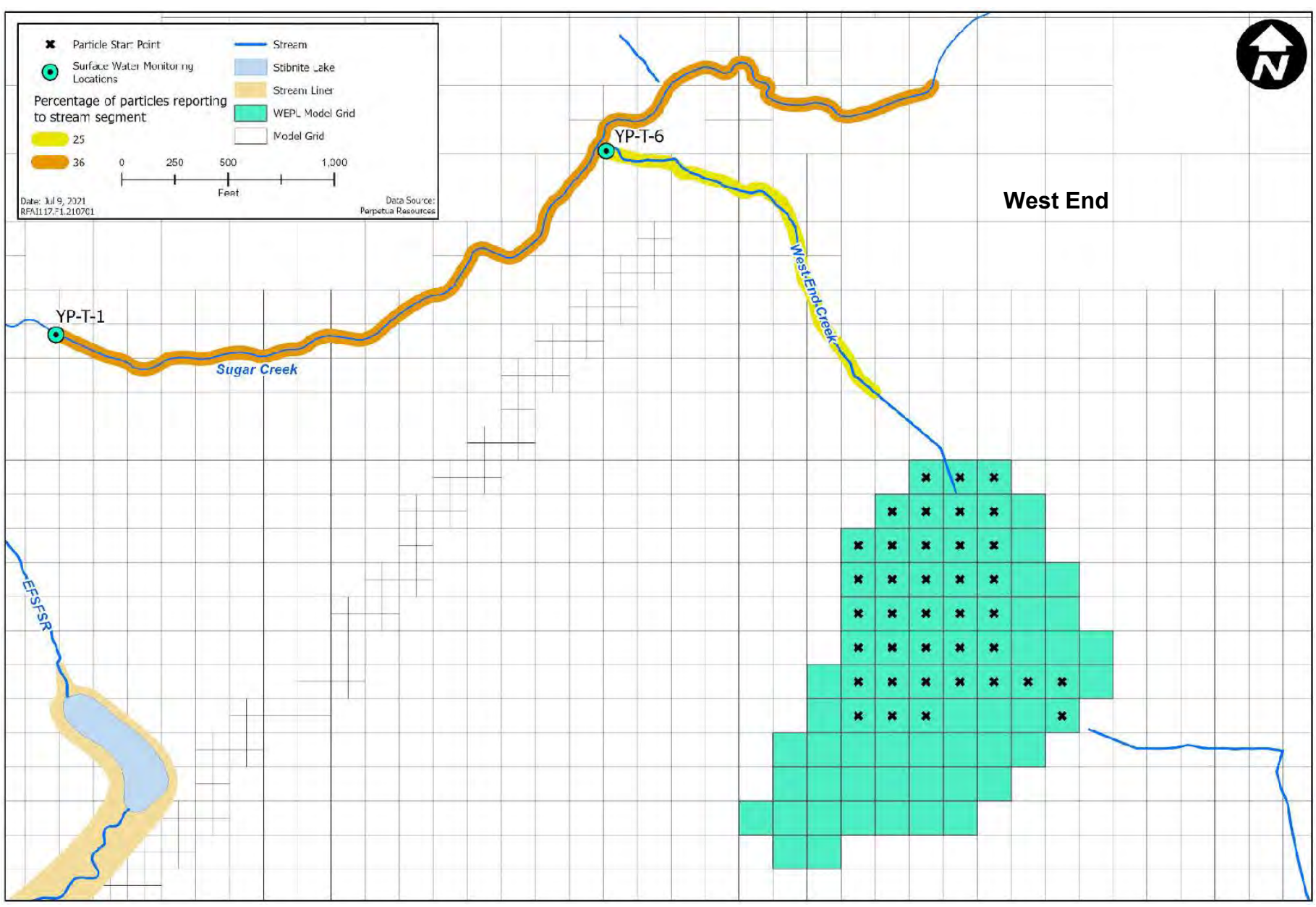
Surface Water Chemistry

The results of the individual facility water chemistry models for the TSF, TSF Buttress, the backfilled Hangar Flats, Yellow Pine and Midnight pits, West End pit lake, and WTP effluent water quality were incorporated into a site-wide water chemistry (SWWC) model to provide an overall prediction of surface water concentrations in Meadow Creek, the East Fork SFSR, West End Creek and Sugar Creek (SRK 2021a). The water chemistry models were coupled with surface and groundwater flow predictions from the site-wide water balance and hydrogeological model (Brown and Caldwell 2021a, 2021e). The SWWC model quantifies surface water analyte concentrations at a series of prediction nodes downgradient of the mine facilities (**Figure 4.9-21**).

Constituent leaching from haul roads and access roads by meteoric and snowmelt runoff was evaluated using the site-wide water balance to estimate flows and humidity cell data to estimate runoff water chemistry. Details of the assessment can be found in SRK 2021a. Leachate chemistry from road surface materials is predicted have circumneutral pH with analyte concentrations below surface water standards. Use of chemical additives for dust control on roadways is not expected to add constituents to surface water. Dust control products, such as magnesium chloride, lignin sulfonate, or other appropriate and environmentally-acceptable products, to further enhance dust control at the site would be incorporated. The Forest Service would require that where haul roads pass within 25 feet (slope distance) of surface water, dust abatement would only be applied to a 10-foot swath down the centerline of the road. The rate and quantity of application would be regulated to ensure the chemical is absorbed before leaving the road surface. Therefore, effects of haul roads and access roads were not incorporated into the water chemistry modeling but were incorporated into the analysis of sediments and hazardous materials.







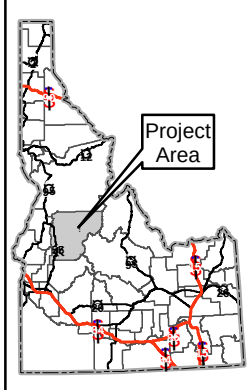
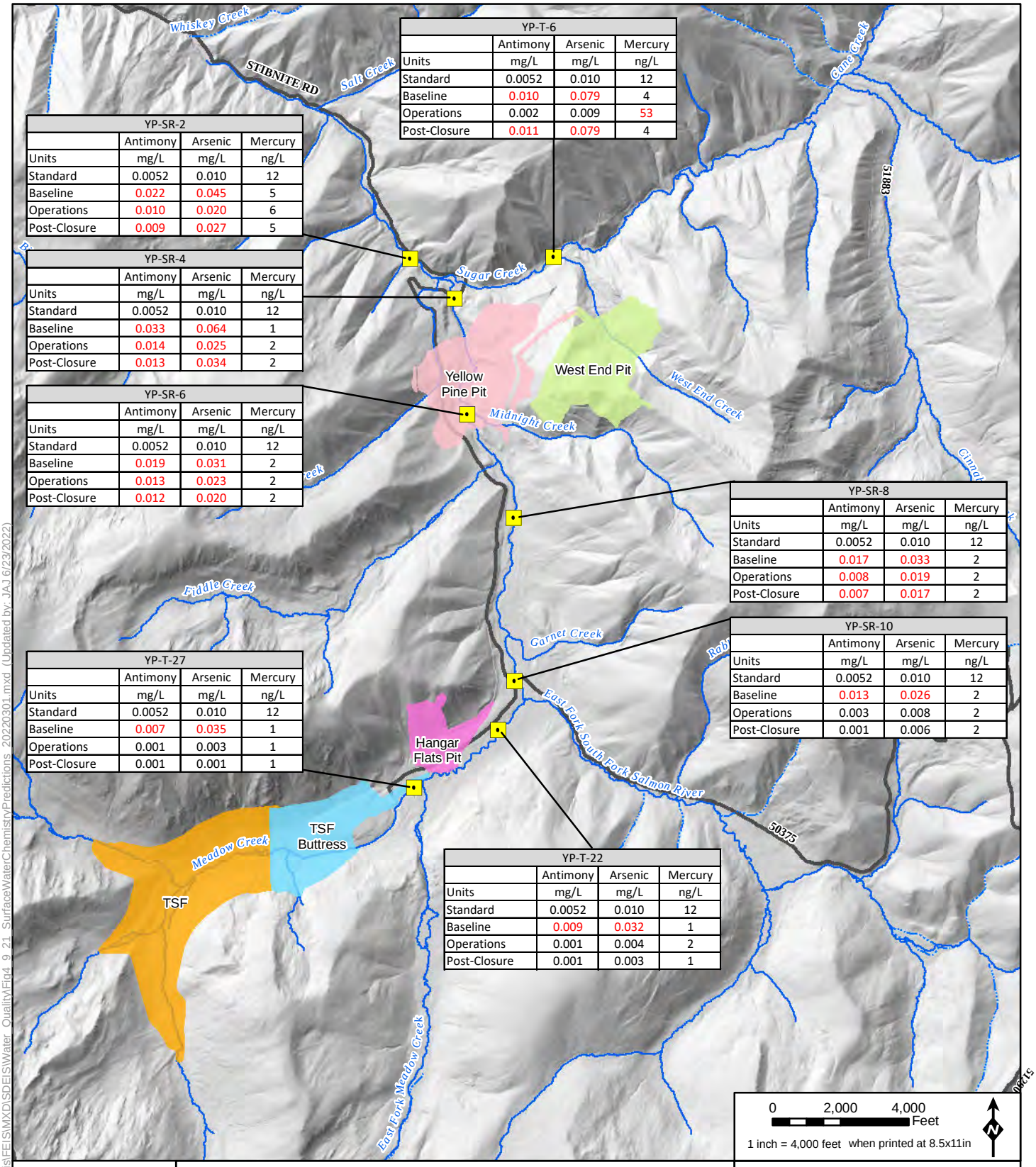


Figure 4.9-20
Predicted Groundwater Discharge to Surface Water

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2020)



YP-T-6	Antimony	Arsenic	Mercury
Units	mg/L	mg/L	ng/L
Standard	0.0052	0.010	12
Baseline	0.010	0.079	4
Operations	0.002	0.009	53
Post-Closure	0.011	0.079	4

YP-SR-2	Antimony	Arsenic	Mercury
Units	mg/L	mg/L	ng/L
Standard	0.0052	0.010	12
Baseline	0.022	0.045	5
Operations	0.010	0.020	6
Post-Closure	0.009	0.027	5

YP-SR-4	Antimony	Arsenic	Mercury
Units	mg/L	mg/L	ng/L
Standard	0.0052	0.010	12
Baseline	0.033	0.064	1
Operations	0.014	0.025	2
Post-Closure	0.013	0.034	2

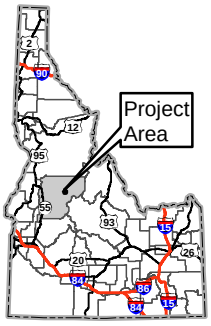
YP-SR-6	Antimony	Arsenic	Mercury
Units	mg/L	mg/L	ng/L
Standard	0.0052	0.010	12
Baseline	0.019	0.031	2
Operations	0.013	0.023	2
Post-Closure	0.012	0.020	2

YP-SR-8	Antimony	Arsenic	Mercury
Units	mg/L	mg/L	ng/L
Standard	0.0052	0.010	12
Baseline	0.017	0.033	2
Operations	0.008	0.019	2
Post-Closure	0.007	0.017	2

YP-SR-10	Antimony	Arsenic	Mercury
Units	mg/L	mg/L	ng/L
Standard	0.0052	0.010	12
Baseline	0.013	0.026	2
Operations	0.003	0.008	2
Post-Closure	0.001	0.006	2

YP-T-27	Antimony	Arsenic	Mercury
Units	mg/L	mg/L	ng/L
Standard	0.0052	0.010	12
Baseline	0.007	0.035	1
Operations	0.001	0.003	1
Post-Closure	0.001	0.001	1

YP-T-22	Antimony	Arsenic	Mercury
Units	mg/L	mg/L	ng/L
Standard	0.0052	0.010	12
Baseline	0.009	0.032	1
Operations	0.001	0.004	2
Post-Closure	0.001	0.003	1



LEGEND

- Prediction Node

Project Components *

SGP Features

- Hangar Flats Pit
- TSF
- TSF Buttress
- West End Pit
- Yellow Pine Pit

Other Features

- Road
- Intermittent Stream
- Perennial Stream

Operations refers to Mine Years -3 through 15.
Post-Closure refers to Mine Years 16 and beyond.

*Mine Site components are associated with 2021 MMP

Figure 4.9-21
Locations for Surface Water Chemistry Predictions
Stibnite Gold Project
Stibnite, ID

Base Layer: Midas Hillshade Raster 10m
Other Data Sources: Perpetua; Boise National Forest; Payette National Forest

Document Path: U:\2037\21981\03_data\gis_cad\gis\FEIS\MXD\SDEIS\Water_Quality\Fig4_9_21_SurfaceWaterChemistryPredictions_20220301.mxd (Updated by: JAJ 6/23/2022)

Construction and operation of the Burntlog Maintenance Facility and the SGLF would have the potential for increased runoff, erosion, sedimentation (as a result of vegetation removal and excavation of soil, rock, and sediment) and fuel and/or material discharge to nearby waterbodies during operations (if not properly stored or contained). However, design features proposed by Perpetua, regulatory and Forest Plan requirements required by the Forest Service, and permit stipulations from state and federal agencies (including BMPs, sanitary wastewater, and SPCC Plan) would control runoff, erosion, sedimentation, and the potential for discharges. Therefore, effects of the Burntlog Maintenance Facility and the SGLF were considered to be negligible to surface water quality analysis.

Predicted water chemistry at the assessment nodes was determined by mixing the predicted mine-impacted water chemistry originated from the modeled project facilities with catchment runoff. Catchment runoff is the proportion of surface water flow derived from meteoric and snow melt runoff. Catchment runoff would consist of runoff from the disturbed ground associated with historical mine facilities and undisturbed native ground. The percentage of disturbed ground within the catchment of each prediction node is summarized in **Table 4.9-16**. Runoff from disturbed and undisturbed ground was assigned water chemistries associated with observed concentrations in water chemistry samples from the area. Additional details for this surface water chemistry modeling can be found in SRK 2021a.

Table 4.9-16 Summary of Disturbed Catchment Percentages

Assessment Node	Watercourse	Disturbed Catchment (% of total catchment)*
YP-T-27	Meadow Creek	0.3
YP-T-22	Meadow Creek	0.4
YP-SR-10	East Fork SFSR	3.0
YP-SR-8	East Fork SFSR	0.9
YP-SR-6	East Fork SFSR	0.8
YP-SR-4	East Fork SFSR	1.5
YP-T-1	Sugar Creek	0.1
YP-SR-2	East Fork SFSR	0.01

*The proportions are not cumulative and are calculated using the disturbed area downstream of upstream assessment locations
Source: SRK 2021a

For predicting future surface water concentrations, disturbance associated with the SODA/Bradley tailings and Hecla Heap was not incorporated because those facilities are proposed to be reclaimed during operations. Conversely, reclamation of the Bradley dumps is not included in the model because that reclamation is not part of the 2021 MMP. Therefore, leachate from the Bradley dumps was incorporated in the model, and recharge estimates were assumed to remain the same as existing conditions during operations and post-operations.

To minimize the volumes of contact water encountering project disturbance and requiring treatment, the project would divert upstream non-contact water to prevent it from interacting with SGP facilities during operations. **Table 4.9-17** provides a summary of the non-contact diversion channels that are considered in

the SWWC model. At closure, the diversion channels would be decommissioned, and non-contact water would follow its natural drainage pathways.

Table 4.9-17 Summary of Diversion Channels included in the Surface Water Chemistry Model

Diversion Channel	Description
North Diversion	Diverts non-contact runoff from the north of the TSF and TSF Buttress to Meadow Creek
South Diversion	Diverts Meadow Creek and its tributaries from the south and west of the TSF around the TSF
Hennessy Diversion	Diverts water from Hennessy Creek away from the Yellow Pine pit to Fiddle Creek
Midnight Diversion	Diverts Midnight Creek away from the Yellow Pine pit to the East Fork SFSR
West End Diversion	Diverts upper West End Creek around the West End pit
East Fork SFSR Tunnel	Diverts the East Fork SFSR around the Yellow Pine pit downstream of YP-SR-6 to upstream of YP-SR-4

Source: SRK 2021a

Predicted surface water concentrations at node YP-T-22 on Meadow Creek downstream of the TSF and TSF Buttress are lower for most analytes compared to existing conditions (**Table 4.9-18** and **Figure 4.9-22**). This prediction is related to the removal of historical unlined mine waste disposal areas from the Meadow Creek drainage and the construction of lined and covered facilities as part of the project. The exception to the reduced analyte concentrations are mercury concentrations which exhibit some variability during the operational and early closure periods attributable to predicted variations in effluent chemistry from the water treatment plant. Predicted long-term surface water mercury concentrations are comparable to the existing conditions at the location. Mercury concentrations remain below the most stringent applicable water quality standard under existing conditions and throughout the construction, operating and post-closure periods.

Immediately downstream of the Yellow Pine pit on the East Fork SFSR at node YP-SR-4 (above the confluence with Sugar Creek), predicted surface water chemistry is similar to existing conditions with some variability in predicted antimony, arsenic, and mercury concentrations during the operating and initial closure period (**Table 4.9-19** and **Figure 4.9-23**). Compared to existing conditions, predicted surface water antimony concentrations are lower during the operating period due to the removal of unlined legacy mine wastes then increase slightly post-closure to a concentration below existing conditions as discharging groundwater chemistry is modified by interaction with the Yellow Pine pit backfill. Similarly, predicted arsenic concentrations decrease relative to existing conditions during the operating period then recover to a concentration below existing conditions in the post-closure period. Lastly, predicted mercury concentrations are slightly higher than existing conditions during the operating period due to variability in predicted effluent chemistry from the water treatment plant, then return to concentrations slightly higher than existing conditions post-closure. However, mercury concentrations remain below the most stringent applicable water quality standard under existing conditions and throughout the construction, operating and post-closure periods.

Table 4.9-18 Summary of Predicted Concentrations at YP-T-22

Parameter	Units	*Strictest Potentially Applicable Surface Water Quality Criteria*	Existing Conditions Mine Year -37 to -3			Open Pit Mining Mine Year -2 to 12			Post-Mining during Water Treatment Mine Year 13 to 40			Post-Mining no Water Treatment Mine Year 41 to 112		
			Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum
pH	mg/L	*6.5 - 9*	7.2	6.9	7.3	7.2	6.9	7.3	7.1	6.6	7.3	7.0	6.6	7.3
Total Alkalinity	mg/L	*>20*	46	24	58	34	18	48	33	18	42	31	18	39
Ag	mg/L	*0.0007*	0.00001	0.0000099	0.000011	0.000012	0.0000099	0.000048	0.000018	0.000010	0.00004	0.000019	0.00001	0.000042
Al	mg/L	*0.05*	0.011	0.006	0.026	0.012	0.0069	0.027	0.012	0.0062	0.027	0.011	0.0061	0.025
As	mg/L	*0.01*	0.032	0.004	0.075	0.0038	0.0014	0.018	0.003	0.0012	0.0134	0.0025	0.0012	0.0037
B	mg/L	-	0.01	0.0074	0.012	0.016	0.0082	0.09	0.016	0.008	0.045	0.011	0.0065	0.012
Ba	mg/L	*2.0*	0.0048	0.0026	0.0068	0.0058	0.0039	0.012	0.0061	0.003	0.0126	0.0048	0.003	0.0067
Be	mg/L	-	0.0000096	0.0000091	0.00001	0.000011	0.0000088	0.000025	0.000063	0.0000099	0.000343	0.000016	0.00001	0.000035
Ca	mg/L	-	14	6.3	18	9.5	5.2	14	8.7	4.5	12	8.1	4.5	11
Cd	mg/L	*0.00033*	0.0000097	0.0000094	0.000011	0.000011	0.0000096	0.000033	0.000012	0.0000095	0.000024	0.000014	0.00001	0.000024
Cl	mg/L	*230*	2.3	0.24	5.4	0.34	0.16	2.1	0.2	0.15	0.3	0.19	0.14	0.25
Co	mg/L	-	0.00018	0.000021	0.0004	0.000052	0.00001	0.00042	0.000509	0.00001	0.003352	0.000019	0.00001	0.000028
Cr	mg/L	*0.0106*	0.0002	0.00013	0.00028	0.0002	0.00010	0.001	0.00025	0.000089	0.00082	0.00014	0.000074	0.00029
Cu	mg/L	*0.002*	0.00034	0.00016	0.002	0.00028	0.00018	0.0013	0.00029	0.00014	0.00067	0.00022	0.00013	0.00029
F	mg/L	*2.0*	0.11	0.085	0.15	0.14	0.095	0.24	0.13	0.085	0.15	0.12	0.078	0.15
Fe	mg/L	*0.3*	0.053	0.0095	0.14	0.014	0.0083	0.027	0.014	0.0081	0.02	0.012	0.008	0.017
Hg	mg/L	*0.000012*	0.000001	0.00000048	0.0000023	0.0000015	0.00000068	0.0000049	0.0000012	0.00000059	0.0000023	0.0000011	0.00000057	0.000002
K	mg/L	-	0.97	0.55	1.4	0.75	0.5	2.9	0.6	0.47	0.8	0.62	0.46	0.74
Mg	mg/L	-	2.1	1.0	3.1	1.7	0.88	4.5	1.5	0.8	2	1.4	0.79	1.8
Mn	mg/L	*0.05*	0.024	0.001	0.056	0.0032	0.001	0.017	0.0019	0.00073	0.005	0.0014	0.00072	0.002
Mo	mg/L	-	0.0011	0.00059	0.0014	0.0011	0.00053	0.0083	0.0019	0.00053	0.008	0.0026	0.00095	0.0079
Na	mg/L	-	2.7	1.5	3.8	2.3	1.4	6.4	2	1.3	4	1.8	1.3	2.1
Ni	mg/L	*0.024*	0.00018	0.00011	0.00022	0.00026	0.0001	0.0027	0.0008	0.0001	0.0033	0.00084	0.00014	0.003
P	mg/L	-	0.02	0.012	0.025	0.021	0.015	0.12	0.048	0.017	0.185	0.026	0.018	0.047
Pb	mg/L	*0.0009*	0.000018	0.0000097	0.00011	0.000032	0.00001	0.00034	0.000022	0.0000093	0.000071	0.000012	0.0000083	0.000017
Sb	mg/L	*0.0052*	0.0092	0.0014	0.025	0.0012	0.00029	0.014	0.00074	0.00029	0.0056	0.00055	0.00029	0.00102
Se	mg/L	*0.0031*	0.0005	0.0005	0.00051	0.0005	0.00038	0.00061	0.0005	0.00032	0.00067	0.00046	0.00032	0.0005
SO_4	mg/L	*250*	6.3	2.1	12	3.6	1.4	12	3.2	1.4	7	2.6	1.4	3.7
Tl	mg/L	*0.000017*	0.00001	0.00001	0.000011	0.00001	0.0000077	0.000011	0.00001	0.0000065	0.000012	0.0000096	0.0000064	0.000011
V	mg/L	-	0.00022	0.00015	0.00029	0.00021	0.00015	0.00034	0.00067	0.0001	0.00351	0.00018	0.0001	0.00027
Zn	mg/L	*0.054*	0.00081	0.00046	0.0018	0.001	0.00048	0.0067	0.00115	0.00038	0.0039	0.00063	0.00034	0.0018
TDS	mg/L	*500*	57	27	80	40	21	82	37	20	51	34	20	43
NO2 + NO3	mg/L as N	-	0.5	0.32	0.58	0.7	0.3	11	0.44	0.26	0.58	0.42	0.25	0.56

Source: SRK 2021a
Average, minimum and maximum values are calculated based on the monthly predicted concentrations over the indicated time period.
Shading indicates value is greater than Strictest Potentially Applicable Surface Water Quality Criteria.

Table 4.9-19 Summary of Predicted Concentrations at YP-SR-4

Parameter	Units	*Strictest Potentially Applicable Surface Water Quality Criteria*	Existing Conditions Mine Year -37 to -3			Open Pit Mining Mine Year -2 to 12			Post-Mining during Water Treatment Mine Year 13 to 40			Post-Mining no Water Treatment Mine Year 41 to 112		
			Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum
pH	mg/L	*6.5 - 9*	7.3	7.0	7.5	7.3	7.0	7.5	7.3	7.0	7.5	7.3	6.9	7.4
Total Alkalinity	mg/L	*>20*	45	26	60	51	24	68	46	24	65	44	24	60
Ag	mg/L	*0.0007*	0.00001	0.0000098	0.000011	0.00001	0.0000063	0.000012	0.000011	0.0000063	0.000031	0.00001	0.0000057	0.000017
Al	mg/L	*0.05*	0.0091	0.0066	0.019	0.0086	0.004	0.019	0.0074	0.0043	0.02	0.007	0.0039	0.019
As	mg/L	*0.01*	0.064	0.019	0.12	0.025	0.013	0.097	0.035	0.013	0.063	0.034	0.014	0.06
B	mg/L	*-*	0.011	0.0096	0.012	0.013	0.0065	0.029	0.014	0.009	0.043	0.011	0.009	0.023
Ba	mg/L	*2.0*	0.014	0.006	0.021	0.0093	0.0055	0.019	0.0083	0.0053	0.013	0.008	0.0053	0.01
Be	mg/L	*-*	0.000012	0.00001	0.000015	0.00001	0.0000085	0.000014	0.000022	0.0000095	0.000083	0.000012	0.00001	0.000017
Ca	mg/L	*-*	15	6.7	18	13	6.3	17	10	5.9	16	10	5.9	15
Cd	mg/L	*0.00033*	0.00001	0.0000098	0.000011	0.000011	0.0000059	0.000018	0.000011	0.0000075	0.000023	0.00001	0.0000068	0.000015
Cl	mg/L	*230*	0.8	0.29	1.2	0.32	0.17	0.85	0.45	0.17	0.8	0.45	0.18	0.7
Co	mg/L	*-*	0.000096	0.000027	0.0002	0.000081	0.000015	0.00029	0.000174	0.000015	0.00085	0.000064	0.000013	0.00015
Cr	mg/L	*0.0106*	0.0002	0.00015	0.00029	0.00022	0.00011	0.00048	0.0002	0.00013	0.00045	0.00016	0.00012	0.00031
Cu	mg/L	*0.002*	0.00034	0.00021	0.0014	0.00034	0.00017	0.0012	0.0003	0.00017	0.00093	0.00027	0.00017	0.00083
F	mg/L	*2.0*	0.11	0.092	0.15	0.12	0.053	0.16	0.1	0.079	0.17	0.1	0.074	0.15
Fe	mg/L	*0.3*	0.027	0.013	0.041	0.015	0.01	0.027	0.014	0.0105	0.016	0.013	0.0109	0.015
Hg	mg/L	*0.000012*	0.0000012	0.00000017	0.000003	0.000002	0.00000046	0.0000034	0.0000019	0.000001	0.0000034	0.0000016	0.00000091	0.0000033
K	mg/L	*-*	0.92	0.58	1.1	0.9	0.56	1.3	0.76	0.55	1.4	0.72	0.55	1.0
Mg	mg/L	*-*	3.8	1.3	4.8	3.3	1.3	5.0	2.7	1.3	5	2.5	1.3	4.2
Mn	mg/L	*0.05*	0.022	0.0043	0.044	0.0043	0.00083	0.05	0.0053	0.0009	0.011	0.0054	0.00092	0.012
Mo	mg/L	*-*	0.00093	0.00052	0.0015	0.0013	0.00062	0.0037	0.0014	0.00061	0.007	0.0014	0.00088	0.0031
Na	mg/L	*-*	2.7	1.5	3.5	2.5	1.4	4.5	2.5	1.4	8	2.3	1.4	3.0
Ni	mg/L	*0.024*	0.00027	0.00011	0.0004	0.00032	0.00011	0.0012	0.00042	0.00011	0.00106	0.0004	0.00021	0.001
P	mg/L	*-*	0.028	0.018	0.039	0.02	0.014	0.036	0.024	0.014	0.054	0.019	0.013	0.028
Pb	mg/L	*0.0009*	0.000018	0.000011	0.00008	0.000034	0.00001	0.00014	0.000055	0.000013	0.0002	0.00004	0.000011	0.00018
Sb	mg/L	*0.0052*	0.033	0.0077	0.056	0.014	0.0049	0.063	0.013	0.005	0.023	0.013	0.0054	0.023
Se	mg/L	*0.0031*	0.0005	0.00049	0.00051	0.00049	0.00025	0.00051	0.00039	0.00029	0.00051	0.00038	0.00026	0.00049
SO_4	mg/L	*250*	16	2.5	32	5.7	1.7	26	6.8	1.7	17	6.5	1.8	9.9
Tl	mg/L	*0.000017*	0.000012	0.00001	0.000013	0.000011	0.0000056	0.000014	0.0000085	0.0000063	0.000013	0.0000083	0.0000058	0.000013
V	mg/L	*-*	0.00017	0.00014	0.00022	0.00017	0.000127	0.00021	0.00027	0.00013	0.00087	0.00016	0.00013	0.00021
Zn	mg/L	*0.054*	0.0014	0.00065	0.0018	0.0011	0.00054	0.0031	0.0012	0.00064	0.0042	0.001	0.00061	0.002
TDS	mg/L	*500*	67	29	97	57	26	98	52	26	88	50	26	71
NO2 + NO3	mg/L as N	*-*	0.42	0.27	0.62	0.6	0.32	2.3	0.44	0.36	0.65	0.43	0.35	0.56

Source: SRK 2021a
Average, minimum and maximum values are calculated based on the monthly predicted concentrations over the indicated time period.
Shading indicates value is greater than Strictest Potentially Applicable Surface Water Quality Criteria.

Immediately downstream of the West End pit on West End Creek at node YP-T-6 (above the confluence with Sugar Creek), predicted surface water chemistry is modified by diversion of West End Creek around the pit area and predicted operational period water chemistry is based observed analyte concentrations in West End Creek above the pit area (**Table 4.9-20** and **Figure 4.9-24**). Compared to existing conditions, predicted surface water antimony concentrations are lower during the operating period due to the creek diversion then return to existing conditions during the closure period as a result of West End pit lake chemistry effects on surface water and groundwater. Similarly, predicted arsenic concentrations decrease relative to existing conditions during the operating period then recover to existing conditions in the post-closure period. Lastly, predicted mercury concentrations are an order of magnitude higher than existing conditions during the operating period due to the observed upper West End Creek concentrations, then return to existing conditions post-closure. During operations, mercury concentrations are greater than the most stringent applicable water quality standard because the surface water in upper West End Creek is above the standard under existing conditions. Post-closure mercury concentrations return to a level below the most stringent applicable water quality standard.

Downstream of the project on the East Fork SFSR at node YP-SR-2 (below the confluence with Sugar Creek), predicted surface water chemistry is largely unchanged from existing conditions with some variability in predicted antimony, arsenic, and mercury concentrations during the operating and initial closure period (**Table 4.9-21** and **Figure 4.9-25**). Compared to existing conditions, predicted surface water antimony concentrations are lower during the operating period due to the removal of unlined legacy mine wastes then increase slightly post-closure to a concentration below existing conditions as recovering groundwater levels result in increased discharge to surface water. Similarly, predicted arsenic concentrations decrease relative to existing conditions during the operating period then recover to a concentration comparable to existing conditions in the post-closure period. Lastly, predicted mercury concentrations are slightly higher than existing conditions during the operating period due to variability in predicted effluent chemistry from the water treatment plant, then return to concentrations comparable to existing conditions post-closure. However, mercury concentrations remain below the most stringent applicable water quality standard under existing conditions and throughout the construction, operating and post-closure periods.

During operations, West End Creek would be diverted around the operations associated with the West End pit. Under existing conditions West End Creek has antimony and arsenic concentrations above stream surface water standards. Existing mercury concentrations in West End Creek are greater than standards above the West End pit area (approximately 50 ng/L) and less than standards below the pit area (approximately 4 ng/L). This suggests that a naturally-occurring mechanism reduces mercury concentrations in the creek between the sample locations upstream and downstream of the pit area.

Diversion of West End Creek around the pit area during operations has the potential to affect the naturally-occurring reduction in mercury concentrations, allowing higher upstream concentrations to appear in the downstream segment. Therefore, water chemistry forecasting conservatively utilizes the higher mercury concentrations from upstream of the pit area in assessing West End Creek and downstream mercury concentrations (SRK 2021a). However, predicted downstream mercury concentrations remain lower than surface water standards.

During the construction, operations, and post-closure periods, predicted water chemistry in Sugar Creek differs very little from baseline conditions (SRK 2021a). A slight predicted decrease in antimony concentrations (0.004 mg/L to 0.003 mg/L), a slight predicted increase in arsenic concentrations (0.013 mg/L to 0.014 mg/L), and a slight predicted increase in mercury concentrations (6 ng/L to 8 ng/L) are predicted in association with the closure of the Bailey Tunnel and the removal of its contributions to Sugar Creek chemistry plus the arrival of groundwater outflow from the West End pit lake in the post-closure period (SRK 2021a). Existing upstream contributions from Cinnabar Creek, a tributary to Sugar Creek, would continue to exert control on predicted Sugar Creek mercury concentrations in the operational and post-closure periods.

Effects of the project on surface water concentrations are expected to be negligible relative to applicable standards and calculated human health criteria, permanent, and localized. Effects of chemistry changes on fish and human health are described in **Sections 4.12.2** and **4.18.2**, respectively.

Organic Carbon

Sewage from the planned worker housing facility would be managed via a wastewater treatment plant that would discharge via a surface water outfall directly to the East Fork SFSR. A package plant consisting of a membrane bioreactor or equivalent system would treat the sanitary wastewater to meet applicable IPDES permit standards, and effluent would be discharged in an acceptable manner as approved by the permit. Sewage effluent systems would have waste containment and runoff control structures to prevent escape of untreated waste to the East Fork SFSR. The discharge volume from the wastewater treatment plant would vary between the mine construction, operation, and closure and reclamation periods, depending on the number of workers present at the SGP. However, the overall discharge rate from the plant is expected to be small relative to ambient flow in the East Fork SFSR (Brown and Caldwell 2020a).

Surface water quality changes resulting from the wastewater treatment plant discharge have not been calculated through modeling exercises. Qualitatively, operation of the wastewater treatment plant would incrementally increase organic carbon mass loading rates in the Headwater East Fork SFSR subwatershed. But the overall impact on organic carbon concentrations in the river are expected to be low given the small volume of wastewater effluent relative to average streamflow, and the planned adherence to IPDES permit limits for the treated water discharge.

Effects of the SGP on organic carbon in surface water are expected to be minor, long-term, and localized. An incremental increase in organic carbon content due to wastewater effluent (as described above) would yield an incremental increase in methylation potential (see below).

Aerial Deposition

Air emissions from the project have the potential to contribute metals to the ground surface via wet and dry deposition that have the potential to affect surface water chemistry. Most of these contributions would be in the form of particulate matter, but a portion of the local aerial deposition of mercury may also occur in elemental form. Total mercury emissions from the project are predicted to be approximately 13.6 pounds of mercury per year.

Table 4.9-20 Summary of Predicted Concentrations at YP-T-6

Parameter	Units	*Strictest Potentially Applicable Surface Water Quality Criteria*	Existing Conditions Mine Year -37 to -3			Open Pit Mining Mine Year -2 to 12			Post-Mining during Water Treatment Mine Year 13 to 40			Post-Mining no Water Treatment Mine Year 41 to 112		
			Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum
pH	mg/L	*6.5 - 9*	8.2	8.0	8.4	7.7	7.4	7.9	8.2	8.0	8.4	8.2	8.0	8.4
Total Alkalinity	mg/L	*>20*	122	105	126	123	108	126	121	105	126	122	101	126
Ag	mg/L	*0.0007*	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000011	0.00001	0.000010	0.000011
Al	mg/L	*0.05*	0.0022	0.0013	0.005	0.0033	0.0014	0.004	0.0024	0.0013	0.005	0.0022	0.0013	0.005
As	mg/L	*0.01*	0.079	0.064	0.088	0.0086	0.0078	0.0089	0.079	0.064	0.094	0.079	0.064	0.095
B	mg/L	*-*	0.012	0.011	0.013	0.013	0.011	0.015	0.013	0.011	0.04	0.013	0.011	0.042
Ba	mg/L	*2.0*	0.017	0.016	0.02	0.016	0.014	0.018	0.018	0.016	0.02	0.017	0.015	0.02
Be	mg/L	*-*	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000010	0.0000085	0.00001	0.0000099	0.0000078	0.00001
Ca	mg/L	*-*	42	38	54	31	28	34	43	34	54	42	32	54
Cd	mg/L	*0.00033*	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.000018	0.00001	0.00001	0.000018
Cl	mg/L	*230*	0.2	0.19	0.21	0.18	0.15	0.19	0.2	0.19	0.28	0.2	0.19	0.29
Co	mg/L	*-*	0.000032	0.00001	0.00005	0.000015	0.00001	0.000023	0.000029	0.00001	0.00005	0.000033	0.00001	0.00005
Cr	mg/L	*0.0106*	0.00022	0.0001	0.00037	0.00033	0.00029	0.00048	0.00022	0.0001	0.00037	0.00022	0.000092	0.00037
Cu	mg/L	*0.002*	0.00025	0.00015	0.0005	0.00013	0.00011	0.00017	0.00026	0.00015	0.00057	0.00026	0.00015	0.00057
F	mg/L	*2.0*	0.13	0.11	0.17	0.14	0.11	0.17	0.14	0.11	0.17	0.13	0.099	0.17
Fe	mg/L	*0.3*	0.01	0.0093	0.012	0.011	0.01	0.014	0.01	0.007	0.012	0.01	0.007	0.012
Hg	mg/L	*0.000012*	0.0000043	0.0000037	0.0000056	0.000053	0.000037	0.000063	0.0000044	0.0000037	0.0000097	0.0000043	0.0000037	0.0000095
K	mg/L	*-*	1.9	1.7	2.3	1.1	0.85	1.1	1.9	1.7	2.3	1.9	1.6	2.3
Mg	mg/L	*-*	17	15	22	10	9.0	11	18	15	22	17	14	22
Mn	mg/L	*0.05*	0.00074	0.0005	0.00081	0.00093	0.00053	0.0013	0.00074	0.0005	0.0018	0.00078	0.0005	0.002
Mo	mg/L	*-*	0.0017	0.0015	0.0019	0.00009	0.00005	0.00012	0.0017	0.0013	0.0019	0.0017	0.0012	0.0019
Na	mg/L	*-*	1.1	0.91	1.3	0.34	0.32	0.36	1.1	0.91	1.3	1.1	0.9	1.3
Ni	mg/L	*0.024*	0.00035	0.00025	0.00052	0.00016	0.0001	0.00027	0.00033	0.00024	0.00052	0.00035	0.0002	0.00052
P	mg/L	*-*	0.019	0.017	0.022	0.018	0.016	0.023	0.019	0.017	0.022	0.019	0.017	0.022
Pb	mg/L	*0.0009*	0.000013	0.00001	0.000028	0.00001	0.00001	0.000013	0.000017	0.00001	0.00024	0.000019	0.00001	0.00025
Sb	mg/L	*0.0052*	0.01	0.0079	0.012	0.0021	0.0018	0.0022	0.01	0.0079	0.014	0.011	0.0079	0.014
Se	mg/L	*0.0031*	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.00043	0.0005	0.0005	0.00039	0.0005
SO_4	mg/L	*250*	55	38	94	0.82	0.65	0.9	56	36	94	54	30	94
Tl	mg/L	*0.000017*	0.000012	0.00001	0.000014	0.000011	0.00001	0.000013	0.000011	0.0000095	0.000014	0.000012	0.0000083	0.000014
V	mg/L	*-*	0.00021	0.0001	0.00023	0.00019	0.00017	0.00025	0.0002	0.0001	0.00023	0.00021	0.0001	0.00023
Zn	mg/L	*0.054*	0.00059	0.00048	0.00085	0.00056	0.00044	0.0008	0.00063	0.00048	0.002	0.00062	0.00048	0.0021
TDS	mg/L	*500*	192	158	250	119	105	129	194	152	251	191	140	251
NO2 + NO3	mg/L as N	*-*	0.69	0.53	0.89	1.0	0.28	6.0	0.69	0.5	0.89	0.69	0.43	0.89

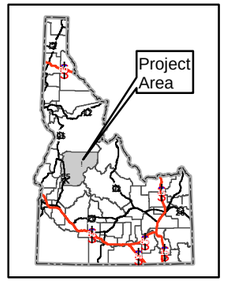
Source: SRK 2021a
Average, minimum and maximum values are calculated based on the monthly predicted concentrations over the indicated time period.
Shading indicates value is greater than Strictest Potentially Applicable Surface Water Quality Criteria.

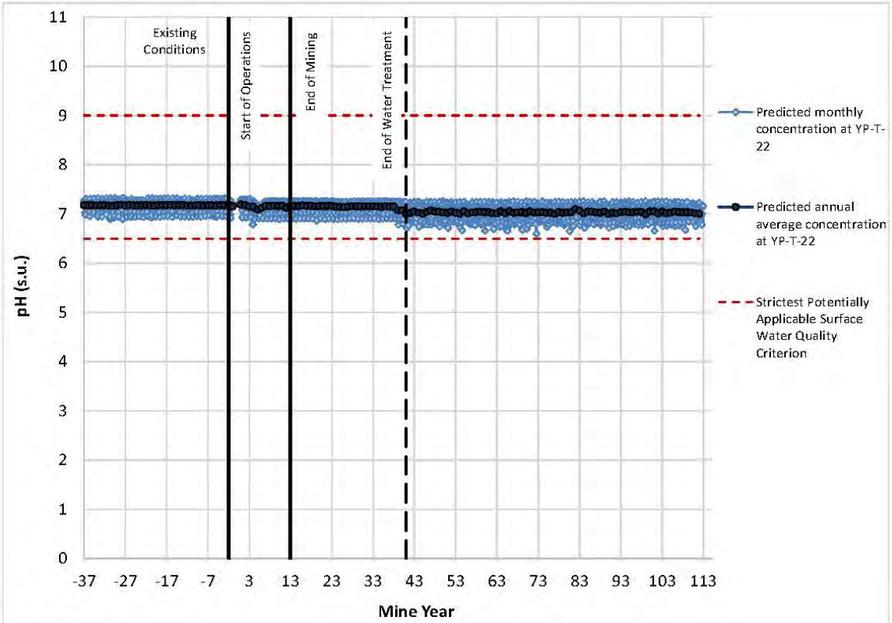
Table 4.9-21 Summary of Predicted Concentrations at YP-SR-2

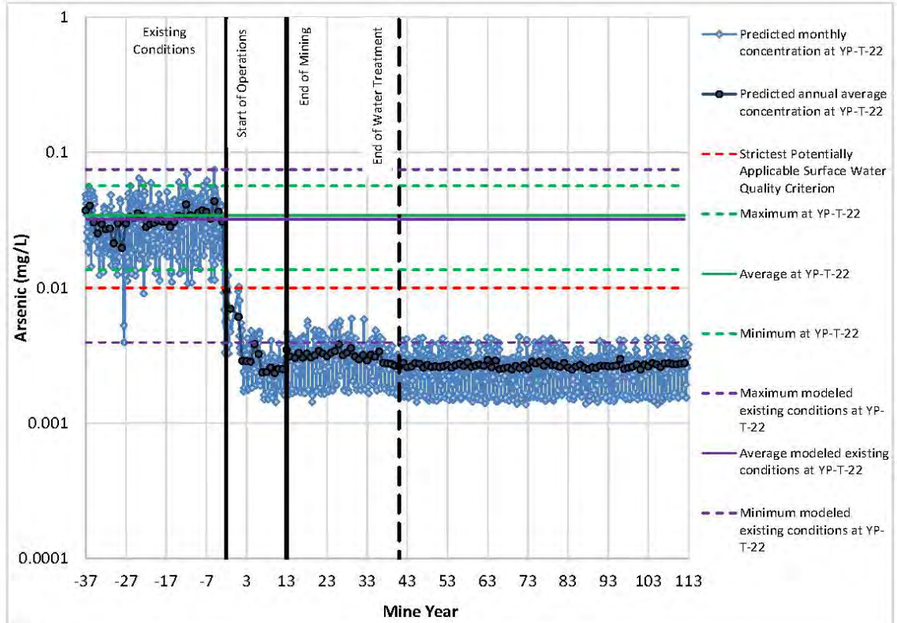
Parameter	Units	*Strictest Potentially Applicable Surface Water Quality Criteria*	Existing Conditions Mine Year -37 to -3			Open Pit Mining Mine Year -2 to 12			Post-Mining during Water Treatment Mine Year 13 to 40			Post-Mining no Water Treatment Mine Year 41 to 112		
			Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum	Average	Minimum	Maximum
pH	mg/L	*6.5 - 9*	7.3	7.1	7.5	7.3	7.1	7.5	7.3	7.0	7.5	7.3	7.0	7.5
Total Alkalinity	mg/L	*>20*	49	29	60	53	27	64	49	27	63	49	27	60
Ag	mg/L	*0.0007*	0.00001	0.0000099	0.000011	0.00001	0.0000077	0.000012	0.000011	0.0000077	0.000023	0.00001	0.0000074	0.000015
Al	mg/L	*0.05*	0.0079	0.0051	0.017	0.0075	0.0048	0.017	0.0068	0.004	0.017	0.0065	0.0038	0.017
As	mg/L	*0.01*	0.045	0.014	0.076	0.02	0.01	0.066	0.028	0.01	0.045	0.027	0.011	0.047
B	mg/L	*-*	0.012	0.0098	0.017	0.013	0.009	0.024	0.014	0.01	0.032	0.012	0.01	0.021
Ba	mg/L	*2.0*	0.013	0.0067	0.018	0.011	0.0061	0.017	0.0098	0.0058	0.013	0.0096	0.0058	0.011
Be	mg/L	*-*	0.000011	0.00001	0.000013	0.00001	0.0000091	0.000012	0.000018	0.0000097	0.000059	0.000011	0.00001	0.000015
Ca	mg/L	*-*	16	8.3	18	15	7.7	17	13	7.2	17	12	7.3	16
Cd	mg/L	*0.00033*	0.00001	0.0000099	0.00001	0.000011	0.0000075	0.000016	0.000011	0.0000086	0.000018	0.00001	0.0000082	0.000013
Cl	mg/L	*230*	0.58	0.25	0.87	0.28	0.17	0.61	0.36	0.17	0.6	0.36	0.17	0.51
Co	mg/L	*-*	0.000072	0.00002	0.00014	0.00006	0.000013	0.00021	0.000122	0.000013	0.00058	0.000051	0.000012	0.00013
Cr	mg/L	*0.0106*	0.00017	0.00014	0.00023	0.00018	0.00012	0.00037	0.00017	0.00013	0.00033	0.00015	0.00012	0.00025
Cu	mg/L	*0.002*	0.00032	0.00023	0.00098	0.00031	0.0002	0.00077	0.00029	0.0002	0.00064	0.00028	0.0002	0.0006
F	mg/L	*2.0*	0.12	0.11	0.15	0.13	0.086	0.16	0.12	0.1	0.16	0.11	0.09	0.15
Fe	mg/L	*0.3*	0.021	0.012	0.029	0.014	0.011	0.021	0.013	0.01	0.015	0.013	0.011	0.015
Hg	mg/L	*0.000012*	0.0000048	0.0000032	0.0000096	0.0000057	0.0000037	0.00001	0.0000052	0.0000032	0.0000093	0.0000052	0.000003	0.0000094
K	mg/L	*-*	0.87	0.57	1.0	0.85	0.56	1.1	0.77	0.55	1.2	0.75	0.55	0.96
Mg	mg/L	*-*	3.7	1.6	4.4	3.3	1.5	4.5	2.9	1.4	4	2.9	1.5	4.1
Mn	mg/L	*0.05*	0.014	0.0028	0.028	0.0031	0.00073	0.032	0.0038	0.00077	0.008	0.0038	0.00077	0.0085
Mo	mg/L	*-*	0.00099	0.00059	0.0014	0.0012	0.00058	0.0027	0.0013	0.00059	0.0049	0.0013	0.00079	0.0027
Na	mg/L	*-*	2.6	1.5	3.2	2.4	1.5	3.9	2.5	1.5	6	2.3	1.5	2.9
Ni	mg/L	*0.024*	0.00025	0.00011	0.00035	0.00028	0.00011	0.0009	0.00035	0.00011	0.00087	0.00033	0.00018	0.00084
P	mg/L	*-*	0.024	0.018	0.031	0.02	0.015	0.03	0.022	0.015	0.042	0.019	0.015	0.026
Pb	mg/L	*0.0009*	0.000018	0.000011	0.000056	0.000028	0.000011	0.0001	0.000043	0.000021	0.00014	0.000035	0.00002	0.00013
Sb	mg/L	*0.0052*	0.022	0.0052	0.037	0.0097	0.0035	0.041	0.0095	0.0034	0.016	0.0093	0.0038	0.016
Se	mg/L	*0.0031*	0.0005	0.00049	0.00051	0.00049	0.00035	0.0005	0.00043	0.00036	0.00051	0.00042	0.00035	0.00049
SO_4	mg/L	*250*	14	3.2	23	6.7	2.3	20	7.3	2.4	15	7.1	2.5	9.8
Tl	mg/L	*0.000017*	0.000012	0.00001	0.000014	0.000011	0.0000091	0.000014	0.00001	0.0000088	0.000013	0.00001	0.0000087	0.000013
V	mg/L	*-*	0.00016	0.00014	0.00019	0.00016	0.00013	0.0002	0.00022	0.00013	0.00062	0.00015	0.00013	0.00018
Zn	mg/L	*0.054*	0.0011	0.00064	0.0014	0.00093	0.00057	0.0023	0.001	0.00063	0.0029	0.00086	0.0006	0.0015
TDS	mg/L	*500*	67	33	87	61	31	88	57	30	82	56	30	71
NO2 + NO3	mg/L as N	*-*	0.49	0.32	0.71	0.6	0.31	1.7	0.5	0.34	0.72	0.49	0.33	0.72

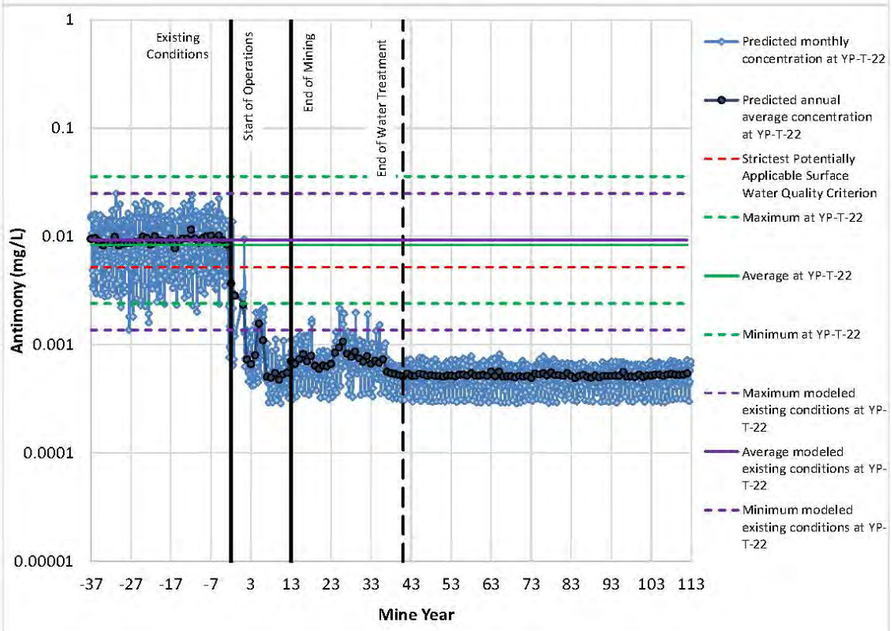
Source: SRK 2021a

Average, minimum and maximum values are calculated based on the monthly predicted concentrations over the indicated time period.
Shading indicates value is greater than Strictest Potentially Applicable Surface Water Quality Criteria.









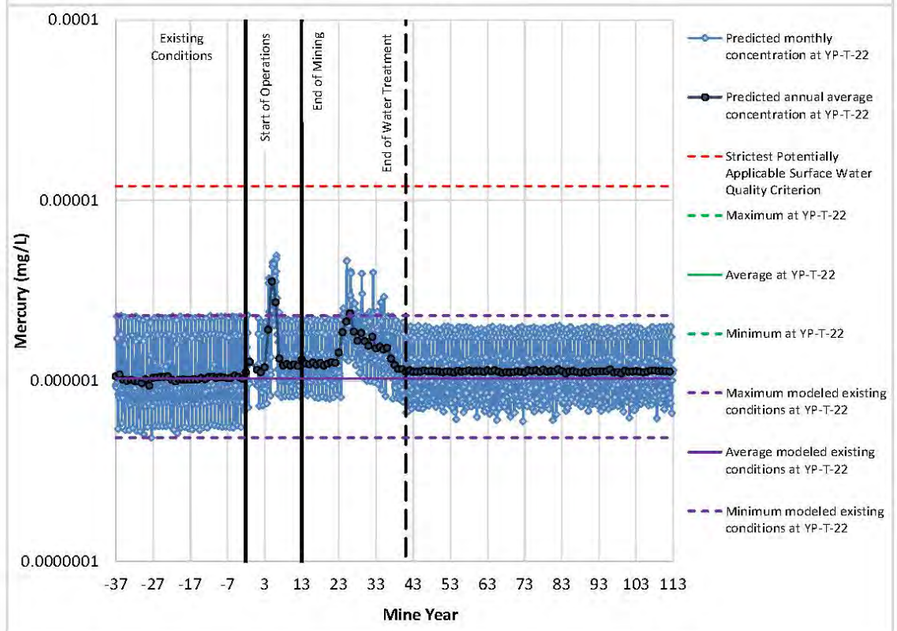
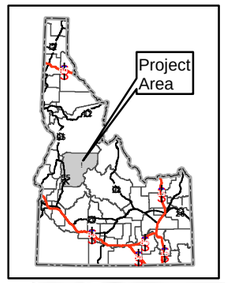
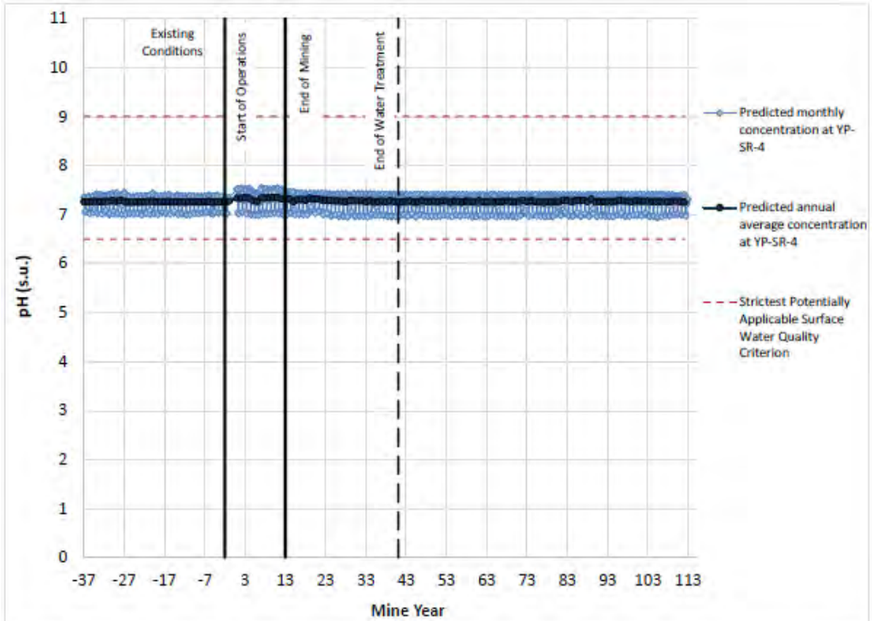


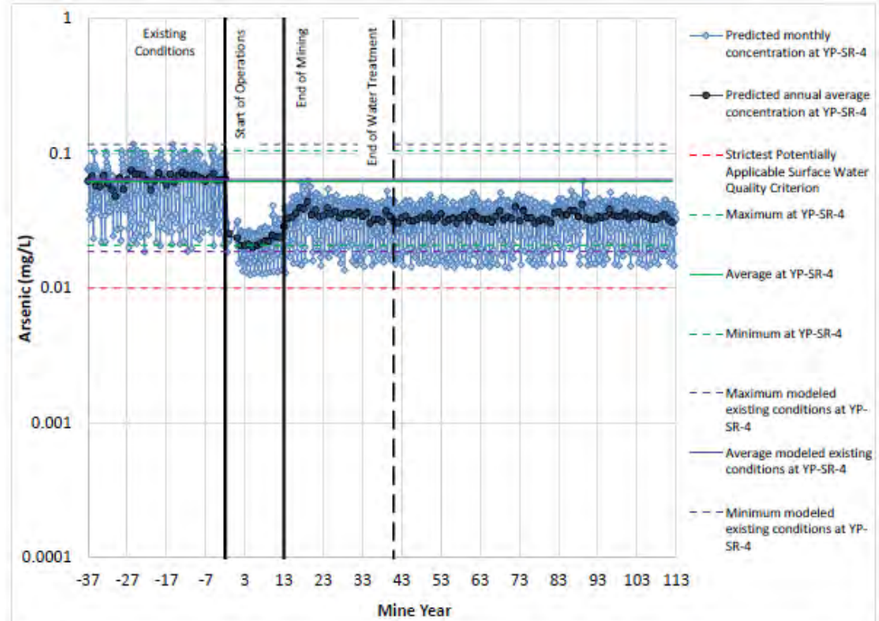
Figure 4.9-22
Predicted Surface Water Chemistry Downstream of the Tailings Storage Facility and Buttress (YP-T-22)

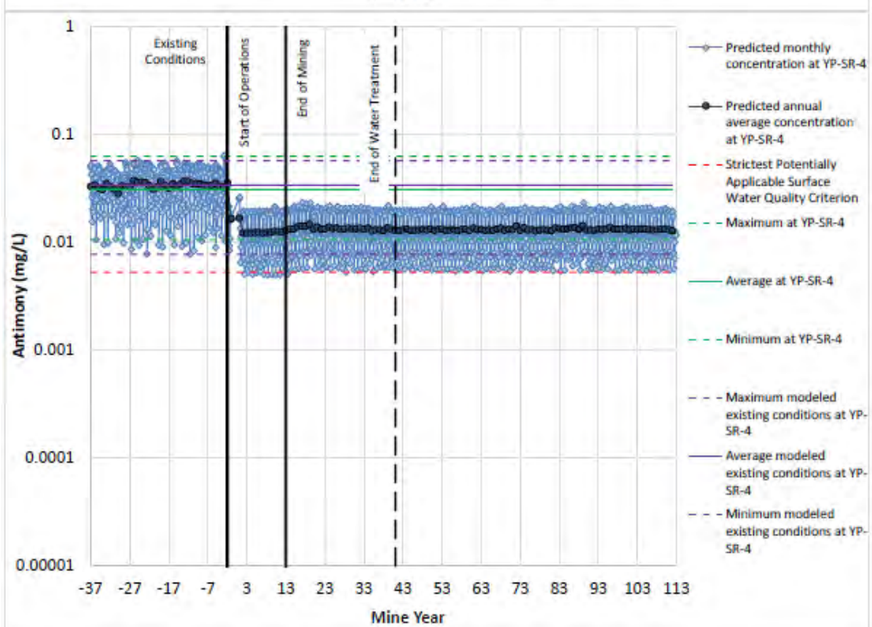
Stibnite Gold Project
Stibnite, ID

Data Sources: (SRK 2021)









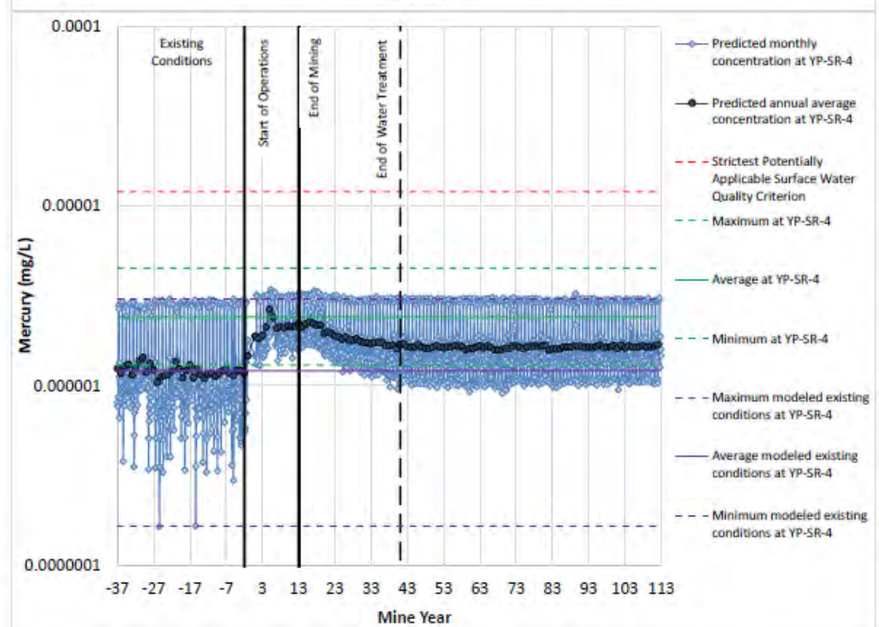
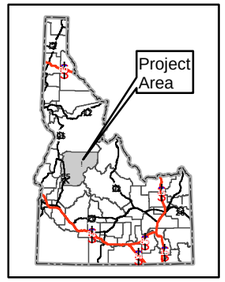
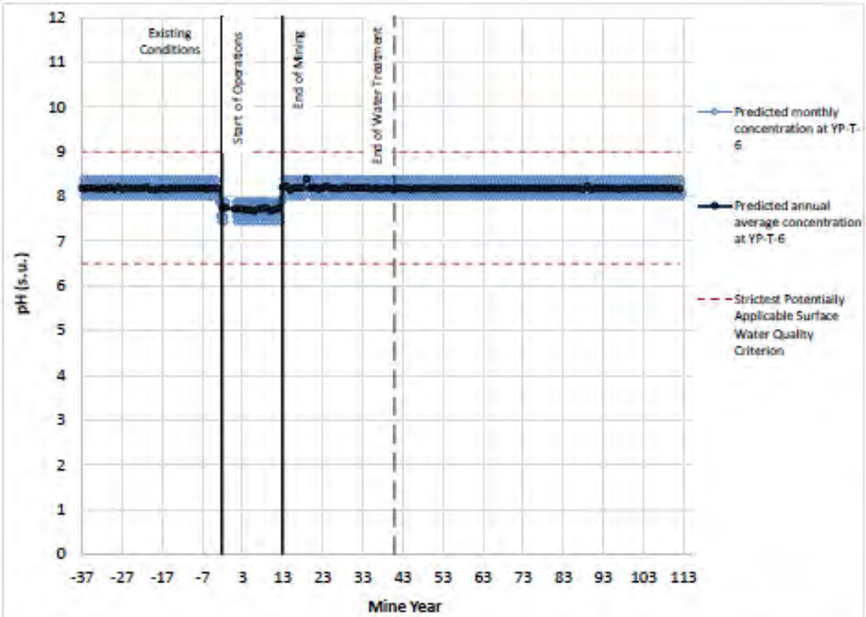
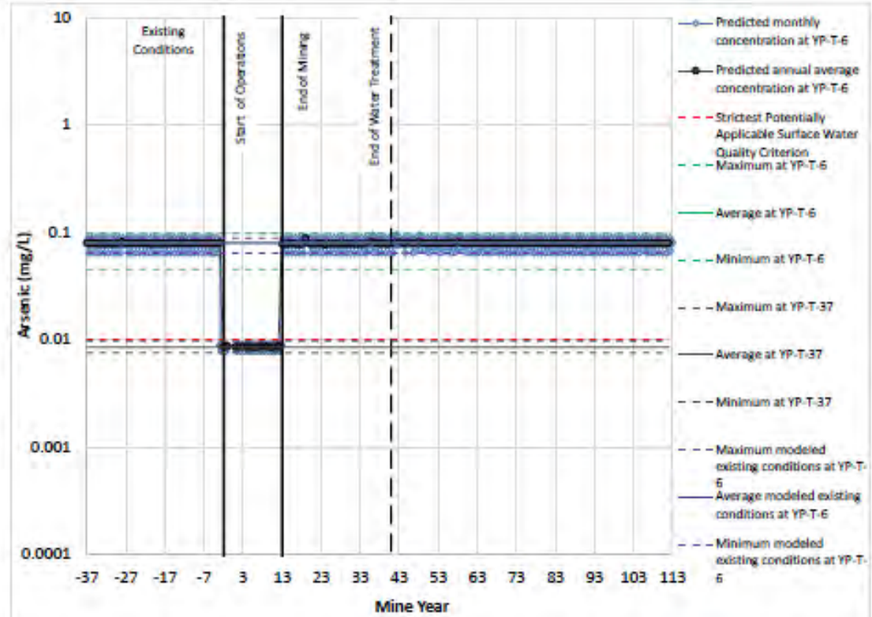


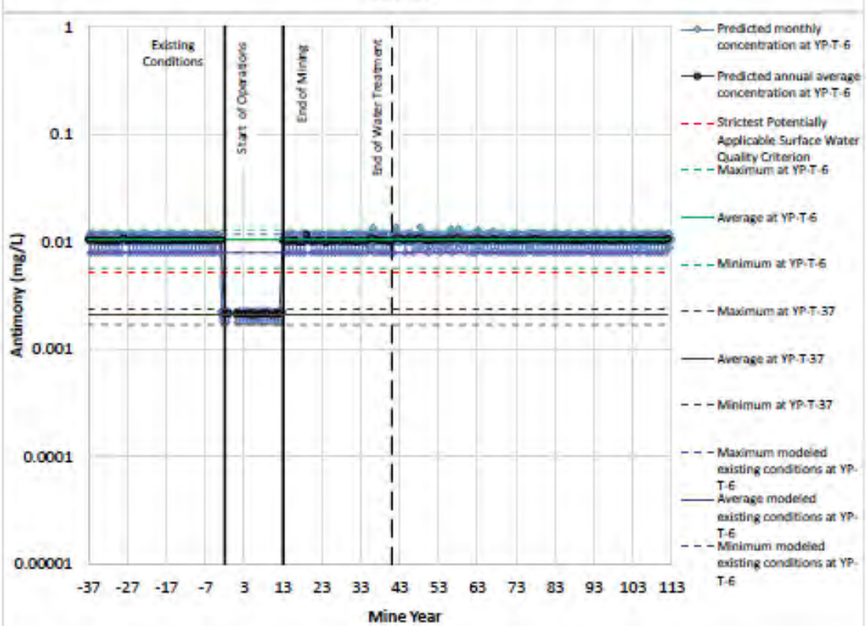
Figure 4.9-23
Predicted Surface Water Chemistry Downstream of Yellow Pine Pit (YP-SR-4)
Stibnite Gold Project

Data Sources: (SRK 2021)









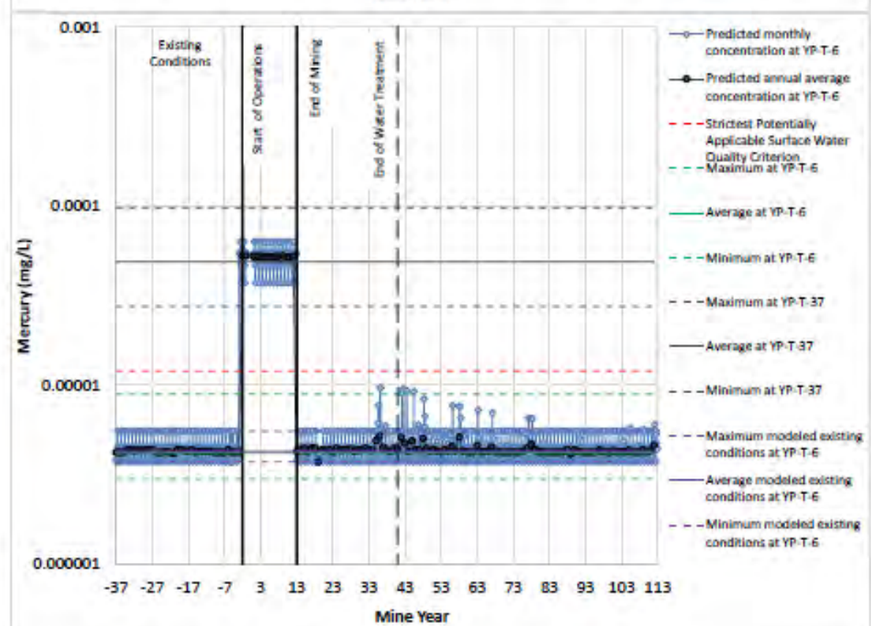
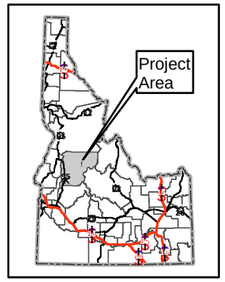
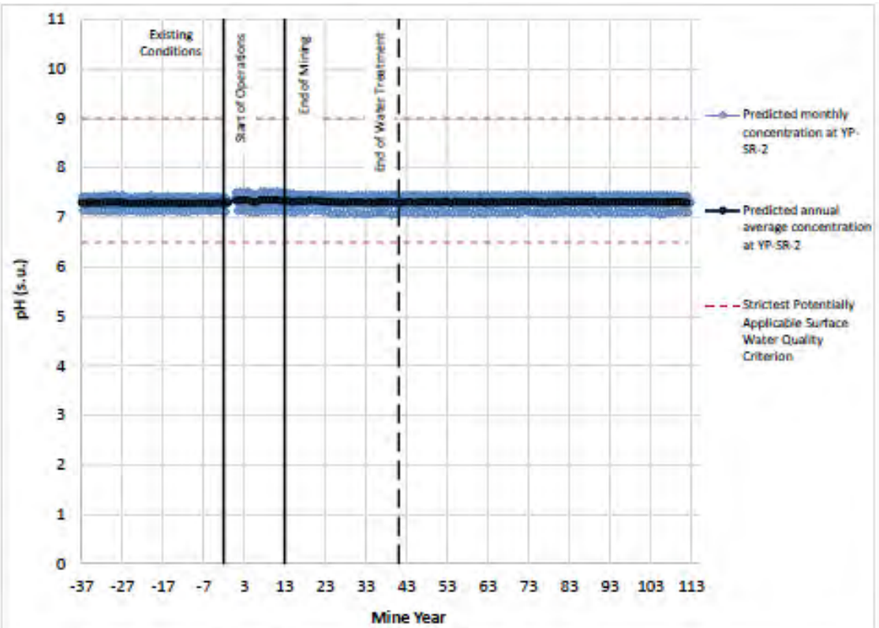
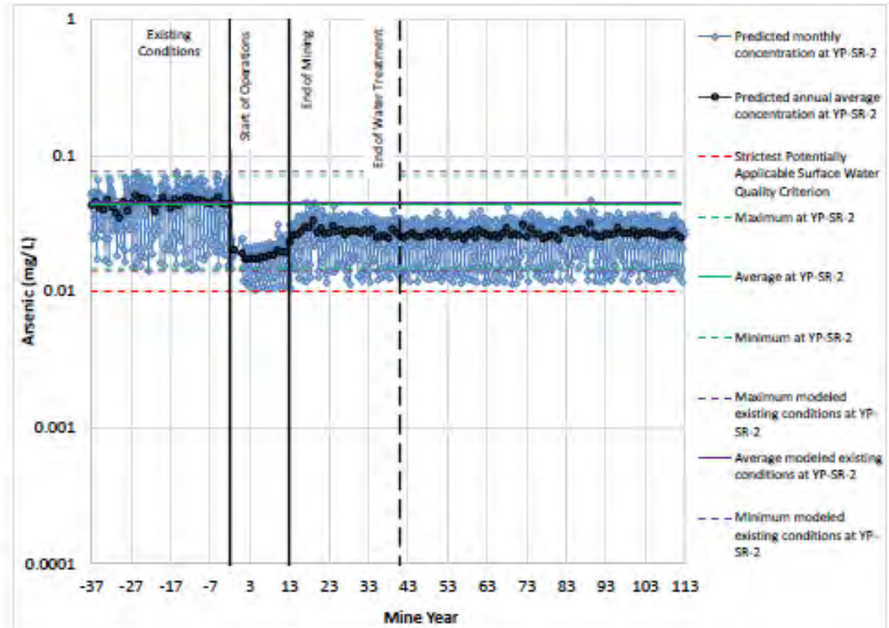


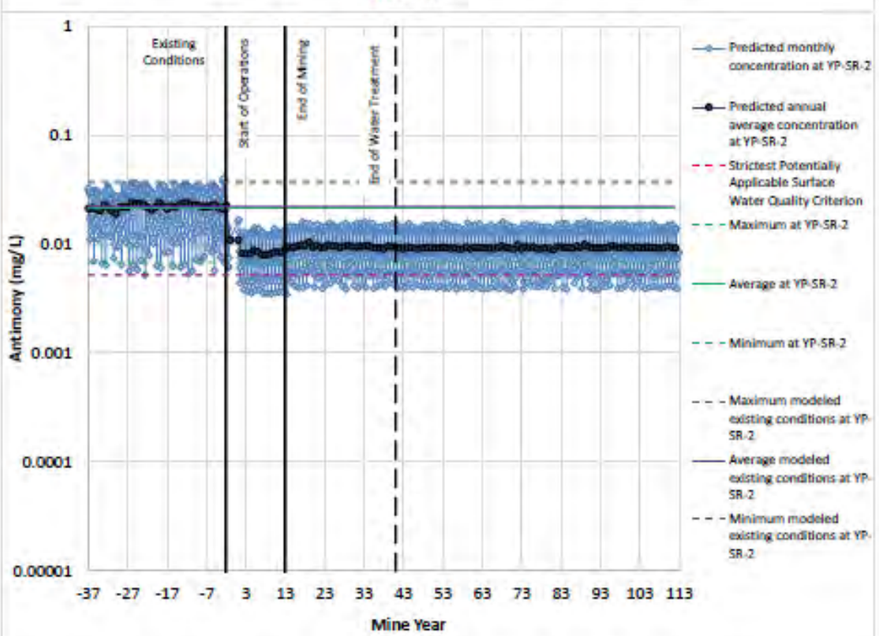
Figure 4.9-24
Predicted Surface Water Chemistry Downstream of West End Pit (YP-T-6)
Stibnite Gold Project

Data Sources: (SRK 2021)









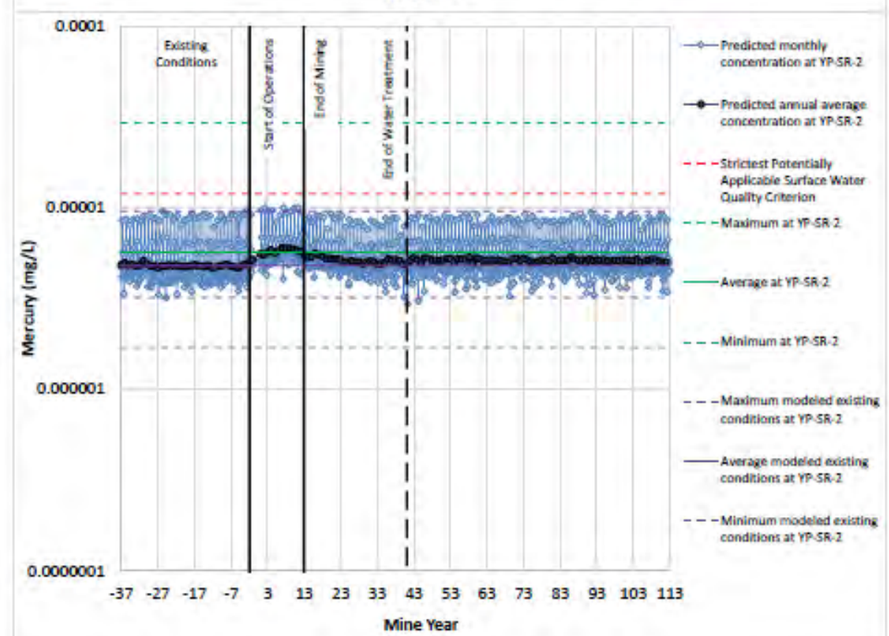


Figure 4.9-25
Predicted Surface Water Chemistry Downstream of the Stibnite Mine Area (YP-SR-2)

Stibnite Gold Project
Stibnite, ID

Data Sources: (SRK 2021)

Actual local mercury deposition rates from project emissions depend on the fractions of particulate versus gaseous mercury emissions. Particulate emissions generally deposit on the ground surface nearer to their source while gaseous emissions tend to deposit farther from the source or potentially become part of global atmospheric mercury burden.

Ratios of stream mercury loads to atmospheric mercury deposition rates have been reported in watersheds affected by gold and silver mining (Domagalski et al. 2016). The effects of aerial mercury deposition on stream loads are variable based on watershed area, mineralization present, land development, rainfall, and soil adsorption characteristics. In smaller watersheds hosting precious metal mining, total mercury stream loads are higher relative to the mass associated with aerial deposition with erodible sediments contributing relatively more to the stream load. Contributions from aerial deposition appear in stream loads over time as deposited mercury retained in soils is re-mobilized by local precipitation.

Therefore, aerial deposition would have a minor to moderate, long-term effect on particulate mercury loads in streams within the project area watershed, depending on the annual precipitation conditions.

Methylmercury

Predictive modeling indicates that mine facilities and water treatment would contribute dissolved mercury to surface waters primarily during the operating and early post-closure periods. These contributions are expected to increase the total mercury concentrations in surface waters compared to baseline conditions during those periods, while remaining below stream surface water standard values. Increases in total mercury may also result in increased methylmercury concentrations. There are many factors that affect methylmercury formation as methylation efficiency is influence by pH, sulfate, total organic carbon, bacteria activity, and wetland abundance (**Figure 4.9-26**). An incremental increase in organic carbon content due to wastewater effluent (as described above) would yield an incremental increase in methylation potential.

A ratio method to estimate methylmercury concentrations from predicted total mercury concentrations was applied per the approach and data collection by Holloway et al. (2017) that showed methylmercury concentrations were up to two percent of total mercury concentrations in samples from Sugar Creek and the East Fork SFSR. For Meadow Creek, the East Fork SFSR, and Sugar Creek, predicted total mercury concentrations varied up to 5 ng/L compared to existing conditions which ranged between 2.5 ng/L and 159 ng/L. Application of the methylation ratio to 5 ng/L would result in a predicted increase of methylmercury concentrations up to 0.1 ng/L for these surface waters. If upstream total mercury concentrations in West End Creek persist to downstream areas of the creek due to its diversion around the West End pit area, application of the methylation ratio would indicate a potential increase of methylmercury concentrations up to 0.9 ng/L in that portion of West End Creek.

Sediment

Surface disturbance caused by the project would cause erosion of soil and overburden material. These eroded sediments could in turn affect surface water quality if the sediment is blown or washed into adjacent streams. Erosion and sedimentation effects on surface water quality are indicated primarily by changes in turbidity and total suspended solids in the receiving waters such as historical sediment effects on the SFSR. Predictions of these water quality indicators were not included in the surface water

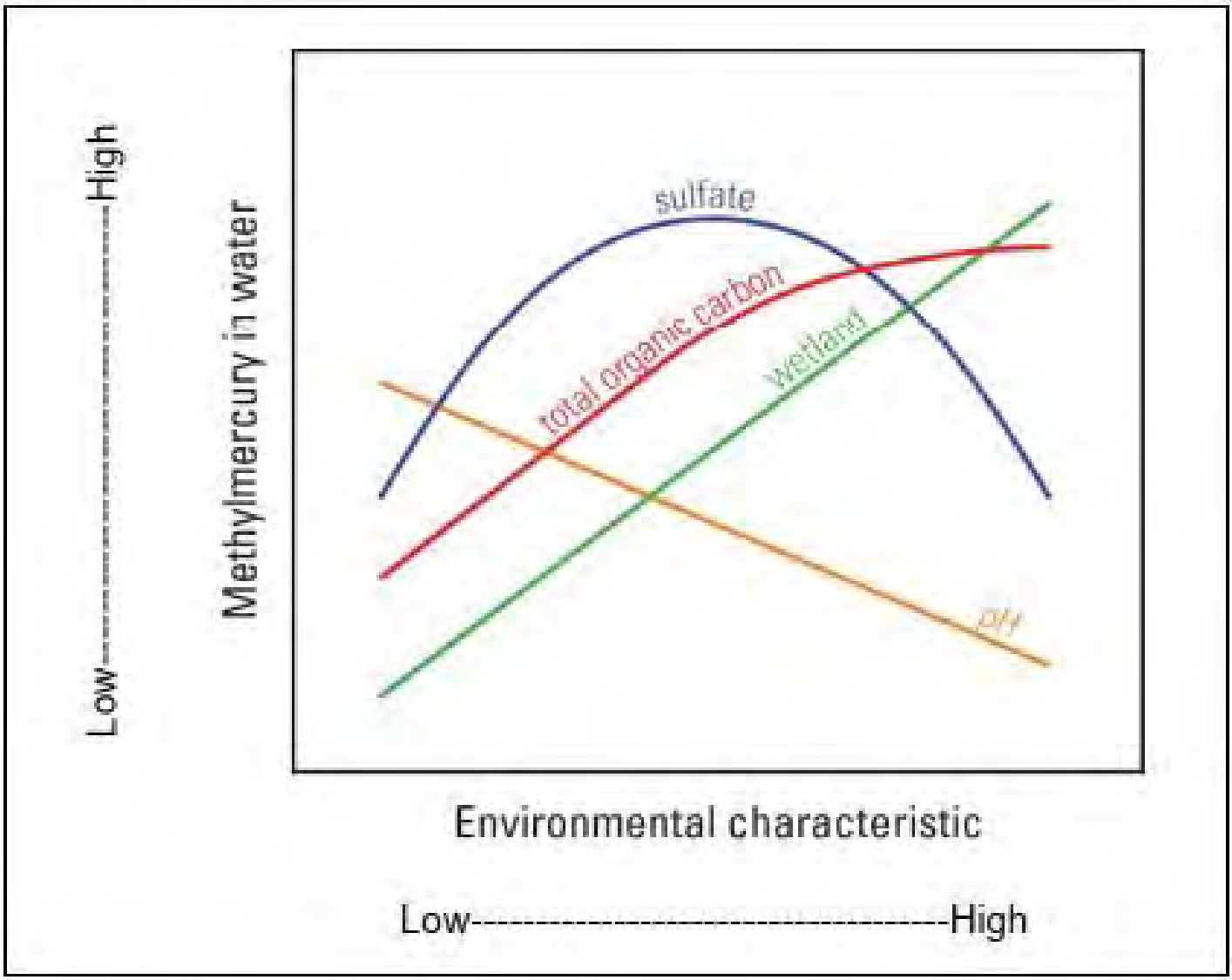
chemistry modeling. As such, changes in turbidity and total suspended solids have been qualitatively assessed using best available data and consideration of proposed management strategies for the SGP.

Proposed activities at the SGP would result in some erosion and sedimentation within Meadow Creek, Sugar Creek, and the East Fork SFSR during active surface material disturbance associated with mine construction, operations, reclamation, and closure, with the greatest potential for in-stream impacts occurring during times of higher overland flow. The effect to surface water quality as a result of sedimentation and erosion would be limited by applicable mitigation strategies and control techniques, by the limited duration of surface disturbing activities, and by the adaptability of the receiving environment (as indicated by the typically low baseline levels of total suspended solids and turbidity with seasonally variable spikes at times of higher overland flow).

Another SGP component that could increase stream sediment loads is draining the current Yellow Pine pit lake in preparation for mining. Perpetua would limit the potential for sedimentation impacts by following conditions in the Dewatering Practices section of their current Multi-Sector General Permit, or the Multi-Sector General Permit that is in place at the time (Brown and Caldwell 2020a). During mine construction, the Yellow Pine pit would be drained after the East Fork SFSR has been diverted around the pit lake, and the lake stage would be allowed to passively drop to the lake outlet elevation. The remaining water in the lake would then be withdrawn near the shoreline or from a floating intake managed to prevent disturbance of bottom sediments, thereby minimizing turbidity in the lake and in the discharged water. Water removed from the lake would be pumped downstream without treatment except for turbidity controls as needed. After the pit lake level is sufficiently below the outlet elevation, the nearly empty pit would be used for storm water management during pre-stripping of the pit highwalls. When complete drainage of the pit is necessary for mining, any water remaining in the pit bottom would be managed as contact water (i.e., either be used for construction purposes, transferred to the TSF for future use in ore processing, or contained in contact water ponds). By managing the Yellow Pine pit in this manner, excess sediment loading in the East Fork SFSR could effectively be prevented.

Surface water quality also could be impacted during construction, operations, closure, and reclamation by fugitive dust from vehicles and heavy equipment that settles into adjacent water bodies. Reduction of these potential impacts would be achieved through fugitive dust control at the SGP. In dry months, Perpetua would spray water on mine haul roads as necessary to mitigate dust emissions in compliance with state and Forest Service requirements.

The extent of sedimentation effects from erosion and fugitive dust would be concentrated at the SGP; however, due to the nature of sediment transport by streams, the geographic extent of the impact could extend farther downstream in the East Fork SFSR depending on site- and event-specific factors. The duration for traffic-related dust and erosion/sedimentation would last throughout the mine construction, operations, and post closure periods; however, the potential for these effects would be incrementally reduced during closure and reclamation due to reduced activity at the SGP and stabilization of disturbed areas.



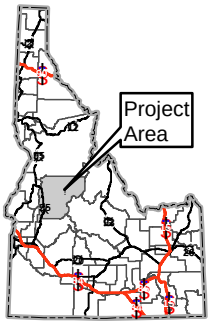


Figure 4.9-26
Relationships between Surface Water Characteristics and Mercury Methylation

Stibnite Gold Project
Stibnite, ID
Data Sources: (USGS 2015)

Construction and use of roads can accelerate erosion and sediment delivery to streams and have been identified as the primary contributor of sediments to stream channels in managed watersheds (Trombulak and Frissell 2000). Roads are often chronic sources of sediment delivery from cut-slopes, ditch- lines, and running surfaces, and act as potential sites for accelerated mass movements (e.g., mud slides). Roads can also intercept subsurface flows, concentrate surface flows in ditch lines and through culverts and bridges, and act as direct conduits for sediment delivery to stream channels (Beschta 1978). The minimum road culvert size for mining projects in Idaho is 18-inch diameter (IDAPA 20.03.02.140.05.c).

The access roads used under the 2021 MMP would cross 71 different named and unnamed streams, as inventoried in **Table 4.9-22**.

Table 4.9-22 Access Road Stream Crossings

Road/Component	Route/Access	Number of Crossings[1]	Stream Names
Warm Lake Road (CR 10-579)	Johnson Creek Route & Burntlog Route	16	Alpine Creek Beaver Creek [combined biota/habitat bioassessments (COLD)] Big Creek Deep Creek Little Creek Little Pearsol Creek Pearsol Creek SFSR [water temperature (SS), sedimentation (COLD)] Warm Lake Creek [water temperature (SS)] 7 Unnamed creeks
Johnson Creek Road (CR 10-413)	Johnson Creek Route	16	Bear Creek Coffee Creek Ditch Creek Halfway Creek Hanson Creek Johnson Creek [water temperature (SS)] Lunch Creek Moose Creek Olson Creek Park Creek Pid Creek Riordan Creek Rustican Creek Sheep Creek Trapper Creek Trout Creek

Road/Component	Route/Access	Number of Crossings[1]	Stream Names
McCall-Stibnite Road (CR 50-412)	Johnson Creek Route	11	3 Unnamed creeks Double A Creek East Fork SFSR [arsenic (DWS), arsenic (SCR)] Profile Creek [water temperature (SS)] Tamarack Creek Salt Creek Sugar Creek [mercury (COLD), arsenic (SCR)] Vibika Creek Whiskey Creek
Johnson Creek Road (CR 10-413)	Burntlog Route	21	Burntlog Creek East Fork Burntlog Creek East Fork SFSR Johnson Creek Landmark Creek [water temperature (SS)] Peanut Creek Rabbit Creek Riordan Creek Trapper Creek Unnamed creeks (12)
Cabin Creek Groomed OSV Route (FR 467)	Cabin Creek Groomed OSV Route	7	Cabin Creek [water temperature (SS)] Lunch Creek [water temperature (SS)] Pid Creek [water temperature (SS)] Park Creek [water temperature (SS)] Sheep Creek [water temperature (SS)] Trout Creek [water temperature (SS)] Warm Lake Creek

Source: IDEQ 2020a
Any 303(d) listings in brackets
[1] The number of crossings listed for each road segment/route is for individual streams; in some cases, the road/route segment may cross one or more streams at multiple locations.
COLD = cold water aquatic life
DWS = domestic water supply
SCR = secondary contact recreation
SS = salmonid spawning
CR = County Road.
FR = National Forest System Road.

During the construction phase (approximately 2 to 3 years), the SGP would be accessed via Warm Lake Road (CR 10-579 and then the Johnson Creek Route (Johnson Creek Road [CR 10-413] and McCall-Stibnite [CR 50-412] Road), which would cross 43 of the 71 streams listed in **Table 4.9-22**. In addition to these stream crossings, the Johnson Creek Route is located in close proximity to streams (i.e., within 100 feet) for 6.5 miles or 18 percent of its 36-mile length. A total of 45 heavy vehicles and 20 light vehicles are anticipated on average per day (year-round) during construction, for an AADT total of 65 round trips utilizing the Johnson Creek Route.

During the Burntlog Route construction including bridge and culvert installations, the potential exists for increased runoff, erosion, and sedimentation as a result of localized vegetation removal and excavation of soil, rock, and sediment, which could result in increased sediment load in streams. Expected permit stipulations from the IDWR and IDEQ would ensure that streambank vegetation would be protected except where its removal is absolutely necessary; that new cut or fill slopes not protected with some form of riprap would be seeded and planted with native vegetation to prevent erosion; use of temporary erosion and sediment control BMPs associated with a stormwater pollution prevention plan; and that all activities would be conducted in accordance with Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations.

For stream crossings, Perpetua would replace existing, or install new, culverts or bridges at crossings along the Johnson Creek (CR 10-579), McCall-Stibnite (CR 50-412), and Burnt Log (FR 447) roads. Existing bridges and culverts along Warm Lake Road would remain. If not properly designed, constructed, and maintained, culverts and bridges could constrict natural streamflow leading to an increase in water velocity at the downstream end of the structure. This could lead to stream bank and/or streambed erosion, and/or excessive erosion at the structure. Erosion of the streambed and/or banks could result in downstream sedimentation, a change in the morphology of the stream, and/or a change to the aquatic habitat. If a structure does not allow for adequate flow, water could pool excessively on the upstream side. As such, stream crossings associated with access roads would be designed to minimize potential impacts on surface water hydrology, water quality, and fish passage. The Forest Service would require stream crossings to be designed to accommodate a 100-year flood recurrence interval, unless site-specific analysis using calculated risk tools, or another method determines a more appropriate recurrence interval.

Utilities associated with the project (existing transmission line upgrades and structure work, right-of-way (ROW) clearing, new transmission line, and transmission line access roads) would cross 37 different streams, as inventoried in **Table 4.9-23**.

Of the 37 streams that would be crossed, 26 would be related to the upgrade of existing IPCo transmission lines, where the existing transmission line ROW crosses various streams. The existing transmission line would be upgraded from 69-kV to 138 kV service, which would require removing vegetation to widen the ROW corridor and replacing existing power poles with taller structures. Structure work would result in some ground disturbance at or near five streams. Use of the transmission line access road to facilitate year- round maintenance of the line also would result in disturbance at three stream crossings. Additionally, Perpetua would construct a new 8.5-mile, 138-kV transmission line from the Johnson Creek substation to a new substation at the SGP. The new transmission line corridor would require vegetation clearing along the ROW (intersecting three streams).

Table 4.9-23 Utility Stream Crossings

Component	Number of Intersects[1]	Stream Names
Upgraded Transmission Line	26	Alpine Creek Bear Creek Beaver Creek [combined biota/habitat bioassessments (COLD)] Big Creek Boulder Creek [total phosphorus (COLD, sedimentation (COLD), flow regime alterations (COLD), temperature (COLD)] Cabin Creek [water temperature (SS)] Coffee Creek Deep Creek Ditch Creek Halfway Creek Hanson Creek Hargrave Creek Hot Spring Creek [total phosphorus (COLD)] Johnson Creek [water temperature (SS)] Lake Fork [low flow alterations (COLD)] Little Creek Little Pearsol Creek Moose Creek Olson Creek Pearsol Creek Rustican Creek SFSR [water temperature (SS), sedimentation (COLD)] Trapper Creek Trout Creek [water temperature (SS)] Warm Lake Creek [water temperature (SS)] Willow Creek [total phosphorus (COLD)]
Structure Work for Upgraded Transmission Line	5	Beaver Creek [combined biota/habitat bioassessments (COLD)] Big Creek Hot Spring Creek [total phosphorus (COLD)] Pearsol Creek Willow Creek [total phosphorus (COLD)]
Transmission Line Access Road	3	Big Creek Cabin Creek [water temperature (SS)] Unnamed Creek
New Transmission Line	3	No Man's Creek Riordan Creek Unnamed Creek

Source: IDEQ 2020a
Any 303(d) or total maximum daily load listings in brackets
[1] The number of intersects listed for each component is for individual streams; in some cases, the utility-related component may intersect one or more streams at multiple locations.
COLD = cold water aquatic life
SS = salmonid spawning

During transmission line upgrades and new transmission line construction, the potential exists for increased runoff, erosion, and sedimentation as a result of vegetation removal within the ROW, and the localized excavation of soil, rock, and sediment for structure work and/or ROW access roads. Expected permit stipulations from IDWR and IDEQ would be similar to the examples provided above for access roads and would ensure the use of erosion and sediment control BMPs associated with a stormwater pollution prevention plan. All activities would be conducted in accordance with Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations. It is important to note that ROW vegetation clearing would be for the purpose of maintaining low height during operations and would not entail clearing and grubbing to bare soil. Consequently, the vegetation root structure within soils would be retained, reducing erosion concerns.

Based on the type of vegetation removal, the localized and discontinuous ground disturbance for structure footings and ROW access roads, and permit-related requirements including use of BMPs, the potential for transmission line-related erosion and sedimentation would be minimal (i.e., limited to periods of substantial overland flow). The duration of erosion/sedimentation potential would occur from the time new transmission line is constructed until it is reclaimed at the end of mine closure and reclamation (approximately 25 years). The upgrades to IPCo's existing transmission line corridor would be permanent. Due to the nature of sediment transport by streams, the geographic extent of increased sedimentation could be hundreds of feet to miles, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

During the mining and ore processing operations phase (approximately 15 years), SGP access would use the same existing Warm Lake Road (CR 10-579) and then the Burntlog Route (upgraded portions of Burnt Log Road [FR 477] and new road portions connecting to Meadow Creek Lookout Road [FR 51290]), which would cross 37 of the 71 streams (**Table 4.9-22**). The Burntlog Route alignment would be located within 100 feet of streams for approximately 1.69 miles or four percent of its 38.2-mile length. A total of 49 heavy vehicles and 19 light vehicles are anticipated on average per day (year-round) during operations, for an AADT total of 68 round trips utilizing the Burntlog Route. Additionally, public access along the Cabin Creek groomed OSV route during operations would include a total of 7 stream crossings.

For operation and use of the Burntlog Route, the potential for sedimentation would be reduced using standard erosion control measures, such as silt fencing, ditch checks, and other measures, which would be installed and maintained to minimize the potential for erosion and sedimentation. Numerous small (15- to 60-inch) drainage culverts would be installed along the Burntlog Route to reduce rutting and shunt water out of ditches and off the road prism, which would serve to reduce erosion from the road into streams. Perpetua would maintain a hardened road surface with gravel surfacing to promote an efficient and useable all-weather road (Perpetua 2021e, Transportation Management Plan).

Additionally, Perpetua would be required to comply with specific design requirements as part of the IDWR Stream Channel Alteration Permit, such as line of approach, minimum bridge clearance and minimum culvert size per length, and anchoring on steep slopes. Bridges and culverts would be maintained to allow proper drainage and limit sediment delivery to area streams.

Based on permit-related design requirements, use of BMPs, and required maintenance activities, the potential for access road-related erosion and sedimentation would be minimal (limited to periods of substantial overland flow, such as from very large rainfall events). The duration for this erosion/sedimentation potential would last throughout the entire period of use of the Burntlog Route (approximately 25 years) until it is reclaimed. Due to the nature of sediment transport by streams, the geographic extent of the impact could be hundreds of feet to miles, depending on many site- and event-specific factors, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

During winter months, the Burntlog Route would be plowed for snow removal and sanded for winter driving safety. When practicable, snow would be removed down to the gravel, however, a snow-packed road surface could develop during the winter months. When snow-packed surfaces occur, sand/gravel would be applied to prevent vehicle slide offs. To protect surface water, snow removal standards or performance would include depositing snow and ice away from stream channels; maintaining appropriate snow floor depth to protect the roadway; clearly marking culverts and stream crossings; and no use of ice and snow removal chemicals.

It also should be noted that use of the Burntlog Route (in-lieu of the existing roads along the Johnson Creek Route) could lower sedimentation impacts by reducing the number of stream crossings (37 versus 43 crossings) and eliminating travel along and adjacent to Johnson Creek and the East Fork SFSR, as Johnson Creek and McCall-Stibnite roads follow and have multiple crossings of these two waterbodies.

During the closure and reclamation phase, traffic along the Burntlog Route would be reduced to a total of 13 heavy vehicles and 12 light vehicles on average per day (year-round), for an AADT total of 25 round trips.

Overall, based on identified maintenance activities, design features proposed by Perpetua, environmental protection measures required by the Forest Service, and permit stipulations from state and federal agencies, traffic-related dust and erosion/sedimentation would be within the normal range of properly maintained forest roads. The duration for traffic-related dust and erosion/sedimentation would last throughout the entire period of use of Burntlog Route (approximately 25 years) until it is successfully reclaimed; however, the potential for these effects would be incrementally reduced during closure and reclamation (when AADT would be reduced from 68 to 25 round trips). Due to the nature of airborne dust and sediment transport by streams, the geographic extent of the impact could be hundreds of feet to miles, depending on many site- and event-specific factors, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

The effects of the SGP on sedimentation are expected to be moderate, long-term, and localized.

Fuels and Hazardous Chemicals

There is the potential for spills to occur along access roads as fuel and other materials are trucked to and from the SGP. If a spill were to occur at a stream crossing or near a stream, surface water could be impacted. Discussion of very low probability scenarios for a large release (tanker truck or concentrate truck rollover), and more probable scenarios involving small releases, is provided in Forest Service 2021k. Overall, regulatory and Forest Plan requirements required by the Forest Service, EDFs proposed

by Perpetua, and permit stipulations and regulatory requirements from state and federal agencies (including use of USDOT-certified containers and USDOT-registered transporters) would reduce the risk of spills and ensure that effective response is provided should a spill occur.

The combination of the proposed environmental protection practices and committed design measures would minimize the risk of accidental releases during the transportation, storage, management, and use of hazardous materials. Spills of fuels, oil or chemicals at the SGP would be retained in the secondary containment areas and cleaned up without release to the environment. At the SGP the most likely releases to the environment would be rare, small-scale spills of fuel or hydraulic oil from mobile mining equipment that would be quickly contained and cleaned up by SGP personnel leaving de minimis residuals. Spills from transportation of fuel, oil or chemicals along the proposed transportation routes beyond the SGLF (Burntlog or Johnson Creek roads) would be unlikely due to the receiving operations for chemicals at the SGLF and traffic controls exerted along the access roads for fuel to mitigate risks associated with travel on unpaved roads with steep grades. It would be more likely that spills of bulk liquids transported to the SGP (fuel, oil, acids) could be the result of accidents on the public highways. Perpetua is coordinating with local communities to address their potential needs for responding to accidents involving fuels and hazardous materials.

The overall environmental impacts from the reasonably foreseeable releases of hazardous materials under the 2021 MMP are considered to be localized, temporary, and minor to moderate depending on the type of material releases and the location of the spill.

Surface Water Temperature

Water temperature affects biological activity of aquatic organisms as well as the solubility of dissolved oxygen in stream waters. Thermal criteria describe thresholds and frequencies that aquatic species can tolerate without suffering adverse effects and are often specified for different seasons and life stages. The most commonly used metrics include the maximum weekly maximum temperature during the Summer and Fall seasons. This section describes the predicted temperatures resulting from construction, operation, and closure of the SGP. The companion SGP Fisheries and Aquatic Habitat Specialist Report (Forest Service 2022i) evaluates the impacts of these predicted stream temperatures on fish species (**Section 4.12.2**).

Under the 2021 MMP, changes to stream flow, groundwater-surface water interactions, and stream shading have the potential to affect stream temperatures. Surface water tends to warm when streams become shallower, receive smaller amounts of groundwater discharge (see **Section 4.8.2**), or receive more direct sunlight due to removal of riparian vegetation. Effluent from permitted discharges also can affect stream temperature. Predictions of future stream temperatures were generated by Brown and Caldwell (2021i) using a surface water temperature model. Forecasting future water temperatures over the post-closure period involves uncertainty associated with the performance and durability of implemented surface water restoration features (e.g., restored stream channels, Stibnite Lake feature), riparian planting, and closure water management plus broader climatic conditions. Model uncertainty and sensitivity is described further in **Section 4.9.2.4**, with approaches to mitigate forecasting and implementation uncertainty discussed in **Section 4.9.3**. This section describes the model results associated with the effective and durable implementation of the closure design and riparian plantings.

The temperature modeling scenario accounts for the following aspects of the SGP surface water management:

- Lining of some channels (preventing exchange with groundwater),
- Mining and vegetation removal (altering shade and topography),
- Dewatering pits (lowering of the groundwater table with subsequent reductions to stream flow rates in some reaches), and
- Permitted discharge of treated water or non-contact water to surface water.

This stream temperature description focuses on comparing predicted future temperatures to existing temperature conditions. Additional details regarding the modeling can be located in Brown and Caldwell 2021e, 2021i. The long-term post-closure results presented depend on the successful implementation of two reclamation features that contribute to controlling the temperature of stream flows in the project area:

- Establishment of 18-foot wide vegetation zones consisting of willow, spruce, and other riparian species that effectively shade stream flows in the restored and native stream channels in the mine area (Brown and Caldwell 2021i), and
- Development of the lined Stibnite Lake lacustrine feature above the cover of the Yellow Pine pit backfill to moderate maximum stream temperatures.

Improvements to stream shading were introduced into the stream restoration and closure programs in recognition of the significant affect solar radiation has on stream flow temperatures. Focused riparian re-vegetation efforts are supported by overall site re-vegetation and closure planning that reclaims disturbance in the vicinity of the stream channels. The relationship between shade addition or removal on stream temperatures has been observed in multiple locations in the northwest U.S. (Brown and Caldwell 2021i).

During operations, predicted maximum stream temperatures in the Yellow Pine pit area increase relative to existing conditions due in part to the removal of the pit lake there which acts to dampen diurnal variability of the water temperatures. Development of the Stibnite Lake feature to mimic the thermal characteristics of the existing pit lake would restore that dampening effect and promote the return of water temperatures toward existing conditions (Brown and Caldwell 2021i). The magnitude of stream flow temperature decreases related to shading varies with the recovery time of riparian vegetation and the effectiveness of its cover in inhibiting warming by solar radiation directly on the stream water (**Section 4.9.3**). **Table 4.9-24** summarizes the predicted stream water temperatures based on designed effectiveness of riparian recovery. Temperature effects for riparian recovery less than design are described in **Section 4.9.3**.

Table 4.9-24 Highest Simulated Temperatures (°C) across Mine Years for Surface Water Areas

Area	Simulated Daily Temperature Statistic	No Action	Mine Year 6	Mine Year 12	Mine Year 18	Mine Year 27	Mine Year 52	Mine Year 112	Maximum Increase from No Action
Upper East Fork SFSR (above Meadow Creek)	Summer Max:	13.7	13.8	13.8	13.8	13.8	13.8	13.8	0.1
	Fall Max:	11.1	11.0	11.0	11.0	11.0	11.0	11.0	-
	Summer Avg:	10.3	10.2	10.3	10.3	10.3	10.3	10.3	-
	Fall Avg:	8.8	8.8	8.9	8.8	8.9	8.8	8.9	0.1
Meadow Creek above EFMC	Summer Max:	17.9	14.6	14.6	14.6	24.5	19.9	16.9	6.6
	Fall Max:	15.1	12.2	11.5	11.5	17.9	14.1	12.4	2.8
	Summer Avg:	12.7	11.2	11.2	11.2	15.0	13.2	12.4	2.3
	Fall Avg:	10.4	9.1	9.1	9.4	11.1	10.2	9.7	0.7
Meadow Creek below EFMC	Summer Max:	19.8	17.2	16.8	16.7	18.5	16.6	15.3	-
	Fall Max:	16.2	15.9	13.7	13.3	13.9	12.4	11.6	-
	Summer Avg:	13.4	12.4	12.1	12.1	13.9	12.8	12.2	0.5
	Fall Avg:	10.8	10.2	9.9	10.0	10.7	9.9	9.6	-
Middle East Fork SFSR (between Meadow and Fiddle Creeks)	Summer Max:	17.4	16.2	15.8	16.0	16.4	15.3	14.8	-
	Fall Max:	14.0	13.6	12.7	12.7	12.6	12.0	11.8	-
	Summer Avg:	12.3	11.7	11.5	11.6	12.4	11.8	11.5	-
	Fall Avg:	9.9	9.5	9.4	9.5	9.8	9.4	9.3	-
Fiddle Creek	Summer Max:	11.5	11.9	11.5	11.6	11.9	11.6	11.6	0.4
	Fall Max:	10.1	10.4	10.3	10.3	10.6	10.4	10.3	0.5
	Summer Avg:	9.5	9.7	9.6	9.5	9.7	9.6	9.6	0.2
	Fall Avg:	8.3	8.3	8.3	8.2	8.4	8.3	8.3	0.1
Lower East Fork SFSR (between Fiddle and Sugar Creek)	Summer Max:	17.4	16.1	18.1	18.3	17.7	16.4	16.0	0.9
	Fall Max:	14.0	13.3	14.7	14.1	13.4	12.6	12.4	0.7
	Summer Avg:	13.5	11.6	13.7	13.8	13.9	13.3	13.1	0.4
	Fall Avg:	10.6	9.4	10.3	10.2	10.3	9.9	9.8	-
West End Creek	Summer Max:	12.9	21.7	19.1	20.9	20.6	16.8	16.8	8.0
	Fall Max:	11.0	17.1	17.3	16.2	16.2	13.2	13.2	6.3
	Summer Avg:	11.1	13.7	12.7	16.8	16.8	16.8	16.8	5.9
	Fall Avg:	9.6	10.4	10.3	13.2	13.2	13.2	13.2	3.6

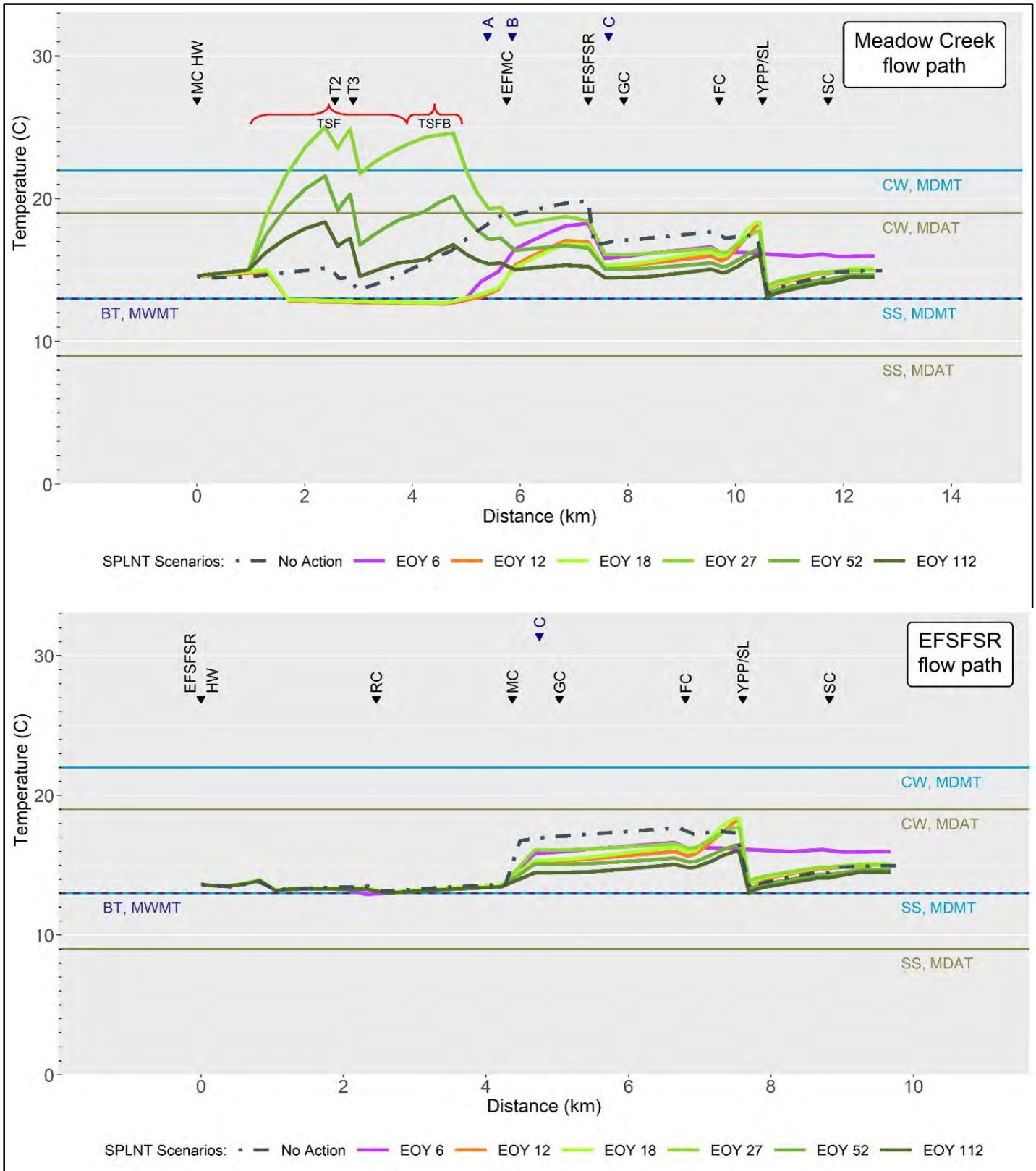
Area	Simulated Daily Temperature Statistic	No Action	Mine Year 6	Mine Year 12	Mine Year 18	Mine Year 27	Mine Year 52	Mine Year 112	Maximum Increase from No Action
Lower Sugar Creek	Summer Max:	15.4	15.7	15.6	15.7	15.5	15.5	15.4	0.3
	Fall Max:	12.2	12.3	12.3	12.2	12.2	12.2	12.2	0.1
	Summer Avg:	10.7	10.8	10.7	10.8	10.8	10.7	10.7	0.1
	Fall Avg:	9.1	9.1	9.1	9.1	9.1	9.1	9.1	-
East Fork SFSR downstream of Sugar Creek	Summer Max:	14.9	15.9	15.0	15.1	15.0	14.7	14.5	1.0
	Fall Max:	11.9	12.5	11.6	11.6	11.6	11.3	11.3	0.6
	Summer Avg:	13.0	11.3	13.1	13.2	13.3	12.9	12.7	0.3
	Fall Avg:	10.3	9.2	10.1	10.0	10.1	9.8	9.7	-

Source: Brown and Caldwell 2021i
°C = degree Celsius; Avg = average; EOY = end of year

Figures 4.9-27 and **4.9-28** summarize the predicted maximum weekly summer condition and maximum weekly fall condition for stream reaches of Meadow Creek and the East Fork SFSR. In the figures, predicted temperature statistics are compared to existing conditions and standards utilized by the Forest Service. Additional comparisons to Idaho standards and reference values can be located in Brown and Caldwell 2021i. The effects of these temperatures on fish and aquatic resources are included in the evaluation of those resources in **Section 4.12.2** and the SGP Fish and Aquatic Habitat Specialist Report (Forest Service 2022i).

In Meadow Creek above the confluence with the East Fork SFSR, predicted water temperatures are cooler than existing conditions during the operating period. These cooler temperatures are attributable to the diversion of Meadow Creek around mine facilities in diversion channels and/or pipelines where the stream flow is less exposed to the warming influence of solar radiation. Upon closure, Meadow Creek would be routed into restored stream channels on top of the covered TSF. Initially during the post-closure period, the residence time of surface flow in the low-gradient sinuous restored stream channel would allow warming of temperatures above existing conditions and standards.

Following closure, predicted temperatures between the TSF and the confluence of Meadow Creek and EFMC (Blowout Creek) decrease as a net effect of increases in riparian shading plus recovery of groundwater discharge and surface water inflow. Under baseline conditions, this portion of Meadow Creek is a zone of groundwater discharge (Brown and Caldwell 2017a). Groundwater production by dewatering and industrial supply wells lowers water levels and groundwater discharge to surface water during operations. In addition, underdrain flow from the TSF is intercepted during operations. During closure, flows from cooler temperature groundwater discharge and underdrains increase in this area and riparian shading reduces the warming effect of solar radiation, resulting in lower predicted stream temperatures over time. Uncertainties in the predicted cooling effects of groundwater discharge and riparian shading are discussed further in **Section 4.9.2.4**.



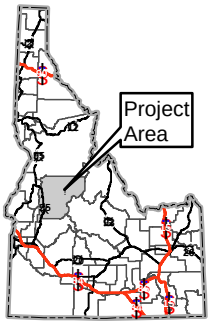
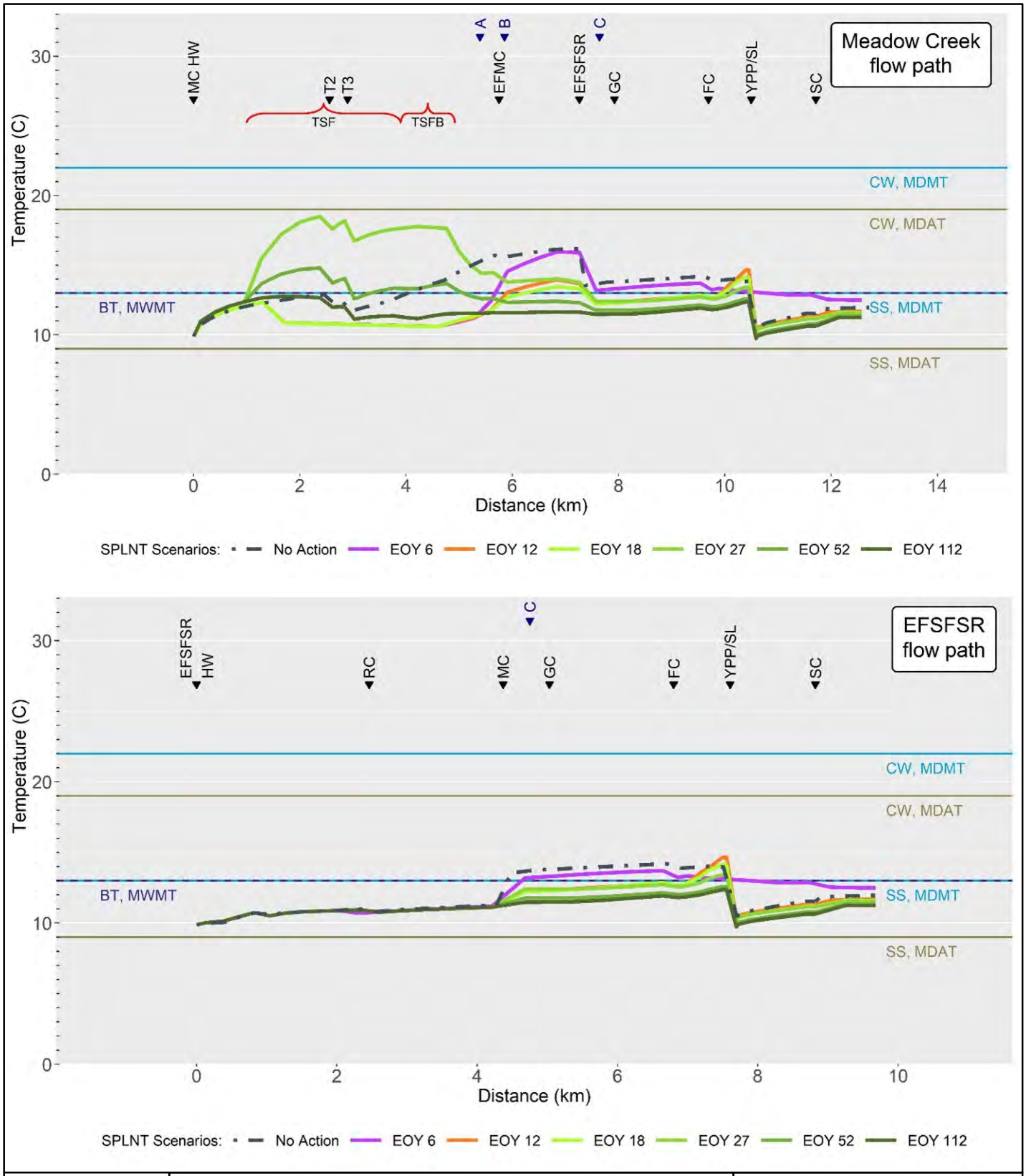


Figure 4.9-27
Predicted Maximum Temperatures for the Maximum Weekly Summer Temperature in Meadow Creek and the EFSFSR

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021b)



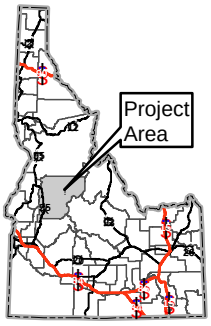


Figure 4.9-28
Predicted Maximum Temperatures for the Maximum Weekly Fall Temperature in Meadow Creek and the EFSFSR

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2021b)

Predicted temperatures above the confluence of Meadow Creek and the East Fork SFSR are predicted to be comparable to the existing condition within approximately 10 years after reclamation and then continue to cool over time. On the Meadow Creek segment atop the reclaimed TSF, temperature reductions would occur more slowly remaining warmer than existing conditions after 100 years. Predicted timing of temperature reductions is subject to the uncertainty in the forecasting the implementation and durability of the stream restoration and riparian planting (**Section 4.9.2.4**).

In the East Fork SFSR, predicted water temperatures above the Yellow Pine pit area are cooler than existing conditions throughout the operations and closure periods as surface water diversions during operations and stream restoration plus riparian plantings reduce the solar radiation incident to surface flow. In the Yellow Pine pit area and downstream, maximum temperatures are higher than existing conditions while average temperatures are lower than existing conditions due to the removal of the pit lake's moderating effect on maximum stream temperatures. In the post-closure period, development of the Stibnite Lake feature is predicted to reduce maximum temperatures to approximately the level of existing conditions with an associated increase in average temperatures to within one-half degree Celsius of existing conditions. Uncertainty in post-closure temperature predictions is discussed further in **Section 4.9.2.4**.

Several sizes of lake features ranging from 30 to 100 percent of the existing surface area and 40 to 100 percent of the existing volume of the Yellow Pine pit were evaluated. A design lake feature elongated along the direction of stream flow with the same depth of the Yellow Pine pit lake (i.e., approximately 30 feet) and 55 percent of its surface area was selected based on results from GLM modeling. Residence times for the existing Yellow Pine pit (2.6 to 3.6 days) and proposed Stibnite Lake feature (1.5 to 2.0 days) are both short. These short residence times allow for mixing of incoming stream flow with the approximately 16 million gallons of lake water to reduce diurnal fluctuations while increasing average temperatures (Brown and Caldwell 2021i). The reductions in maximum temperature and increases in average temperature were incorporated into the water temperature predictions (**Table 4.9-24**). Without the effects of the lacustrine feature, downstream maximum and average temperatures would be essentially the same as upstream maximum and average temperatures. These effects were incorporated into the impacts analyses on fisheries (Forest Service 2022i). Achievement of these predicted temperatures would depend on the effective and durable installation of the Stibnite Lake feature.

Durability of the Stibnite Lake feature would be partially dependent on effective control of sediment upstream of its location which could deposit and alter the restored stream and lacustrine features. As an initial step, the unstable slopes in lower Blowout Creek, which represent the largest single source of sediment in the subwatershed, would be stabilized during the construction period. During operations and closure, sediment would be managed under the facilities stormwater management plan followed by a reclamation program incorporating upland stabilization and revegetation measures. Restored stream channels designs include stabilizing features such as meadows and step pools which are low slope, unconfined reaches that would inhibit sediment transport downstream. The effectiveness of these measures would be assessed under the site EMMP to identify and address excessive and/or unexpected areas of erosion and sediment generation.

Uncertainties in the predicted cooling effects of the Lake Stibnite lacustrine feature are discussed further in **Section 4.9.2.4**.

West End Creek flows are predicted to warm during the operating period as ground disturbance and dewatering pumping reduce cooling influences of vegetation shading and groundwater discharge. Formation of the West End pit lake acts permanently raise temperatures compared to existing conditions in the stream segment immediately below that area which receives discharges of groundwater that has interacted with the pit lake. However, these increased temperatures in West End Creek have little influence on predicted temperatures in Sugar Creek between its confluence with West End Creek and above its confluence with the East Fork SFSR.

The limited disturbance associated with the GMS in the Fiddle Creek drainage associated has little effect on predicted Fiddle Creek temperatures above its confluence with the East Fork SFSR.

Compared to existing conditions, project operations are predicted to increase temperatures in West End Creek by up to 9ºC and the East Fork SFSR below the Yellow Pine pit area by up to 3ºC. Upon closure activities, Meadow Creek temperatures are predicted to increase by up to 10ºC as the stream channel is restored atop the TSF while formation of the West End pit lake raises temperatures in West End Creek by approximately 4ºC. With the exception of the West End Creek segment below the pit area, predicted temperatures return to existing conditions over a period of approximately 100 years as stream restoration and riparian plantings along with the moderating effect of the Stibnite Lake feature take effect (see also **Section 4.9.3**).

The consequences of increased stream temperatures are related to fish habitat and are evaluated in the Fish and Aquatic Habitat Specialist Report (Forest Service 2022i). This analysis is able to conclude that changes in stream water temperatures would be localized and long-term except for a segment in West End Creek where the effect would be permanent. During the operating period as the Yellow Pine pit is mined (i.e., Mine Year 6), summer and fall maximum temperatures in the East Fork SFSR below the Sugar Creek confluence are predicted to be warmer than existing conditions by up to one degree Celsius, while average summer and fall temperatures are predicted to be cooler than existing conditions. The higher maximum temperatures would raise maximum temperatures by less than one degree Celsius in the downstream reach of the East Fork SFSR until mixing with influent tributaries (Salt and Pepper Creek and Tamarack Creek) and groundwater discharge returned temperatures to existing conditions approximately two miles downstream from Sugar Creek. Aside from the operating period, predicted maximum and average summer and fall water temperatures in the East Fork SFSR below Sugar Creek are comparable to existing conditions and would also be comparable in the downstream reach. The implications of forecasting uncertainty of these affects are described in **Section 4.9.2.4** with mitigation measures developed to address uncertainty described in **Section 4.9.3**. The impacts to fisheries are discussed in **Section 4.12.2**.

Impaired Water bodies

Of the 71 stream crossings for access roads, 14 are listed by IDEQ as impaired. **Table 4.9-25** lists the Category 4 or 5 streams, the cause of impairment, and the beneficial use.

Table 4.9-25 Access Road Stream Crossings of Impaired Waters

Road	Stream Name	IDEQ Category	Cause of Impairment (Designated Beneficial Use[1])
Burntlog Road & Stibnite Road	East Fork SFSR	5	Arsenic (DWS) Arsenic (SCR)
Burntlog Road & Johnson Creek Road	Johnson Creek	4A	Water temperature (SS)
Burntlog Road	Landmark Creek	4A	Water temperature (SS)
Cabin Creek Groomed OSV	Cabin Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Lunch Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Park Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Pid Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Sheep Creek	4A	Water temperature (SS)
Johnson Creek Road & Cabin Creek Groomed OSV	Trout Creek	4A	Water temperature (SS)
McCall-Stibnite Road	Profile Creek	4A	Water temperature (SS)
McCall-Stibnite Road	Sugar Creek	5	Mercury (COLD) Arsenic (SCR)
Warm Lake Road	Beaver Creek	5	Combined biota/habitat bioassessments (COLD)
Warm Lake Road	SFSR	4A	Water temperature (SS) Sedimentation (COLD)
Warm Lake Road	Warm Lake Creek	4A	Water temperature (SS)

Source: IDEQ 2020a
[1] DWS = domestic water supply; SCR = secondary contract recreation; SS = salmonid spawning; COLD = cold water aquatic life.

Most of the impaired waterbodies are listed for temperature, which is affected when riparian vegetation canopy shading is reduced from natural and anthropogenic impacts such as landslides or wildfires, road construction, and timber harvest. Access roads associated with the project would likely have a very small effect on temperature at stream crossings, where vegetation removal of shade-providing canopy would be localized, if required at all.

Access road crossings of the East Fork SFSR and Sugar Creek are unlikely to contribute arsenic or mercury loading because those road crossings are outside the mineralized areas targeted by the mine operations. Additionally, the Warm Lake Road crossings of the SFSR and Beaver Creek are existing paved crossings, where additional SGP-related traffic would not be expected to contribute to sedimentation at the SFSR Bridge or have effects to biota or habitat in Cascade. As such, access roads associated with the project would not be expected to affect overall progress toward beneficial use attainment of listed streams.

4.9.2.3 Johnson Creek Route Alternative

The water quality effects of the Johnson Creek Route Alternative and 2021 MMP are comparable with regard to contact water, water treatment, groundwater chemistry, surface water chemistry, stream temperature, and impaired water bodies. The change in site access does result in some differences in effects of sedimentation and fuels and hazardous chemicals.

Construction and operation of the Landmark Maintenance Facility and the SGLF would have the potential for increased runoff, erosion, sedimentation (as a result of vegetation removal and excavation of soil, rock, and sediment) and fuel and/or material discharge to nearby waterbodies during operations (if not properly stored or contained). However, design features proposed by Perpetua, regulatory and Forest Plan requirements required by the Forest Service, and permit stipulations from state and federal agencies (including BMPs, sanitary wastewater treatment, and SPCC Plan) would control runoff, erosion, sedimentation, and the potential for discharges. Therefore, effects of the Landmark Maintenance Facility and the SGLF were considered to be negligible to surface water quality analysis.

Sediment

The number of streams crossed along the Johnson Creek Route (43) would be fewer compared to the 2021 MMP as a result of the Burntlog Route not being constructed and used during operations. However, the Johnson Creek Route, adjacent to Johnson Creek and the East Fork SFSR, would be widened and upgraded under this alterative. Therefore, surface water quality impacts from erosion and sedimentation during access road construction could increase during the construction activities and would require implementation of sediment and erosion BMPs.

Use of the Johnson Creek Route for site access would avoid construction-related impacts from sedimentation at 21 different streams compared to the 2021 MMP. These streams include Burntlog Creek, East Fork Burntlog Creek, the East Fork SFSR, Johnson Creek, Landmark Creek, Peanut Creek, Rabbit Creek, Riordan Creek, Trapper Creek, and 12 unnamed waterbodies.

During mine construction, the number of daily vehicle trips to the SGP would be comparable between the alternatives. The number of daily vehicle trips also would be the same during mine operations and reclamation; however, all vehicle trips would traverse the Johnson Creek Route under this alternative, resulting in greater use of the Johnson Creek Route access roads, and more fugitive dust generation and greater wear and tear on the road surface. In addition, use of the Johnson Creek Route would require two additional years of construction. The resulting surface water quality impacts from erosion and sedimentation would therefore differ in location and extent compared to 2021 MMP but would be similar in magnitude because the number of vehicle trips to the SGP would remain the same.

Prevention of these types of impacts would be achieved through proper road design, construction, grade control, fugitive dust control and, in the winter months, snow removal and “sanding” using gravel and coarse sand with minimal fines to avert slippery conditions and reduce off-site sedimentation during the spring runoff season.

Overall, based on identified maintenance activities, design features proposed by Perpetua, regulatory and Forest Plan requirements required by the Forest Service, and permit stipulations from state and federal

agencies, traffic-related dust and erosion/sedimentation would be within the normal range of properly maintained NFS roads. The duration for traffic-related dust and erosion/sedimentation would last throughout the entire period of use of the Johnson Creek Route (approximately 40 years); however, the potential for these effects would be incrementally reduced during closure and reclamation (when AADT would be reduced). Due to the nature of airborne dust and sediment transport by streams, the geographic extent of the impact could be hundreds of feet to miles, depending on many site- and event-specific factors, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

The effects of the Johnson Creek Route Alternative of sedimentation would be moderate, long-term, and localized.

Fuels and Hazardous Chemicals

The potential for surface water quality impacts from accidental fuel or chemical spills along the mine access roads would be comparable between the alternatives. However, all vehicle trips would traverse the Johnson Creek Route under this alternative, resulting in greater use of the Johnson Creek Route access roads. The potential location and extent of accidental spills would therefore differ compared to the 2021 MMP. The Johnson Creek Route is located in close proximity to streams (i.e., within 100 feet) for 6.5 miles or 18 percent of its approximately 36-mile length, so the potential for fuel and hazardous chemical spills impacting surface water quality is higher than for travel on the Burntlog Route which is within 100 feet of a stream for 1.69 miles or four percent of its length. Overall design features proposed by Perpetua, mitigation measures required by the Forest Service, and permit stipulations and regulatory requirements from state and federal agencies (including use of USDOT-certified containers and USDOT-registered transporters) would reduce the risk of spills and promote effective response should a spill occur.

The effects of spills associated with the Johnson Creek Route alternative on surface water would be major, temporary, and localized.

4.9.2.4 Model Sensitivity and Uncertainty

The model results discussed for groundwater and surface water are based on calibrated groundwater flow, stream and pit lake temperature, and geochemical equilibrium balance models (Brown and Caldwell 2018a, 2021a, 2021b, 2021g; SRK 2018b, 2021b).

In the site-wide water chemistry model, constituents and nodes where the relative percent difference between simulated and observed analyte concentrations was greater than a 20 percent threshold range for analytical variation (which included antimony and arsenic at several nodes), the discrepancy between simulated and observed concentrations was attributed to diffuse unquantified sources of constituent loading in the East Fork SFSR between Fiddle Creek and Sugar Creek, likely originating from several sources including mineralized bedrock outcrops and subsurface groundwater load inputs. To improve the model calibration, additional loading was added or subtracted from the simulation of the existing condition to represent the non-specific input to the river and achieve calibration for each constituent at each node. This is standard model calibration practice, and the additional loads that were added or subtracted to achieve calibration for the existing condition were carried forward to the simulation of the 2021 MMP used to generate future water quality predictions.

Despite the calibration of the water chemistry model, there is uncertainty inherent in the model predictions, as there would be for any model of this type. The technical adequacy review identified the following sources of model uncertainty and potentially non-conservative model assumptions:

- During the geochemical characterization program, three development rock samples were reported with paste pH less than 6. Although materials submitted for kinetic testing did not generate acidity during the duration of those tests (up to 197 weeks), actual long-term conditions for the proposed mine facilities could vary the rate of sulfide oxidation along with the leachate pH and/or leached analyte concentrations.
- First-flush chemistry for contact water coming from development rock was not considered relevant to surface water quality predictions (SRK 2018a). This is deemed a non-conservative assumption. First-flush releases from the development rock material could cause short-term increases in downstream concentrations above and beyond what is currently predicted by the model.
- Air temperature correction factors used to scale laboratory reaction rates to field conditions by the model could underestimate actual reaction rates and chemical releases from mined materials, and hence, surface water quality impacts.
- The surface water quality model predictions do not include mass loading inputs from permitted IPDES outfalls that would be required for the SGP. Additionally, mercury inputs from atmospheric deposition caused by the SGP have not been considered in the model. These additional loads were discussed qualitatively or semi-quantitatively in the analysis above but could modify future analyte concentrations compared to predicted values.
- Model-predicted concentrations generated by the SWWC Model are for the dissolved fraction only and may underpredict concentration levels for constituents such as mercury that have been shown to occur in particulate form.

The degree of potential predictive error from the above model assumptions and SGP design features was evaluated through sensitivity analysis simulations (SRK 2019, 2021b). Of the model uncertainties identified above, the sensitivity analysis mainly addressed the potential for acid-generation (via the NPR cutoff value used to classify PAG material) and the air temperature correction used to scale laboratory reaction rates to field conditions. Additional model runs also were conducted to evaluate the sensitivity of scaling assumptions related to the proportion of preferential flow paths and finer particle gradation in the TSF Buttress and pit backfills, as well as the pit wall fracture thickness and density. Findings from the SWWC model sensitivity analysis evaluation include the following (SRK 2019a, 2021b):

- Varying model input parameters for the sensitivity analysis had little effect on the mine operations model results.
- In one of the model sensitivity runs, the NPR cutoff for defining PAG material was increased to 2 (resulting in a greater percentage of pit wall rock and development rock lithology types being classified as PAG). The post-closure model results were not sensitive to increasing the NPR cutoff. The lack of model sensitivity to this parameter occurs because the mass loading rates for some constituents are lower in the PAG model source term input compared to some non-PAG units (SRK 2019). Thus, increasing the percentage of PAG rock in the TSF Buttress and pit lake models does not lead to higher predicted post-closure concentrations.

- The model is not sensitive to varying the pit wall blast-damaged zone thickness.
- The model is most sensitive to inputs that vary the bulk scaling factor of reactive rock, including the percentage of development rock fines, the percentage of rock contacted due to preferential flow paths through the TSF Embankment and Buttress, and increasing the reaction temperature.
- When the bulk scaling factor of reactive rock is increased, concentrations of arsenic, antimony, sulfate, mercury, and aluminum are predicted to increase in contact water derived from the mined materials (SRK 2019). The constituents exceeding surface water standards in contact water were the same as those predicted for the 2021 MMP (SRK 2018a, 2021a), but the duration of contact water exceedances was affected in the model sensitivity runs.

Although not considered in the sensitivity analysis, mass loading from IPDES outfalls was examined in a water treatment scenario evaluated in the Water Quality Management Plan (Brown and Caldwell 2020a). Results of the water treatment simulation show that concentration reductions achieved by treating mine contact water greatly outweigh any loading contribution from the water treatment plant outfall (**Figure 4.9-21**).

Overall, the sensitivity analyses (SRK 2019, 2021b) and the water treatment evaluations (Brown and Caldwell 2020a, 2021f) address model uncertainty and non-conservative assumptions associated with acid-generation potential, IPDES outfalls, and air temperature correction factors. The sensitivity analysis and model treatment simulations show that changing the NPR cutoff for defining PAG material and adding the load from the water treatment plant outfall do not substantially alter predicted mine operational or post closure concentrations. However, increasing the reaction temperature in mined materials and pit walls was shown to produce higher post-closure arsenic concentrations in the pit lakes and downstream assessment nodes. Incorporation of first-flush chemistry in the model predictions would slightly increase predicted analyte concentrations. Effects of model uncertainty from simulating dissolved rather than total concentrations have not been evaluated, but total concentrations of analytes that appear in particulate form would be greater than the simulated dissolved concentrations.

For stream water temperature modeling, inherent sources of model uncertainty include:

- the actual effectiveness, timing, and sustainability of the shading effects of riparian plantings beside restored stream channels on reclaimed versus native soils and in an environment affected by weather events and wildfire which would be based on shading effects rather than typical reclamation revegetation goals (e.g., 70% of pre-existing cover),
- the actual effectiveness of the constructed and lined Stibnite Lake feature in achieving simulated surface water temperature reductions attributed to the unlined Yellow Pine pit lake. Introduction of the lined lacustrine feature atop the lined and covered backfill in the Yellow Pine pit would modify the volume of diffuse subsurface groundwater inflow. The lined Stibnite Lake feature would receive inflow from the cover material in contrast to the existing groundwater inflow from native bedrock into the Yellow Pine pit Lake. Depending on the hydraulic properties of the cover material compared to the native bedrock, the volume of groundwater inflow to the lake could differ from existing inflow rates with associated implications for resulting lake water temperature. The current temperature model does not incorporate any potential cooling effects from subsurface inflow into the Stibnite Lake feature,

- spatial variability associated with the reduction and recovery of groundwater levels and groundwater discharge to surface water, and
- potential broader effects of climate change on air temperature, meteoric precipitation, weather events, wildfire, and plant growth.

These sources of uncertainty relate largely to spatially and temporally variable implementation success and sustainability of closure activities which are difficult simulate directly with a temperature model. Qualitatively however, insufficiently effective closure activities and/or adverse changes in broader climate conditions could result in higher than predicted stream temperatures.

4.9.3 Mitigation Measures

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. The mitigation measures described below are in addition to the Forest Service requirements and EDFs accounted for in the preceding impact analysis.

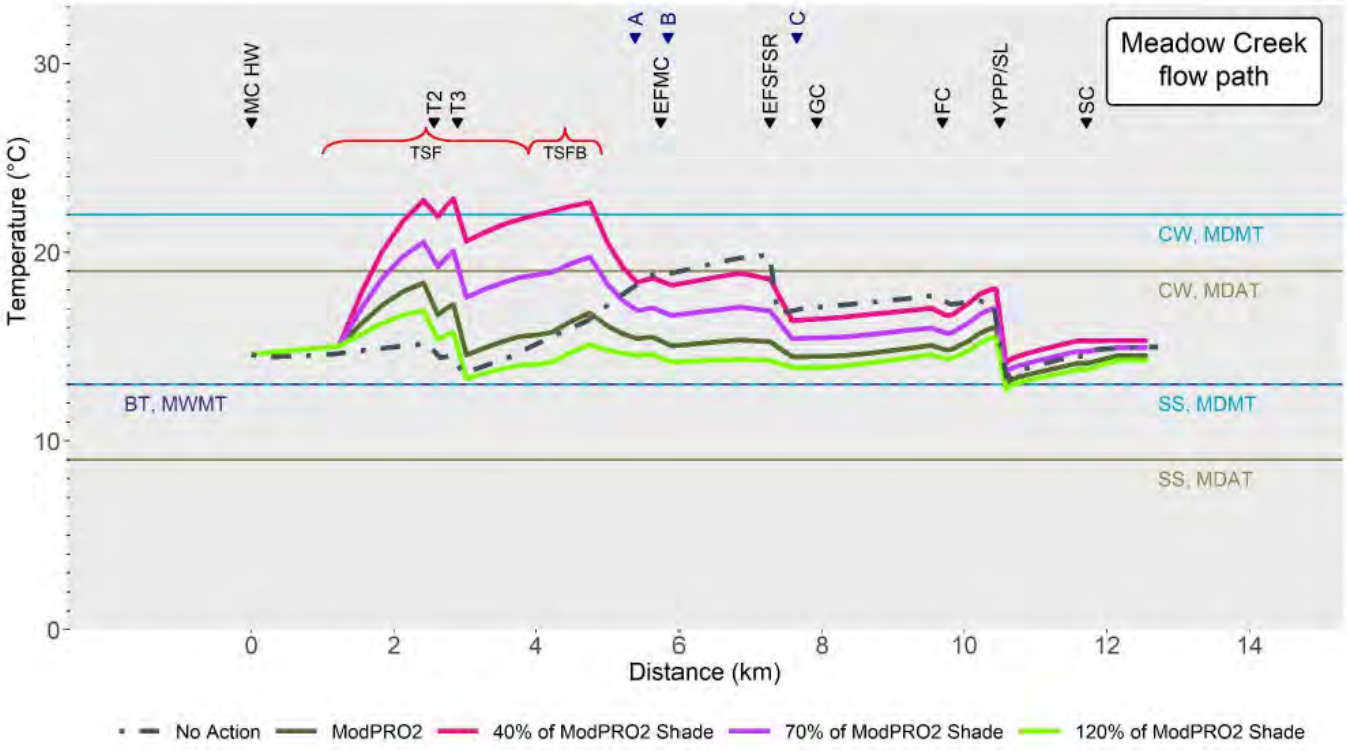
Issue: Long-term performance of stream temperature reduction measures may have the potential to not fully achieve the forecasted stream temperature results. For example, the restored stream channel across the closed TSF may experience different consolidation, hydrologic, and/or re-vegetation performance compared to model forecasts that would affect its viability for reducing stream temperature as well as maintaining a physically and chemically stable closure for the TSF.

Mitigation Measure - Contingent Stream Temperature Reduction Measures: Due to inherent limitations in modeling and forecasting stream flow temperatures over a multi-decade period, effectiveness of the actual performance of TSF consolidation, stream channel restoration, riparian plantings, and other temperature reduction measures implemented may differ from forecast. At less than full design efficiency, predicted stream temperatures remain elevated in the TSF area and near existing conditions in downstream areas without realizing the benefit of the restored stream channel over the TSF on reducing stream temperatures below the existing condition (**Figure 4.9-29**).

Without this temperature reduction, stream temperatures downstream of the Yellow Pine pit area could also be greater than existing conditions.

Ditches and pipelines utilized to divert water around the TSF during operations are expected to result in cooler water temperatures downstream than existing conditions. In addition, these diversions would not be affected by TSF consolidation or implementation of stream channel restoration. Therefore, these surface flow diversions would continue to be utilized and not be removed/reclaimed until:

1. TSF consolidation appropriate for stream channel restoration could be verified via consolidation monitoring and remodeling for the as-built tailings facility,
2. Stream restoration design and implementation could be re-assessed prior to construction by resurveying the as-built and partially consolidated TSF surface to determine whether design stream gradients could be achieved or whether the stream channel design would need adjustment to accommodate the gradients of post-consolidation TSF surface, and



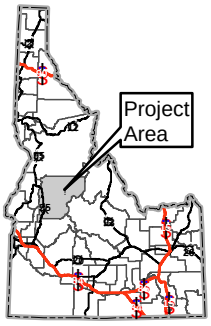


Figure 4.9-29
Sensitivity Analysis of Predicted MWMT Summer Temperature in Meadow Creek and the EFSFSR

Stibnite Gold Project
Stibnite, ID

Data Sources: (Brown & Caldwell 2022)

3. Achievement of design shading effects of riparian plants on stream temperatures could be re-assessed prior to construction by measuring the success of establishing riparian plantings at locations outside the TSF footprint (e.g., Hangar Flats pit diversion corridor, TSF Buttress, across the Yellow Pine pit backfill or others) or a TSF-analogous test plot location utilizing the design cover materials and thicknesses.

Operational period maintenance practices for the diversions would remain into effect into the closure and post-closure period to prevent sedimentation and other factors from impairing the effective use of the diversions. Upon verification of the items above with any associated design adjustments, stream water temperature monitoring data in the constructed restored stream channel would be collected to confirm the performance of the temperature reduction measures. In an event where monitoring data indicated that acceptable stream temperatures would not be attained, the ditch and pipeline diversions would be re-commissioned and utilized to convey surface flows until an effective planting design would be developed and implemented.

Effectiveness: This monitoring and mitigation measure would be effective in reducing stream temperatures to predicted levels. However, it could delay the reclamation of surface water diversion ditches and pipelines for a period of several years, until stream temperature reductions could be achieved by shading, channel reconfiguration, or other means. This could delay the placement of up to 33,000 BCY of growth media. Any extended usage of the operational period diversion may also affect the implementation of approximately 121 acres of riparian planting and wetlands restoration plus the establishment of potential fish habitat on the reclaimed TSF area. However, the stream temperatures could be more conducive to fish occupancy in reaches of the East Fork SFSR in the mine site area (see **Section 4.12** for additional details).

Issue: As with any predictive model, limitations to long-term water chemistry modeling may result in underestimation of the nature and/or extent of surface water and groundwater quality impacts.

Monitoring Measure - Water Resource Monitoring Plan Implementation: Because construction, operation, and closure of the proposed Project has potential to impact surface or groundwater resources, a focused Water Resources Monitoring Plan for the approved project would be developed by Perpetua. As the mine owner/operator, Perpetua would be responsible for the implementation of the Water Resources Monitoring Plan for any approved action incorporating the confirmation of predicted surface water and groundwater chemistry plus surface water temperature. The plan would include mined development rock and ore, surface water, groundwater, and meteorological monitoring requirements. Monitoring results would be provided to the Forest Service on a quarterly basis and summarized in an annual report. Perpetua would be responsible for continued monitoring and reporting of surface and groundwater chemistry and temperature prior to, during, and after operations for a period of time in the post-reclamation period. The plan would be reviewed and approved by the Forest Service and implemented prior to the commencement of mining. State authorizations may also have monitoring requirements and these requirements along with monitoring already conducted or proposed could be applied to satisfy the needs of this mitigation measure.

Effectiveness: This monitoring measure would provide for identification of potential impacts to groundwater and surface water resources as a result of mine-related water management activities.

Implementation of this monitoring measure in conjunction with associated mitigation measures is anticipated to mitigate any impacts that deviate outside model uncertainty to surface water and groundwater resources resulting from mine-related water management during the construction, mining, and closure periods. If such deviation is observed, actions may consist of additional investigation and evaluation, including additional monitoring as necessary, to determine effective management practices and prevent adverse impacts.

Issue: Despite the best efforts at calibration and validation predictive modeling of groundwater and surface water chemistry and temperature entails uncertainty and future field conditions may vary form model predictions.

Monitoring Measure - Updated Geochemical and Temperature Modeling: Geochemical modeling and/or temperature modeling would be updated as necessary (at the request of the Forest Service) if monitoring results obtained from the Water Resources Monitoring Plan or other data collection indicate a change in water quality conditions that would significantly influence prediction and recognition of potential mine impacts. The Forest Service's review of quarterly and annual monitoring results compared to predicted conditions would provide early warning of potentially unanticipated, undesirable impacts to water resources to allow for implementation of appropriate mitigation measures. Implementation of these mitigation measures would reduce or eliminate potential impacts to water quality.

Effectiveness: Implementation of this monitoring measure is expected to be effective in sustaining predictive models as usable evaluation tools that reflect site conditions and monitoring data for the purpose of predicting impacts and developing effective management practices.

4.9.4 Irreversible and Irretrievable Commitments of Public Resources

4.9.4.1 No Action Alternative

Under the No Action Alternative, there would be no open pit mining or removal of legacy waste material at the mine site. Consequently, no changes would occur to current geochemical, surface water, or groundwater conditions in the analysis area, and no change to the current commitment of these resources would occur. Therefore, there would be no irreversible or irretrievable commitment of geochemical, surface water, or groundwater resources.

4.9.4.2 Action Alternatives

With respect to geochemistry, gold, silver, and antimony are non-renewable resources that would be mined from ore deposits and then milled to remove the metals, constituting an irreversible commitment of mineral/geochemical resources. Other metals and elements present in the Yellow Pine, Hangar Flats, and West End Deposits that are not currently economically viable also would be removed from their native geologic setting and may not be retrievable in the future.

Additionally, under the 2021 MMP, the geochemistry of the mine site would be altered by removing and disposing of legacy mine waste, and by introducing new sources of waste material to the natural environment, including tailings, development rock, and exposed leachable material in the pit walls. The geochemical changes brought about by mining would therefore be irretrievable, because in many cases

the geochemical impacts to groundwater chemistry and the West End pit lake are predicted to persist into the post-closure period.

No irreversible surface water quality impacts would occur because surface water is a renewable resource. However, surface water quality changes caused by the 2021 MMP would effectively be irretrievable because uses could be impaired until impacts were abated by EDFs and/or mitigation measures.

Groundwater at the mine site also can be considered a renewable resource because it is adequately replenished by natural recharge, preventing the occurrence of irreversible groundwater impacts except beneath mine facilities such as the TSF, the TSF Buttress, Hangar Flats pit backfill and Yellow Pine pit backfill where reductions in recharge caused by cover systems would permanently lower groundwater levels. Formation of the West End pit lake would also permanently lower groundwater levels in its vicinity. Irretrievable impacts would occur when concentration changes in the mine site groundwater are predicted to persist throughout the entire 100-year post closure period. This type of long-term concentration change would be considered an irretrievable impact because it may limit the productivity of groundwater for designated uses.

Under the Johnson Creek Route Alternative, irreversible geochemical impacts would be the same as for the 2021 MMP. Irretrievable geochemical and water quality impacts also would be the same.

4.9.5 Short-term Uses versus Long-term Productivity

4.9.5.1 No Action Alternative

Under the No Action Alternative, there would be no open pit mining or removal of legacy waste material at the SGP. Consequently, no short-term use would occur that would affect geochemical, surface water, or groundwater resources, and no change in long-term productivity would occur.

4.9.5.2 Action Alternatives

Mining by its nature is a short-term land use that typically results in long-term impacts by permanently altering the natural environment. For the 2021 MMP, mining-related changes include open pit mining and disposition of mine waste material in the TSF, the TSF Buttress, and pit backfills. The long-term impacts associated with these features have been quantified through modeling as discussed above, and would be offset to a degree by removal, reprocessing, and disposal of the SODA and Bradley tailings material currently present in Meadow Creek valley. However, there are still several constituents that are predicted to be elevated above existing conditions and/or applicable water quality standards in surface water or groundwater throughout the entire 100-year model-simulated post closure period, attributable to a combination of existing conditions and mine-impacted waters. Due to these predicted water quality changes, water treatment of several mine-related discharges would be required to maintain the long-term productivity of water resources both within and downstream of the mine area until facility seepage collection plus cover and liner systems effectively abate discharge of mine-impacted water to the environment (over approximately 40 years).

Under the Johnson Creek Route Alternative, long-term losses of groundwater and surface water productivity would be the same as the 2021 MMP except that transportation-related impacts to surface waters in the Johnson Creek drainage could be greater in nature and/or extent.

4.10 Vegetation

4.10.1 Impact Definitions and Effects Analysis Indicators and Methodology

The analysis of effects on vegetation includes the following issues and indicators:

Issue: The SGP would impact forested PVGs within Forest Service-administered land and could impact the ability of these areas to reach desired conditions.

Indicators:

- Acres of SGP disturbance to previously undisturbed forest PVGs within Forest Service-administered land.

Issue: The SGP would impact non-forested areas (i.e., those that are identified through PVG mapping as not being successional to forests) within Forest Service-administered land and could impact the ability of these areas to reach desired conditions.

Indicators:

- Acres of SGP disturbance to previously undisturbed non-forested areas within Forest Service-administered land.

Issue: The SGP would impact vegetation outside the boundaries of the Forests.

Indicators:

- Acres of SGP disturbance in previously undisturbed LANDFIRE existing vegetation types outside Forest Service boundaries.

Issue: The SGP would remove whitebark pine individuals, and habitat conversion associated with the SGP would impact seed production, dispersal, and establishment of this species.

Indicators:

- Number of acres of whitebark pine occupied habitat impacted by the SGP.
- Estimated number of mature whitebark pine trees to be cut during SGP construction.

Issue: The SGP would impact known occurrences of Regional and Forest-specific designated sensitive and forest watch plant species.

Indicators:

- Presence of known occurrences of sensitive or forest watch plant species or occupied habitat within 300 feet of the SGP disturbance area.

Issue: The SGP would result in a direct loss of modeled potential habitat for Regional and Forest-specific designated sensitive and forest watch plant species.

Indicators:

- Acres of modeled potential habitat for Regional and Forest-specific designated sensitive and forest watch plant species disturbed by the SGP.

Issue: SGP actions would result in increased potential for non-native plant establishment and spread.

Indicator:

- Total acres of land disturbed by the SGP.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1**.

4.10.2 Direct and Indirect Effects

4.10.2.1 No Action Alternative

Under the No Action Alternative, the mining, ore processing, and related activities under the two action alternatives would not take place and there would be no direct or indirect effects to vegetation and no changes to current conditions for vegetation in the analysis area from the SGP. 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 Mining Law.

Perpetua would continue to implement surface exploration and associated activities that have been previously approved on NFS lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project EA (Forest Service 2015c). These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads) and drilling on both NFS and private lands at and in the vicinity of the mine site. These exploration and subsequent reclamation activities would have only a small direct effect on vegetation resources, as the disturbance footprint associated with the Golden Meadows EA is limited to the temporary access roads to pads and the exploration drilling holes.

Perpetua would be required to continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and EA, which include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using

standard reclamation practices, and monitoring to ensure that sediment and stormwater BMPs are in place and effective so that impacts to vegetation are avoided or minimized.

4.10.2.2 2021 MMP

Impacts to Forested Vegetation Communities within Forest Service-Managed Land

Anticipated acreages of direct impacts of vegetation clearing to previously undisturbed forested PVGs within Forest Service-managed lands under the 2021 MMP are presented in **Table 4.10-1**. These areas would not maintain or move towards desired conditions into the foreseeable future. Most impacts to PVGs under the 2021 MMP would be related to disturbance activities at the Operations Area Boundary and would occur in the Warm, Dry Subalpine Fir (PVG 7) and Persistent Lodgepole Pine (PVG 10) types, which are the most extensive PVGs in the analysis area. This would result primarily in localized, long-term and permanent, moderate impacts to forested vegetation communities within Forest Service-managed land, depending on the SGP component and specific PVG type impacted.

Table 4.10-1 Acres of Disturbance to Previously Undisturbed Forested PVGs under the 2021 MMP

PVG	Mine Site	Off-site Facilities	Access Roads	Utilities	Tall Tree Clearing[1]	Total[2]
PVG 1 – Dry Ponderosa Pine/ Xeric Douglas-fir	-	-	1.3	1.0	0.5	2.8
PVG 2 – Warm, Dry Douglas-fir/ Moist Ponderosa Pine	0.5	-	31.9	155.0	52.8	240.1
PVG 3 – Cool, Moist Douglas-fir	-	-	-	7.9	2.7	10.6
PVG 4 – Cool, Dry Douglas-fir	4.9	-	29.1	109.4	38.8	182.2
PVG 5 – Dry Grand Fir	-	-	-	67.6	22.6	90.1
PVG 6 – Moist Grand Fir	-	-	-	41.5	14.6	56.1
PVG 7 – Warm, Dry Subalpine Fir	498.3	1.6	131.9	81.5	28.5	741.8
PVG 8 – Cool Moist Subalpine Fir	-	-	-	-	-	-
PVG 9 – Hydric Subalpine Fir	3.8	-	12.3	11.7	4.4	32.2
PVG 10 – Persistent Lodgepole Pine	251.0	2.9	199.4	172.1	53.8	679.1
PVG 11 – High Elevation Subalpine Fir (with Whitebark Pine)	-	-	21.0	19.6	7.4	48.1
Total[2]	**758.4**	**4.5**	**427.0**	**667.2**	**226.1**	**2,083.2**

Source: Perpetua 2021a; Acres of direct impacts were calculated by overlaying SGP components with PVG data (Forest Service 2005a, 2017a), omitting areas of previous mine site disturbance (Perpetua 2021a).

[1]Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.

[2]Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

Impacts to Non-Forested Vegetation Communities within Forest Service-Managed Land

Anticipated acreages of direct impacts of vegetation clearing to previously undisturbed areas identified as not successional to forested PVGs within Forest Service-managed lands under the 2021 MMP are presented in **Table 4.10-2**. These areas would not maintain or move towards desired conditions into the foreseeable future. Most impacts to these areas would be related to disturbance activities at the mine site and would occur in the Douglas-fir and Lodgepole Pine existing vegetation types. This would result primarily in localized, short-term, long-term, and permanent, moderate impacts to non-forested vegetation communities within Forest Service-managed land, depending on the SGP component and specific vegetation type impacted.

Table 4.10-2 Acres of Disturbance to Areas Identified as not Successional to Forested PVGs under the 2021 MMP

Existing Vegetation Type[1]	Mine Site	Access Roads	Utilities	Tall Tree Clearing[2]	Off-site Facilities	Total
Aspen	-	0.1	-	0.1	-	0.1
Burned Forest Shrublands	-	1.8	3.5	1.3	-	6.6
Burned Herblands	5.4	2.8	7.7	2.5	-	18.4
Burned Sparse Vegetation	0.3	5.5	1.1	0.6	-	7.2
Developed	8.9	0.2	0.2	-	-	9.3
Douglas-fir	6.8	12.5	10.8	3.7	-	33.7
Douglas-fir/Lodgepole Pine	5.9	0.1	0.1	-	-	6.1
Douglas-fir/Ponderosa Pine	-	0.9	0.7	0.2	-	1.8
Engelmann's Spruce	-	-	0.4	0.2	-	0.7
Forblands	-	4.7	2.0	0.8	-	7.5
Forest Shrublands	-	1.2	4.0	1.2	-	5.2
Grasslands	2.0	0.2	1.5	0.5	-	4.1
Lodgepole Pine	10.4	7.2	5.9	2.7	-	26.2
Mountain Big Sagebrush	-	0.3	-	-	-	0.3
Ponderosa Pine	-	0.2	4.5	1.7	-	6.4
Riparian Herblands	1.9	0.4	1.3	- 0.4	-	4.1
Riparian Shrublands/ Deciduous Forests	1.7	0.3	4.7	2.1	-	8.9
Sparse Vegetation	7.2	0.3	0.1	0.0	-	7.7
Subalpine Fir	-	5.0	1.0	00.4	-	6.4
Water	-	0.1	0.3	0.1	-	0.5

Existing Vegetation Type[1]	Mine Site	Access Roads	Utilities	Tall Tree Clearing[2]	Off-site Facilities	Total
Whitebark Pine	-	0.1	0.1	-	-	0.3
Total[3]	**50.3**	**42.5**	**50.0**	**18.7**	**-**	**161.5**

Source: Perpetua 2021a; Acres of direct impacts were calculated by overlaying SGP components with PVG data (Forest Service 2005a, 2017a) and VCMQI mapping (Forest Service 2016b, 2021d), omitting areas of previous mine site disturbance (Perpetua 2021a).

[1]PVG mapping and existing vegetation mapping are performed using different processes and different objectives. As such, forest existing vegetation types may occur within areas identified as not successional to forests in PVG mapping, and alternatively, non-forest existing vegetation types may occur in areas identified as successional to forests in PVG mapping.

[2]Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.

[3]Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

Impacts to Vegetation Communities Outside Forest Service-Managed Land

Anticipated acreages of vegetation clearing in vegetation communities outside Forest Service-managed lands under the 2021 MMP are presented in **Table 4.10-3**. In addition to the direct impact of vegetation clearing, these areas would experience the types of indirect impacts described below. This would result primarily in localized, short-term, long-term, and permanent, moderate impacts to vegetation communities outside Forest Service-managed land, depending on the SGP component and specific vegetation type impacted.

Table 4.10.3 Acres of Disturbance to Vegetated Acres Outside Forest Service-Managed Lands under the 2021 MMP

LANDFIRE Vegetation Class Name	Utilities	Tall Tree Clearing[1]	Off-site Facilities	Total
Interior Western North American Temperate Ruderal Grassland	33.7	17.9	-	51.6
Interior Western North American Temperate Ruderal Shrubland	6.1	2.8	-	9.0
Inter-Mountain Basins Montane Sagebrush Steppe	2.3	1.1	-	3.4
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	0.6	0.5	-	1.1
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	31.2	14.7	10.9	56.9
Northern Rocky Mountain Foothill Conifer Wooded Steppe	-	-	0.1	0.1
Northern Rocky Mountain Lower Montane Riparian Shrubland	5.5	2.4	0.3	8.1
Northern Rocky Mountain Lower Montane Riparian Woodland	6.3	3.0	5.9	15.2
Northern Rocky Mountain Mesic Montane Mixed Conifer Forest	2.6	1.1	0.7	4.4

LANDFIRE Vegetation Class Name	Utilities	Tall Tree Clearing[1]	Off-site Facilities	Total
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	7.8	2.3	-	10.1
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	16.6	5.6	0.9	23.0
Northern Rocky Mountain Subalpine Deciduous Shrubland	3.5	1.0	-	4.5
Rocky Mountain Alpine-Montane Wet Meadow	38.3	20.1	0.0	58.5
Rocky Mountain Cliff Canyon and Massive Bedrock	1.7	0.4	0.1	2.2
Rocky Mountain Lodgepole Pine Forest	16.5	6.1	2.9	25.5
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	0.0		-	0.0
Rocky Mountain Subalpine-Montane Mesic Meadow	1.7	0.7	-	2.4
Open Water	6.6	3.3	-	9.9
Agricultural, Developed	111.4	68.3	2.5	216.0
TOTALS[2]	**292.4**	**133.5**	**24.3**	**450.2**

Source: Perpetua 2021a; Acres of direct impacts were calculated by overlaying SGP components outside Forest Service boundaries with LANDFIRE data (USGS 2016a).
[1]Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.
[2]Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

Impacts to Whitebark Pine

Based on the results of the species-specific field surveys conducted for the SGP in 2019 (Tetra Tech 2020b), the 2021 MMP would impact approximately 259.4 acres of occupied whitebark pine habitat and would remove an estimated 1,236 individual trees, 23 of which would be mature, cone-bearing individuals. This would result primarily in localized, long-term and permanent, moderate impacts to the whitebark pine.

Detailed calculations of impacts to whitebark pine occupied habitat and individual trees are reported in the SGP Vegetation Specialist Report Appendix F (Forest Service 2022g). The Forest Service has preliminarily determined that the 2021 MMP would impact whitebark pine but would not jeopardize the continued existence of this species.

Impacts to Known Locations of Sensitive and Forest Watch Species

Construction of the 2021 MMP would impact several known occurrences of sensitive and forest watch plant species as described in the following subsections.

Bent-flowered Milkvetch (*Astragalus vexilliflexus* var. *vexilliflexus*)

Several subpopulations of a single occurrence of bent-flowered milkvetch, a PNF forest watch species, occur to the east of the SGP (IFWIS 2017; Mancuso 2016). One of the bent-flowered milkvetch subpopulations (the Cinnabar Peak subpopulation) extends from approximately one-quarter mile to approximately 300 feet upslope of the West End Creek diversion (Mancuso 2016).

The 2021 MMP could impact the Cinnabar Peak subpopulation due to its proximity to the West End Creek diversion. The most likely impact of the SGP on this subpopulation would be dust associated with construction of the West End Creek diversion, which could travel upslope and impact this subpopulation or its pollinators. Impacts of dust on the Cinnabar Peak subpopulation could range from mild metabolic inhibition or inhibition of pollination to mortality of individuals; dust also could inhibit pollination success. These impacts may result in reduced ability of this subpopulation to serve as a seed source for future conservation efforts for this species.

The area of potential exploratory drilling overlaps with subpopulations of this species. Exploratory drilling within this area has the potential to impact this species directly through removal or crushing and/or via dust deposition or impacts to pollinators.

The combination of these potential impacts would result primarily in localized, long-term and permanent, moderate impacts to the bent-flowered milkvetch. Therefore, the 2021 MMP may indirectly impact bent-flowered milkvetch individuals (one out of a total of approximately 653 individuals within 10 populations identified on the PNF) and habitat but would not likely contribute to a loss of viability of the species within the planning area (i.e., PNF-administered lands).

Least Moonwort (*Botrychium simplex*)

Two subpopulations of a single occurrence of least moonwort, a Forest Service sensitive species on the PNF and a forest watch species on the BNF, are located in swales adjacent to Johnson Creek Road (CR 10-413) (IFWIS 2017) in the BNF. Increased vehicle travel on this road associated with SGP activities would increase dust impacts that could impact these subpopulations and the swale habitat they occur in as compared to current conditions. Maintenance work on this road, such as ditch and culvert repair and adding gravel to the road surface also could increase dust impacts as well as increase impacts associated with potential hydrologic alterations on these subpopulations and associated swales. These subpopulations were not observed by Forest Service surveyors in the most recent survey year (2005) (IFWIS 2017); however, if they still exist, increased dust deposition could result in impacts ranging from metabolic inhibition or mortality of individuals.

The combination of these potential impacts would result primarily in localized, long-term and permanent, moderate impacts to the least moonwort. Therefore, the 2021 MMP may indirectly impact least moonwort individuals (two out of a total of approximately 1,731 individuals in 14 populations on the PNF) and habitat but would not likely contribute to a loss of viability of the species within the planning area (i.e., BNF-administered lands).

Blandow's Helodium (*Helodium blandowii*)

A single occurrence of Blandow's helodium, a forest watch species on both the PNF and BNF, is found in the analysis area near Trapper Creek, within approximately 100 feet from where the Burntlog Route would cross the Trapper Flat wetland in the BNF (IFWIS 2017). Construction of the road in this area could impact hydrology of the wetland that this species inhabits, which could result in conditions that would not support this occurrence.

The SGP also could impact this occurrence due to dust associated with construction of the road and vehicle travel in this area. Increased dust deposition could result in impacts ranging from metabolic inhibition to mortality of individuals.

The combination of these potential impacts would result primarily in localized, long-term and permanent, moderate impacts to the Blandow's helodium. Therefore, the 2021 MMP may indirectly impact Blandow's helodium individuals (one) but would not likely contribute to loss of viability of the species within the planning area (i.e., BNF-administered lands).

Sweetgrass (*Hierochloe odorata*)

Two subpopulations of a single occurrence of sweetgrass, a forest watch species on the BNF, are located in wetlands near Trapper Creek, the closest being approximately 780 feet and the farthest being 1,000 feet from new construction for the Burntlog Route in the BNF (IFWIS 2017). This species is in an area that is hydrologically connected to wetlands that would be impacted by construction of the Burntlog Route, and therefore, it is considered to be within the analysis area. Construction of the Burntlog Route through the wetlands in this area could impact hydrology of the wetland that this species inhabits, which could result in conditions that would not support these subpopulations.

This potential impact would result primarily in localized, long-term and permanent, moderate impacts to sweetgrass. Therefore, the 2021 MMP may indirectly impact sweetgrass individuals (two) and habitat but would not likely contribute to loss of viability of the species within the planning area (i.e., BNF-administered lands).

Sacajawea's Bitterroot (*Lewisia sacajaweana*)

One occurrence of Sacajawea's bitterroot, a Forest Service sensitive species on both the PNF and BNF, occurs approximately 300 feet above Warm Lake Road (CR 10-579) and the existing transmission line corridor near the intersection of Warm Lake Road with Curtis Creek Road (IFWIS 2017) in the BNF. This occurrence is on a hillside above a portion of Warm Lake Road, and the polygon for this occurrence overlaps a transmission line access road that would be used during transmission line reconstruction and SGP operation. Spur road construction and use of this dirt road during transmission line reconstruction and SGP operation would create dust that could negatively impact this occurrence of Sacajawea's bitterroot. Impacts of dust on this species could range from mild metabolic inhibition to mortality of individuals.

The combination of these potential impacts would result primarily in localized, long-term and permanent, moderate impacts to the Sacajawea's bitterroot. Therefore, the 2021 MMP may indirectly impact Sacajawea's bitterroot individuals (one out of approximately 157,023 individuals in 27 populations on the PNF) and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area (i.e., BNF-administered lands).

Rannoch-rush (*Scheuchzeria palustris*)

One occurrence of Rannoch-rush, a forest watch species on the BNF, is located in a wetland in the Mud Lake area in the BNF (IDFG 2004; IFWIS 2017). This occurrence is within 300 feet of an existing portion of Burnt Log Road (FR 447). This occurrence is likely to be impacted by dust associated with road widening and vehicle travel on the Burntlog Route in this location. This occurrence also could be subject to other potential indirect effects described, under Indirect Impacts. The most likely impact of the SGP on this occurrence is dust associated with construction of the road and vehicle travel in this area. Increased dust deposition could result in impacts ranging from metabolic inhibition or mortality of individuals.

This potential impact would result primarily in localized, long-term and permanent, moderate impacts to the Rannoch-rush. Therefore, the 2021 MMP may indirectly impact Rannoch-rush individuals (one) and habitat but would not likely contribute to loss of viability to the species within the planning area (i.e., BNF-administered lands).

Impacts to Modeled Potential Habitat for Sensitive and Forest Watch Species

Table 4.10-4 presents acres of modeled potential habitat for special status plant species that would be directly impacted under the 2021 MMP by SGP component. Direct removal of potential habitat would occur in these areas, as well as the indirect of impacts described below.

Impacts to habitats for sensitive and forest watch species would predominantly occur at the mine site, with lesser extents of impacts occurring along access roads and transmission lines, including in areas of tall tree clearing. This would result primarily in localized, long-term and permanent, moderate impacts to sensitive and Forest Watch Species, depending on the SGP component and specific modeled habitat impacted.

Table 4.10-4 Acres of Direct Impacts to Modeled Special Status Plant Potential Habitat under the 2021 MMP

Scientific Name (Common Name)	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total[1]
Allotropa virgata (Candystick)	57.6	8.6	16.3	5.6	-	88.2
Astragalus vexilliflexus var. *vexilliflexus* (Bent-flowered milkvetch)	6.8	3.1	5.9	2.1		17.9
Botrychium lineare and *B. simplex* (Slender moonwort and least moonwort)	140.4	17.2	45.5	17.8		220.8
Botrychium crenulatum (Scalloped moonwort)	1.4	1.6	5.6	2.1		10.7
Bryum calobryoides (Beautiful bryum)		1.6	6.4	2.4		10.4
Buxbaumia viridis (Green bug moss)	1.8	7.0	21.8	7.9		38.6
Calamagrostis tweedyi (Cascade reedgrass)	499.2	200.6	140.0	46.7	0.8	887.2
Carex livida (Livid sedge)	165.5	20.8	45.6	17.4		249.2
Carex straminiformis (Shasta sedge)		72.6	23.4	8.1		104.1
Cicuta bulbifera (Bulblet-bearing water hemlock)	60.4	6.6	126.8	39.2		233.0
Douglasia idahoensis (Idaho douglasia)		22.0	4.0	1.5		27.5
Draba incerta (Yellowstone draba)		34.9	18.2	6.3		59.4
Drosera intermedia (Spoonleaf sundew)	165.5	20.8	45.6	17.4		249.2
Epilobium palustre (Swamp willow weed)	0.3	0.2	9.4	3.7		13.5
Epipactis gigantea (Giant helleborine orchid)		1.7	9.0	3.2		13.9
Helodium blandowii (Blandow's helodium)	142.6	3.5	40.0	15.1		201.3
Hierochloe odorata (Sweetgrass)	84.3	19.8	66.1	19.5		189.7
Lewisia sacajaweana (Sacajawea's bitterroot)	141.5	178.5	70.5	23.0		413.5
Mimulus clivicola (Bank monkeyflower)		2.1	46.9	15.5		64.4

Scientific Name (Common Name)	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total[1]
Penstemon laxus (Tufted penstemon)	28.4	1.2	30.7	10.1		70.4
Polystichum kruckebergii (Kruckeberg's sword-fern)	97.2	43.8	48.6	13.7	0.3	203.5
Rhynchospora alba (White beaksedge)	34.7	1.6	32.9	12.2		81.4
Sanicula graveolens (Sierra sanicle)	119.9	46.7	13.4	3.7		183.7
Saxifraga tolmiei var. *ledifolia* (Tolmie's saxifrage)	52.2	49.3	18.0	6.1	0.3	125.9
Scheuchzeria palustris (Rannoch-rush)	165.5	20.8	45.6	17.4		249.2
Sedum borschii and *S. leibergii* (Borch's stonecrop and Leiberg stonecrop)	32.0	3.1	0.6	0.4		35.9
Triantha occidentalis ssp. *brevistyla* (Short-style tofieldia)	132.8	12.6	30.5	11.5		187.4

Source: Stantec 2022.
[1]Due to rounding, numbers presented may not sum precisely. Total acreages for features are presented as modeled potential habitat for many species overlap that of other species.

Increased Potential for Non-Native Plant Establishment and Spread

Anticipated acreages of vegetation disturbance to previously undisturbed vegetation communities both inside and outside Forest Service boundaries under the 2021 MMP are presented in **Table 4.10-5**. Increased establishment and spread of non-native plants are possible in these areas. This would result primarily in regional, localized, temporary, short-term, and long-term, moderate impacts related to the increased potential for non-native plant establishment, depending on the SGP component and specific vegetation type impacted.

Table 4.10-5 Total Acres of Disturbance to Vegetation Communities due to SGP Components under the 2021 MMP

Vegetation	Mine Site	Access Roads	Utilities	Tall Tree Clearing[1]	Off-site Facilities	Total[2]
Forest PVGs (1-11) within Forest Service boundaries	1,011.8	427.0[3]	667.8	226.8	4.5	2,338.0
Non-forest Areas within Forest Service boundaries	663.2	42.8	50.5	19.0	0	775.5
LANDFIRE vegetation outside Forest Service boundaries	0	0	292.4	133.5	24.3	450.2
Totals[2]	**1,675**	**469.8**	**1,010.8**	**379.3**	**28.8**	**3,563.7**

Source: Perpetua 2021a; Acres of direct impacts to forest PVGs and non-forest areas within Forest Service boundaries were calculated by overlaying SGP components with PVG data (Forest Service 2005a, 2017a) and VCMQI mapping (Forest Service 2016b, 2021d), omitting areas of previous mine site disturbance (Perpetua 2021a). Acres of direct impacts to LANDFIRE vegetation outside Forest Service boundaries were calculated by overlaying SGP components outside Forest Service boundaries with LANDFIRE data (USGS 2016a).

[1]Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.

[2]Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

[3]Does not include 15 acres of unmapped PVG areas located on the Salmon-Challis National Forest.

4.10.2.3 Johnson Creek Route Alternative

Under the Johnson Creek Route Alternative, the mine site and utilities would operate similarly to the 2021 MMP. However, the Burntlog Route would not be constructed, and the Johnson Creek Route would be used for access during mine construction, operations, and closure and reclamation. The Landmark Maintenance Facility would be relocated to the west and located on NFS land near the intersection of Warm Lake and Johnson Creek roads, where it would be accessed via Warm Lake Road.

Impacts to Forested Vegetation Communities within Forest Service-Managed Land

Anticipated acreages of disturbance associated with all SGP features in mapped PVGs under the Johnson Creek Route Alternative during the construction phase are presented in **Table 4.10-6**. These areas would not maintain or move towards desired conditions into the foreseeable future. As under the 2021 MMP, most impacts to PVGs would be related to disturbance activities at the mine site and would occur in the Warm, Dry Subalpine Fir (PVG 7) and Persistent Lodgepole Pine (PVG 10) types. This would result primarily in localized, long-term and permanent, moderate impacts to forested PVGs within Forest Service-managed land, depending on the SGP component and specific PVG type impacted.

Table 4.10-6 Acres of Disturbance to Previously Undisturbed Forested PVGs under the Johnson Creek Route Alternative

PVG	Mine Site	Access Roads	Utilities	Tall Tree Clearing[1]	Off-site Facilities	Total[2]
PVG 1 – Dry Ponderosa Pine/ Xeric Douglas-fir	-	33.5	2.6	1.3	-	37.4
PVG 2 – Warm, Dry Douglas-fir/ Moist Ponderosa Pine	0.5	95.7	167.4	59.9	-	323.5
PVG 3 – Cool, Moist Douglas-fir	-	-	8.5	3.0	-	11.6
PVG 4 – Cool, Dry Douglas-fir	3.1	55.8	109.0	38.8	0.3	207.0
PVG 5 – Dry Grand Fir	-	-	71.0	23.8	-	94.8
PVG 6 – Moist Grand Fir	-	-	45.7	15.5	-	61.2
PVG 7 – Warm, Dry Subalpine Fir	491.4	30.4	81.5	28.5	1.9	633.7
PVG 8 – Cool Moist Subalpine Fir	-	-	-	-	-	-
PVG 9 – Hydric Subalpine Fir	3.8	12.1	11.7	4.4	-	32.0
PVG 10 – Persistent Lodgepole Pine	250.2	50.5	171.5	53.8	2.6	528.6
PVG 11 – High Elevation Subalpine Fir (with Whitebark Pine)	-	2.7	19.6	7.4	-	29.8
TOTALS[2]	**749.0**	**280.6**	**688.5**	**236.5**	**4.8**	**1,959.4**

Source: Perpetua 2021a; Acres of direct impacts to modeled habitat were calculated by overlaying SGP components with PVG data (Forest Service 2005a, 2017a), omitting areas of previous mine site disturbance (Perpetua 2021a).
[1]Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.
[2]Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

Impacts to Non-Forested Vegetation Communities within Forest Service-Managed Land

Anticipated acreages of direct impacts of vegetation clearing to previously undisturbed areas identified as not successional to forested PVGs within Forest Service-managed lands under the Johnson Creek Route Alternative are presented in **Table 4.10-7**. These areas would not maintain or move towards desired conditions in the foreseeable future. As under the 2021 MMP, most impacts to these areas would be related to disturbance activities at the mine site and would occur in the Douglas-fir and Lodgepole Pine existing vegetation types. This would result primarily in localized, short-term, long-term, and permanent, moderate impacts to non-forested vegetation communities within Forest Service-managed land, depending on the SGP component and specific vegetation type impacted.

Table 4.10-7 Acres of Disturbance to Areas Identified as not Successional to Forested PVGs under the Johnson Creek Route Alternative

Existing Vegetation Type[1]	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Total[2]
Aspen	-	-	-	0.1	0.1
Burned Forest Shrublands	-	0.5	3.5	1.3	5.3
Burned Herblands	5.4	1.2	7.7	2.5	16.8
Burned Sparse Vegetation	0.3	0.2	1.1	0.6	2.0
Developed	8.9	0.3	0.2	-	9.3
Douglas-fir	6.7	8.3	10.5	3.7	29.1
Douglas-fir/Lodgepole Pine	5.9	0.1	0.1	-	6.1
Douglas-fir/Ponderosa Pine	-	1.8	0.7	0.2	2.8
Engelmann's Spruce	-	-	0.4	0.2	0.7
Forblands	-	-	2.0	0.8	2.8
Forest Shrublands	-	-	4.0	1.2	5.3
Grasslands	2.0	0.3	1.5	0.5	4.2
Lodgepole Pine	10.2	12.9	5.9	2.7	31.7
Mountain Big Sagebrush	-	-	-	-	-
Mountain shrubland	-	2.6	-	-	2.6
Ponderosa Pine	-	0.4	4.5	1.7	6.6
Riparian Herblands	1.9	0.2	1.3	0.4	3.9
Riparian Shrublands/ Deciduous Forests	1.7	0.1	4.7	2.1	8.6
Sparse Vegetation	7.2	4.4	0.1	-	11.7
Subalpine Fir	-	0.1	1.0	0.4	1.5
Water	-	0.3	0.3	0.1	0.7
Whitebark Pine	-	-	0.1	-	0.1
TOTALS[2]	**50.0**	**33.5**	**49.7**	**18.7**	**151.9**

Source: Perpetua 2021a; Acres of direct impacts were calculated by overlaying SGP components with PVG data (Forest Service 2005a, 2017) and VCMQI mapping (Forest Service 2016b, 2021d), omitting areas of previous mine site disturbance (Perpetua 2021a).

[1]PVG mapping and existing vegetation mapping are performed using different processes and different objectives. As such, forest existing vegetation types commonly occur within areas identified as not successional to forests in PVG mapping, and alternatively, non-forest existing vegetation types commonly occur in areas identified as successional to forests in PVG mapping.

[2]Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

Impacts to Vegetation Communities Outside Forest Service-Managed Land

Anticipated acreages of direct impacts of vegetation clearing in vegetation communities outside Forest Service-managed lands under the Johnson Creek Route Alternative are presented in **Table 4.10-8**. These areas also would experience the types of indirect impacts described below. This would result primarily in localized, short-term, long-term, and permanent, moderate impacts to vegetation communities outside Forest Service-managed land, depending on the SGP component and specific vegetation type impacted.

Table 4.10-8 Acres of Disturbance to Vegetated Acres Outside Forest Service-Managed Lands under the Johnson Creek Route Alternative

LANDFIRE Vegetation Class Name	Utilities	Tall Tree Clearing[1]	Off-site Facilities	Total
Interior Western North American Temperate Ruderal Grassland	33.7	17.9	-	51.6
Interior Western North American Temperate Ruderal Shrubland	6.1	2.8	-	9.0
Inter-Mountain Basins Montane Sagebrush Steppe	2.3	1.1	-	3.4
Middle Rocky Mountain Montane Douglas-fir Forest and Woodland	0.6	0.5	-	1.1
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest	31.2	14.7	10.9	56.8
Northern Rocky Mountain Foothill Conifer Wooded Steppe	-	-	0.1	0.1
Northern Rocky Mountain Lower Montane Riparian Shrubland	5.5	2.4	0.3	8.1
Northern Rocky Mountain Lower Montane Riparian Woodland	6.3	3.0	5.9	15.2
Northern Rocky Mountain Mesic Montane Mixed Conifer Forest	2.6	1.1	0.7	4.4
Northern Rocky Mountain Montane-Foothill Deciduous Shrubland	7.8	2.3	-	10.1
Northern Rocky Mountain Ponderosa Pine Woodland and Savanna	16.6	5.6	0.9	23.0
Northern Rocky Mountain Subalpine Deciduous Shrubland	3.5	1.0	-	4.5
Rocky Mountain Alpine-Montane Wet Meadow	38.3	20.1	0.0	58.5
Rocky Mountain Cliff Canyon and Massive Bedrock	1.7	0.4	0.1	2.2
Rocky Mountain Lodgepole Pine Forest	16.5	6.1	2.9	25.5
Rocky Mountain Subalpine Mesic-Wet Spruce-Fir Forest and Woodland	0.0	-	-	0.0
Rocky Mountain Subalpine-Montane Mesic Meadow	1.7	0.7	-	2.4
Open Water	6.6	3.3	-	9.9
Agricultural, Developed	111.4	50.5	2.5	164.3
TOTALS[2]	292.4	133.5	24.3	450.2

Source: Perpetua 2021a; Acres of direct impacts were calculated by overlaying SGP components outside Forest Service boundaries with LANDFIRE data (USGS 2016a).

[1]Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.

[2]Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

Impacts to Whitebark Pine

The Johnson Creek Route Alternative would impact 108.4 acres of occupied whitebark pine habitat and would remove an estimated 767 individual trees, 23 of which would be mature, cone-bearing individuals. This would result primarily in localized, long-term and permanent, moderate impacts to the whitebark pine. The Forest Service has preliminarily determined that the Johnson Creek Route Alternative would impact whitebark pine but would not jeopardize the continued existence of this species.

Impacts to Known Locations of Sensitive and Forest Watch Species

Construction of the Johnson Creek Route Alternative would impact several known occurrences of sensitive and forest watch plant species as described in the following subsections. However, impacts to Blandow's helodium (*Helodium blandowii)*, Sweetgrass (*Hierochloe odorata)*, and Rannoch-rush (*Scheuzeria palustris)* populations would not occur under this alternative because these species do not occur near the components of the Johnson Creek Route Alternative.

The impacts to the Bent-flowered Milkvetch and Sacajawea's Bitterroot under the Johnson Creek Route Alternative are the same as described for the 2021 MMP.

Least Moonwort (*Botrychium simplex*)

The Johnson Creek Route Alternative could impact subpopulations of the occurrence of least moonwort in the same manner as described under the 2021 MMP. However, due to the localized nature of impacts within roadside swales under the Johnson Creek Route Alternative, impacts to this species may be greater than under the 2021 MMP. The combination of these potential impacts would result primarily in localized, long-term and permanent, moderate impacts to the least moonwort. Therefore, the Johnson Creek Route Alternative may indirectly impact least moonwort individuals (two) and habitat but would not likely contribute to a loss of viability of the species within the planning area (i.e., BNF-administered lands).

Impacts to Modeled Potential Habitat for Sensitive and Forest Watch Species

Table 4.10-9 presents acreages of direct impacts to modeled potential habitat for special status plant species that would be directly impacted under the Johnson Creek Route Alternative. Direct removal of potential habitat would occur in these areas, as well as the types of impacts described in **Section 4.10.2.2**.

As described for the 2021 MMP, impacts to habitats for sensitive and forest watch species would predominantly occur at the mine site, with lesser extents of impacts occurring along access roads and transmission lines, including in areas of tall tree clearing. This would result primarily in localized, long-term and permanent, moderate impacts to sensitive and Forest Watch Species, depending on the SGP component and specific modeled habitat impacted.

Table 4.10-9 Acres of Direct Impacts to Modeled Special Status Plant Potential Habitat under the Johnson Creek Route Alternative

Scientific Name (Common Name)	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total[1]
Allotropa virgata (Candystick)	55.8	5.6	16.3	5.6	1.8	85.2
Astragalus vexilliflexus var. *vexilliflexus* (Bent-flowered milkvetch)	6.8	1.9	5.9	2.1	-	16.7
Botrychium lineare and *B. simplex* (Slender moonwort and least moonwort)	140.6	5.9	45.4	17.8	-	209.7
Botrychium crenulatum (Scalloped moonwort)	1.4	2.1	5.6	2.1	-	11.2
Bryum calobryoides (Beautiful bryum)	-	2.6	6.4	2.4	-	11.4
Buxbaumia viridis (Green bug moss)	1.8	9.1	21.8	7.9	-	40.7
Calamagrostis tweedyi (Cascade reedgrass)	498.0	20.3	139.6	46.7	-	704.7
Carex livida (Livid sedge)	165.6	4.5	45.6	17.4	-	233.1
Carex straminiformis (Shasta sedge)	-	3.8	23.4	8.1	-	35.4
Cicuta bulbifera (Bulblet-bearing water hemlock)	59.7	13.5	126.7	39.2	-	239.1
Douglasia idahoensis (Idaho douglasia)	-	1.1	4.0	1.5	-	6.6
Draba incerta (Yellowstone draba)	-	1.9	18.2	6.3	-	26.4
Drosera intermedia (Spoonleaf sundew)	165.6	4.5	45.6	17.4	-	233.1
Epilobium palustre (Swamp willow weed)	0.3	0.5	9.4	3.7	-	13.8
Epipactis gigantea (Giant helleborine orchid)		2.9	9.0	3.2	-	15.1

Scientific Name (Common Name)	Mine Site	Access Roads	Utilities	Tall Tree Clearing	Off-site Facilities	Total[1]
Helodium blandowii (Blandow's helodium)	142.7	4.3	40.0	15.1	-	202.2
Hierochloe odorata (Sweetgrass)	84.4	5.8	66.1	19.5	-	175.8
Lewisia sacajaweana (Sacajawea's bitterroot)	140.8	6.4	70.5	23.0	-	240.7
Mimulus clivicola (Bank monkeyflower)	-	4.3	46.8	15.5	-	66.6
Penstemon laxus (Tufted penstemon)	28.0	2.9	30.7	10.1	-	71.8
Polystichum kruckebergii (Kruckeberg's sword-fern)	96.8	9.7	48.6	13.7	-	168.8
Rhynchospora alba (White beaksedge)	34.8	3.9	32.9	12.2	-	83.7
Sanicula graveolens (Sierra sanicle)	119.2	9.5	13.4	3.7	-	145.8
Saxifraga tolmiei var. *ledifolia* (Tolmie's saxifrage)	52.2	4.2	18.0	6.1	-	80.5
Scheuchzeria palustris (Rannoch-rush)	165.6	4.5	45.6	17.4	-	233.1
Sedum borschii and *S. leibergii* (Borch's stonecrop and Leiberg) stonecrop	32.0	1.3	0.6	0.4	-	34.2
Triantha occidentalis ssp. *brevistyla* (Short-style tofieldia)	132.8	1.1	30.5	11.5	-	175.9

Source: Acres of direct impacts to modeled habitat were calculated by overlaying SGP components with modeled potential habitat reported in Stantec 2022.
[1]Due to rounding, numbers presented in this table may not sum precisely to the totals provided. No total acreages are presented for SGP components in this table as modeled potential habitat for many species overlaps that of other species.

Increased Potential for Non-Native Plant Establishment and Spread

Anticipated acreages of vegetation disturbance to previously undisturbed vegetation communities both inside and outside Forest Service boundaries under the Johnson Creek Route Alternative are presented in **Table 4.10-10**. Increased establishment and spread of non-native plants is possible in these areas. This would result primarily in regional, localized, temporary, short-term, and long-term, moderate impacts related to the increased potential for non-native plant establishment, depending on the SGP component and specific vegetation type impacted.

Table 4.10-10 Total acres of Disturbance to Vegetation Communities due to SGP Components under the Johnson Creek Route Alternative

Vegetation	Mine Site	Access Roads	Utilities	Tall Tree Clearing[1]	Off-site Facilities	Total[2]
Forest PVGs (1-11) within Forest Service boundaries	1,001.5	282.2[3]	666.5	226.8	4.8	2,181.8
Non-forest Areas within Forest Service boundaries	661.5	36.6	50.2	19	0	767.3
LANDFIRE vegetation outside Forest Service boundaries	0	0	292.4	133.5	24.3	450.2
TOTALS[2]	**1,663.0**	**318.8**	**1,009.1**	**379.3**	**29.1**	**3,399.3**

Source: Perpetua 2021a; Acres of direct impacts to forest PVGs and non-forest areas within Forest Service boundaries were calculated by overlaying SGP components with PVG data (Forest Service 2005a, 2017) and VCMQI mapping (Forest Service 2016b, 2021d), omitting areas of previous mine site disturbance (Perpetua 2021a). Acres of direct impacts to LANDFIRE vegetation outside Forest Service boundaries were calculated by overlaying SGP components outside Forest Service boundaries with LANDFIRE data (USGS 2016a).

[1]Tall tree clearing would only be performed in areas with tree species, and as such, tall tree clearing may not occur to the full extent of acreages reported in this column.

[2]Due to rounding, numbers presented in this table may not sum precisely to the totals provided.

[3]Does not include 10 acres of unmapped PVG areas located on the Salmon-Challis National Forest.

4.10.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Vegetation.

4.10.4 Irreversible and Irretrievable Commitments of Public Resources

4.10.4.1 No Action Alternative

Under the No Action Alternative, there would be no irreversible or irretrievable commitment of vegetation resources.

4.10.4.2 Action Alternatives

Certain biological resources that would be affected by the 2021 MMP and the Johnson Creek Route Alternative are renewable only over long-time spans, including mature vegetation, special status plants, seedbanks, and topsoil. Loss of these resources would be considered irreversible. Soils would be stockpiled and reused to the greatest degree possible, but there would still be some irreversible commitment of soil to the SGP under this alternative.

The 2021 MMP and Johnson Creek Route Alternative would remove the land from other uses while the SGP is in operation, but the use would eventually be reversed through revegetation except for the approximately 278 acres of land where revegetation would not occur (i.e., in areas of new, permanent pit lakes or portions of pit highwalls that are too steep for re-vegetating). The temporal loss of the land for other uses would be irretrievable. This includes the loss of soil resources; even with reclamation (Tetra Tech 2021a), the temporal loss of the resource is irretrievable. Whitebark pine individuals removed for construction of the SGP would be irretrievable. Vegetation impacts also be greater under the 2021 MMP in the area of the Meadow Creek Lookout Road (FR 51290) from the Burntlog Route at the upper portion of Blowout Creek drainage to Monumental Summit, which would be improved for public access to connect with Thunder Mountain Road under this alternative.

4.10.5 Short-term Uses versus Long-term Productivity

4.10.5.1 No Action Alternative

Under this alternative, SGP would not be undertaken. Consequently, there would be no change in the current status of vegetation conditions in the SGP area, and no impacts to productivity would occur.

4.10.5.2 Action Alternatives

Short-term uses of vegetation resources for construction and operation of the 2021 MMP and Johnson Creek Route Alternative would impact the long-term productivity of these resources. The time required for revegetated areas to return to their pre-impact functionality, or for reclaimed areas to achieve functionality, would depend on the current condition and physical characteristics of each disturbance location and vegetation type present. In general, organic soils would take much longer to return relative to mineral soils (particularly alluvial soils); forested areas would take much longer to return relative to herbaceous vegetation; and vegetation in higher elevations would take longer to return relative to lower elevations where growing seasons are longer.

Long-term impacts on vegetation productivity also could result from indirect impacts on vegetation adjacent to the mine site or new/improved access roads. Fragmentation and changes to vegetation composition would reduce the functional capacity of vegetated areas, which would permanently reduce vegetation productivity in the area. Mine operations and related actions of the 2021 MMP and Johnson Creek Route Alternative would dominate land use, and predominantly prevent vegetation re-growth, on approximately 278 acres of land containing existing vegetation resources. Some portions of the analysis area containing existing vegetation resources, particularly those in the footprints of the pits, TSF, and TSF Buttress, would likely never return to their pre-SGP productive capacity due to limitation on rooting depth (most applicable to larger shrub and tree species) related to the depth of the growth media and waste rock that would function as substrate for the foreseeable future.

Construction and operation of the mine could also affect long-term vegetation productivity by increasing sedimentation from erosion and increasing the amount of pollutants and fine-grained sediments delivered to the area via surface water runoff.

4.11 Wetlands and Riparian Resources

4.11.1 Impact Definitions and Effects Analysis Indicators and Methodology

Wetlands and riparian resources were identified as a significant issue. The analysis of effects to wetlands and riparian resources includes the following issues and indicators:

Issue: Construction and operation of mine infrastructure would remove wetlands and riparian resources, impact ecological function, and fragment wetland habitat.

Indicators:

- Acres of wetland and riparian habitat permanently lost through construction of Project components.
- Acres of wetland and riparian habitat temporarily lost through construction of Project components.
- Functional units of high-value wetlands lost due to project construction, as demonstrated using the functional assessment method.
- Area of wetlands that would be affected by new or improved roads.
- Qualitative analysis of effects of wetland and riparian habitat fragmentation in affected areas.

Issue: The SGP may affect water balance, which could reduce seasonal water input frequency and duration for wetlands adjacent to and downstream of SGP features.

Indicator: Acres of wetland that would be within the footprint of groundwater drawdown.

Issue: SGP-related activities may affect wetlands and riparian areas through changes to water temperature, and concentration of key contaminants.

Indicator: Qualitative analysis of estimated changes in water quality parameters based on predictive water modelling in wetland areas.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1.**

Aquatic Resources, to include wetlands, have been delineated within the analysis area have been delineated as part of multiple baseline studies conducted between 2011 and 2019. The data from these reports is used to describe the baseline condition relative to the distribution and quantity of wetlands, streams, open waters, and riparian areas. In addition to delineating wetlands, wetland functions and values were assessed using the Montana Wetland Assessment Method (MWAM) (Berglund and McEldowney

2008). The MWAM is a functional assessment approach for quantifying wetland impacts and mitigation that is regionally appropriate for Idaho.

4.11.2 Direct and Indirect Effects

4.11.2.1 No Action Alternative

The SGP would not be implemented; therefore, there would be no SGP-related direct or indirect effects to wetlands or riparian areas. Wetlands and riparian areas in the mine site portion of the analysis area would continue to be affected by existing natural events such as landslides and fires and human-induced effects from existing sources of sedimentation (e.g., Blowout Creek), and contamination (e.g., legacy mining, including tailings in floodplains, and stream diversions). Wetlands would continue to function within natural ecosystem processes that include these natural events as they have evolved with those events and are adapted to the ongoing disturbance regime. Ecological succession would continue to occur in these areas, with changes driven by disturbance and species maturation.

The approximately 847 acres of the mine site and vicinity modified by human activity and considered highly disturbed would continue to affect wetland and waterway functions through sedimentation and erosion into wetlands and riparian areas. Blowout Creek would continue to contribute sediment and erosion to downstream waters and wetlands. Permitted exploration activities within the mine site would continue to occur and could include small, localized impacts to wetlands and riparian areas.

4.11.2.2 2021 MMP

Construction of the TSF, TSF Buttress, open pits, new roads and improvements to existing roads, transmission lines and associated access roads, borrow sites, new off-site facilities, and other surface disturbances in the analysis area would result in impacts to wetlands and riparian areas and their associated functions. Losses of wetland and riparian areas and their functions would occur throughout the construction and operation phases.

Loss of Wetland and Riparian Areas

<u>Mine Site Focus Area</u>

Acres of wetlands and riparian areas (RCAs) that would be directly lost and linear feet of streams that would be lost under the 2021 MMP are shown in **Table 4.11-1**. This table also presents acres that would be indirectly lost due to wetland type conversion due to the clearing of tall trees around the transmission line. However, potential wetland and riparian area losses due to other indirect impacts (e.g., hydrology changes) would be contained within a 45.08-acre area of delineated wetlands within the mine dewatering drawdown area (**Figure 4.8-10**). This acreage represents an over-estimate of actual potential indirect effects as some of that area is accounted for within direct affects and dewatering drawdown would not affect wetlands unless they are hydraulically connected to the groundwater experiencing drawdown. All wetland and RCA impacts at the mine site would occur within the Headwaters East Fork SFSR watershed. The magnitude of impacts would be major (i.e., a large measurable change), localized, and the impacts would range from temporary to permanent.

Off-Site Focus Area

Acres of wetlands and RCAs that would be directly impacted in the off-site focus area under the 2021 MMP are shown in **Table 4.11-2** and by HUC 10 drainage basin in **Table 4.11-3**. For context, linear feet of streams that would be impacted are also shown in both tables. The greatest impacts in areas outside the mine site would occur in the Johnson Creek watershed, with fewer impacts in the other watersheds. Impacts on wetlands due to construction, maintenance, and use of the Burntlog Route would contribute the greatest proportion of direct impacts to wetlands due to access road construction as the width of this route would be approximately four times wider than standard roads in this area. Of the disturbance listed in **Tables 4.11-2** and **4.11-3**, approximately 50.7 acres would be temporary.

Most indirect effects have not been quantified and it is acknowledged that indirect effects due to changes in hydrology and water quality may lead to wetland and riparian losses beyond estimates in **Tables 4.11-2** and **4.11-3** if these indirect impacts do occur. Although not quantified, the amount of additional loss from these mechanisms is expected to be minor (i.e., a change in conditions that would be measurable but slight). For examples, modifications to groundwater and surface water flows are not expected outside the mine area (Forest Service 2022e) while effects on water quality attributable to road usage are expected to be limited by applicable regulation, design features, and BMPs (Forest Service 2022f). Regarding the clearing of tall trees, clearing within 50 feet of the centerline of transmission lines could impact wetlands and riparian areas due to the of loss of overstory components. Loss of overstory in forested wetlands could lead to conversion to other wetland types even when reduction in total wetland acreage would not occur. Potential wetland conversion losses due to the clearing of tall trees are included.

Impacts on Wetland and Riparian Functions

Impacts to wetland and riparian area functions would occur due to both direct effects (e.g., excavation and fill) and indirect effects such as changes to hydrology, changes to water quality, or dust and/or mercury deposition. Wetland functional units that would be loss due to direct impacts and indirect impacts due to wetland conversion are presented in **Table 4.11-4**. An estimated total of 1,054.4 wetland functional units would be lost, approximately 375.9 of which would be due to impacts to high value wetlands. Because some of the functional units that would be lost would be due to temporary impacts associated with transmission line construction, the estimated total of functional units that would be lost is greater than reported in the CMP (which only considered permanent effects). Approximately 414.1 of the functional units lost would be temporary. As project design progresses, temporary loss would be better defined. Permanent and temporary losses would constitute a major effect. Functional loss due to other indirect effects, including changes in hydrology, water quality, and increase dust and/or mercury deposition has been examined through inspection of dewatering drawdown and distance to roadways, but is difficult to quantify precisely. As a result, functional units that would be lost if these indirect effects occur, may be underestimated.

Table 4.11-1 2021 MMP Impacts to Wetlands, Streams, and RCAs in the Mine Site Focus Areas

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Perennial Streams (feet)	Non-Perennial Streams (feet)	RCAs (acres)[2]
Blowout Access Road	<0.1							0.3
Blowout Borrow	1.4	4.3	6.7		12.3	5,742.4	930.5	40.4
Blowout Creek Rock Drain	0.1				0.1	1,779.7		3.9
Burntlog Route - Existing	0.3		<0.1		0.3	17.5	1,567.8	2.4
Burntlog Route Cut/Fill	<0.1	0.5	0.3		0.8	391.0	257.4	11.2
East Fork SFSR Inlet		<0.1	0.2		0.3	494.8		4.1
East Fork SFSR Outlet			<0.1		<0.1	12.9		3.3
Fiddle GMS		0.8			0.8	1,407.6		18.6
Garnet Creek Restoration	0.5		0.5		1.0	328.5		2.1
Hangar Flats Haul Road	0.4	<0.1	0.8		1.2	955.6	812.0	6.3
Hangar Flats Incidental	0.1	<0.1	1.4		1.5	1,101.5	60.1	5.5
Hangar Flats pit	0.7		0.4		1.0	241.2		14.9
Hangar Flats Stockpile	0.8		0.5	0.1	1.4		1,737.2	3.0
Midnight Diversion	<0.1		<0.1		<0.1	189.3	48.1	0.6
Midnight Incidental								3.1
Plant Diversion	<0.1		0.1		0.2		388.5	1.0
Plant Outfall			<0.1		<0.1			0.3
Plant Site	1.5	0.6	1.0	<0.1	3.2	1,460.9	1,117.4	34.0
Plant Site Access Road		<0.1	1.3		1.3		478.7	7.5
Plant Site Haul Road	0.4	0.1	0.9	<0.1	1.4	465.0	1,891.3	27.7
Plant Site Haul Road Incidental	<0.1		0.2		0.3		429.7	0.3
Plant Site Stockpile	1.3	0.5	1.0		2.7		711.7	1.1
Pond Tunnel Area			0.1		0.1	260.6		4.6
Security Building			<0.1		<0.1			

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Perennial Streams (feet)	Non-Perennial Streams (feet)	RCAs (acres)[2]
SODA	0.6			0.1	0.7	2,037.6		16.4
Transmission Line Access - Minor Improvements	0.1	0.1	<0.1		0.2		34.6	0.9
Transmission Line ROW - New		0.1	0.7		0.8	197.7	418.1	1.0
Truck Shop	0.1		<0.1		0.1	39.4		14.5
TSF	4.0	41.1	13.2		58.3	18,665.3	6,226.8	166.6
TSF Buttress	11.6		2.0	0.3	13.9	4,639.6		60.0
TSF Diversion	<0.1	2.5	0.4		2.9	363.9	265.2	5.6
West End Construction Road	<0.1		0.5		0.6	1,599.7		21.0
West End Creek Outfall			<0.1		<0.1	25.9		0.4
West End Diversion	<0.1				<0.1		151.2	2.9
West End pit			0.6		0.6		857.0	26.4
West End pit Incidental								0.9
West End Pond								2.6
West End Restoration								0.4
Workers Housing	<0.1		<0.1		<0.1			1.9
Yellow Pine Access Road	<0.1		<0.1		<0.1	352.1		5.9
Yellow Pine Construction Road		0.1			0.1	283.4		4.2
Yellow Pine Construction Laydown			<0.1		<0.1	78.8		5.2
Yellow Pine pit	1.5	0.1	4.9	4.5	11.0	6,326.0	698.9	80.1

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Perennial Streams (feet)	Non-Perennial Streams (feet)	RCAs (acres)[2]
Yellow Pine pit Incidental	<0.1		0.1		0.1	734.2		5.1
Wetland Conversion Losses from Tall Tree Clearing[3]		<0.1	0.1		0.2			
Totals[1]	**25.4**	**51.0**	**38.3**	**5.0**	**119.8**	**50,192.0**	**19,082.2**	**618.9**

Source: AECOM 2020d; Table prepared using wetland delineation data (HDR 2013, 2014a, 2014b, 2015a, 2016b, 2017g, 2017h, Tetra Tech 2021d) and RCA spatial data intersected with SGP components.

[1] Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

[2] RCA acres come from Forest Service RCA data intersected with SGP components (AECOM 2020d). Because the RCA data comes from different data than the stream data and is only applicable to NFS land, RCA acres do not match directly with the stream acres listed.

[3] Tall tree clearing was only considered a possible impact to areas where tree species may grow (PFO and PSS wetlands). Information on tree presence in RCAs was not available at the time of analysis and therefore tree clearing in RCAs could not be quantified.

PEM = Palustrine emergent

PFO = Palustrine forested

PSS = Palustrine scrub-shrub

Table 4.11-2 2021 MMP Impacts to Wetlands, Streams, and RCAs in the Off-site Focus Areas

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Perennial Streams (feet)	Non-Perennial Streams (feet)	RCAs (acres)[2]
Access Roads								
Yellow Pine Access Road						32.0	<0.1	<0.1
Burntlog Route – Existing – Improvements	0.5	0.1	<0.1		0.6	156.4	766.0	11.4
Access Road Cut/Fill								
Burntlog Route Cut/Fill	3.1	1.2	1.7		6.2	2,004.1	2,732.0	36.8
Access Road Work Areas								
Burntlog Route Borrow Source	0.1		0.6		0.8			1.9
Burntlog Route Staging Area								2.9
Off-Site Facilities								
Burntlog Maintenance Facility			0.1		0.1			
Logistics Facility	0.1		0.6		0.8			
OSV Routes								
OSV Route	<0.1		0.2		0.2	47.7	121.7	4.3
Transmission Line Access Roads								
Transmission Line Access - Bladed	0.2		<0.1		0.2	245.5		1.9
Transmission Line Access - Major Improvements	0.4	0.3	1.0		1.6	1,337.1	386.7	29.7
Transmission Line Access - Minor Improvements	0.8	0.1	0.4	<0.1	1.3	2,081.1	1,526.4	26.2
Transmission Line ROW[3]								
Transmission Line ROW - Existing/Upgrade	21.5	0.5	14.8	0.2	37.0	14,407.9	6,510.7	132.4
Transmission Line ROW - New	2.8	2.0	1.6	<0.1	6.3	1,707.2	674.7	14.8
Transmission Line Work Areas								
Transmission Line Pulling and Tensioning Work Area	0.7		0.3		1.0	247.2	856.9	11.2

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Perennial Streams (feet)	Non-Perennial Streams (feet)	RCAs (acres)[2]
Transmission Line Staging Work Area			0.6		0.6		422.2	10.7
Transmission Line Structure Removal	1.2				1.2			
Transmission Line Structure Work Area	8.3	<0.1	1.2	<0.1	9.6	1,198.1	668.4	15.1
Wetland Conversion Losses from Tall Tree Clearing[4]		2.1	6.8		8.9			
Totals[1]	**39.9**	**6.2**	**30.0**	**0.3**	**76.3**	**23,464.2**	**14,665.8**	**299.5**

Source: AECOM 2020d; Table prepared using wetland delineation data (HDR 2013, 2014a, 2014b, 2015a, 2016b, 2017g, 2017h, Tetra Tech 2021d) and RCA spatial data intersected with SGP components.

[1] Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

[2] RCA acres come from Forest Service RCA data intersected with SGP components (AECOM 2020d). Because the RCA data comes from different data than the stream data and is only applicable to NFS land, RCA acres do not match directly with the stream acres listed.

[3] Disturbance includes both temporary and permanent effects associated with transmission line construction.

[4] Tall tree clearing was only considered a possible impact to areas where tree species may grow (PFO and PSS wetlands). Information on tree presence in RCAs was not available at the time of analysis and therefore tree clearing in RCAs could not be quantified.

PEM = Palustrine emergent

PFO = Palustrine forested

PSS = Palustrine scrub-shrub

Table 4.11-3 Losses of Wetlands, Streams, and RCAs within the Off-site Focus Area by Watershed under the 2021 MMP

Drainage Basin (HUC 10)	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Perennial Streams (feet)	Non-Perennial Streams (feet)	RCA (acres)[2]
Big Creek-North Fork Payette River	8.8	0.7	6.6	<0.1	16.1	4,028.6	2,927.3	33.2
Cascade Reservoir	15.9		<0.1		16.0	218.1	477.5	
Gold Fork River	0.9		0.8	0.2	1.9			
Johnson Creek	9.6	3.2	14.1		26.9	11,736.3	7,240.3	182.3
Lake Fork-North Fork Payette River	2.2		0.9		3.1	283.1	365.3	
Headwaters East Fork SFSR	1.3	2.2	<0.1		3.5	1,500.7	626.8	4.2
Upper SFSR	1.2	<0.1	7.4		8.7	5,715.0	3,028.5	79.8
Totals[1,3]	39.9	6.2	30.0	0.3	76.3	23,481.7	14,665.8	299.5

Source: AECOM 2020d; Table prepared using wetland delineation data (HDR 2013, 2014a, 2014b, 2015a, 2016b, 2017g, 2017h, Tetra Tech 2021d) and RCA spatial data intersected with SGP components.

[1] Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

[2] RCA acres come from Forest Service RCA data intersected with SGP components (AECOM 2020d). Because the RCA data comes from different data than the stream data and is only applicable to NFS land, RCA acres do not match directly with the stream acres listed.

[3] Disturbance includes both temporary and permanent effects associated with transmission line construction.

PEM = Palustrine emergent

PFO = Palustrine forested

PSS = Palustrine scrub-shrub

Table 4.11-4 Losses of Wetland Acreages and Functional Units under the 2021 MMP

Assessment Area (AA)	AA Number	AA Category[1]	Impacted Wetland Area (acres)	Baseline Function	Impacted Habitat Value (FUs)[2]
Upper Meadow Creek	1	II	52.2	6.7	349.7
Upper Meadow Creek Seeps	2	II	3.3	5.5	18.2
Lower Meadow Creek	3	III	33.9	4.5	152.6
Lower Meadow Creek Seeps	4	III	4.3	5.6	24.1
EFMC	5	III	0.1	4.3	0.4
East Fork South Fork Valley	6	III	17.1	5.6	95.8
Fiddle Creek	7	III	0.9	5.4	4.9
Hennessy Creek	8	III	0.4	4.2	1.7
Midnight Creek	9	III	1.3	2.9	3.8
West End Creek	10	III	0.7	2.7	1.9
Burntlog	11	III	7.7	3.9	30.0
Riordan Road Alternative and Powerline Corridor[3]	12	III	6.1	4.2	25.6
Johnson Creek Road Alternative[3]	13	III	8.4	4.7	39.4
Cabin Trout[3]	14	III	14.7	5.5	80.9
Upper East Fork SFSR	15	II	0.4	6.7	2.7
Stibnite Road Wetlands	16	III		3.8	
Transmission Line and Warm Lake[3]	17	III	11.4	5.7	65.0
Transmission Line – Valley[3]	18	III	29.5	5.0	146.0
Yellow Pine pit	19	IV	4.5	2.6	11.7
Rabbit Creek Slope Wetlands	20	III		4.0	
Thunder Mountain Road	21	III	<0.1	5.4	
Totals[4]			**196.9**	**n/a**	**1,054.4**

Source: Tetra Tech (2021c). Refer to Appendix A (Table A-2) for AA-specific information.
[1] Wetland categories range from I (highest functional value) to IV (lowest functional value). No Category I wetlands were documented in the analysis area. Category II wetlands are considered high-value for the purposes of this analysis.
[2] Functional unit impacts were calculated based on percentage of AA impacted; this calculation assumes equal distribution of functions over the area of a wetland.
[3] Disturbance and function units impacted in these AAs includes both temporary and permanent effects associated with transmission line construction.
[4] Due to rounding, numbers presented in this table may not add up precisely to the totals provided.
AA = Assessment Area

The magnitude is expected to be greater on roads used for the SGP than would be expected on standard roads due to frequency of travel, size of equipment, and use across seasons. In addition, the Burntlog Route would be near Mud Lake, which is characterized by IDFG as a poor fen (IDFG 2004). Indirect impacts of road improvements and vehicle travel (i.e., increased dust) are likely to impact this fen and degrade its function as habitat for a fen-specific special status plant, Rannoch-rush (*Scheuchzeria palustris*), which is described further in **Section 4.10** Vegetation. Although the impact of dust deposition

has not been quantified, effect magnitude would most likely be minor (small but measurable change) and long-term, limited to the life of the SGP. Effects from changes to hydrology (e.g., construction effects on local drainage and shallow groundwater paths) and water quality could range from negligible to moderate and could be long-term or permanent depending on the actual impact.

Indirect effects to wetland and riparian functions have not been quantified, and although discussed qualitatively, are not represented in impact acreages reported for each action alternative. Regarding dust and/or mercury deposition, SGP construction and operation (particularly road construction and use) could indirectly affect wetlands through increased dust and/or mercury deposition. Potential impacts of dust on vegetation are described in **Section 4.10** Vegetation, but in general impacts could alter water quality parameters and inhibit the metabolic processes of plants, which would result in impacts to individuals ranging from mild metabolic inhibition to mortality (Farmer 1993). A reduction in vegetation coverage would result in a loss of wetland and riparian functions as described in the previous paragraph.

Wetlands and Riparian Area Fragmentation

The total extent of wetland losses would be approximately 119.8 acres at the mine site and 76.3 acres outside the mine site. Losses of RCAs would occur on approximately 619 acres at the mine site and 300 acres outside the mine site. New roads would bisect 39 total individual wetlands. Fragmentation effects could occur as a result of these impacts.

Alteration of Wetlands and Riparian Areas Due to Changes in Water Balance

The 2021 MMP could affect hydrology due to changes in surface water or groundwater inputs. Impacts due to surface water input changes have not been quantified. However, impacts to water balance through groundwater drawdown, which could reduce seasonal water input frequency and duration for on-site and off-site downstream wetlands was estimated based on groundwater modeling. Acres of wetlands in the maximum groundwater drawdown area under the 2021 MMP are presented in **Table 4.11-5**. These predicted acreages are subject to uncertainties in the numerical groundwater flow predictions. Sensitivity analyses for the extent of groundwater drawdown cones indicated there could be slight changes to the acreages of wetlands in the drawdown area associated with the selection of model parameters (Forest Service 2022e). The entirety of these wetlands also would be subject to direct impacts from SGP component construction, and the acreages presented below are already accounted for in the acreages presented in **Table 4.11-1**.

Table 4.11-5 Acres and Types of Wetlands in the Maximum Drawdown Area under the 2021 MMP

	PEM Wetland	PFO Wetland	PSS Wetland	Open Water	Total Wetlands[1]
Acres of Wetlands	7.2	7.0	28.4	4.2	46.7

Source: AECOM 2020d; Merged simulated alluvial and bedrock groundwater drawdown contour (maximum drawdown area for all Mine Years combined).
[1] Due to rounding, numbers presented in this table may not add up precisely to the totals provided.
PEM = Palustrine emergent
PFO = Palustrine forested
PSS = Palustrine scrub-shrub

Alteration of Wetland and Riparian Areas Du to Change in Water Quality

Changes to water quality parameters would occur under the 2021 MMP during the construction and operation phases. The 2021 MMP would improve some of the existing water quality conditions observed in Meadow Creek and the East Fork SFSR by removing and repurposing legacy mine wastes. However, the 2021 MMP would have direct permanent impacts on water quality, as it would contribute new sources of mine waste material to the East Fork SFSR drainage.

Indirect effects to wetlands and riparian areas could occur under the 2021 MMP if the quantity and or quality of surface and groundwater flows, including the chemical characteristics of the waters, temperature characteristics of waters, change downstream of disturbance areas, and if those changes impact water quality or habitat conditions during active mining and after SGP closure. This could include the effects of placing the TSF and TSF Buttress in stream valleys, which could introduce contaminants or cause temporary changes to pH, temperature, and dissolved oxygen levels. The effects of the SGP on Water Quantity and Water Quality are described in **Sections 4.8** and **4.9**, respectively.

4.11.2.3 Johnson Creek Route Alternative

Under the Johnson Creek Alternative, the mine site and utilities would be constructed and operated the same as under the 2021 MMP therefore not discussed further below. As a result, impacts to wetlands and riparian areas would be the same in those areas and differences between the two action alternatives would be due to the differences in access routes. The following subsections provide details on the extent of impacts under the Johnson Creek Route Alternative.

Loss of Wetland and Riparian Areas

Off-Site Focus Areas

Acres of impacts to wetlands, RCAs, and streams in the off-site focus area under the Johnson Creek Route Alternative are shown in **Table 4.11-6**. Impacts to wetlands and riparian areas associated with widening, maintenance, and use of the Johnson Creek Route would be similar to the wetland impacts associated with the Burntlog Route, as described under the 2021 MMP. These include direct loss, fragmentation, and indirect effects such as dust. Wetlands and riparian areas along Johnson Creek are lower in their respective watershed (i.e., farther downstream) as the route is largely located along the East Fork SFSR. Thus, the road impacts would affect wetlands and riparian areas at the confluences of several drainages that feed into the East Fork SFSR, which would have a larger effect on the river. In comparison, the construction of the Burntlog Route described under the 2021 MMP would cross through several drainages but would generally be perpendicular to those waters.

Table 4.11-7 shows acres of impacts to wetlands and RCAs in the off-site focus area by HUC 10 drainage basin (i.e., watershed) under the Johnson Creek Route Alternative. The greatest extent of wetland and riparian impacts in areas outside the mine site would occur in the Johnson Creek watershed, with lesser extents of impacts to wetlands and riparian areas in the other watersheds. Much of the transmission line disturbance would be considered temporary. Of the disturbance listed in **Tables 4.11-6** and **4.11-7**, approximately 50.7 acres would be temporary.

Impacts on Wetland and Riparian Functions

An estimated total of 1,028.3 wetland functional units would be lost as a result of SGP construction under the Johnson Creek Route Alternative, approximately 370.6 of which would be due to impacts to high-value wetlands (**Table 4.11-8**). Wetland functional units would be lost due to direct impacts and indirect impacts due to wetland conversion. Because some of the functional units that would be lost would be due to temporary impacts associated with transmission line construction, the estimated total of functional units that would be lost is greater than reported in the CMP (which only considers permanent effects). Approximately 414.1 of the functional units lost would be temporary. As project design progresses, temporary loss would be better defined. The loss of functional units would constitute a major permanent effect. Functional loss due to other indirect effects, including changes in hydrology, water quality, and increase dust and/or mercury deposition has not been quantified. As a result, functional units that would be lost if these indirect effects do occur may be underestimated.

The magnitude of these type of effects are expected to be greater along the Johnson Creek Route than would be expected on standard roads due to frequency of travel, size of equipment, and use across seasons. However, the potential impacts would be less than for the Burntlog Route, as the Johnson Creek Route is not near Mud Lake and would not have impacts on the fen. Although the impact of dust deposition has not been quantified, effect magnitude would most likely be minor (small but measurable change) and long-term, limited to the life of the SGP. Effects from changes to hydrology and water quality could range from negligible to moderate and could be long-term or permanent depending on the actual impact.

Table 4.11-6 Johnson Creek Route Alternative Impacts to Wetlands, Streams, and RCAs in the Off-site Focus Area

SGP Component	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Perennial Streams (feet)	Non-Perennial Streams (feet)	Total RCAs (acres)[2]
Yellow Pine Access Road						32.0		<0.1
Johnson Creek Access Road Cut/Fill	0.1	0.1	2.2		2.4	506.4	577.3	87.5
Stibnite Access Road Cut/Fill	<0.1		<0.1		<0.1	60.7	2.4	17.3
Landmark Maintenance Off-Site Facility								2.2
Logistics Off-Site Facility	0.1		0.6		0.8			
OSV Route	<0.1		0.3		0.3	34.0	163.5	3.9
Transmission Line Access Road - Bladed	0.2		<0.1		0.2	245.5		1.8
Transmission Line Access Road - Major Improvements	0.4	0.3	0.9		1.6	1,337.1	386.7	29.2
Transmission Line Access Road - Minor Improvements	0.8	0.1	0.4	<0.1	1.3	2,081.1	1,526.4	26.1
Transmission Line ROW - Existing/Upgrade[3]	21.5	0.5	14.8	0.2	37.0	14,391.7	6,510.7	131.3
Transmission Line ROW – New [3]	2.8	2.0	1.6	<0.1	6.3	1707.2	674.7	14.8
Transmission Line Pulling and Tensioning Work Area	0.7		0.3		1.0	247.2	856.2	11.1
Transmission Line Staging Work Area			0.6		0.6		422.2	10.7
Transmission Line Structure Removal Work Area	1.2				1.2			
Transmission Line Structure Work Area	8.3	<0.1	1.2	<0.1	9.6	1,198.1	668.4	15.0
Wetland Conversion Losses from Tall Tree Clearing[4] Work Area		2.1	6.8		8.9			
Totals[1]	**36.1**	**5.1**	**29.8**	**0.3**	**71.2**	**21,841.0**	**11,788.5**	**352.6**

Source: AECOM 2020d; Table prepared using wetland delineation data (HDR 2013, 2014a, 2014b, 2015a, 2016b, 2017g, 2017h, Tetra Tech 2021d) and RCA spatial data intersected with SGP components.

[1] Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

[2] RCA acres come from Forest Service RCA data intersected with SGP components (AECOM 2020d). Because the RCA data comes from different data than the stream data and is only applicable to NFS land, RCA acres do not match directly with the stream acres listed.

[3] Disturbance includes both temporary and permanent effects associated with transmission line construction.

[4] Tall tree clearing was only considered a possible impact to areas where tree species may grow (PFO and PSS wetlands). Information on tree presence in RCAs was not available at the time of analysis and therefore tree clearing in RCAs could not be quantified.

PEM = Palustrine emergent; PFO = Palustrine forested; PSS = Palustrine scrub-shrub

Table 4.11-7 Losses of Wetlands, Streams, and RCAs within the Off-site Focus Area by Watershed under the Johnson Creek Route Alternative

Drainage Basin (HUC 10)	PEM Wetlands (acres)	PFO Wetlands (acres)	PSS Wetlands (acres)	Open Water (acres)	Total Wetlands (acres)[1]	Perennial Streams (feet)	Non-Perennial Streams (feet)	RCA (acres)[2]
Big Creek-North Fork Payette River	8.8	0.7	6.6	<0.1	14.3	4,028.6	2,927.3	33.2
Cascade Reservoir	15.9		<0.1		16.0	218.1	477.6	
Gold Fork River	0.9		0.8	0.2	1.7			
Johnson Creek	5.7	2.1	13.0	<0.1	17.2	9,902.7	4,264.5	198.3
Lake Fork-North Fork Payette River	2.2		0.9		2.7	283.1	365.3	
Headwaters East Fork SFSR	1.4	2.2	0.9		3.9	1,711.0	731.9	41.3
Upper SFSR	1.2	<0.1	7.4		6.5	5,715.0	3,028.5	79.8
Totals[1,3]	**36.1**	**5.1**	**29.8**	**0.3**	**71.2**	**21,858.5**	**11,795.1**	**352.6**

Source: AECOM 2020d; Table prepared using wetland delineation data (HDR 2013, 2014a, 2014b, 2015a, 2016b, 2017g, 2017h, Tetra Tech 2021d) and RCA spatial data intersected with SGP components.

[1] Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

[2] RCA acres come from Forest Service RCA data intersected with SGP components (AECOM 2020d). Because the RCA data comes from different data than the stream data and is only applicable to NFS land, RCA acres do not match directly with the stream acres listed.

[3] Disturbance includes both temporary and permanent effects associated with transmission line construction.

PEM = Palustrine emergent

PFO = Palustrine forested

PSS = Palustrine scrub-shrub

Table 4.11-8 Losses of Wetland Acreages and Functional Units under the Johnson Creek Route Alternative

Assessment Area (AA)	AA Number	AA Category[1]	Impacted Wetland Area (acres)	Baseline Function	Impacted Habitat Value (FUs)[2]
Upper Meadow Creek	1	II	52.2	6.7	349.7
Upper Meadow Creek Seeps	2	II	3.3	5.5	18.2
Lower Meadow Creek	3	III	33.9	4.5	152.6
Lower Meadow Creek Seeps	4	III	4.3	5.6	24.1
EFMC	5	III	0.1	4.3	0.4
East Fork South Fork Valley	6	III	17.1	5.6	95.8
Fiddle Creek	7	III	0.9	5.4	4.9
Hennessy Creek	8	III	0.4	4.2	1.7
Midnight Creek	9	III	1.3	2.9	3.8
West End Creek	10	III	0.7	2.7	1.9
Burntlog Route	11	III		3.9	
Riordan Road and Powerline Corridor[3]	12	III	6.1	4.2	25.6
Johnson Creek Route Alternative[3]	13	III	8.4	4.7	39.4
Cabin Trout[3]	14	III	14.7	5.5	80.9
Upper East Fork SFSR	15	II	0.4	6.7	2.7
Stibnite Road Wetlands	16	III	0.9	3.8	3.4
Transmission Line and Warm Lake[3]	17	III	11.4	5.7	65.0
Transmission Line – Valley[3]	18	III	29.6	5.0	146.5
Yellow Pine pit	19	IV	4.5	2.6	11.7
Rabbit Creek Slope Wetlands	20	III		4.0	
Thunder Mountain Road	21	III	<0.1	5.4	
Totals[4]			**190.2**	**n/a**	**1,028.3**

Source: Tetra Tech (2021c). Refer to Appendix A (Table A-3) for AA-specific information.

[1] Wetland categories range from I (highest functional value) to IV (lowest functional value). No Category I wetlands were documented in the analysis area. Category II wetlands are considered high-value for the purposes of this analysis.

[2] Functional unit impacts were calculated based on percentage of AA impacted; this calculation assumes equal distribution of functions over the area of a wetland.

[3] Disturbance and function units impacted in these AAs includes both temporary and permanent effects associated with transmission line construction.

[4] Due to rounding, numbers presented in this table may not add up precisely to the totals provided.

AA = Assessment Area

Wetland and Riparian Area Fragmentation

Under the Johnson Creek Route Alternative, the total extent of wetland losses would be approximately 119.8 acres at the mine site and 71.2 acres outside the mine site. Losses of RCAs would occur on approximately 618.9 acres at the mine site and 353 acres outside the mine site. New roads would bisect six total individual wetlands. Fragmentation effects could occur as a result of these impacts.

Alteration of Wetland and Riparian Areas Due to Change in Water Balance

Impacts of altered hydrology, including groundwater drawdown, would be the same as described under the 2021 MMP.

Alteration of Wetland and Riparian Areas Due to Change in Water Quality

Impacts of altered water quality would be the same as described under the 2021 MMP.

4.11.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis.

In order for the USACE to issue a permit under Section 404 of the CWA and authorize dredge or fill placement in WOTUS, all unavoidable impacts to jurisdictional WOTUS must be mitigated. The final rule for Compensatory Mitigation for Losses of Aquatic Resources (U.S. Environmental Protection Agency and USACE 2008) states a preference for achieving mitigation by first trying to find available wetland mitigation credits from an agency-approved wetland mitigation bank. When mitigation bank credits are not available, the final rule directs 404 permit applicants to seek out opportunities to use in-lieu fee programs to satisfy mitigation needs. In-lieu fee programs are generally operated by public resource agencies that accept money for wetland impacts within a specific geography and periodically use that money to fund wetland restoration, creation, or enhancement projects within that same geography. Perpetua proposes to accomplish compensatory mitigation for impacts to wetlands through a combination of mitigation bank credits in the North Fork Payette subbasin and permittee-responsible on-site mitigation within the SFSR subbasin (Tetra Tech 2021b).

The two action alternatives include activities that would result in permanent impacts to WOTUS including wetlands. Therefore, Perpetua would need to submit and gain approval for a final compensatory wetland mitigation plan, and then implement and maintain the planned wetlands in coordination with the USACE, as part of their CWA 404 permit. Without this permit, work in WOTUS cannot legally commence. A CMP (Tetra Tech 2021b) that addresses compensation for lost wetland areas and functions has been provided by Perpetua. The CMP addresses compensatory mitigation for the permanent impacts described in this EIS, which would be accomplished through a combination of mitigation bank credits and the creation of new wetlands and enhancing and reclaiming existing wetlands in the general vicinity of the impact areas. The CMP also addresses compensatory mitigation to reduce the temporal loss of aquatic functions and potential risks associated with actions described in the CMP. Temporal loss of functions and values is discussed further below.

The current CMP describes an accounting process for tracking the various wetland impacts (losses) and associated wetland mitigation (gains). The CMP uses the MWAM functional assessment tool to determine functional units for each affected wetland assessment area. These units are based on a combination of MWAM scores and acres of wetlands. When these functional units would be lost due to development in the associated wetland those losses are considered “debits.” Conversely, the creation of new wetlands can result in “credits” by assessing and estimating the predicted functional scores and area of proposed wetlands that would be created, restored, or enhanced. Using this system of accounting for wetland credits and debits, the CMP provides a ledger that itemizes debits throughout the construction and operating phases and proposed credits for conceptual wetland creation actions. This system of accounting for losses and compensatory gains is intended to demonstrate a means of ensuring that adequate mitigation would be provided regardless of the final impact area/selected action alternative. The ledger can be scaled up or down to identify the appropriate wetland credits needed to compensate for the final determination of wetland debits, which would be documented in the CWA 404 permit. The ledger system also provides a way to track and assess temporal effects, which as described in **Section 4.11.2** are the effects that come from the loss of wetland functions during the period between impacts and compensatory mitigation.

Based on the CMP ledger of debits and credits, the amount of time associated with the temporal impacts related to wetlands is approximately 20 years, during which time as many as 576 functional units are outstanding (Tetra Tech 2021c). These temporal effects would only occur within the Salmon River Drainage because effects within the Payette River Drainage would be mitigated via mitigation bank credits. Coordination with the USACE for approval of existing and predicted wetland functional assessment scores is ongoing and may also result in changes relative to the totals listed in this section. Wetland baseline functions may be revised in a way that results in a change to baseline functional scores. Final impact acreages would be determined as part of the CWA Section 404 permit application and would be agreed upon by the USACE.

The current CMP describes a plan to locate the compensatory wetland mitigation sites within the same subbasins as the associated wetland impact sites. However, although the proposed compensatory wetland mitigation sites would be within the subbasins where impacts occur, they would all be located around the mine site area where the majority of wetland impacts would occur, with no mitigation sites proposed along the access roads and the transmission line routes. The current location and configuration of mitigation sites identified in the CMP were selected based on suitable hydrology and compatibility with watershed-scale features and on the likelihood that compensatory mitigation wetlands would be sustainable within 5 years (Tetra Tech 2021b). At the conclusion of the Forest Service process, final wetland impacts would be assessed, any agreed upon off-site compensatory mitigation projects would be finalized, and a final mitigation plan would be prepared, including a final assessment of functional units lost and created, and then the final credits/debits would be documented in an application for CWA Section 404 permit.

4.11.4 Irreversible and Irretrievable Commitments of Public Resources

4.11.4.1 No Action Alternative

Under the No Action alternative there would be no irreversible or irretrievable commitment of wetlands or riparian areas associated with the SGP.

4.11.4.2 Action Alternatives

The loss of the wetland and riparian acres and their functions as a result of the SGP would be irreversible in their original locations. However, compensatory wetland mitigation would allow for the extent and functions of lost wetlands to be reestablished in other locations. These impacts would be less under the Johnson Creek Route Alternative due to the Burntlog Route not being built.

4.11.5 Short-term Uses versus Long-term Productivity

4.11.5.1 No Action Alternative

The No Action Alternative would not affect the short-term use or long-term productivity of wetlands or riparian areas in the analysis area.

4.11.5.2 Action Alternatives

Short-term uses of wetland and riparian resources for construction and operation of the SGP would impact the long-term productivity of these resources. Construction and operation of the mine site would permanently fill more than 119 acres of wetlands under the Action Alternatives, resulting in a permanent loss of wetland functions and loss of long-term productivity of this resource. Compensatory mitigation would be implemented to ensure no net loss of wetland functions; however, some long-term wetland productivity loss would still occur. The time required for revegetated wetlands to return to their pre-impact functionality, or for compensatory wetlands to achieve functionality, would depend on the current condition and physical characteristics of each wetland. In general, organic soils would take much longer to return relative to mineral soils (particularly alluvial soils); forested wetland vegetation would take much longer to return relative to herbaceous vegetation; and vegetation in higher elevations would take longer to return relative to lower elevations where growing seasons are longer.

Long-term impacts on wetland productivity also could result from indirect impacts on wetlands adjacent to the mine site or new/improved access roads. Fragmentation, disruption of wetland hydrologic inputs, and changes to vegetation composition would reduce the functional capacity of remaining wetlands, which would permanently reduce wetland productivity in the area.

Construction and operation of the mine could affect long-term wetland and riparian productivity by increasing sedimentation from erosion and increasing the amount of pollutants and fine-grained sediments delivered to receiving waters (including wetlands) via surface water runoff. Mitigation measures required by both the Forest Service and the USACE are expected to reduce the amount of sedimentation-caused wetland impacts. The USACE is working with Perpetua to address wetland impacts through compensatory mitigation.

4.12 Fish Resources and Fish Habitat

4.12.1 Impact Definitions and Effects Analysis Indicators and Methodology

Construction and operation of mine infrastructure may impact the quality and quantity of water, and habitat for Chinook salmon, steelhead, bull trout, and westslope cutthroat trout. Project activities may also affect fish behavior and reproductive success and may result in injury or mortality of Chinook salmon, steelhead, bull trout, and westslope cutthroat trout in the analysis area.

The analysis of effects on Fisheries and Aquatic Habitat includes the following identified issues and indicators:

Issue: The SGP may cause changes in aquatic habitat in the analysis area that may affect aquatic species, including federally listed fish species and aquatic habitat (e.g., designated Critical Habitat) and Management Indicator Species within and downstream of the SGP area.

Indicators:

- Changes in water chemistry.
- Change in stream flow.
- Change in length of stream and lake habitat directly impacted by channel removal.
- Changes in water temperature (degrees Celsius [°C]).
- Change in amount of total useable Chinook salmon IP habitat.
- Loss of Chinook salmon Critical Habitat.
- Change in total useable steelhead IP habitat.
- Change in length of bull trout habitat.
- Change in bull trout occupancy probability.
- Change in access to bull trout lake habitat.
- Loss of bull trout Critical Habitat.
- Change in length of westslope cutthroat trout habitat (km)
- Change in westslope cutthroat trout occupancy probability
- Changes in stream peak and baseflow (cfs).

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1**.

The analysis area for fish and aquatic habitat includes the area where effects (direct/indirect and cumulative) may be caused by the proposed activities (FSH.1909.15, 15.2a). Alternative components include the mine site, all associated mine support infrastructure, all access and haul roads (proposed and existing), all utility infrastructure (proposed and upgraded), and off-site facilities.

A summary of the available data was compiled for specific watersheds/subwatersheds and individual species (Chinook salmon, steelhead trout, bull trout, and westslope cutthroat trout). Data was obtained and modeled using various sources and consisted of different metrics, such WCIs. The information used to describe the existing condition of fish and fish habitat in the analysis area was gathered from numerous

sources, including federal and state resource agencies, the Nez Perce Tribe, and Perpetua. AECOM 2020a provides a list of fish and stream habitat data collected in the analysis area between 1991 and 2019 (**Table 4.12-1**).

To further describe the existing condition of habitat in the analysis area for special status fish species, additional modeling was performed and the studies and outcomes are described in technical memoranda (ESS 2019a. 2019b, 2019c, 2019d, 2019e, 2019f, 2019g, 2019h, AECOM 2020a, 2020b) and the SGP Fisheries and Aquatic Habitat Specialist Report (Forest Service 2022i).

4.12.2 Direct and Indirect Effects

Direct and indirect effects described in this section are considered to be negative unless explicitly described as beneficial.

To analyze impacts on fish resources and aquatic habitat the following assumptions were made:

- The proposed East Fork SFSR fish tunnel under the 2021 MMP would provide passage for all four special status fish species. This assumption is based on professional judgment and review of other similar or longer tunnels that have been documented to be fish passable (Gowans et al. 2003; Rogers and Cane 1979; Wollebaek et al. 2011). This analysis also includes a brief description of the effects if the tunnel does not provide passage as planned (USFWS 2019b).

- The constructed and enhanced stream reaches would perform as described in the Stream Design Report (Rio ASE 2021).

- The stream temperature analysis is based on the duration of SGP phases as: construction – 3 years; mining – 15 years; closure and reclamation – 5 years; and post-closure to Mine Year 112.

- The stream flow analysis within the combined stream and pit water temperature models (SPLNT models, Brown and Caldwell 2018b, 2021e, 2021i) accurately reflect future conditions, which is based on historic conditions.

Much of the aquatic habitat modeling and analysis presented in this section is based on the hydrologic and site-wide water chemistry modeling performed by Perpetua or its consultants. Predictions generated by groundwater and hydrologic models (Brown and Caldwell 2021e) are associated with a degree of uncertainty and can be limited in their predictive ability (see **Sections 4.8.2.4**, **4.9.2.4**, and the uncertainty sections of Forest Service 2022e, 2022f).

Table 4.12-1 Fisheries and Stream Habitat Data Collected Within and Near the Analysis Area, 1991-2019

Data Source	Project/Study	Location	Data Years	Available Data	Data Collection Methods	Species Information	Reference
Boise National Forest	Boise National Forest Aquatic Database	Analysis area and vicinity	1991-2016	Habitat, fish community	Electrofishing, snorkel, eDNA, PIBO and other stream habitat surveys	Chinook salmon, bull trout, westslope cutthroat trout, *Oncorhynchus mykiss*	BNF 2017
Brown and Caldwell	Yellow Pine Pit Fish Monitoring Summary	Yellow Pine Pit	2018-2019	Fish community	Seining and hook-and-line angling.	Chinook salmon, bull trout, westslope cutthroat trout, rainbow trout, whitefish	Brown and Caldwell 2019b, 2020b
GeoEngineers	Aquatic Resources 2016 Baseline Study Addendum Report	Mine site Study Area	2015	Fish community, population estimates	Electrofishing/mark-recapture surveys	Chinook salmon, bull trout, westslope cutthroat trout, *Oncorhynchus mykiss*	GeoEngineers 2017
Great Ecology	Supplemental Stream and Wetland Baseline Data Report for the Stibnite Gold Project	Mine site Study Area, as well as access roads	2018	Habitat	Stream habitat surveys	Habitat data only	Great Ecology 2018
HDR	Stream Functional Assessment	Mine site Study Area	2015-2016	Habitat	Stream habitat surveys	N/A	HDR 2016c
MWH	Aquatic Resources 2016 Baseline Study	Mine site Study Area	2012-2016	Habitat, fish community, macroinvertebrates, fish tissue	Electrofishing, snorkel, eDNA, PIBO and other stream habitat surveys	Chinook salmon, bull trout, westslope cutthroat trout, *Oncorhynchus mykiss*	MWH 2017

Data Source	Project/Study	Location	Data Years	Available Data	Data Collection Methods	Species Information	Reference
Nez Perce Tribe	Status and Monitoring of Natural and Supplemented Chinook Salmon	Johnson Creek, Burntlog Creek, East Fork SFSR (tributaries, including Meadow Creek)	2005-2017	Adult and smolt data; redd counts	Weir counts and spawning ground survey	Chinook salmon	Rabe and Nelson 2007, 2008, 2009, 2010, 2013, 2014 Rabe et al. 2016a, 2016b, 2017, 2018
Nez Perce Tribe	Chinook and Bull Trout Redd Count Data	Johnson Creek, Burntlog Creek, East Fork SFSR, and tributaries, including Meadow Creek	1998-2018	GIS data on redd counts	Spawning ground survey	Chinook salmon and bull trout	Nez Perce Tribe 2018
Stantec	Aquatic Resources Baseline Study Tech Memos	Mine site Study Area, as well as access roads and control sites	2017-2019	Habitat and fish community	Stream habitat and eDNA surveys	Chinook salmon, bull trout, westslope cutthroat trout, *Oncorhynchus mykiss*	Stantec 2018, 2019, 2020

Source: AECOM 2020a

[1] Available data: stream habitat (e.g., habitat unit, riparian habitat, PIBO methodology, substrate type, water temperature, water velocity), fish community (e.g., eDNA, presence/absence, redd counts, juvenile density), tissue residues (metals), population estimates, etc.

[2] Data collection methods applied (e.g., fish surveys, weir counts, spawning ground surveys, stream habitat surveys (e.g., PIBO).

Several assumptions regarding physical, biological, and chemical conditions were made to address incomplete information at the time of this analysis.

- Reach-specific fish spatial distribution (i.e., presence/absence) data were not available for all streams potentially affected by the action alternatives, especially the streams outside the mine site. Population estimates were not available; as described in the Aquatic Resources 2016 Baseline Study Report Addendum (GeoEngineers 2017), the results of the multiple years of diver-based snorkel surveys are limited and variable.

- Some habitat conditions could not be quantitatively evaluated due to a lack of available data or a suitable site-specific model (e.g., impacts of stream flow reductions on overwintering fish, and a site-specific stream flow/productivity model). Other examples include lack of modeling of existing habitat for many fish at multiple life stages. There is a lack of a site-specific, two-dimensional hydraulic-based habitat suitability model. The nearest sites where data have been collected and modeling performed are on several streams in the Upper East Fork of the Salmon River (Sugar Creek, Tamarack Creek, Profile Creek, Quartz Creek, and the East Fork SFSR).

4.12.2.1 No Action Alternative

Under the No Action Alternative, the Forest Service would not approve the SGP, and therefore no activities proposed on Forest Service lands would be approved. Under the No Action Alternative, there would be no surface (open-pit) mining or ore processing to extract gold, silver, and antimony, and no underground exploration or sampling or related operations and facilities on NFS lands. Perpetua could continue to conduct surface exploration that has been previously approved. Perpetua would continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations (Midas Gold 2016b). These commitments include reclamation of the drill pads and temporary roads and monitoring to ensure that BMPs are in place and effective so that soil erosion and other potential resource impacts are avoided or minimized. This also would include monitoring commitments required by the Forest Service relating to the Golden Meadows Exploration EA (Forest Service 2015c).

Current authorized uses by Perpetua on patented mine/mill site claims, and on PNF and BNF would continue. Uses of NFS lands include mineral exploration, dispersed and developed recreation, such as pleasure driving, hunting, off-highway-vehicle use, camping, hiking, snowmobiling, bird watching, target shooting, firewood cutting, and other forms of recreation. Private businesses, such as outfitter and guide services, also operate on the Forest through special use permits. Access to public land in the area would continue as governed by law, regulation, policy, and existing and future landownership constraints, the latter of which may include denial of access over private land.

Under the No Action Alternative there would be no SGP-caused impacts on physical stream channels, WCIs, individual fish (including federally listed and forest service species sensitive species), or fish habitat.

4.12.2.2 2021 MMP

The descriptions of effects are organized as follows: direct impact-causing activities (i.e., physical stream channel changes) and the Direct Effects to Individuals section, are discussed first because those activities would have the greatest potential to impact fish and aquatic habitat at the mine site. Habitat changes are described next (Watershed Condition Indicators/Habitat Elements) and separated into two subsections (mine site and off-site). This is followed by more detailed descriptions of impacts to each of the four main species (Chinook salmon, steelhead trout, bull trout, and westslope cutthroat trout).

Direct and Indirect Impacts to Individuals

The following analysis of effects associated with fish resources and aquatic habitat is considered within the overall context that resident and anadromous fish species could be affected, including three species listed as threatened under the ESA, and one Forest Service sensitive species. While these listed and sensitive species are the focus of the analyses, the effects described are expected to be similar for all fish species in the analysis area.

Dewatering, Fish Salvage, Relocation

Dewatering, fish salvage, and relocation may be necessary for culvert replacement, new culvert installation, and potentially for bridge maintenance, and could cause injury or mortality to fish in the immediate vicinity or during relocation activities if required. The standard procedures to be developed for dewatering at the mine site also would be used for activities in all other SGP areas (Brown and Caldwell, McMillen Jacobs, and BioAnalysts, 2021b); therefore, the number of injuries or mortalities is expected to be minimized. Approximately 71 water crossings would be required for access roads, and a number of these would cross fish-bearing waterbodies. Fish salvage would be required for dewatering and all in-water work at stream crossings in all fish-bearing water bodies and fish impacts would be limited to minor (less than 10 percent) incidental take associated with fish salvage. Fish salvage work would require prior state and federal agency consultations and would follow USFWS Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards (USFWS 2012). Dewatering and in-water work at stream crossings would be spatially limited relative to the larger-scale work occurring in the active mine area. Therefore, effects of the SGP on fish would be negligible, temporary, and localized.

Fish salvage and relocation would be conducted prior to stream channel dewatering due to mining, construction, restoration, road crossing maintenance, or other activities. Brown and Caldwell, McMillen Jacobs, and BioAnalysts, 2021b outlines the sequence for fish salvage work including site preparation, work area isolation, fish capture, fish handling, and fish relocation. Dewatering would impact streams including East Fork SFSR upstream from Yellow Pine pit lake, East Fork SFSR downstream from Yellow Pine pit lake, Fiddle Creek, Meadow Creek and tributaries, and EFMC. In total, 17.11 km of stream channel are estimated to be subject to dewatering and fish salvage. In some cases, reaches would be dewatered, and fish salvaged, more than once. Fish salvage would prevent population-level impacts to fish within the active mine area but result in some incidental mortality (generally less than 10 percent), and have a moderate, localized, long-term impact on all fish species within the study area. Additional information on the rescue and relocation protocols and implementation is provided in the Fisheries and Aquatic Resources Mitigation Plan (Brown and Caldwell, McMillen Jacobs, and BioAnalysts 2021b).

Salvage and relocation of fish from the Yellow Pine pit lake (19,267 square meters) would require a larger and longer effort than fish salvage in dewatered stream reaches. However, impacts to fish species present and incidental mortality are expected to be similar. A fish barrier would be installed and designed to allow fish to leave the Yellow Pine pit lake but not allow fish to migrate upstream. The purpose of the barrier would be to ensure that the fewest number of individual ESA-listed fish species are present in the Yellow Pine pit lake when the draining process begins. The upstream fish barrier would be in place in advance of the completion of the East Fork SFSR tunnel and diversion of the East Fork SFSR into the tunnel to minimize fish abundance in the lake prior to dewatering (Brown and Caldwell, McMillen Jacobs, and BioAnalysts 2021b). In other respects, dewatering and fish salvage in the Yellow Pine pit lake would be similar to other areas of the SGP with prior agency consultation, less than 10 percent mortality, and following USFWS Recommended Fish Exclusion, Capture, Handling, and Electroshocking Protocols and Standards (USFWS 2012). Dewatering and associated fish salvage in the Yellow Pine pit lake would have a moderate, localized, long-term impact on all fish species within the study area.

Noise and Vibration

Access Roads, Utilities, and Offsite Facilities

Blasting would occur during construction of portions of the Burntlog Route and the new transmission line. Explosives would also be used to fracture rock from mine operations. Blasting can cause serious injury or mortality to fish; however, these activities would follow applicable regulations and standards (described in more detail below). Therefore, negligible, temporary, and localized effects to fish or fish habitat are expected from blasting along portions of the Burntlog Route.

Operations

Explosives would be used to fracture rock from mine operations. Explosives detonated near water produce shock waves that may be lethal or damaging to fish, fish eggs, or other aquatic organisms. Outside of the zone of lethal or harmful shock waves, the vibrations caused by drilling and blasting have the potential to disturb fish causing stress or altering behavior. Most of the blasting required at the mine site would be in and near the Yellow Pine, Hangar Flats, and West End pits, with some that may be required for construction of stream diversions at the TSF, YPP, and TSF Buttress. Such blasting would generally occur on hillsides and at higher elevations, with considerable distance between streams and the origin of the blasts. Blasting and drilling activities near fish-bearing streams have the potential to affect fish by producing hydrostatic pressure waves, and create underwater noise and vibration, thereby temporarily altering in-stream conditions. Effects on fish from changes in hydrostatic pressure are not related to the distance of the fish from the point of impact, but to the level and duration of the sound exposure (Hastings and Popper 2005).

In order to avoid injury, instantaneous sound levels should be less than 206 peak dB and extended time should be less than 187 dB (183 dB for fish less than 2 grams) sound exposure level, referenced at 1 micropascal (re 1 µPa) for sound traveling through water, measured at a distance of 10 meters (Fisheries Hydroacoustic Working Group 2008).

In addition to sound effects, excessive ground vibrations have the potential to affect fish, particularly the sensitive egg life stage (Timothy 2013, Kolden and Aimone-Martin 2013). Smirnov (1954, as cited in

Alaska Department of Fish and Game 1991) found significant egg mortality caused by ground vibrations with a peak particle velocity (PPV) of 2 inches per second (ips). Jensen and Collins (2003) found that a PPV of 5.8 ips resulted in 10 percent mortality of Chinook salmon embryos. Faulkner et al. (2008) found that PPVs up to 9.7 ips resulted in significantly higher mortality in *O. mykiss* eggs but there was no increase in mortality when exposed to PPVs of 5.2 or less. The Alaska Department of Fish and Game have PPV restrictions of 2.0 ips to protect salmonids (Timothy 2013). The reported PPV value for an in situ soil sampling rig at a distance of 100 feet is 0.011 ips (ATS Consulting 2013).

Safe setback distances for blasting in or near water for the protection of fish have been established (Dunlap 2009; Kolden and Aimone-Martin 2013; Timothy 2013; Wright and Hopky 1998). Perpetua (2021a) has committed to comply with blasting standards set forth in Wright and Hopky (1998), and Timothy (2013). These standards have been shown to minimize the risk of injury or mortality to all life stages of fish.

As part of the SGP EMMP, an Explosives and Blasting Management Plan would be developed that would ensure compliance with the blasting requirements of the MSHA, 30 CFR 56, Subpart E – Explosives and 30 CFR 57, Subpart E – Explosives. The blasting plan would include the setback distances and other BMPs.

A spreadsheet tool was developed to compute the required setback distances from fish-bearing streams and lakes (Brown and Caldwell, McMillen Jacobs, and BioAnalysts 2021b). The results indicate that a 425-foot blasting setback from the closest point in the blast field to stream and lake habitats should be protective in most cases, assuming a 40-foot bench height. These findings were used to examine likely areas where blasting would be near streams or lakes. For a 20-foot bench height, the examination indicated that a 239-foot blasting setback could be met everywhere within the mine plan. Considering a 40-foot bench, blasts may encroach on the 425-foot blasting setback in limited areas adjacent to the Yellow Pine pit lake near the East Fork SFSR tunnel and adjacent to the Hangar Flats pit where Meadow Creek is closest to the pit. In those areas where blasting is nearer to streams and lakes and impacts may occur, it is possible that the bench heights could be adjusted to 20 feet, reducing the required setback.

In addition to protective setbacks and bench height, Perpetua may employ other methods when warranted, such as using controlled blasting techniques following industry BMPs, modifying blasting variables including charge size, and vibration and overpressure monitoring.

Because all blasting would be conducted in compliance with applicable regulations and standards (Brown and Caldwell, McMillen Jacobs, and BioAnalysts 2021b), the noise and vibration effects of the SGP to fish are expected to be negligible, long-term, and localized. Little to no effects is expected to fish or aquatic habitat from blasting along portions of the Burntlog Route and transmission line.

Spill Risk

There is the potential for spills to occur along access roads as fuel and other materials are trucked to and from the SGP during construction of the access roads and mine facilities (see also **Section 4.7.2.2**). If a spill were to occur at a stream crossing or near a stream, surface water could be impacted. Although not all waterbodies crossed via culvert are fish-bearing, spills into any waterway could travel downstream to fish-bearing waters.

Overall, design features (**Section 2.4.9**) and permit stipulations and regulatory requirements from state and federal agencies would reduce the risk of spills and ensure that effective response is provided should a spill occur.

Mine transport begins on Warm Lake Road (CR 10-579) where the risk of spills would be lower, as it is paved and maintained by Valley County and has overall gentler grades. At the intersection of Warm Lake Road and Johnson Creek Road (CR 10-413) the two mine access routes begin, with the Johnson Creek Route north along Johnson Creek Road (CR 10-413) and the Burntlog Route east onto Burnt Log Road (FR 447). The location of the spill risk would change as the SGP progresses under the 2021 MMP. Johnson Creek and the portion of the East Fork SFSR between the village of Yellow Pine and the Operations Area Boundary would be at risk of any significant spills of hazardous materials during the first 1 to 2 years of the SGP when the Johnson Creek Route would be used as the access route during the Burntlog Route construction. For the remainder of the mine life, the waterbodies along the Burntlog Route would be at risk from any significant spills.

The combination of the proposed monitoring, planning, and control practices described in the preceding narrative for transport and handling of fuels and hazardous materials and committed EDFs would minimize the risk of accidental releases during the transportation, storage, management, and use of hazardous materials. Nevertheless, the proximity of the access roads to surface water resources increases the potential for a release to enter water which could result in major impacts.

It is expected that the risk of a spill large enough to negatively affect fish or aquatic habitat would be low, but the risk occurs throughout the period of the operations. The effects of the SGP on fish and aquatic habitat from contaminants from a spill are expected to be minor, long-term, and localized.

Altered Physical Stream Structure

The SGP would result in stream channel changes, including dewatering, restoration, and enhancements within the active mine area (**Figure 4.12-1)**. Physical alterations to stream structure from the SGP that would result in impacts to fish generally fall into three phased categories construction, active mining, and reclamation and restoration.

Construction and operation under the 2021 MMP would eliminate the existing Yellow Pine pit lake, and important bull trout rearing/feeding habitat, and stream reaches currently occupied by Chinook salmon, steelhead, bull trout, and westslope cutthroat trout. The Yellow Pine pit lake would be replaced with a lake feature called Stibnite Lake which would be designed to serve similar functions to the existing Yellow Pine pit lake including lentic fish rearing/feeding habitat and temperature buffering (Rio ASE 2021). Relative to baseline conditions, construction during the active life of the mine would result in a maximum of 4 percent loss of stream channel habitat upstream from the Sugar Creek confluence occurring by Mine Year 12 based on total estimated stream length (Rio ASE 2021). Reclamation and restoration starting in the active mining period and continuing post-closure would result in a 4 percent increase in total channel habitat length relative to baseline conditions. Specific stream channel restoration plans are discussed in the Stibnite Gold Stream Design Report (Rio ASE 2021).

The construction and operation of the East Fork SFSR fishway would allow any fish passing through the fishway to access upstream areas thereby limiting the overall fish population impact of habitat reduction in the area of the active mine for a period of approximately 12 years. The fishway would serve to reduce the overall impacts of dewatering the diversion, and stream channel elimination in the active mine. Protective measures, such as routing stream flow around construction areas or during stream restoration activities would be implemented to protect water quality (see the SGP Fisheries and Aquatic Habitat Specialist Report for additional details, Forest Service 2022i).

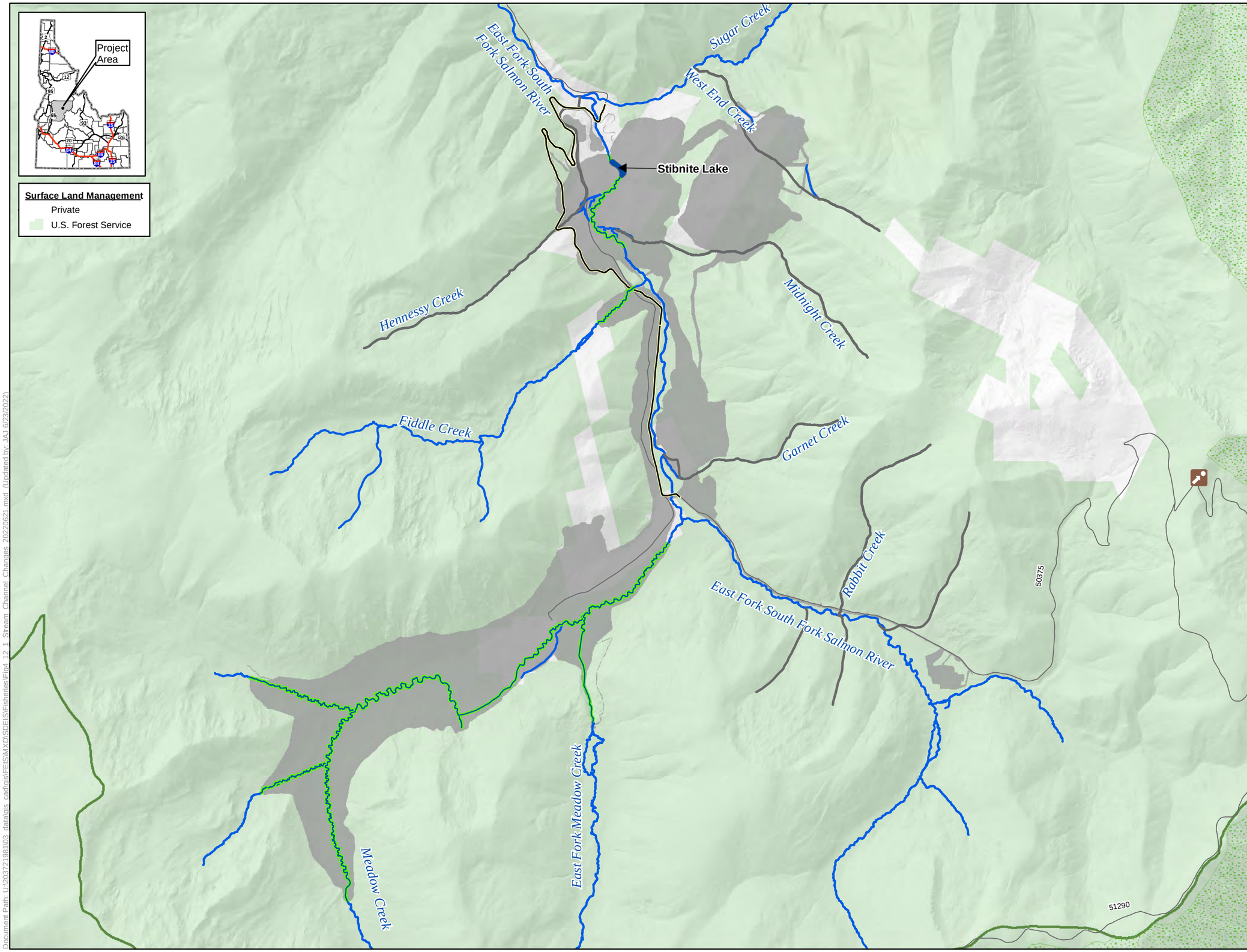
Changes in age structure, habitat use, productivity, and species composition would occur within the study area during the period of active mining due to extensive physical stream structure changes (**Figure 4.12-1**). However, the spatial extent and magnitude of these changes would be reduced by fisheries protection measures such as the East Fork SFSR fishway. By Mine Year 11, the fishway would be replaced with an open channel through which volitional passage could occur. Incremental improvements in fish passage and habitat quality would occur through the restoration process leading to an improved permanent condition relative to baseline as described below.

Restoration of stream and lake habitats and riparian vegetation within the active mine area after reclamation would result in a net increase in stream length and accessible fish habitat post-closure relative to baseline conditions and volitional fish access to habitats upstream of the Yellow Pine pit lake (Rio ASE 2021). The Stibnite Lake would provide lentic rearing habitat within the mine area for bull trout and other species without impeding upstream passage. During the 12-year period in which the Yellow Pine pit lake is unavailable and before the Stibnite Lake is created, bull trout would not have access in the mine area to lake habitat, an important habitat for the adfluvial bull trout. This would result in a major, long-term, localized impact to bull trout.

Stream enhancements in the East Fork SFSR and lower Meadow Creek would include improvements to physical channel processes and habitat largely within the existing stream channel. This would be accomplished by selectively installing large woody debris and rock structures, creating pools, enabling improved sediment sorting, and generally increasing hydraulic and habitat diversity. Enhancement efforts also may include floodplain reconnection and establishment of riparian vegetation, achieved by excavation of legacy fill material down to bankfull level (Rio ASE 2021).

The Fisheries and Aquatic Resource Mitigation Plan and the FOMP (Brown and Caldwell, McMillen Jacobs, and BioAnalysts 2021a and 2021b) describe in detail how impacts to fish populations within the SGP would be mitigated through fish salvage/rescue in dewatered channels, minimizing runoff impacts, use of fish screens to prevent entrainment, and operation of the East Fork SFSR fishway or trap and truck alternatives.

The effects of the 2021 MMP construction activities would have a major, short-term, localized impact on Chinook salmon, steelhead, bull trout, and westslope cutthroat trout. The restoration activities, particularly providing volitional passage in the East Fork SFSR, would result in a major, permanent, regional, and beneficial effect on Chinook salmon, steelhead, bull trout, and westslope cutthroat trout within the vicinity of the mine.



LEGEND

Project Components*

- SGP Features
- Post-Closure Perennial Restored
- Stream **
- Non-fish-bearing Stream
- Stibnite Lake
- Public Access Road ***

Other Features

- U.S. Forest Service
- Wilderness
- Monumental Summit
- Road

* Project Components are associated with all Alternatives
** 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

0 0.25 0.5 Miles

1 inch = 0.5 miles when printed at 11x17

Figure 4.12-1
Stream Channel Changes During Construction, Active Mining, and Reclamation/Restoration Phases
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

Impacts to Watershed Condition Indicators/Aquatic Habitat Elements

Water Temperature

Predicted future temperature increases resulting from the 2021 MMP were evaluated using a SPLNT model (Brown and Caldwell 2021i) which calculated a MWMT for SGP area stream segments (see also **Section 4.9.2.3**).

The fish species of greatest management concern considered in this analysis that would be impacted by the SGP are all salmonids that are adapted to a cold-water thermal regime, requiring the species life stages, they may be impaired or their survivability decreases.

A summary of predicted water temperatures under the 2021 MMP are presented in **Table 4.12-2**. The periods evaluated include the baseline conditions, those within the mine operations (Mine Years 6, 12, and 18), one within the closure and reclamation period (Mine Year 22), and several in the post-closure period (Mine Years 27, 32, 52, and 112). The post-closure period represents how the mine site would function after the facilities and permitted discharges have been removed, dewatering and mining have been discontinued, and the channels and vegetation have been fully reclaimed.

The SPLNT model used for the temperature predictions in **Table 4.12-2** does not account for changes to stream temperatures caused by changing climate conditions. This means that modeled future water temperatures (e.g., Mine Year 112) assumed that without the 2021 MMP, stream temperatures would be similar to the historic water temperature data (Brown and Caldwell 2018b). Water temperatures would likely be higher if climate change had been incorporated into the model. Climate change would be expected to increase water temperatures from baseline estimates to the end of the mine operations by as much as 0.1°C to 2.0°C based on forecasts for 2030-2059 (Isaak et al. 2016). This range of expected temperature increase attributable to climate change is based on a forecast period approximately 75 years shorter than the model predictions through Mine Year 112. Due to the potential effects of climate change and other uncertainties in stream water temperatures over the long-term such as effects of stream restoration and riparian shading, later year model predictions have more uncertainty than earlier year model predictions. This uncertainty is discussed further in the sensitivity analysis section of Brown and Caldwell 2018b and the uncertainty analysis section of Forest Service 2022f.

In the East Fork SFSR upstream from Meadow Creek, water temperatures tend to be cooler than the downstream reaches because this consists of the headwaters. Water temperatures in this section of the East Fork SFSR under the 2021 MMP would be similar to those under baseline conditions.

Meadow Creek upstream from EFMC has decreasing water temperatures during mine operations and closure/reclamation activities (Mine Year 6 through 18 as shown in **Table 4.12-2**) because water being piped is not exposed to solar radiation. Once the pipeline is removed, however, water temperatures increase until around Mine Year 27, at which time the replanted riparian vegetation becomes more established and stream shade is increased and water temperatures begin to decrease. This decrease continues through at least Mine Year 112. The temperature changes within the portion of Meadow Creek adjacent to the TSF area were also examined. This portion of Meadow Creek exhibits the specific effects of existing mining disturbance on the baseline condition and then the specific effects of TSF operation followed by stream restoration across the TSF and TSF Buttress. Predicted temperatures during the early

years of restored flow across the TSF and TSF Buttress are higher than average temperatures over the entirety of Meadow Creek because early revegetation efforts have not reached their riparian shading potential. However, the difference from existing conditions is smaller because the TSF area has a higher temperature under existing conditions than Meadow Creek as a whole.

EFMC experiences an increase in summer and fall maximum water temperatures during mine operations and closure/reclamation activities (Mine Year 6 through 18) and post-closure until Mine Year 52, at which point the temperatures decline compared to the baseline conditions (**Table 4.12-2**). Restoration activities on the EFMC is slated to begin in Mine Year 1, with the construction of the rock drain starting in Mine Year 3. EFMC flowing through the rock drain would reduce its exposure to solar radiation, thus resulting in a decrease in change in water temperatures between the meadow and the lower section of EFMC during the summer and fall months. By Mine Year 112, the difference in water temperature between the meadow and the lower EFMC is around 0.5°C for both the summer and fall maximums.

Water temperatures in the warmer summer and fall months in Meadow Creek downstream from EFMC substantially decreases relative to the baseline conditions during mine operations and closure/reclamation activities (Mine Year 6 through Mine Year 18), though there is an increase at Mine Year 27, which then continues to decline until Mine Year 112 (**Table 4.12-2**). These decreases during mine operations are a result of decreased solar radiation upstream sources. The removal of the low-flow piping along the TSF in Mine Year 23 would result in water temperatures increasing, though not as high as baseline conditions, and subsequently decreasing as the revegetation efforts take effect. This section retains some connection to groundwater which helps maintain a lower temperature as well.

The East Fork SFSR between Meadow Creek and Yellow Pine pit experiences decreases in summer maximum water temperatures relative to baseline conditions. There is a slight increase in temperatures, still lower than baseline, after Mine Year 22 once the low-flow piping along the TSF is removed, and temperatures continue to decrease once the revegetation efforts take effect). Fall maximum water temperature decrease throughout the operations, closure, and post-closure periods (**Table 4.12-2**).

East Fork SFSR between Yellow Pine pit and Sugar Creek, and similarly the East Fork SFSR roughly 1 km downstream from Sugar Creek, experiences an increase in summer and fall maximum water temperatures at Mine Year 6 because of the draining of the Yellow Pine pit lake followed by active mining and mine dewatering that removes cooling influences of upstream shading and groundwater discharge to surface water (**Table 4.12-2**). By Mine Year 112, summer maximum water temperatures in the East Fork SFSR between Yellow Pine pit and Sugar Creek are about 0.4°C higher than baseline conditions, but fall maximum temperatures, and summer maximum and fall maximum temperatures below Sugar Creek end up between 0.1 and 0.6°C below baseline conditions (**Table 4.12-2**).

The effects of the SGP on fish caused by changes to water temperature are expected to be minor to moderate, permanent, and localized for the East Fork SFSR and upstream from Meadow Creek, Meadow Creek upstream from the EFMC, EFMC, and East Fork SFSR downstream from Yellow Pine pit, but major, permanent, localized, and beneficial for Meadow Creek downstream from the EFMC, and for the East Fork SFSR between Meadow Creek and Yellow Pine pit.

Sediment and Turbidity

Fish population abundance, distribution, and survival have been linked to levels of turbidity and silt deposition. Excess sediment can degrade spawning gravels, reduce embryo survival and emergence, impair growth and survival of juvenile salmonids, fill pool habitat, and reduce the productivity of aquatic macroinvertebrates and other prey items for fish (Bjornn et al. 1977; Suttle et al. 2004). Prolonged exposure to high levels of suspended sediment would create a loss of visual capability in fish in aquatic habitats within the study area, leading to reduced feeding and growth rates; a thickening of the gills, potentially causing the loss of respiratory function; clogging and abrasion of gills; and increases in stress levels, reducing the tolerance of fish to disease and toxicants (Waters 1995, Newcombe and Jensen 1996; Wilber and Clark 2001). It can also cause the movement and redistribution of fish populations.

Outside the Mine Site Area

Construction and use of roads can accelerate erosion and sediment delivery to streams and have been identified as the primary contributor of sediments to stream channels in managed watersheds (Trombulak and Frissell 2000). During the Burntlog Route construction, including bridge and culvert installations, the potential exists for increased runoff, erosion, and sedimentation resulting from localized vegetation removal and soil excavation which could result in increased sediment load in streams. Construction of and upgrades to access roads and utilities associated with the SGP creates a potential for increased runoff, erosion, and sedimentation as a result of localized vegetation removal and excavation of soil, rock, and sediment, which could result in increased sediment load in streams. Permit stipulations from IDWR and IDEQ would ensure streambank vegetation would be protected except where its removal is necessary. New cut or fill slopes not protected with some form of stabilization measures would be seeded and planted with native vegetation to prevent erosion. Use of temporary erosion and sediment control BMPs also would be employed.

During the construction phase, the 2021 MMP would be accessed by routes that would cross 43 streams (**Section 4.9** and **4.16**). In addition to these stream crossings, approximately 6.5 miles (18 percent of its 36-mile length) of the Johnson Creek Route is located in close proximity to streams (i.e., within 100 feet). The number of vehicle trips per day also is used in this analysis as a metric for potential increases in erosion and sedimentation. **Section 4.16** discusses the number of trips per day during construction, operation, and closure and reclamation. A total of 65 vehicle trips per day would occur during the construction phase. During the mining and ore processing operations phase (approximately 15 years), a total of 50 vehicle trips per day are anticipated on average per day (year-round) during operations utilizing the Burntlog Route. During the closure and reclamation phase, traffic along the Burntlog Route would be reduced to a total of 27 vehicle trips per day (year-round).

Table 4.12-2 Maximum Weekly Water Temperatures during July (Summer) and September (Fall) for Modeled Mine Years for the 2021 MMP

Stream Drainage	Season	Baseline (°C)	2021 MMP Mine Year								Change from Baseline		
			6 (°C)	12 (°C)	18 (°C)	22 (°C)	27 (°C)	32 (°C)	52 (°C)	112 (°C)	to 27 (°C)	to 52 (°C)	to 112 (°C)
East Fork SFSR Upstream of Meadow Creek	Summer	13.4	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	-0.1	-0.1	-0.1
	Fall	11.0	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	-0.1	-0.1	-0.1
Meadow Creek Upstream of EFMC	Summer[1]	14.0	12.4	12.3	12.4	12.4	20.8	18.6	17.1	15.1	6.8	3.1	1.1
	Fall[1]	12.0	10.5	10.5	10.5	10.5	16.0	13.8	12.7	11.3	4.0	0.7	-0.7
	Summer[2]	16.8	13.5	13.0	13.1	13.1	21.7	20.2	18.5	16.0	4.9	1.7	-0.8
	Fall[2]	14.2	11.2	11.0	11.1	11.0	15.9	14.4	13.1	11.5	1.7	-1.1	-2.7
Meadow Creek Downstream of EFMC	Summer	19.4	17.6	16.5	16.3	16.1	18.5	17.9	16.6	15.2	-1.4	-2.8	-4.2
	Fall	15.9	15.5	13.6	13.2	13.0	13.9	13.3	12.4	11.6	-2.0	-3.5	-4.3
EFMC	Summer	14.6	15.8	15.4	15.3	15.2	14.9	14.8	14.4	14.2	0.3	-0.2	-0.4
	Fall	12.6	13.5	13.1	12.9	12.8	12.8	12.6	12.4	12.3	0.2	0.0	-0.3
East Fork SFSR between Meadow Creek and Yellow Pine pit	Summer	17.3	16.3	15.6	15.8	15.9	16.3	15.9	15.2	14.7	-1.0	-2.1	-2.6
	Fall	13.9	13.5	12.6	12.6	12.4	12.5	12.3	11.9	11.7	-1.4	-2.0	-2.2
East Fork SFSR between Yellow Pine pit and Sugar Creek	Summer	14.1	16.1	15.8	15.7	15.6	15.6	15.4	14.8	14.5	1.5	0.7	0.4
	Fall	11.2	13.0	12.4	12.0	11.8	11.8	11.6	11.3	11.1	0.6	0.1	-0.1
East Fork SFSR Downstream of Sugar Creek	Summer	14.9	16.0	15.0	15.1	15.1	15.0	14.9	14.7	14.5	0.1	-0.2	-0.4
	Fall	11.9	12.5	11.6	11.6	11.5	11.6	11.5	11.3	11.3	-0.3	-0.6	-0.6

Increased temperatures attributable to climate change are not incorporated in the reported predicted values.

Uncertainty in predicted temperature values increases over time due to assumptions made about the effects of stream restoration and riparian shading. The presented temperatures are based on effective implementation of the stream restoration and riparian shading.

[1] Temperatures based on distance-weighted average of all QUAL2K reaches.

[2] Temperatures based on distance-weighted average of the QUAL2K reaches along the TSF and TSF Buttress area downstream.

For stream crossings, Perpetua would replace existing, or install new, culverts or bridges at crossings along the Johnson Creek (CR 10-579), McCall-Stibnite (CR 50-412), and Burnt Log (FR 447) roads. Stream crossings associated with access roads would be designed to minimize potential impacts on surface water hydrology, water quality, and fish passage. The Forest Service would require stream crossings to be designed to accommodate a 100-year flood recurrence interval, unless site-specific analysis using calculated risk tools, or another method determines a more appropriate recurrence interval.

During the Burntlog Route construction including bridge and culvert installations, the potential exists for increased runoff, erosion, and sedimentation as a result of localized vegetation removal and excavation of soil, rock, and sediment, which could result in increased sediment load in streams. Expected permit stipulations from the IDWR and IDEQ would ensure that streambank vegetation would be protected except where its removal is absolutely necessary; that new cut or fill slopes not protected with some form of riprap would be seeded and planted with native vegetation to prevent erosion; use of temporary erosion and sediment control best management practices (BMPs) associated with a stormwater pollution prevention plan; and that all activities would be conducted in accordance with Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations.

For the Burntlog Route, the potential for sedimentation would be minimized using standard erosion control measures, such as silt fencing, ditch checks, and other measures, which would be installed and maintained to minimize the potential for erosion and sedimentation. Numerous small (15- to 60-inch) drainage culverts would be installed along the Burntlog Route to reduce rutting and shunt water out of ditches and off the road prism, which would serve to reduce erosion from the road into streams. Perpetua would maintain a hardened road surface with gravel surfacing to promote an efficient and useable all-weather road while minimizing erosion (Perpetua 2021a). Perpetua would also be required to comply with specific design requirements as part of the IDWR Stream Channel Alteration Permit, such as line of approach, minimum bridge clearance and minimum culvert size per length, and anchoring on steep slopes. Bridges and culverts would be maintained to allow proper drainage and limit sediment delivery to area streams. Based on permit-related design requirements, use of BMPs, and required maintenance activities, the potential for access road-related erosion and sedimentation would be minimal (limited to periods of substantial overland flow, such as from very large rainfall events).

Utilities associated with the SGP (existing transmission line upgrades and structure work, right-of-way (ROW) clearing, new transmission line, and transmission line access roads) would cross 37 different streams, as identified in Table 7-20 in the Water Quality Specialist Report (Forest Service 2022f). Of the 37 streams that would be crossed, 26 would be related to the upgrade of existing IPCo transmission lines, where the existing transmission line ROW crosses various streams. During transmission line upgrades and new transmission line construction, the potential exists for increased runoff, erosion, and sedimentation as a result of vegetation removal within the ROW, and the localized excavation of soil, rock, and sediment for structure work and/or ROW access roads. Expected permit stipulations from IDWR and IDEQ would be similar to the examples provided above for access roads and would ensure the use of erosion and sediment control BMPs associated with a stormwater pollution prevention plan. ROW vegetation clearing would retain vegetation root structure within soils thus reducing erosion concerns. Surface water quality also could be impacted during construction by fugitive dust from vehicles and heavy equipment that settles into adjacent water bodies. Reduction of these potential impacts would be achieved through fugitive dust control at the SGP. In dry months, Perpetua would spray water on mine

haul roads as necessary to mitigate dust emissions in compliance with state and Forest Service requirements.

The extent of sedimentation effects from fugitive dust would be concentrated at the SGP; however, due to the nature of sediment transport by streams, the geographic extent of the impact could extend farther downstream in the East Fork SFSR depending on site- and event-specific factors. The duration for traffic-related dust and erosion/sedimentation would last throughout the mine construction, operations, and post-closure periods; however, the potential for these effects would be incrementally reduced during closure and reclamation due to reduced activity at the SGP and stabilization of disturbed areas. Therefore, the effects of fugitive dust on fish would be minor, long-term and localized. The effects of the SGP construction of temporary roads and transmission lines on sedimentation on fish and aquatic habitat are expected to be moderate, short-term, and localized.

Within the Mine Site Area

Construction and active mining would disturb, excavate, and move soil and overburden thereby raising the potential for sediment runoff and suspended sediment increases in surface waters. Total suspended solids (TSS) in surface water are generally correlated with turbidity (NTU), which is a more visually apparent estimator of sediment contamination. Under baseline conditions, turbidity is generally low (less than 5 NTU) with occasional spikes of up to 70 NTU during snowmelt or rainfall events (Forest Service 2022f). The greatest potential for Project-related increases in stream sedimentation would come during storm events causing overland flow across exposed soil, excavated areas, and roads. BMPs would be employed for near-stream or instream work such as removal of legacy materials and stream restoration to minimize the potential for coarser sediment generation or mass wasting that would affect sediment transport and deposition. Under baseline conditions, sediment entering the East Fork SFSR primarily comes from Sugar Creek, Meadow Creek, and EFMC. Applicable sediment control design techniques BMPs would be used to minimize sediment runoff and erosion along roads and excavated areas. On the mine site and along the Burntlog route, expected permit conditions from IDWR and IDEQ would protect streambank vegetation, require culvert maintenance, and require low impact snow removal techniques.

Surface water quality also could be impacted during operations, closure, and reclamation by fugitive dust from vehicles and heavy equipment that settles into adjacent water bodies, as described above, outside the mine site area.

Potential Project-related sediment impacts on fish would include temporary turbidity increases during runoff events and localized deposition of fine sediment in stream channels. Turbidity increases during runoff events have the potential to temporarily change fish behavior but are unlikely to be severe enough, relative to baseline fluctuations, to cause fish mortality or health impacts. Increases in fine sediment deposition within stream channels have the potential to decrease spawning gravel suitability and decrease benthic invertebrate production within gravel riffles. These impacts would impact spawning/incubation and rearing/feeding life stages, respectively, of Chinook salmon, steelhead, bull trout, and westslope cutthroat trout. With the application of sediment reduction BMP's and surface runoff minimizing design techniques, the impacts of sediment in surface water to fish are predicted to be measurable but not severe, limited to the mine area, and occur during the active mining period. However, the restoration efforts in the

EFMC would result in a substantial decrease in sediment input into Meadow Creek and the East Fork SFSR.

The effects of the 2021 MMP on sediment and turbidity on Chinook salmon, steelhead, bull trout, and westslope cutthroat trout would be moderate, permanent, and localized.

Physical Barriers

Physical barriers can affect fish population dynamics by reducing or blocking access to fish habitat. These barriers can be natural (gradient, woody debris, etc.) or human-made (culverts, altered creek channels due to human activities). Fish passage barriers can negatively impact fish population dynamics by reducing, or completely blocking, available habitat during certain life stages. Existing fish passage barriers within the mine site were identified as either complete - no species can move upstream or downstream at any time of year; or partial - the barrier may not exist at high flows but at certain flows (i.e., low flows) some fish may not be able to pass. Passage barriers are further categorized by natural - not caused by human action, such as a rock dam, log jam, and steep slopes; or artificial - caused by human action, such as culverts, stream alteration, and surface water diversions (BioAnalysts 2019).

Outside the Mine Site Area

During the construction of the Burntlog Route or of temporary roads, culverts would be constructed or replaced. Surveys were conducted to identify fish bearing streams along the Burntlog Route (Rio ASE 2021). Any new or reconstructed crossing is required to be fish passable, which would increase or re-establish fish access where it had been reduced or blocked unless there is a risk of passing non-native fish species. The potential re-establishment of access upstream of these culverts could affect the composition of the aquatic community. Changes in types of fish present and the abundance of fish could increase the risk of injury and mortality for some species. For instance, additional habitat could benefit some species, while the presence of additional fish in previously inaccessible reaches would introduce competition for resources. These changes may affect the distribution and relative abundance of fish populations in affected streams.

Furthermore, establishing or increasing access could allow non-native species to access upstream habitat that is currently blocked, such as brook trout. Brook trout are known to compete with bull trout for resources and habitat (USFWS 2008a)). Brook trout also are known to hybridize with cutthroat trout, which has the potential to negatively impact the genetic integrity, and/or result in negative changes to the local population of cutthroat trout (USFWS 2008a)). According to the Forest Plan standard, no barrier would be removed if increasing access between non-native species to sensitive native species would occur. Additionally, brook trout presence is minimal along the Burntlog Route (MWH 2017, Stantec 2018 and 2019).

The effects of the SGP on fish access during construction of temporary roads are expected to be negligible, short-term, and localized.

Within the Mine Site Area

Existing and predicted fish passage barriers, as well as the removal of barriers resulting from the 2021 MMP are shown in **Figure 4.12-2**. **Table 4.12-3** presents a summary of the fish barriers conditions, as well as the length of stream channel changes post-closure, which includes both the new access as well as blocked access to stream channels into existing stream reaches in construction diversion and stream enhancements.

Species-specific impacts to aquatic habitat resulting from passage barriers were assessed for Chinook salmon and steelhead through the evaluation of the extent of both Critical Habitat and IP. Impacts to aquatic habitat from passage barriers for bull trout and westslope cutthroat trout were assessed by quantifying the extent of Critical Habitat (bull trout) and occupancy probability (for both). Additional information is provided below and in ESS 2019b.

The greatest benefit to Chinook salmon and steelhead passage comes in Mine Year -1 with the construction of the fishway, which would allow these species to volitionally access habitat that they have not naturally accessed for decades. The fishway may be a partial barrier by discouraging migration of some fish, but the extent of this is unknown. By Mine Year 11, the East Fork SFSR, where the Yellow Pine pit is located, would have been restored, providing natural conditions for volitional passage. Additionally, the box culvert, 2.88 km upstream from the Yellow Pine pit cascade barrier would be modified to provide full passage. This substantially increases the amount of habitat volitionally available to Chinook salmon and steelhead that are not currently accessible (**Table 4.12-3**).

Based on the current known extent of bull trout occupancy, bull trout may be extirpated from the reaches upstream from the TSF when the reaches within the footprint would be dewatered and flow would be diverted into the diversions that route water around the facilities. With the gradient barrier that would be created along the TSF, there would be no mechanism by which bull trout would be able to volitionally (i.e., naturally) recolonize the reaches upstream from or on top of the TSF. Based on the current known extent westslope cutthroat trout occupancy, fish in the upper headwaters of Meadow Creek would remain isolated.

The effects of the SGP on fish access for Chinook salmon and steelhead, to upstream habitat are expected to be major, permanent, and localized benefits, but for bull trout and westslope cutthroat trout the effects are expected to be major, permanent, and localized impacts.

Table 4.12-3 Length of Habitat Gained or Lost under Post-Closure Conditions for Relative to Baseline Conditions Existing and Expected Future Fish Passage Barriers Constructed or Removed in Mine Site Area Streams

Stream/ Location	Mine Year Added/Removed	Length of Chinook Salmon Habitat (km)		Length of Steelhead Habitat (km)		Length of Bull Trout and Cutthroat Trout Habitat (km)	
		Change Attributed to Barrier [1,2]	Change in Total Available[1,2,3]	Change Attributed to Barrier[2]	Change in Total Available[2]	Change Attributed to Barrier[1,4]	Change in Total Available[1,4]
Existing Barriers							
EFSFSR above YPP (02) Artificial – Gradient	Removed: Mine Year -1 (Tunnel); Mine Year 11 (Channel reconstruction)	+19.65[1] +8.87[2]	+1.44[1] +0.27[2]	+8.72[2]	+1.77[2]	+19.54[1] +32.82	+1.31[1] +1.96[4]
EFSFSR (203) Artificial – Box Culvert	Removed: Mine Year -1	+16.87[1] +6.29[2]	+1.44[1] +0.27[2]	+6.90[2]	+1.77[2]	+16.66[1] 26.43	+1.31[1] +1.96[4]
Fiddle Creek (04) Artificial – Gradient	Removed: Mine Year -4	NP	NP	NP	NP	NP[1] -0.72[4]	NP[1] +1.96[4]
Fiddle Creek (200) Artificial - Culvert	Removed: Mine Year -4	NP	NP	NP	NP	NP[1] 0.71[4]	NP[1]
Meadow Creek (05) Artificial - Gradient	Removed: Mine Year 3	NP	NP	NP	NP	NP	NP
East Fork Meadow Creek (06) Natural - Gradient	Removed: Mine Year -1	NP	NP	NP	NP	NP	NP
Created Barriers							
Meadow Creek Diversion Artificial – Gradient	New: Mine Year -2	NP	NP	NP	NP	NP	NP
Meadow Creek TSF Artificial - Gradient	New: Mine Year 18	0.58 -1.02[2]	+1.44[1] +0.27[2]	-0.14	+1.77	-0.61[1] +0.28[4]	+1.31[1] +1.96[4]
East Fork Meadow Creek Artificial – Rock Drain/Gradient	New: Mine Year -1	NP	NP	NP	NP	NP[1]	NP[1]
East Fork Meadow Creek Artificial - Gradient	New: Mine Year 22	NP	NP	NP	NP	NP[1] -0.63[4]	NP[1] +1.96[4]

[1] Results based on potential Critical Habitat
[2] Results based on usable Intrinsic Potential habitat, but not always accessible
[3] Not all of the total habitat is accessible habitat under baseline conditions
[4] Results based on usable occupancy potential, but not always accessible
EFSFSR = East Fork South Fork Salmon River; km = kilometer; NP = not present, YPP = Yellow Pine pit

Chemical Contaminants

Outside the Mine Site Area

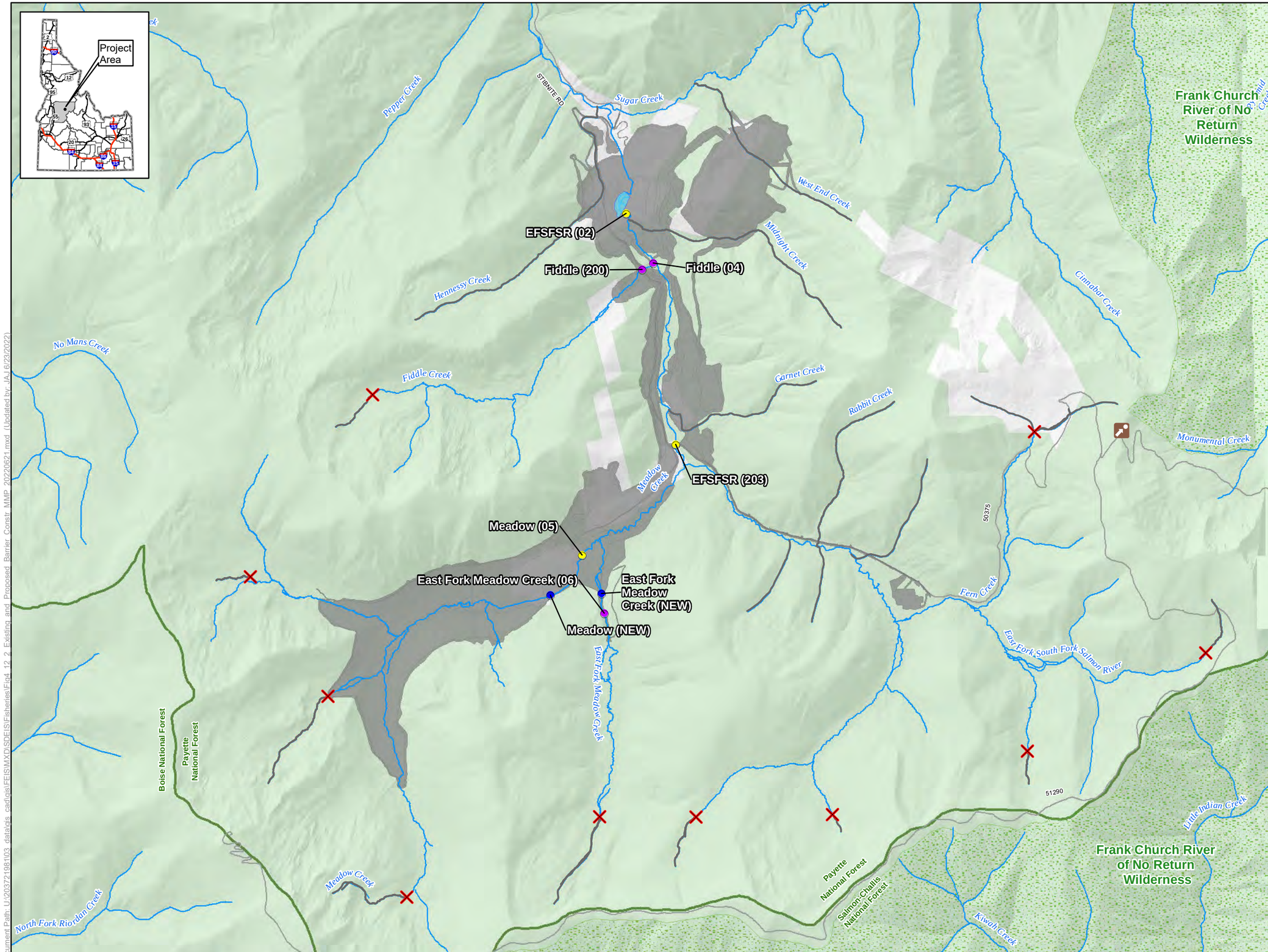
There is the potential for spills to occur along access roads as fuel and other materials are trucked to and from the 2021 MMP. If a spill were to occur at a stream crossing or near a stream, surface water could be impacted. Discussion of very low probability scenarios for a large release (tanker truck or concentrate truck rollover), and more probable scenarios involving small releases, is provided **Section 4.9**. Overall, EDFs (**Section 2.4.9**) and permit stipulations and regulatory requirements from state and federal agencies (including use of USDOT-certified containers and registered transporters) would reduce the risk of spills and ensure that effective response is provided should a spill occur.

The most probable release scenario associated with truck transport on the access routes to the SGP would be relatively small amounts of fuel spilled from vehicles themselves and attributed to mechanical failure or human error. Under this scenario, immediate cleanup actions would include deployment of containment and spill recovery materials, and removal of impacted soil. Fuel spilled to soils/roadbed could be readily contained and recovered, while fuel which enters waterways via roadside drainages may be difficult or impossible to fully recover and there would be potential for migration beyond the immediate spill area. Spill response materials on the vehicles and pre-positioned along the access routes and in SGP response vehicles would include materials to contain and recover floating oil. Response actions would include notification to the appropriate regulatory agencies.

Small volume release scenarios would be temporary due to prompt response and cleanup actions; however, higher volume/lower probability spill scenarios could result in longer-term remedial actions and impacts. The risk of spills would last throughout the life of the SGP (long term). Effects would generally be local and in close proximity to the release source in most scenarios; however, if surface or groundwater were to be impacted with fuels or other hazardous materials, the potential for migration beyond the local area could occur.

A low probability release of liquid petroleum or hazardous material from a bulk truckload could potentially occur assuming the puncture of the bulk tanker in the accident. Under this scenario, spilled material would be released to the immediate roadbed area, and potentially impact physical resources and ecological receptors (e.g., vegetation or wildlife) and nearby surface water depending on the topography and location. Spill response and recovery measures such as containment, deployment of absorbent materials, removal of impacted roadbed material and vegetation, and deployment of water-based spill recovery materials and equipment (as needed) would help to limit impacts.

A release of large quantities of solid hazardous materials such as cyanide or antimony concentrate would also be unlikely. Breaches of the shipping containers for these materials in the case of an accident could release the solid materials to the ground where it would reside until response actions are taken to mechanically clean it up, along with any contaminated soil. Migration of these solid materials from the immediate release site would be less likely than for liquid materials but could be possible in wet weather conditions. Again, spill response and recovery measures would help to limit impacts.



LEGEND

- Upstream Extent of Fish Presence
- Existing Barrier No Change
- Existing Barrier With Change
- New Barrier

Project Components*

- SGP Features

Other Features

- U.S. Forest Service
- Wilderness
- Monumental Summit
- County
- Road
- Non-fish-bearing Stream
- Stream/River
- Lake/Reservoir

*Project Components are associated with 2021 MMP
Note:
East Fork Meadow Creek is also known as Blowout Creek
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 0.3 0.6 Miles
1 inch = 0.6 miles when printed at 11x17

Figure 4.12-2
Existing and Proposed Barrier Construction or Removals for the Modified Mine Plan 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

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The pilot vehicles that would accompany all transports of fuel or hazardous materials between the SGLF and the Operations Area Boundary would carry spill response tools and materials, communications equipment, and drivers trained in spill responses. Thus, response to a small to moderate spill of fuel or hazardous material during transit over the SGP access roads would essentially be immediate.

Spill containment and countermeasures equipment and materials would be pre-positioned at the SGP mine site, Burntlog Maintenance Facility, and SGLF. In the event of a major spill requiring assistance from any of these locations, the radio communications between the pilot vehicles and these facilities would enable a timely response which would take an estimated 45 minutes to mobilize and arrive at the spill site.

Close proximity of access roads to surface water resources increases the potential for spilled material on the roadways to enter water, thus increasing the potential consequences of a spill. The Burntlog Route crosses 37 streams and includes 9 miles of road that are within 0.5 mile of surface water resources. The Johnson Creek Route crosses 43 different streams and includes 27 miles of road that are within 0.5 mile of surface water resources, including several miles that parallel the fish-bearing East Fork SFSR and Johnson Creek waterways. Though the Burntlog Route includes a greater number of stream crossings, the Johnson Creek Route includes significantly greater proximity to water resources. The potential consequences from trucking spills would thus be greater along the Johnson Creek Route that would be utilized during construction of the Burntlog Route.

Of all the substances to be transported, fuel may pose the highest risk to fish and fish habitat with delivery of 5.8 million gallons of diesel and 0.5 million gallons of gasoline expected annually via tanker truck. This is because large quantities of diesel fuel are transported in each load, numerous trips are made each year, and the substance is a liquid that rapidly flows down gradient toward nearby streams. The intensity of the impact of a hazardous materials spill on fish and aquatic habitat could be high; as a large diesel spill could kill 100 percent of the Chinook salmon juveniles, adults, alevins, and eggs for a considerable distance (several miles) downstream of the accident (NMFS 1995). In terms of toxicity to water-column organisms, diesel is one of the most acutely toxic oil types. Fish, invertebrates, and aquatic vegetation that come in direct contact with a diesel spill may be killed (EPA 2019c). The severity of the impact would depend on the timing, size, and location of the spill. Small spills in deep open waters are expected to rapidly dilute; however, fish kills have been reported for small spills in confined, shallow water (EPA 2019c). Diesel from a spill could mix with spawning gravels and sand and be retained in the stream substrate for a year or more, and thereby negatively affect salmon eggs, alevins, and juveniles for several years (Korn and Rice 1981; Moles et al. 1981).

It is expected the risk associated with a spill large enough to negatively affect fish or aquatic habitat would generally be low but possible. An exception may be when materials are transported during inclement weather conditions, this could increase the risk to moderate. Spills during the winter would be easier to contain because spilled material would not penetrate frozen ground as readily as unfrozen ground, and snow could absorb the spilled material, in addition to the visual contrast between snow and fuel could aid in cleanup. However, areas that are harder to access may increase the time it takes to access and cleanup a spill, creating the potential for fish or aquatic habitat to be in contact with a hazardous material longer and could impact more fish or fish habitat.

While the likelihood of a spill is negligible to moderate, the magnitude of impacts could be major to individuals exposed to harmful concentrations of hazardous materials making impacts of spills moderate, temporary, and localized depending on the type of material releases, the location of the spill, and the presence of fish and aquatic species in the affected area.

Within the Mine Site Area

The West End pit lake would not be reclaimed or restored and would therefore have impacts on fish in perpetuity. Based on the pit lake geochemical model (**Section 4.9**), predicted West End pit lake water chemistry exhibits circumneutral pH conditions with TDS concentrations below 130 mg/L. Antimony, arsenic, and mercury concentrations that exceed the strictest potentially applied water quality standards throughout the operating and closure period. Predicted concentrations of copper and lead are predicted to exceed the strictest potentially applied water quality standards during pit dewatering operations, when produced water is routed for consumptive use and water treatment but decrease below those levels during as the lake fills. Concentrations of arsenic, mercury, and antimony are predicted to slightly exceed the strictest potentially applied water quality standards permanently post-closure. The West End pit lake would be fishless given the absence of fish in West End Creek. Therefore, impacts to fish from contaminants in the West End pit lake would be limited to contaminants entering Sugar Creek via outlet spillage or seepage after the closure and reclamation of the mine. The volume of water entering Sugar Creek would be small relative to the flow of the creek and any contaminants from the West End pit lake would be further diluted at the confluence with the East Fork SFSR. Effects of the SGP to fish, including Chinook salmon, steelhead, bull trout, and west slope cutthroat trout, as well as other native fish species in Sugar Creek, from the West End pit lake contaminants would be minor, permanent, and localized.

Wastewater treatment plant effluent would be discharged to the East Fork SFSR at a location near the worker housing facility. The sanitary wastewater treatment and discharge would occur at a single location during the active life of the mine and therefore impacts to fish would be minor, long-term, and localized.

Fuel storage and handling would be conducted in accordance with a SPCC Plan that would utilize surface storage tanks with primary and secondary containment. There would not be any uncontained or underground infrastructure associated with fuel storage. Therefore, releases from fuel storage would not be expected to contact the environment or affect fish and aquatic habitat, so effects would be none to negligible, long-term, and localized.

Long-term impacts from contaminants would include those during the active mine life and reclamation periods during which contact water would be treated to minimize multiple contaminants. Chemical contaminant loads were modeled under baseline, active mining, and post-reclamation conditions at multiple sites within the 2021 MMP (**Table 4.12-4**) (**Section 4.9**). Impact magnitudes for contaminants are measured relative to IDEQ criteria for protection of aquatic life.

Table 4.12-4 Exceedance of Analysis Criteria, Operations and Post Closure for Assessment Nodes

Constituent of Concern Analysis Criteria		Aluminum[1] 0.36 mg/L	Copper[2] 0.0024 mg/L	Antimony[3] 0.0056 mg/L	Arsenic[4] 0.010 mg/L	Mercury[5] 2 ng/L (total mercury)
Nodes	**Stream**	**Exceedance During Operations (Highest Concentration)[6]**				
YP-T-27	Meadow Creek	None	None	Seasonal peaks lower than baseline seasonal peaks (0.007 mg/L versus 0.018 mg/L).	Seasonal peaks lower than baseline seasonal peaks (0.023 mg/L versus 0.083 mg/L).	Seasonal peaks above baseline seasonal peaks (5 ng/L versus 2 ng/L).
YP-T-22	Meadow Creek	None	None	Seasonal peaks lower than baseline seasonal peaks (0.014 mg/L versus 0.025 mg/L).	Seasonal peaks lower than baseline seasonal peaks (0.018 mg/L versus 0.075 mg/L).	Seasonal peaks above baseline seasonal peaks (5 ng/L versus 2 ng/L).
YP-SR-10	East Fork SFSR	None	None	Seasonal peaks lower than baseline seasonal peaks (0.018 mg/L versus 0.030 mg/L).	Seasonal peaks lower than baseline seasonal peaks (0.023 mg/L versus 0.051 mg/L).	Seasonal peaks higher than baseline seasonal peaks (4 ng/L versus 3 ng/L).
YP-SR-8	East Fork SFSR	None	None	Concentrations below baseline conditions (0.004 to 0.021 mg/L versus 0.006 to 0.031 mg/L) throughout mining.	Concentrations below baseline conditions (0.012 to 0.032 mg/L versus 0.018 to 0.052 mg/L) throughout mining.	Seasonal peaks higher than baseline seasonal peaks (4 ng/L versus 3 ng/L).
YP-SR-6	East Fork SFSR	None	None	Concentrations below baseline conditions (0.005 to 0.027 mg/L versus 0.006 to 0.030 mg/L) throughout mining.	Concentrations at or below baseline conditions (0.013 to 0.041 mg/L versus 0.017 to 0.041 mg/L) throughout mining.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L).
YP-SR-4	East Fork SFSR	None	None	Concentrations primarily below baseline conditions (0.005 to 0.063 mg/L versus 0.008 to 0.056 mg/L) throughout mining. Concentrations above baseline occur in Mine Year -2 at the transition from baseline to construction.	Concentrations below baseline conditions (0.013 to 0.097 mg/L versus 0.019 to 0.120 mg/L) throughout mining.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L).

Constituent of Concern Analysis Criteria		Aluminum[1] 0.36 mg/L	Copper[2] 0.0024 mg/L	Antimony[3] 0.0056 mg/L	Arsenic[4] 0.010 mg/L	Mercury[5] 2 ng/L (total mercury)
Nodes	**Stream**	**Exceedance During Operations (Highest Concentration)[6]**				
YP-SR-2	East Fork SFSR	None	None	Concentrations primarily below baseline conditions (0.004 to 0.041 mg/L versus 0.005 to 0.037 mg/L) throughout mining. Concentrations above baseline occur in Mine Year -2 at the transition from baseline to construction.	Concentrations below baseline conditions (0.010 to 0.066 mg/L versus 0.014 to 0.076 mg/L) throughout mining.	Concentrations at or slightly above baseline conditions (4 to 10 ng/L versus 3 to 10 ng/L) throughout mining.
YP-T-6	West End Creek	None	None	None	None	Concentrations above baseline conditions 37 to 63 ng/L versus 4 to 6 ng/L) throughout mining.
YP-T-1	Sugar Creek	None	None	None	Concentrations at or slightly below baseline conditions (0.007 to 0.015 mg/L versus 0.007 to 0.016 mg/L) throughout mining.	Concentrations at or slightly above baseline conditions (6 to 9 ng/L versus 6 to 8 ng/L) throughout mining.
YP-T-27	Meadow Creek	None	None	Seasonal peaks lower than baseline seasonal peaks (0.008 mg/L versus 0.018 mg/L) until Mine Year 20.	Seasonal peaks lower than baseline seasonal peaks (0.017 mg/L versus 0.083 mg/L) until Mine Year 20.	Seasonal peaks at baseline seasonal peaks (2 ng/L versus 2 ng/L) throughout post-closure period.
YP-T-22	Meadow Creek	None	None	Seasonal peaks lower than baseline seasonal peaks (0.006 mg/L versus 0.025 mg/L) until Mine Year 20.	Seasonal peaks lower than baseline seasonal peaks (0.013 mg/L versus 0.075 mg/L) until Mine Year 20.	Seasonal peaks at baseline seasonal peaks (2 ng/L versus 2 ng/L) throughout post-closure period.
YP-SR-10	East Fork SFSR	None	None	None	Seasonal peaks lower than baseline seasonal peaks (0.013 mg/L versus 0.075 mg/L) until Mine Year 20.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L) throughout post-closure period.

Constituent of Concern Analysis Criteria		Aluminum[1] 0.36 mg/L	Copper[2] 0.0024 mg/L	Antimony[3] 0.0056 mg/L	Arsenic[4] 0.010 mg/L	Mercury[5] 2 ng/L (total mercury)
Nodes	**Stream**	**Exceedance During Operations (Highest Concentration)[6]**				
YP-SR-8	East Fork SFSR	None	None	Seasonal peaks lower than baseline seasonal peaks (0.011 mg/L versus 0.031 mg/L) throughout post-closure-period.	Concentrations below baseline conditions (0.012 to 0.025 mg/L versus 0.018 to 0.052 mg/L) throughout post-closure period.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L) throughout post-closure period.
YP-SR-6	East Fork SFSR	None	None	Concentrations below baseline conditions (0.005 to 0.020 mg/L versus 0.006 to 0.030 mg/L) throughout post-closure period.	Concentrations below baseline conditions (0.012 to 0.029 mg/L versus 0.017 to 0.041 mg/L) throughout post-closure period.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L) throughout post-closure period.
YP-SR-4	East Fork SFSR	None	None	Concentrations below baseline conditions (0.005 to 0.023 mg/L versus 0.008 to 0.056 mg/L) throughout post-closure period.	Concentrations below baseline conditions (0.013 to 0.063 mg/L versus 0.019 to 0.120 mg/L) throughout post-closure period.	Seasonal peaks at baseline seasonal peaks (3 ng/L versus 3 ng/L) throughout post-closure period.
YP-SR-2	East Fork FSFSR	None	None	Concentrations below baseline conditions (0.003 to 0.016 mg/L versus 0.005 to 0.037 mg/L) throughout post-closure period.	Concentrations below baseline conditions (0.010 to 0.047 mg/L versus 0.014 to 0.076 mg/L) throughout post-closure period.	Concentrations at or slightly below baseline conditions (3 to 9 ng/L versus 3 to 10 ng/L) throughout post-closure period.
YP-T-6	West End Creek	None	None	Concentrations slightly above baseline conditions (0.008 to 0.014 mg/L versus 0.008 to 0.012 mg/L) throughout post-closure period.	Concentrations slightly above baseline conditions (0.064 to 0.094 mg/L versus 0.064 to 0.088 mg/L) throughout post-closure period.	Concentrations above baseline conditions (4 to 10 ng/L versus 4 to 6 ng/L) throughout post-closure period.

Constituent of Concern Analysis Criteria		Aluminum[1] 0.36 mg/L	Copper[2] 0.0024 mg/L	Antimony[3] 0.0056 mg/L	Arsenic[4] 0.010 mg/L	Mercury[5] 2 ng/L (total mercury)
Nodes	**Stream**	**Exceedance During Operations (Highest Concentration)[6]**				
YP-T-1	Sugar Creek	None	None	None	Concentrations at or slightly above baseline conditions (0.007 to 0.017 mg/L versus 0.007 to 0.016 mg/L) throughout post-closure period.	Concentrations at baseline conditions (6 to 8 ng/L versus 6 to 8 ng/L) throughout post-closure period.

Source: SRK 2018b, Brown and Caldwell 2020b

[1] Aluminum: Lowest predicted for the SGP area based on Recommended Aquatic Life Criteria (EPA 2018); The same water quality data as in the Biotic Ligand Model were used (Brown and Caldwell 2020c)

[2] Copper analysis criteria was derived using the Biotic Ligand Model per guidance contained in IDEQ (2017). A conservative chronic copper analysis criteria was estimated by applying the lowest of the 10th percentile chronic criteria based on regional classifications for the Salmon River Basin, Idaho Batholith, and third order streams. Per the SGP Water Quality Management Plan (Brown and Caldwell 2020a), preliminary calculations using the Biotic Ligand Model and site-specific data have produced similar values to the standard derived using these regional classifications.

[3] Antimony does not have a specified NMFS or USFWS standard and is based on EPA's human health chronic criterion for consumption of water and organisms is 0.0056 mg/L.

[4] Arsenic: NMFS (2014) and USFWS (2015a) both determined jeopardy for the chronic criterion proposed by EPA for Idaho Water Quality Standards (0.150 mg/L). NMFS (2014) directed EPA to promulgate or approve new aquatic life criterion. In the interim, NMFS directed EPA to ensure the 0.010 mg/L human health criterion applied in all NPDES permits. USFWS (2015a) directed EPA to ensure that the 10 µg/L recreational use standard is applied in all WQBELs and Reasonable Potential to Exceed Calculations using the human health criteria and the current methodology for developing WQBELs to protect human health.

[5] Mercury: NMFS (2014) and USFWS (2015a) both determined jeopardy for the chronic criterion proposed by EPA for Idaho Water Quality Standards (0.000012 mg/L total mercury). NMFS (2014) directed EPA to promulgate or approve a new criterion. In the interim, implement the fish tissue criterion that IDEQ adopted in 2005. Where fish tissue is not readily available, then NMFS specified application of a 0.000002 mg/L criteria (as total mercury) in the interim. USFWS (2015a) directed EPA to use the 2001 EPA/2005 Idaho human health fish tissue criterion of 0.3 mg/kg wet weight for WQBELs and reasonable potential to exceed criterion calculations using the current methodology for developing WQBELs to protect human health.

[6] Predicted future concentrations are reported on a monthly basis. Concentrations in some locations vary naturally on a seasonal basis and, therefore, exceed baseline in certain months (usually Spring) and are lower than baseline in other months. Exceedances reported in this table are only those interpreted to be a result of mining activity, and not due to natural seasonal variability.

Copper and Aluminum

Exceedances of criteria for copper and aluminum occur under baseline conditions at some sites near the TSF but not downstream below Sugar Creek under baseline conditions. No exceedances are expected during active mining and post-closure (**Table 4.12-4**). The impacts of copper and aluminum are expected to be minimal relative to baseline conditions. Therefore, the effects of the 2021 MMP on fish are expected to be minor, long-term, and localized.

Arsenic and Antimony

Surface water concentrations of arsenic and antimony downstream from the mine site area would be reduced during the active mining period relative to baseline conditions due to water treatment. Permanent impacts to contaminant concentrations in downstream surface waters would extend post-closure. Model results (**Section 4.9**) indicate antimony concentrations in the East Fork SFSR downstream of Sugar Creek would be reduced permanently post-closure but arsenic concentrations would return to at or near baseline levels over time. The effects of the 2021 MMP on fish related to arsenic and antimony would be minor, long-term, localized, and beneficial.

Mercury

Mercury concentrations in the East Fork SFSR downstream of Sugar Creek would be predicted to increase during active mining due to expanded excavation. Concentration would then be predicted to decrease post-closure but remain slightly elevated relative to baseline conditions (**Section 4.9.2.2** and Forest Service 2022f). Baseline, predicted active mine, and predicted post-closure mercury concentrations in the East Fork SFSR downstream of Sugar Creek would not exceed the aquatic life criterion. However, uncertainty remains whether incremental change in mercury concentrations beyond baseline would increase bioaccumulation of methylmercury in fish tissue at concentrations exceeding the tissue-based criterion. Methylation and bioaccumulation of mercury generally increases downstream in most watersheds. Through bioaccumulation and biomagnification, methylmercury reaches the highest concentrations in the tissues of longer lived, larger, or more piscivorous fish species. Long-term, regional influences on downstream mercury methylation are not quantified.

Stream Flow

Changes in stream flow directly affects fish habitat. Changes to stream flow were evaluated using simulated monthly discharge for the August to March low-flow period for Mine Years -2 through post-closure. **Section 4.8** and the SGP Water Quantity Specialist Report (Forest Service 2022e) provides additional descriptions of how much streamflow changes as a function of mine operations, including locations without gaging data (i.e., downstream of Sugar Creek). **Table 4.12-5** shows predicted (simulated) monthly stream flows during the August to March low flow period at five USGS gaging stations and one location in lower Meadow Creek in mine site streams (**Figure 3.8-3**) and predicted change from average baseline low flow period stream flows. **Figure 4.12-3** shows the percent change in simulated stream flows graphically.

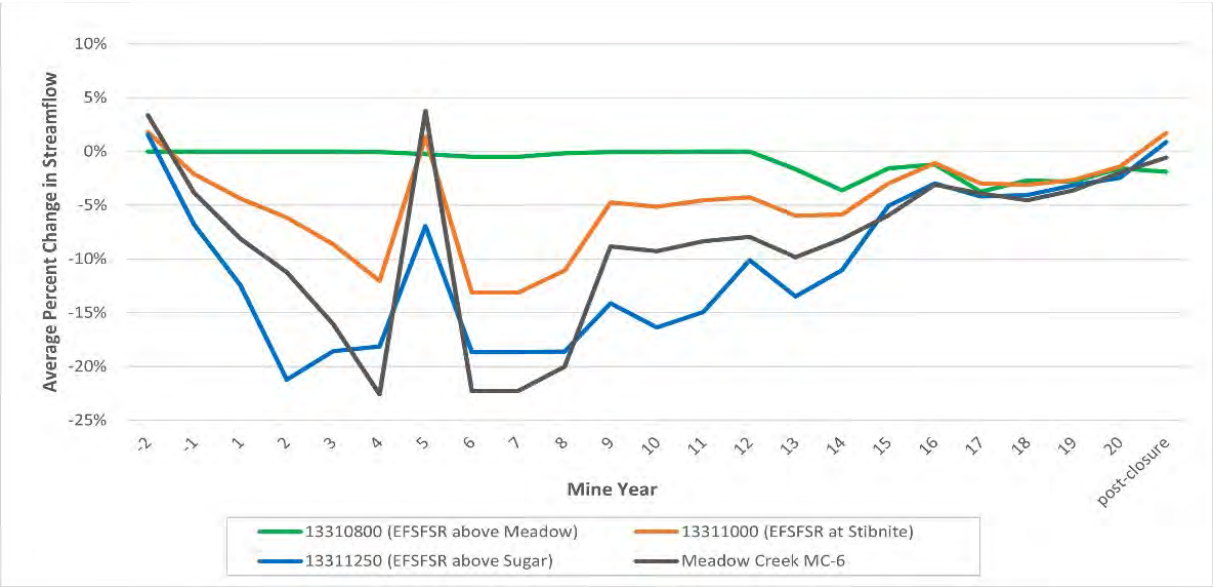


Figure 4.12-3 Average percent change in stream flow during the Low Flow Period (August to March)

Table 4.12-5 Percent Change in Streamflow from Baseline Streamflow for the Low-Flow Period over the Active Mine Years and Post-Closure Period for the 2021 MMP

USGS Gage Mine Year	13311250 East Fork SFSR Upstream of Sugar	1331100 East Fork SFSR at Stibnite	13310800 East Fork SFSR Upstream of Meadow Creek	MC-6 Meadow Creek
-2	1.5%	1.8%	0.0%	3.4%
-1	-6.8%	-2.1%	0.0%	-3.8%
1	-12.4%	-4.4%	0.0%	-8.1%
2	-21.2%	-6.2%	0.0%	-11.2%
3	-18.6%	-8.6%	0.0%	-16.0%
4	-18.1%	-12.0%	0.0%	-22.6%
5	-6.9%	1.4%	-0.2%	3.7%
6	-18.7%	-13.1%	-0.5%	-22.3%
7	-24.8%	-20.4%	-0.5%	-36.4%
8	-18.6%	-11.1%	-0.2%	-20.0%
9	-14.1%	-4.8%	0.0%	-8.8%
10	-16.4%	-5.1%	0.0%	-9.3%
11	-14.9%	-4.5%	0.0%	-8.4%
12	-10.1%	-4.2%	0.0%	-7.9%
13	-13.5%	-6.0%	-1.7%	-9.8%
14	-11.0%	-5.9%	-3.6%	-8.2%
15	-5.1%	-3.0%	-1.6%	-5.9%

USGS Gage Mine Year	13311250 East Fork SFSR Upstream of Sugar	1331100 East Fork SFSR at Stibnite	13310800 East Fork SFSR Upstream of Meadow Creek	MC-6 Meadow Creek
16	-3.0%	-1.1%	-1.2%	-3.1%
17	-4.2%	-3.0%	-3.8%	-3.9%
18	-4.1%	-3.1%	-2.7%	-4.5%
19	-3.1%	-2.6%	-2.8%	-3.6%
20	-2.4%	-1.4%	-1.6%	-2.0%
Post-Closure	0.9%	1.7%	-1.9%	-0.6%

Note: The Low-Flow Period for Post-closure is defined as average of Mine Years 21 through 112. Numbers represent percent change in stream flow; negative numbers indicate a reduction in stream flow while positive numbers indicate an increase in stream flow. Sugar Creek is summarized by itself because data were available for Sugar Creek. There is a relationship between percent change in flow and the amount of available habitat per species and life stage. MC-6 is located in the lower reaches of Meadow Creek.

The greatest predicted changes to stream flow under the 2021 MMP would be in the East Fork SFSR and in Meadow Creek in the vicinity of the TSF. While most of the streams would return to at or near baseline flows post-closure (post-closure flows represent an average of the predicted flows from Mine Years 21 through 112), Meadow Creek flows downstream of the TSF would be reduced by a maximum of 36.4 percent during mine operations. Flow increases in Mine Year 5 at some nodes are due to dewatering and subsequent filling of the Hangar Flats pit and dewatering of the Yellow Pine pit.

The effects of the 2021 MMP on changes in stream flow would be major, long-term (occurring during operations), and localized at the Meadow Creek, East Fork SFSR at Stibnite, and East Fork SFSR upstream from Sugar Creek sites, but minor, long-term (occurring during operations), and localized at the East Fork SFSR upstream from Meadow Creek. Permanent effects from changes in streamflow, that occur during the post-closure would be negligible across all of the mine sites. The effects of reduced stream flow on habitat and productivity are described in the sections below.

Summary of Effects to Watershed Condition Indicators

The WCIs evaluate stream function by measuring elements that reflect water quality, habitat access, channel conditions and dynamics, flow and hydrology, and watershed conditions. Not all WCI indicators summarized for baseline conditions are of equal value in determining the potential impacts of the SGP within the analysis area. The impact analyses addressed the WCIs which are summarized in **Table 4.12-6**.

Table 4.12-6 Summary of Changes to Key Watershed Condition Indicators at the Mine Site

WCI	Stream Segment	Change From Baseline			
		Baseline	Construction (Mine Year -1 to 1)	Operations/ Closure (Mine Year 1 to 20)	Post-Closure (Mine Year 20+)
Water Temperature	East Fork SFSR between Sugar Creek and Yellow Pine pit	FR	FR (*)	FR (*)	FR (+)
	East Fork SFSR between Yellow Pine pit and Meadow Creek	FR	FR (*)	FR (*)	FR (+)
	Meadow Creek and East Fork Meadow Creek	FR	FR (+)	FR (+)	FR (+)
	East Fork SFSR Upstream from Meadow Creek	FR	FR (*)	FR (*)	FR (*)
Sediment and Turbidity	East Fork SFSR between Sugar Creek and Yellow Pine pit	FUR	FUR (*)	FR (*)	FR (+)
	East Fork SFSR between Yellow Pine pit and Meadow Creek	FUR	FUR (*)	FR (*)	FR (+)
	Meadow Creek and East Fork Meadow Creek	FUR	FUR (*)	FR (+)	FR (+)
	East Fork SFSR Upstream from Meadow Creek	FUR	FUR (*)	FUR (*)	FUR (*)
Physical Barriers	East Fork SFSR between Sugar Creek and Yellow Pine pit	FUR	FA (+)	FA (+)	FA (+)
	East Fork SFSR between Yellow Pine pit and Meadow Creek	FUR	FA (+)	FA (+)	FA (+)
	Meadow Creek and East Fork Meadow Creek	FUR	FUR (-)	FUR (-)	FUR (-)
	East Fork SFSR Upstream from Meadow Creek	FUR	FA (+)	FA (+)	FA (+)

WCI	Stream Segment	Change From Baseline			
		Baseline	Construction (Mine Year -1 to 1)	Operations/ Closure (Mine Year 1 to 20)	Post-Closure (Mine Year 20+)
Change in Peak/Base Flows	East Fork SFSR between Sugar Creek and Yellow Pine pit	FA	FA (*)	FR (-) to Mine Year 6 FA (*) after Mine Year 6	FA (*)
	East Fork SFSR between Yellow Pine pit and Meadow Creek	FA	FA (*)	FR (-) to Mine Year 6 FA (*) after Mine Year 6	FA (*)
	Meadow Creek and East Fork Meadow Creek	FA	FA (-)	FR (-) to Mine Year 6 FA (*) after	FA (*)
	East Fork SFSR Upstream from Meadow Creek	FA	FA (*)	FA (*)	FA (*)
Chemical Contaminants	East Fork SFSR between Sugar Creek and Yellow Pine pit	FUR	FUR (*)	FR (+)	FR (+)
	East Fork SFSR between Yellow Pine pit and Meadow Creek	FUR	FUR (*)	FR (+)	FR (+)
	Meadow Creek and East Fork Meadow Creek	FUR	FUR (*)	FR (+)	FR (+)
	East Fork SFSR Upstream from Meadow Creek	FA	FA (*)	FA (*)	FA (*)

Changes from baseline: (+) = increase from baseline functional index; (-) = decrease from baseline functional index; (*) = negligible or no change from baseline functional index
East Fork SFSR = East Fork South Fork Salmon River; FA = Functioning Appropriately; FR = Functioning at Risk; FUR = Functioning at Unacceptable Risk; N/A = not applicable; WCI = Watershed Condition Indicator; YPP = Yellow Pine pit

Impacts to Chinook Salmon

Chinook salmon would be affected by the 2021 MMP through changes in water temperature and flow, which affects other factors such as productivity, intrinsic potential, and Critical Habitat. The effects to Chinook salmon are described below.

Water Temperature

Water temperature is an important factor affecting the survival of each Chinook salmon life stage. The accepted stream temperature thresholds/ranges for life stages were compiled from regulatory standards and other relevant literature (ESS 2019a). ESS (2019a) presents quantification of baseline habitat availability (in relation to stream temperature) for Chinook salmon and analyzes the likely effects of changes to stream temperatures on available habitat as a result of implementation of the SGP. The following is a summary of the analysis and potential impacts from water temperature changes in streams at the mine site (ESS 2019a).

The highest modeled temperatures (i.e., maximum weekly summer temperatures) from SPLNT modeling (Brown and Caldwell 2021i) for a stream reach were compared to accepted stream temperature thresholds/ranges to determine the baseline length of available habitat. Predicted stream temperatures from SPLNT modeling were used to forecast the potential changes to the amount of available habitat for each life stage for multiple Mine Years. Note that the SPLNT model did not consider the effects of climate change; modeled temperature results would likely be higher if climate change had been a factor in the model.

Table 4.12-7 presents the length of usable IP habitat that fall within the temperature threshold categories for Chinook salmon adult migration and early life stages, and length of Critical Habitat for juvenile rearing that fall within the temperature thresholds. Length of habitat for Chinook salmon adult migration and juvenile rearing are based the amount of habitat with suitable thermal conditions using the summer maximum temperatures, which applied a maximum weekly 'constant' temperature for July. Spawning and incubation/emergence apply the fall maximum temperature, which applied a maximum weekly 'constant' temperature for September while spawning and incubation/emergence apply the fall maximum temperature (ESS 2019a).

The adult migration and spawning life stages experience a reduction in habitat that meets the thermal requirements for Chinook salmon. These reductions are either due to water temperatures that are too high or too low for the specific life stage, or due to limited access to suitable habitat (e.g., Meadow Creek). Juvenile rearing life stage experiences increases in thermally suitable habitat. Relative to baseline conditions:

- There would be a decrease in habitat conditions for migrating adults upstream from the Yellow Pine pit lake cascade barrier that meet the temperature criteria because water temperatures are lower than the thermal requirements. These habitats are not volitionally available to Chinook salmon under baseline conditions. The impacts shown are based on water temperatures that are mostly lower than the thermal criteria. While the temperatures are typically lower than the criteria, migration would not be impaired.

- There would be a net decrease in thermally suitable spawning habitat both upstream and downstream from Yellow Pine pit lake cascade barrier during operations and post-closure due to a slightly warmer MWMT.

- There would be a net increase in thermally suitable habitat conditions for incubation and emergence during operations through post-closure both upstream and downstream from the Yellow Pine pit lake cascade barrier.

- There would be a net increase in thermally suitable juvenile rearing habitat during operations through post-closure.

Stream lengths identified in **Table 4.12-7** assume Chinook salmon already occur upstream from the Yellow Pine pit lake; however, unless they are released by IDFG, Chinook salmon do not naturally occur. Therefore, while there is a decrease in thermally suitable habitat, they currently only occur in approximately 2 km of modeled habitat downstream from Yellow Pine pit.

Creeks in the mine site area do experience significant seasonal and diurnal variations, and for mobile life stages (i.e., adults and juveniles), if MWMTs are above the thresholds, fish may avoid areas within streams if they are able, such as finding thermal refuges. Through stream restoration and enhancement actions, stream cover and instream structures may provide thermal refugia.

Based on modeled results, the effects of the 2021 MMP on Chinook salmon caused by changes to temperature-based suitable habitat are expected to be minor, permanent, and localized; however, given Chinook salmon would be able to volitionally access habitat upstream from Yellow Pine pit, the effects of the 2021 MMP on Chinook salmon are expected to have minor, permanent, and localized but beneficial.

Table 4.12-7 Length of Stream Habitat that Meets the Optimal Thermal Requirements for Chinook Salmon Under the 2021 MMP

Life Stage	Base-line (km)	Mine Year 6 (km)	Mine Year 12 (km)	Mine Year 18 (km)	Mine Year 22 (km)	Mine Year 27 (km)	Mine Year 32 (km)	Mine Year 52 (km)	Mine Year 112 (km)	Change from Baseline to Mine Year 112 (km)
Below Yellow Pine pit										
Adult Migration[1]	0	0	0	0	0	0	0	0	0	0
Adult Migration[2]	2.01	1.48	1.66	1.66	1.66	1.66	1.66	1.66	1.66	-0.35
Spawning[3]	0	0	0	0	0	0	0	0	0	0
Spawning[4]	2.01	1.48	1.66	0.73	0.73	1.66	1.66	1.66	1.66	-0.35
Incubation/ Emergence	0	0	0	0	0	0	0	0.73	0.73	+0.73
Juvenile Rearing[5]	2.01	1.48	1.66	1.66	1.66	1.66	1.66	1.66	1.66	-0.35
Total Available Habitat	2.01	1.48	1.66	1.66	1.66	1.66	1.66	1.66	1.66	-0.35
Above Yellow Pine pit										
Adult Migration[1]	2.43	0	0.25	0.69	0.25	2.93	2.68	1.07	0	-2.43
Adult Migration[2]	7.48	3.35	4.25	5.78	5.50	5.78	6.57	6.57	6.57	-0.91
Spawning[3]	1.51	0.28	0	0	0	0	0	0	0	-1.51
Spawning[4]	10.92	6.85	8.02	9.91	9.91	10.07	10.07	10.07	10.07	-0.85
Incubation/ Emergence	3.44	3.50	7.46	7.39	8.02	7.39	7.39	7.39	7.39	+3.95
Juvenile Rearing[5]	17.51	10.94	13.43	13.35	13.35	18.97	18.97	18.97	18.97	+1.46
Total Available Habitat	10.92[6] 13.51[5]	6.85[6] 10.94[5]	8.02[6] 13.43[5]	9.91[6] 13.35[5]	9.91[6] 13.35[5]	10.07[6] 18.97[5]	10.07[6] 18.97[5]	10.07[6] 18.97[5]	10.07[6] 18.97[5]	-0.85[6] +1.46[5]

[1] Results based on USEPA criteria for optimal swimming performance – 15-19°C
[2] Results based on USEPA criteria for minimizing disease risk – 12-13°C and elevated disease risk 14-17°C
[3] Results based on IDAPA criteria of 13°C maximum temperature for spawning
[4] Results based on USEPA criteria of 1-14°C temperature for spawning
[5] Results based on modeled Critical Habitat
[6] Results based on usable IP habitat

Flow Productivity

A flow-productivity model was developed to examine the effects of predicted flow changes associated with the 2021 MMP on Chinook salmon productivity. Annual flow productivity was determined as the long-term percent change from the existing or baseline conditions for each mine year. To analyze the altered stream flow across the mine area, flow-productivity outputs were used from three of the USGS stream flow gages (East Fork SFSR above Sugar, East Fork SFSR at Stibnite, East Fork SFSR above Meadow) and lower Meadow Creek (MC-6).

Table 4.12-8 and **Figure 4.12-4** show the average Chinook salmon flow-productivities for each stream flow site over pertinent periods throughout mine operations and post-closure. The greatest reduction in flow-productivity averaged over the long-term period (Mine Years -2 to 20) are in the East Fork SFSR upstream from Sugar Creek (-10.5 percent) and in Meadow Creek (-8.9 percent). Most of the Chinook salmon productivity on the East Fork SFSR upstream from Sugar Creek is greatly impacted by mine operations that alter stream flow over the life of the mine. Similarly, most of the productivity in Meadow Creek is greatly impacted by changes in stream flow caused by mine operations in Meadow Creek. The East Fork SFSR above Meadow Creek is less impacted by changes in stream flow over the long-term. Similarly, most of the Chinook salmon productivity throughout the mine area is minimally affected by altered stream flow post-closure.

Table 4.12-8 Percent Change in Chinook Salmon Productivity Relative to Baseline Productivity by Mine Year and Location

Period	Mine Year	East Fork SFSR above Meadow Creek Confluence (USGS Gage 13310800)	East Fork SFSR at Stibnite (USGS Gage 13311000)	East Fork SFSR above Sugar Creek Confluence (USGS Gage 13311250)	Meadow Creek (MC-6)
Baseline (Productivity)		1.06	1.06	1.06	1.06
Mine Years -2 to 20 (% Change)	-2	0.0%	2.0%	1.8%	3.9%
	-1	0.0%	-3.3%	-6.4%	-5.9%
	1	0.0%	-6.0%	-15.9%	-10.8%
	2	0.0%	-6.0%	-16.9%	-10.5%
	3	0.0%	-10.8%	-18.4%	-18.6%
	4	-0.1%	-7.2%	-13.7%	-12.2%
	5	-0.4%	-2.4%	-9.3%	-1.7%
	6	-0.6%	-15.7%	-19.5%	-23.4%
	7	-0.4%	-17.7%	-21.4%	-28.6%
	8	-0.1%	-7.4%	-15.1%	-12.7%
	9	0.0%	-4.5%	-13.1%	-8.0%
	10	0.0%	-4.9%	-15.1%	-8.6%
	11	0.0%	-4.9%	-14.5%	-8.6%
	12	-0.6%	-5.4%	-10.0%	-9.4%
	13	-2.5%	-6.2%	-12.7%	-9.4%

Period	Mine Year	East Fork SFSR above Meadow Creek Confluence (USGS Gage 13310800)	East Fork SFSR at Stibnite (USGS Gage 13311000)	East Fork SFSR above Sugar Creek Confluence (USGS Gage 13311250)	Meadow Creek (MC-6)
	14	-3.8%	-6.5%	-11.4%	-9.0%
	15	-0.2%	-1.8%	-3.5%	-4.7%
	16	-2.2%	-3.5%	-3.5%	-4.2%
	17	-3.9%	-4.4%	-4.4%	-5.3%
	18	-1.9%	-3.5%	-3.5%	-4.5%
	19	-3.2%	-3.1%	-3.1%	-3.4%
	20	-1.0%	-1.6%	-1.6%	-0.6%
Mine Years -2 to 20 Productivity (% Change from Baseline)	Minimum	1.02 (-3.9%)	0.87 (-17.7%)	0.83 (-21.4%)	0.78 (-28.6%)
	Mean	1.05 (-1.0%)	1.00 (-5.7%)	0.95 (-10.5%)	0.97 (-8.9%)
	Maximum	1.06 (0.0%)	1.08 (2.0%)	1.08 (1.8%)	1.10 (3.9%)
Post Closure (21 to 112) Productivity (% Change from Baseline)	Mean	1.04 (-1.8%)	1.08 (1.8%)	1.07 (1.1%)	1.05 (-0.6%)

The Mine Years –2 to 20 were selected because stream flows equilibrate at Mine Year 20. Therefore, the post-closure value represents an average annual percent change in productivity for Mine Years 21 through 112.

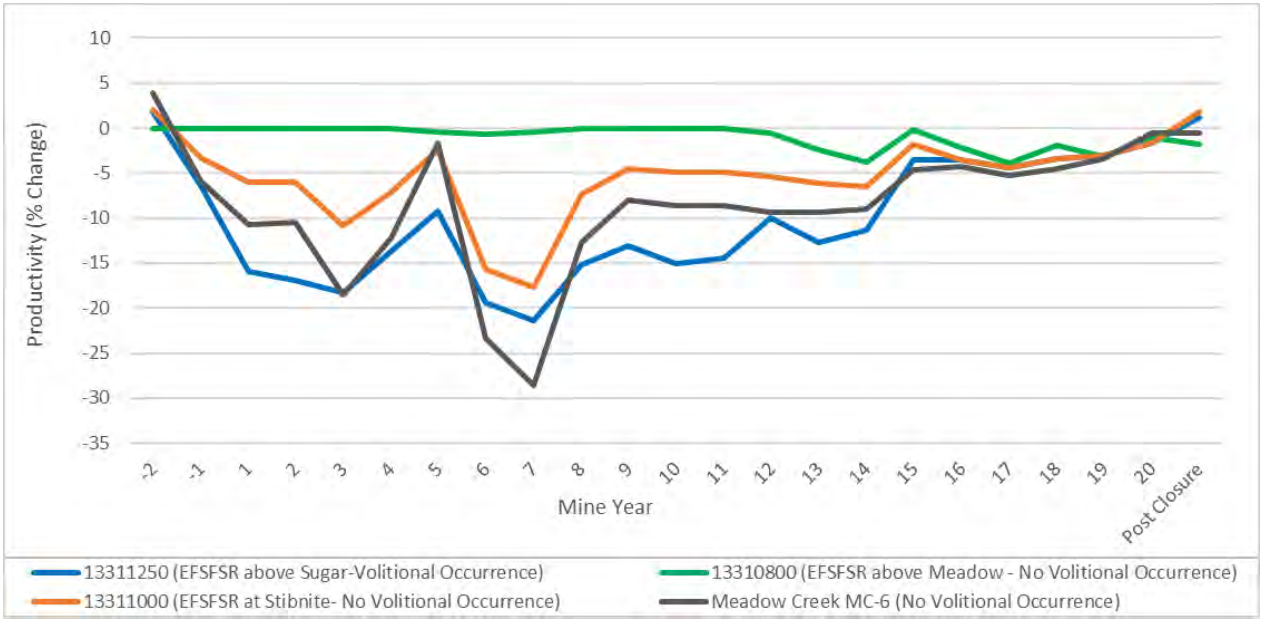


Figure 4.12-4 Percent Change in Chinook Salmon Productivity from Baseline Conditions by Mine Year and Location (USGS Gaging Stations and MC-6)

Changes in Chinook productivity also occur from Mine Years 3 to 8, where productivity fluctuates in the East Fork SFSR above Meadow Creek, East Fork SFSR above Sugar Creek, and Meadow Creek locations (**Table 4.12-8**; **Figure 4.12-4**). This decrease in productivity occurs during periods of mine operations that results in dewatering. The increase in productivity in Mine Year 5 is due to reductions of water abstraction during operations from dewatering and subsequent filling of the Hangar Flats pit and dewatering of the Yellow Pine pit.

It is important to note that under baseline conditions, Chinook salmon do not volitionally occur upstream from the Yellow Pine pit lake cascade barrier. However, at Mine Year -1, the tunnel would be constructed allowing for volitional passage. For the Meadow Creek, East Fork SFSR at Stibnite, and East Fork SFSR above Sugar Creek sites, the effects of the 2021 MMP on Chinook salmon productivity are expected to be moderate, long-term (occurring during operations), and localized. For the East Fork SFSR above Meadow Creek site, the effects of the 2021 MMP on Chinook salmon productivity are expected to be minor, long-term (occurring during operations), and localized. Permanent effects from changes in productivity, that occur during the post-closure would be negligible across all of the mine site.

Intrinsic Potential

Throughout the construction period and life of the mine, the stream length of each ranking of IP model habitat were determined. **Table 4.12-9** summarizes the years in which there is a large change in IP and includes total length of IP in the baseline conditions and at the end of the mine life.

Table 4.12-9 Stream Length with Intrinsic Potential Habitat for Chinook Salmon Throughout the Mine Life

IP Rating	Intrinsic Potential Habitat (km)							
	Baseline	Mine Year 3	Mine Year 5	Mine Year 6	Mine Year 11	Mine Year 15	Mine Years 23 to 112	Net Loss/ Gain
East Fork SFSR and Tributaries Upstream from Yellow Pine pit								
High	0	0	0	0	0	0	0	0
Medium	0.66	0.63	0.63	0.63	0.63	0.63	0.63	-0.03
Low	4.29	4.26	4.26	4.26	4.83	4.83	4.83	+0.54
Negligible	1.05	0.78	0.78	0.78	0.78	0.78	0.78	-0.27
Total IP Habitat	6.00	5.68	5.68	5.68	6.25	6.25	6.25	+0.25
Total Length of Habitat Evaluated	29.01	28.35	28.35	28.35	28.92	28.92	28.92	-0.09
Meadow Creek and EFMC								
High	0.66	0	0	0	0	0	0	-0.66
Medium	0.9	0.31	1.66	0.31	0.31	1.66	2.45	+1.55
Low	1.21	0.24	0.24	0.24	0.24	0.24	0.24	-0.97
Negligible	0.1	0	0	0	0	0	0	-0.1
Total IP Habitat	2.86	0.55	1.89	0.55	0.55	1.89	2.68	-0.18
Total Length of Habitat Evaluated	16.93	15.53	15.53	15.53	15.53	15.53	15.69	-1.24

IP Rating	Intrinsic Potential Habitat (km)							
	Baseline	Mine Year 3	Mine Year 5	Mine Year 6	Mine Year 11	Mine Year 15	Mine Years 23 to 112	Net Loss/ Gain
East Fork SFSR and Tributaries between Yellow Pine pit and Sugar Creek								
High	0	0	0	0	0	0	0	0
Medium	0.18	0	0	0	0	0	0	-0.18
Low	0.84	0.35	0.35	0.35	1.26	1.26	1.26	+0.42
Negligible	0.15	0.12	0.12	0.12	0.12	0.12	0.12	-0.03
Total IP Habitat	1.17	0.47	0.47	0.47	1.38	1.38	1.38	+0.21
Total Length of Habitat Evaluated	4.34	4.47	4.47	4.47	3.45	3.45	3.45	-0.89
East Fork SFSR Downstream from Sugar Creek								
High	0	0	0	0	0	0	0	0
Medium	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0
Low	1.02	1.02	1.02	1.02	1.02	1.02	1.02	0
Negligible	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0
Total IP Habitat	1.11	1.11	1.11	1.11	1.11	1.11	1.11	0
Total Length of Habitat Evaluated	1.11	1.11	1.11	1.11	1.11	1.11	1.11	0
Headwaters East Fork SFSR Subwatershed								
Total IP Habitat Below Yellow Pine pit	2.28	1.58	1.58	1.58	2.49	2.49	2.49	+0.21
Total IP Habitat Above Yellow Pine pit	8.86	6.23	7.57	6.23	6.8	8.14	8.93	+0.07
Total IP Habitat	11.15	7.81	9.15	7.81	9.29	10.63	11.42	+0.28

Km = kilometer; East Fork SFSR = East Fork South Fork Salmon River; IP = Intrinsic Potential

Throughout the life of the mine, most of the changes to IP habitat for Chinook salmon cause major or moderate negative impacts. By Mine Year 3, Meadow Creek would lose all the high and negligible IP and over half the medium and low-quality IP habitat because the mining activities along the TSF would block fish access. Additionally, physical modification of ground surface in the vicinity of the East Fork SFSR causes a loss of medium, low, and negligible quality IP habitat just upstream of Midnight Creek. During Mine Year 5 operational changes at Yellow Pine pit cause flow increases in Meadow Creek drastically raising the medium quality IP habitat however in Mine Year 6 flows return to similar to before reducing medium IP back down again in Mine Year 6. By Mine Year 11, the East Fork SFSR regains some low-quality IP habitat above Midnight Creek due to the start of reclamation and the end of physical modifications of ground surface in the vicinity of East Fork SFSR. By Mine Year 15 and Mine Year 18, Meadow Creek gains back a significant amount of medium quality IP habitat due to dewatering pumping stopping. Finally, by the end of the mine life, the IP habitat stays the same as Mine Year 18 due to presumed wetted widths in the restored stream channels (designed wetted width slightly less than 3.6 m compared to greater than or equal to 3.6 m wetted width required for Chinook salmon).

The IP model does not take current species presence or physical barriers into account, even if the evaluated stream segments are considered usable IP habitat. It is important to note that Chinook salmon do not naturally occur upstream of Yellow Pine pit. Chinook salmon have been periodically translocated upstream of Yellow Pine pit by the IDFG and the Nez Perce Tribe. While there is 11.15 km of usable IP habitat in baseline conditions, only 2.28 km or 20.4 percent of that IP habitat is in stream segments where Chinook salmon naturally occur. In addition, the only high IP habitat found in baseline conditions was in Meadow Creek, some of which is blocked by a physical barrier. By Mine Year 112, 0.21 km or 17.9 percent of the IP habitat downstream of Yellow Pine pit would be gained. Upstream of Yellow Pine pit, 0.07 km or an additional 0.79 percent of IP habitat would be gained and all high IP habitat would be lost. Notably, most of the medium IP that remains in Meadow Creek at Mine Year 23 is also blocked by a physical barrier to Chinook salmon so is not accessible.

Overall, the SGP area gains a length of 0.28 km with Chinook salmon IP habitat by the end of the life of the mine. Meadow Creek has a net loss of 0.18 km, primarily in the portion of Meadow Creek where the TSF would be placed, while all other areas have no overall change or have slight increases. The total changes to IP habitat are as follows: medium IP habitat is increased by 77 percent (1.34 km), less than 1 percent (0.01 km) of low IP habitat is lost, 100 percent (0.66 km) of high IP habitat is lost, and 31 percent (0.40 km) of negligible IP is lost. This equates to a 2 percent (0.28 km) gain of the total IP habitat for Chinook salmon. The long-term changes of IP habitat in Meadow Creek for Chinook salmon are an impact due to the loss of IP habitat, particularly through the placement of the TSF over Meadow Creek. Although there is a loss of habitat in Meadow Creek, there is an overall minor, permanent, increase in IP habitat and a small addition of new low IP habitat on the East Fork SFSR between the Yellow Pine pit and Sugar Creek.

It is important to note that under baseline conditions, Chinook salmon do not volitionally occur upstream from the Yellow Pine pit lake cascade barrier. The effects of the SGP on Chinook salmon IP habitat are expected to be moderate and localized impacts during the mining years, but minor, permanent, and localized benefits post-closure.

Critical Habitat

Critical Habitat for Chinook salmon in the active mine area would be impacted by various activities including active mining, diversions, barrier removal, and stream restoration. The impacts would be related to physical stream channel changes, accidental hazardous material spills, and changes in WCIs – most importantly barriers, stream flow, and water temperature. Chinook salmon Critical Habitat outside the mine site also would be directly affected by culvert installations and would be at risk of accidental hazardous materials spills in the streams adjacent to the access roads.

Access road culvert replacements and new culverts would cause temporary disturbances of Critical Habitat and increase the risk of erosion and sedimentation. The transportation of hazardous materials on access roads and throughout the mine site would increase the risk of spills adjacent to Critical Habitat or in streams/rivers that flow into Critical Habitat in the East Fork SFSR, Johnson Creek, and streams adjacent to Warm Lake Road (CR 10-579). A total of 18 km of Chinook salmon Critical Habitat along the Burntlog Route would be at risk.

An analysis of modeled Critical Habitat currently blocked due to passage barriers indicates that the largest impacts to Critical Habitat for Chinook salmon would come from barrier removal. Nearly 26 km of Critical Habitat are blocked above the Yellow Pine pit cascade barrier, with just over 23 km upstream from the box culvert in the East Fork SFSR under baseline conditions (**Figure 4.12-2**). These barriers would be removed as early as Mine Year -1 to provide upstream access for Chinook salmon. Activities on Meadow Creek would eliminate potential access to much of the stream, including over 6.6 km of modeled Critical Habitat.

It is important to note that under baseline conditions, Chinook salmon do not volitionally occur upstream from the Yellow Pine pit lake cascade barrier. Overall, there would be a localized, permanent, major beneficial effect on access to Critical Habitat for Chinook salmon.

Integration of Effects

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs (e.g., temperature, stream flow) would affect Chinook salmon and habitat in the analysis area under the 2021 MMP. SGP activities that would potentially cause these impacts include, but are not limited to, new road construction, transportation including hazardous materials, stream diversions, and construction and operation activities at the mine site. These effects may cause injury or mortality to individuals and temporarily or permanently displace Chinook salmon from several mine site streams during certain periods when habitat conditions become unsuitable. This would cause a temporal loss of habitat. A summary of the overall net effects to Chinook salmon habitat and specific points regarding the impacts are provided below.

- Changes to water chemistry would primarily have minor effects but would have an unknown level of beneficial effects through the reduction of arsenic and antimony.

- Alterations of the physical structures of the East Fork SFSR and Meadow Creek would result in a net benefit to Chinook salmon. The construction of the fishway, with a later restoration of the East Fork SFSR, would provide volitional access to spawning and rearing habitat that was only accessible when fish were transplanted by IDFG. Additional enhancements to the East Fork SFSR and Meadow Creek would provide additional habitat benefits.

- While there is a modeled loss of thermally-suitable habitat for adult migration of Chinook, this is primarily caused by water temperatures below the temperature criteria, which would not result in impaired movement. Spawning, both upstream and downstream from the YPP and juvenile rearing downstream from the YPP would experience a slight decrease in thermally-suitable habitat downstream from YPP. However, the expansion of habitat availability through the addition of the fishway and the subsequent stream channel restoration provides access to additional spawning and rearing habitat. Diurnal variations will provide reprieves from warmer temperatures and improved habitat structures/enhancements will provide refuges that may provide thermal refugia.

- Changes in flows would result in a net decrease in productivity between baseline conditions and post-closure conditions. Activities during mine operations would result in major reductions in flows and in Chinook salmon flow-based productivity in the East Fork SFSR between Meadow

Creek and Sugar Creek, and in Meadow Creek. The predicted decreases in Chinook salmon productivity during mine operations compared to baseline conditions would be greater than 10 percent in the East Fork SFSR between YPP and Sugar Creek and nearly 9 percent in lower Meadow Creek, and over 5 percent in the East Fork SFSR near Stibnite. There would, as a result, be a net decrease in flow-productivity, particularly for the spawning life stage caused by a reduction in flow. In subsequent years, closure and post-closure periods, would have negligible to minor changes in productivity.

- The removal of barriers would provide access to upstream habitat not previously volitionally accessed. This would result in a net benefit to Chinook salmon. A new barrier would be constructed in Meadow Creek along the TSF; however, this is not a section of Meadow Creek in which Chinook salmon are able to volitionally reach.

- There would be a slight net increase in IP habitat for Chinook salmon. Post-closure, there would be a net increase of approximately 0.28 km (2 percent) of useable habitat in the headwaters of the East Fork SFSR. This is a change from approximately 11.15 km at baseline to 11.42 km in Mine Year 23. The majority of the usable IP habitat identified in the analysis area is habitat not previously volitionally accessed.

- There would be a net increase in access to Chinook salmon Critical Habitat. While construction and mining activities would affect individual fish and may affect the habitat through the introduction of sediment and contaminants, there would be an increase from access to upstream habitat that was not previously volitionally accessible.

Following closure and reclamation, the overall net effect from the SGP would be a net increase in available habitat, however, flows and temperatures make the additional habitat less optimal.

Impacts to Steelhead

Steelhead would be affected by the 2021 MMP through changes in water temperature and flow, which affects other factors such as productivity, intrinsic potential, and Critical Habitat. The effects to steelhead are described below.

Water Temperature

The following is a summary of the analysis and potential impacts from water temperature changes in streams at the mine site from ESS 2019a.

Table 4.12-10 presents the length of intrinsic potential habitat that fall within the temperature threshold categories for steelhead life stages. Length of habitat for steelhead egg incubation/emergence and juvenile rearing are based the amount of habitat with suitable thermal conditions using the summer maximum temperatures. The other life stages are outside the summer – fall modeled parameters, and therefore are not included in the analysis.

As shown in **Table 4.12-10**, there would be no reduction in habitat that meets the thermal requirements for steelhead. Relative to baseline conditions:

- There would be no loss of suitable conditions for egg incubation/emergence.
- There would be a net increase in suitable rearing habitat during operations and post-closure, even with a loss of suitable rearing habitat conditions downstream from the Yellow Pine pit lake cascade barrier.

Based on modeled results, the effects of the 2021 MMP on steelhead caused by changes to temperature-based suitable habitat are expected to be moderate, permanent, and localized, with beneficial effects resulting from increased access to habitats not previously accessible.

Table 4.12-10 Length of Stream Habitat that Meets the Optimal Thermal Requirements for Steelhead Under the 2021 MMP

Life Stage	Baseline (km)	Mine Year 6 (km)	Mine Year 12 (km)	Mine Year 18 (km)	Mine Year 22 (km)	Mine Year 27 (km)	Mine Year 32 (km)	Mine Year 52 (km)	Mine Year 112 (km)	Change from Baseline to Mine Year 112 (km)
Below Yellow Pine pit										
Incubation/ Emergence	0	0	0	0	0	0	0	0	0	0
Juvenile Rearing	2.01	1.48	1.66	1.66	1.66	1.66	1.66	1.66	1.66	-0.35
Total Available Habitat	2.01	1.48	1.66	1.66	1.66	1.66	1.66	1.66	1.66	-0.35
Above Yellow Pine pit										
Incubation/ Emergence	0	0	0	0	0	0	0	0	0	0
Juvenile Rearing	0	8.52	9.35	9.91	9.91	9.28	10.07	10.07	10.07	+10.07
Total Available Habitat	0	8.52	9.35	9.91	9.91	10.07	10.07	10.07	10.07	+10.07

km- kilometer

Flow Productivity

A flow-productivity model was developed to examine the effects of predicted flow changes associated with the 2021 MMP on steelhead productivity. Annual flow productivity was determined as the long-term percent change from the existing or baseline conditions for each mine year. To analyze the altered stream flow across the project area, flow-productivity outputs were used from three of the USGS stream flow gages (East Fork SFSR above Sugar, East Fork SFSR at Stibnite, East Fork SFSR above Meadow) and the lower Meadow Creek (MC-6).

Table 4.12-11 and **Figure 4.12-5** shows the average steelhead productivities for each stream flow site over pertinent periods throughout mine operations and post-closure. The greatest, negative percent changes in flow-productivity averaged over the long-term period (Mine Years -2 to 20) are in the East

Fork SFSR upstream from Sugar Creek (-11.2 percent) and in Meadow Creek (-13.6 percent). Most of the steelhead productivity on the East Fork SFSR upstream from Sugar Creek is greatly impacted by mine operations that alter streamflow over the life of the mine. Similarly, most of the productivity in Meadow Creek is greatly impacted by changes in stream flow caused by mine operations in Meadow Creek. The East Fork SFSR above Meadow Creek is less impacted by changes in stream flow over the long-term. Similarly, most of the steelhead productivity throughout the mine area is minimally affected by altered stream flow post-closure.

Changes in steelhead productivity also occur from Mine Years 3 to 8, where productivity fluctuates in the East Fork SFSR above Meadow Creek, East Fork SFSR above Sugar Creek, and Meadow Creek locations (**Table 4.12-11**, **Figure 4.12-5**). The negative percent changes in productivity occur during periods of mine operations that results in dewatering. The increase in productivity in Mine Year 5 is due to reductions of water abstraction during operations from dewatering and subsequent filling of the Hangar Flats pit and dewatering of the Yellow Pine pit.

It is important to note that under baseline conditions, steelhead do not volitionally occur upstream from the Yellow Pine pit lake cascade barrier. However, at Mine Year -1, the tunnel is constructed allowing for volitional passage. At the Meadow Creek, East Fork SFSR at Stibnite, and East Fork SFSR above Sugar Creek sites, the effects of the 2021 MMP on steelhead productivity are expected to be moderate, permanent, and localized. For the East Fork SFSR above Meadow Creek site, the effects of the SGP on steelhead productivity are expected to be minor, long-term (occur during mining operations), and localized. Permanent effects from changes in productivity, which occur during the post-closure are negligible across the mine site area.

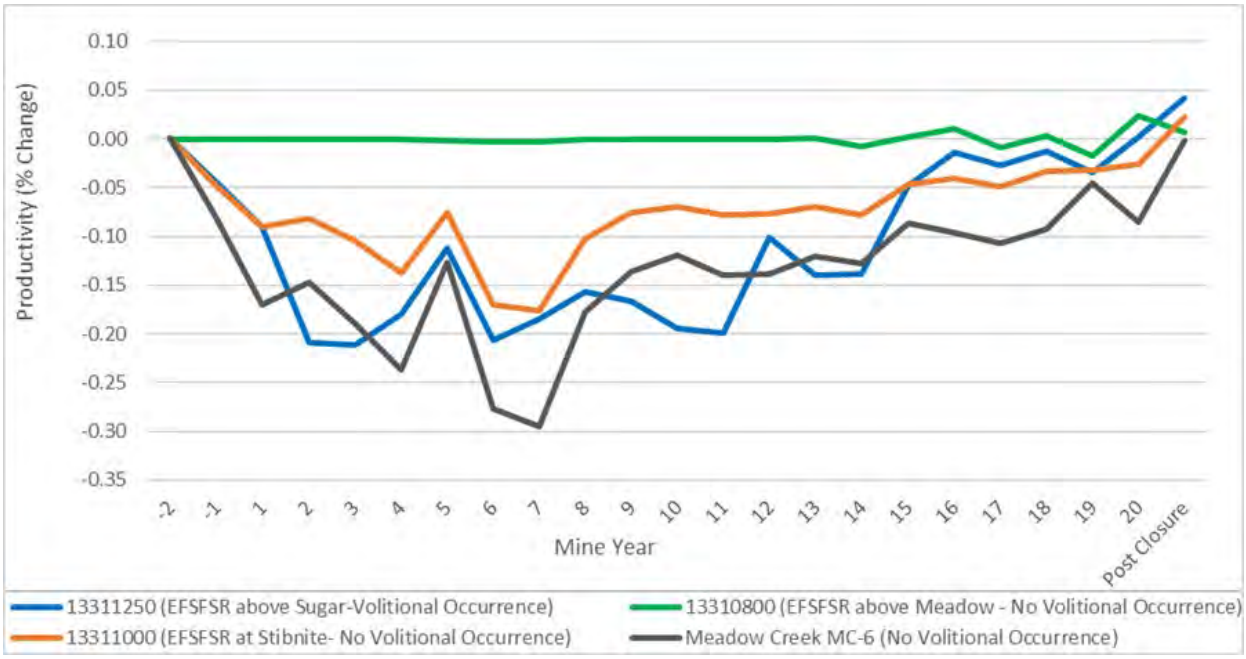


Figure 4.12-5 Percent Change in Steelhead Productivity from Baseline Conditions by Mine Year and Location (USGS Gaging Stations and MC-6)

Table 4.12-11 Percent Change in Steelhead Productivity Relative to Baseline Productivity by Mine Year and Location

Period	Mine Year	East Fork SFSR above Meadow Creek (USGS Gage 13310800)	East Fork SFSR at Stibnite (USGS Gage 13311000)	East Fork SFSR above Sugar Creek (USGS Gage 13311250)	Meadow Creek (MC-6)
Baseline (Productivity)		1.24	1.24	1.24	1.24
Mine Years -2 to 20 (% Change)	-2	0%	0%	0.1%	0.0%
	-1	0%	-4.8%	-4.4%	-8.1%
	1	0%	-9.0%	-9.0%	-17.0%
	2	0%	-8.2%	-20.9%	-14.7%
	3	0%	-10.4%	-21.1%	-19.0%
	4	0%	-13.8%	-18.0%	-23.6%
	5	-0.2%	-7.5%	-11.2%	-12.6%
	6	-0.3%	-17.1%	-20.7%	-27.6%
	7	-0.3%	-17.6%	-18.5%	-29.5%
	8	-0.1%	-10.2%	-15.7%	-17.7%
	9	0%	-7.6%	-16.7%	-13.6%
	10	0%	-7.0%	-19.4%	-11.9%
	11	0%	-7.8%	-20.0%	-14.0%
	12	0%	-7.7%	-10.1%	-13.8%
	13	0%	-7.0%	-14.0%	-12.1%
	14	-0.8%	-7.9%	-13.8%	-12.7%
	15	0.2%	-4.6%	-4.8%	-8.6%
	16	1.0%	-4.0%	-1.4%	-9.6%
	17	-0.9%	-4.9%	-2.7%	-10.7%
	18	0.3%	-3.3%	-1.2%	-9.2%
	19	-1.8%	-3.2%	-3.4%	-4.6%
	20	2.4%	-2.6%	0.2%	-8.5%
Mine Years -2 to 20 Productivity (% Change from Baseline)	Min	1.21 (-1.8%)	1.02 (-17.6%)	0.98 (-21.1%)	0.88 (-29.5%)
	Mean	1.24 (0.0%)	1.14 (-7.6%)	1.10 (-11.2%)	1.02 (-13.6%)
	Max	1.26 (2.4%)	1.24 (0.0%)	1.24 (0.2%)	1.24 (0.0%)
Post Closure 21 to 112 Productivity (% Change from Baseline)	Mean	1.24 (0.7%)	1.27 (2.3%)	1.29 (4.2%)	1.24 (-0.2%)

The Mine Years –2 to 20 were selected because stream flows equilibrate at Mine Year 20. Therefore, the post-closure value represents an average annual percent change in productivity for Mine Years 21 through 112.

Intrinsic Potential

Throughout the construction period and life of the mine, the length of each ranking of IP habitat were determined. **Table 4.12-12** summarizes the years in which there is a large change in IP and includes total IP habitat length in the baseline conditions and at the end of the mine life.

Table 4.12-12 Stream Length with Intrinsic Potential Habitat for Steelhead Throughout the Mine Life

IP Rating	Intrinsic Potential Habitat by Mine Year (km)						
	Baseline	-2	3	11	18	23-112	Net Loss/ Gain
East Fork SFSR and Tributaries Upstream from Yellow Pine pit							
High	2.16	2.16	2.16	2.16	2.16	2.16	0
Medium	0	0	0	0	0	0	0
Low	2.91	2.88	2.88	3.45	3.45	3.45	+0.54
Total IP Habitat	5.07	5.04	5.04	5.61	5.61	5.61	+0.54
Total Length Habitat Evaluated	29.01	28.35	28.35	28.92	29.34	29.97	+0.96
Meadow Creek and EFMC							
High	2.18	1.30	1.89	1.86	2.65	3.21	+1.03
Medium	0.60	0.46	0	0	0	1.27	+0.67
Low	0.87	0.09	0.03	0.03	0.03	0.03	-0.84
Total IP Habitat	3.65	1.85	1.89	1.89	2.68	4.51	+0.86
Total Length Habitat Evaluated	16.93	15.75	15.53	15.53	16.30	17.51	+0.58
East Fork SFSR and Tributaries between Yellow Pine pit and Sugar Creek							
High	0.18	0.12	0.12	0.12	0.12	0.12	-0.06
Medium	0	0	0	0	0	0	0
Low	0.72	0.23	0.23	1.14	1.14	1.14	+0.42
Total IP Habitat	0.90	0.35	0.35	1.26	1.26	1.26	+0.36
Total Length Habitat Evaluated	4.34	4.47	4.47	3.45	3.45	3.45	-0.89
East Fork SFSR Downstream from Sugar Creek							
High	0.03	0.03	0.03	0.03	0.03	0.03	0
Medium	0	0	0	0	0	0	0
Low	1.02	1.02	1.02	1.02	1.02	1.02	0
Total IP Habitat	1.05	1.05	1.05	1.05	1.05	1.05	0
Total Length Habitat Evaluated	1.11	1.11	1.11	1.11	1.11	1.11	0
Headwaters East Fork SFSR Subwatershed							
Total IP Habitat Below Yellow Pine pit	1.95	1.40	1.40	2.31	2.31	2.31	+0.36
Total IP Habitat Above Yellow Pine pit	8.72	6.90	6.94	7.51	8.30	10.13	+1.51
Total IP Habitat	10.67	8.30	8.34	9.82	10.61	12.44	+1.77

Throughout the life of the mine, most of the changes to IP habitat for steelhead result in moderate positive or negative impacts. In Mine Year -1 when the diversion of Meadow Creek occurs, Meadow Creek would lose some high, and most medium and low-quality IP habitat. Additionally, in Mine Year -1, the Yellow Pine pit tunnel construction causes a slight decrease of IP habitat in the East Fork SFSR and tributaries between Yellow Pine pit and Sugar Creek. In Mine Year 3, all medium quality IP habitat is lost, however, 0.59 km of high IP habitat in lower Meadow Creek is added due to an increased bankfull width. Physical modification of ground surface in the vicinity of the East Fork SFSR causes a loss of low IP habitat just upstream of Midnight Creek. In Mine Year 11, the East Fork SFSR regains some low IP habitat above Midnight Creek due to reclamation starting and physical modifications of ground surface in the vicinity of East Fork SFSR end. By Mine Year 18, Meadow Creek gains back high IP habitat due to cessation of dewatering pumping. Finally, at Mine Year 23, Meadow Creek regains additional medium and high-quality IP habitat.

IP does not factor in the actual species presence or physical barriers, but only whether the stream segments are considered usable IP habitat. It is important to note that, under baseline conditions, steelhead do not occur upstream from Yellow Pine pit, and there is a physical barrier to fish in Meadow Creek. While there is 10.67 km of IP habitat in baseline conditions, only 1.95 km or 18.2 percent of that is in stream habitat in which steelhead do currently occur. However, by Mine Year -1 the tunnel construction will allow steelhead access to EFSFSR and its tributaries upstream of the YPP. By Mine Year 23, 1.77 km of IP habitat would be gained from baseline, providing 12.44 km of potential rearing and spawning habitat above and below YPP for steelhead. Within this 12.44 km of IP habitat, a physical barrier blocks 2.62 km of the 4.51 km of IP habitat in Meadow Creek so it would still be inaccessible to steelhead.

Overall, the SGP area gains 1.77 km of steelhead IP habitat by Mine Year 23. Within that gain of IP habitat, high quality IP habitat increased by 18 percent, medium quality IP habitat increased by 112 percent, and low-quality IP habitat increased by 2 percent relative to baseline conditions. This equates to an overall 16.5 percent gain in IP habitat for steelhead. Prior to Mine Year 23, the long-term changes in IP habitat for steelhead have a moderate positive impact in lower Meadow Creek and East Fork SFSR between Meadow Creek and Yellow Pine pit and a major negative impact in upper Meadow Creek and East Fork SFSR between Yellow Pine pit and Sugar Creek. The permanent changes in IP habitat for steelhead have a moderate positive impact. While permanent impacts are mostly positive due to IP habitat improvements in Meadow Creek, there is a moderate permanent impact in upper Meadow Creek.

It is important to note that under baseline conditions, steelhead do not volitionally occur upstream from the Yellow Pine pit lake cascade barrier. Once the tunnel fishway construction and subsequent channel restoration are completed, steelhead will be able to access habitat upstream of YPP except for part of Meadow Creek upstream of a barrier. Overall, the SGP is expected to result in moderate, permanent, and localized benefits to steelhead IP habitat.

Critical Habitat

There is no steelhead trout Critical Habitat upstream from the Yellow Pine pit cascade barrier, but there is Critical Habitat below the barrier. Impacts from 2021 MMP activities at the mine site and those caused by the access roads, transmission lines, or off-site facilities could impact steelhead Critical Habitat. Access road culvert replacements and new culverts would cause temporary disturbances of Critical Habitat and

increase the risk of erosion and sedimentation. The transportation of hazardous materials on access roads and throughout the mine site would increase the risk of spills adjacent to Critical Habitat or in streams/rivers that flow into Critical Habitat in the East Fork SFSR, Johnson Creek, and streams adjacent to Warm Lake Road (CR 10-579). A total of 18 km of steelhead Critical Habitat along the Burntlog Route could be affected.

The gradient barrier at the Yellow Pine pit lake cascade is currently restricting access for steelhead trout to habitat upstream. However, no Critical Habitat is identified for steelhead trout upstream of the barrier. The removal of the Yellow Pine pit barrier at Mine Year -1, would provide access to fish to naturally move upstream. This would create a gain in quantity and quality of available habitat regardless of the lack of identified Critical Habitat for steelhead trout upstream of the Yellow Pine pit barrier.

Overall, the effects of the 2021 MMP are expected to result in minor, long-term, and localized impacts to the steelhead Critical Habitat.

Integration of Effects

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs would affect steelhead and habitat under the 2021 MMP. These effects may cause injury or mortality to individuals and temporarily or permanently displace steelhead from several mine site streams during certain periods when habitat conditions become unsuitable. This would cause a temporal loss of habitat during mine operations.

A summary of the overall net effects to steelhead habitat and specific points regarding the impacts are provided below.

- Changes to water chemistry would primarily have minor effects but would have an unknown level of beneficial effects through the reduction of arsenic and antimony.
- Alterations of the physical structures of the East Fork SFSR and Meadow Creek would result in a net benefit to steelhead. The construction of the fishway, with a later restoration of the East Fork SFSR, would provide volitional access to habitat that was not previously accessible (nearly 9 km). Additional enhancements to the East Fork SFSR and Meadow Creek would provide additional habitat benefits.
- There is a modeled substantial increase in thermally-suitable habitat for juvenile rearing. There is no thermally-suitable habitat for egg incubation and emergence under either baseline conditions or the 2021 MMP, so no net loss. Additionally, steelhead would have access to upstream spawning and rearing habitat, which were not previously accessible.
- Changes in flows would result in a net decrease in productivity between baseline conditions and post-closure conditions. Activities during mine operations would result in major reductions in flows and in steelhead flow-based productivity in the East Fork SFSR between Meadow Creek and Sugar Creek, and in Meadow Creek. There would be a net decrease in steelhead habitat in Meadow Creek, but most flows would return to near baseline conditions in the East Fork SFSR after mine closure and post-closure. In subsequent years, closure and post-closure periods, would have negligible to minor changes in productivity.

- The removal of barriers would provide access to upstream habitat not previously volitionally accessed. This would result in a net benefit to steelhead. A new barrier would be constructed in Meadow Creek along the TSF; however, this is not a section of Meadow Creek in which steelhead are able to volitionally reach.
- There would be a slight net increase in IP habitat for steelhead. Post-closure, there would be a net increase of approximately 1.77 km (16.5 percent) of useable habitat in the headwaters of the East Fork SFSR. This is a change from approximately 10.67 km at baseline to 12.44 km in Mine Year 23. The majority of the usable IP habitat identified in the analysis area is habitat not previously volitionally accessed.
- There would be no change in access to steelhead Critical Habitat because there is no assumed Critical Habitat upstream from the Yellow Pine pit lake. Following the establishment of passage into the upper watershed, NMFS may designate Critical Habitat in the upper watershed.

Following closure and reclamation, the net effect would be an increase in both the quantity and quality of habitat for steelhead trout.

Impacts to Bull Trout

Bull trout would be affected by the 2021 MMP through changes in water temperature and flow, which affects other factors such as habitat through WUA, occupancy probability, and Critical Habitat. The effects to bull trout are described below.

Water Temperature

Water temperature is an important factor affecting the survival of each bull trout life stage. The accepted stream temperature thresholds/ranges for life stages of bull trout were compiled from regulatory standards and other relevant literature and are presented in Table 4 in ESS 2019a. The technical memorandum presents quantification of baseline habitat availability (in relation to stream temperature) for bull trout and analyzes the likely effects of changes to stream temperatures on available habitat as a result of implementation of the SGP. The following is a summary of the analysis and potential impacts from water temperature changes in streams at the mine site.

Table 4.12-13 presents the length of streams that have positive bull trout occupancy probability that fall within the temperature threshold categories for bull trout life stages. Length of habitat for bull trout juvenile rearing are based the amount of habitat with suitable thermal conditions using the summer maximum temperatures, while spawning and incubation/emergence apply the fall maximum temperature. Detailed data for bull trout under the 2021 MMP are presented in the update of ESS 2019a.

Table 4.12-13 Length of Stream Habitat Under the Watershed Condition Indicator Categories for Water Temperatures for Bull Trout Under the 2021 MMP

Life Stage	Baseline (km)	Mine Year 6 (km)	Mine Year 12 (km)	Mine Year 18 (km)	Mine Year 22 (km)	Mine Year 27 (km)	Mine Year 32 (km)	Mine Year 52 (km)	Mine Year 112 (km)	Change from Baseline to Mine Year 112 (km)
Below Yellow Pine pit										
Spawning – FA	0	0	0	0	0	0	0	0	0	0
Spawning – FR	0	0	0	0	0	0	0	0.05	0.05	+0.05
Spawning - FUR	2.01	1.48	1.66	1.66	1.66	1.66	1.66	1.61	1.61	-0.35
Incubation/Emergence - FA	0	0	0	0	0	0	0	0	0	0
Incubation/Emergence - FUR	2.01	1.48	1.66	1.66	1.66	1.66	1.66	1.66	1.66	-0.35
Juvenile Rearing - FA	0	0	0	0	0	0	0	0	0	0
Juvenile Rearing - FR	0	1.48	1.66	1.66	1.66	1.66	1.66	1.66	1.66	+1.66
Juvenile Rearing - FUR	2.01	0	0	0	0	0	0	0	0	-2.01
Total Available Habitat	2.01	1.48	1.66	1.66	1.66	1.66	1.66	1.66	1.66	-0.35
Above Yellow Pine pit										
Spawning – FA	1.62	1.42	2.61	1.42	1.42	1.42	1.42	1.42	1.42	-0.20
Spawning – FR	7.76	6.28	8.24	5.55	6.18	6.34	6.34	6.34	6.34	-1.42
Spawning - FUR	14.82	8.64	5.85	10.78	10.15	8.29	8.29	8.29	8.29	-6.52
Incubation/Emergence - FA	0	0	0	0	0	0	0	0	0	0
Incubation/Emergence - FUR	24.2	16.34	16.70	17.75	17.75	16.05	16.05	16.05	16.05	-8.15
Juvenile Rearing - FA	12.16	10.35	9.90	7.60	7.88	7.76	7.76	7.76	7.76	-4.4
Juvenile Rearing - FR	9.60	5.99	6.55	9.45	9.62	5.36	5.60	7.22	8.29	-1.31
Juvenile Rearing - FUR	2.43	0	0.25	0.69	0.25	2.93	2.68	1.07	0	-2.43
Total Available Habitat	24.2	16.34	16.70	17.75	17.75	16.05	16.05	16.05	16.05	-8.15

km = kilometer; FA = functioning appropriately; FR = functioning at risk; FUR = functioning at unacceptable risk

As shown in **Table 4.12-13**, all life stages experience a reduction in habitat that meets the thermal requirements for bull trout. These reductions are either due to water temperatures that are too high or too low for the specific life stage, or due to limited access to suitable habitat (e.g., Meadow Creek). Relative to baseline conditions:

- There would be a net decrease in thermally suitable conditions for spawning because water temperatures are higher than the thermal requirements. While there is a decrease in the amount of thermally suitable spawning habitat that is considered functioning at risk or functioning at unacceptable risk, there is also a decrease in spawning habitat functioning appropriately.
- There would be a net decrease in thermally suitable habitat functioning appropriately for egg incubation/emergence during operations and post-closure primarily due to the loss of access to the upper Meadow Creek.
- There would be a net decrease in thermally suitable juvenile rearing habitat functioning appropriately during operations through post-closure primarily due to the loss of access to the upper Meadow Creek.

Based on modeled results, the effects of the SGP on bull trout caused by changes to thermally suitable habitat are expected to be major, permanent, and localized.

Weighted Usable Area (PHABSIM)

A PHABSIM model was developed to predict how bull trout habitat changes based upon changes in stream flow associated with different stream reaches throughout the SGP. The PHABSIM data are approximately 30 years old and originated from another project. They represent available data that provide reference information and should not be viewed as directly transferable to the project site. Although the PHABSIM results do not explicitly predict changes in habitat associated with changes in flow related to the proposed project, they do provide data on how the model predicted similar reductions in flow at similar-sized creeks in close proximity would affect habitat for the different life stages of bull trout. The general relationship between the predicted changes in streamflow and the impact to habitat (i.e., WUA) at the mine sites is a general decrease in streamflow results in a general decrease in habitat for the adult and juvenile bull trout life stages.

Under the 2021 MMP, the largest impacts on low-flow discharge would be at Meadow Creek between Mine Year 2 and Mine Year 8. Over this time period, flows are predicted to decrease between 11 percent and 36 percent (**Table 4.12-5**; mean = 18 percent and median = 20 percent). Since Meadow Creek is a small stream, it is represented by Summit Creek (Stream Index 1; Table 6-R1). For Summit Creek, the PHABSIM results indicated an 87 percent reduction in discharge from 7.8 cfs to 1.0 cfs which would result in a 90 percent reduction in adult bull trout habitat. Juvenile bull trout results were slightly lower with an 89 percent reduction in juvenile bull trout habitat. The predicted reduction in adult habitat at Summit Creek associated with a reduction in flow from 7.8 cfs to 4.4 cfs (44 percent decrease) was predicted to equate with a 42 percent decline in adult bull trout habitat and similarly a 41 percent reduction in juvenile bull trout habitat. There were no PHABSIM results provided for smaller decreases in discharge at low flows for this stream size. For Meadow Creek, the impacts on bull trout habitat are major, long-term, and localized.

For the East Fork SFSR above Sugar Creek site, which is represented by Sugar Creek, flows are predicted to decrease between Mine Years 1 and 14 ranging from 7 percent to 25 percent (**Table 4.12-5**; mean = 16 percent and median = 16 percent). For Sugar Creek, the PHABSIM results indicated a 90 percent reduction in discharge from 9.9 cfs to 1.0 cfs which would result in an 88 percent reduction in adult bull trout habitat. Juvenile bull trout habitat reduction results were slightly lower with a –87 percent reduction. The predicted reduction in adult habitat at Sugar Creek associated with a decrease in flow from 7.8 cfs to 4.4 cfs (44 percent) was predicted to equate to a 37 percent decline in adult bull trout habitat and similarly a 33 percent reduction in juvenile bull trout habitat. There were no PHABSIM results provided for smaller decreases in discharge at low flows for this stream size. For East Fork SFSR above Sugar Creek, the impacts on bull trout habitat are major, long term, and localized.

For the East Fork SFSR at Stibnite site, which is represented by East Fork SFSR downstream from Sugar Creek, flows are predicted to decrease between Mine Years 2 and 8 ranging from 6 percent to 20 percent (**Table 4.12-5**; mean = 10 percent and median = 11 percent). For East Fork SFSR downstream from Sugar Creek, the PHABSIM results indicated a 60 percent reduction in discharge from 63 cfs to 25 cfs which would result in a 49 percent reduction in adult bull trout habitat. Juvenile bull trout habitat reduction results were slightly lower with a 45 percent reduction in juvenile bull trout habitat. The predicted reduction in adult habitat at Sugar Creek associated with a decrease in flow from 63 cfs to 44 cfs (30 percent) was predicted to equate to a 15 percent decline in adult bull trout habitat. Juvenile bull trout habitat reduction results were slightly lower with an 11 percent reduction in habitat. There were no PHABSIM results provided for smaller decreases in discharge at low flows for this stream size. For the East Fork SFSR at Stibnite site, the impacts on bull trout habitat are moderate, long term, and localized.

Analysis of relevant PHABSIM modeling from the region indicates SGP discharge impacts on physical habitat would be major, long term, and localized.

Occupancy Probability

The OM is a tool used to determine the probability of a fish species occupying a particular stream reach (occupancy probability) and to predict changes in the probability given changes to site physical characteristics (Isaak et al. 2015, 2017). An OM was developed to quantify potential occupancy probability for bull trout (See ESS 2019f for additional information). The OM calculates occupancy probabilities based on the combination of three independent variables important to bull trout: stream flow, stream temperature, and channel slope. The continuous range of occupancy probabilities are represented as percentages, from 0 percent to 100 percent for each reach. **Table 4.12-14** presents the OM-derived distance-weighted average occupancy probabilities for bull trout by stream reach under the 2021 MMP for six different time periods: Baseline (existing conditions), Mine Year 6 (approximately halfway through mine operations), Mine Year 12 (near the end of mine operations), Mine Year 18 (beginning of the closure and reclamation), Mine Year 27 (post-closure where water temperatures are the highest) and Mine Year 112 (post-closure).

Stream channel alterations in the East Fork SFSR and Meadow Creek would impact occupancy probabilities for bull trout in the mine area. The largest increase in bull trout occupancy probability occurs in the East Fork SFSR between Sugar Creek and the Yellow Pine pit lake in Mine Year 6 but decrease in Mine Year 12 and Mine Year 18 and starts to increase to Mine Year 112 (**Table 4.12-14**). The increase in

Mine Year 6 in the East Fork SFSR is primarily caused by a decrease in average water temperatures between mid-July and late September. Water temperatures have higher maximums, but also lower minimums during this period. During this time period, less water from Meadow Creek is flowing into the East Fork SFSR, which affects the daily temperature moderation. As a result, the lower average temperature results in a higher occupancy probability for bull trout in the East Fork SFSR between the Yellow Pine pit lake and Sugar Creek. The East Fork SFSR upstream of the Yellow Pine pit lake and the Meadow Creek drainage all have increased occupancy probabilities for bull trout over time.

Table 4.12-14 Distance Weighted Average of Occupancy Probabilities (in Percent) for Bull Trout Under the 2021 MMP

Stream Reach	Baseline	Mine Year 6	Mine Year 12	Mine Year 18	Mine Year 27	Mine Year 112
East Fork SFSR upstream from Meadow Creek	8.4%	9.6%	9.5%	8.5%	9.8%	9.7%
Meadow Creek and EFMC	5.7%	6.9%	6.7%	7.8%	5.7%	8.7%
East Fork SFSR between Meadow Creek and Yellow Pine pit	10.1%	12.4%	15.2%	13.8%	13.1%	14%
East Fork SFSR Between Yellow Pine pit and Sugar Creek	15.3%	22.6%	12.4%	12.3%	13.3%	16.1%

A distance-weighted average method was used to represent the average occupancy probability for each stream segment. To produce the distance-weighted average, the occupancy probability of each OM reach was multiplied by the proportion of the reach's stream length to the total length of each stream segment that has some likelihood of being occupied by bull trout. The length of potential habitat available for bull trout are presented in **Table 4.12-15**.

Table 4.12-15 Length of Available Habitat for Potential Occupancy for Bull Trout Under the 2021 MMP

Stream Reach	Baseline (km)	Mine Year 6 (km)	Mine Year 12 (km)	Mine Year 18 (km)	Mine Year 27 (km)	Mine Year 112 (km)
East Fork SFSR upstream from Meadow Creek	13.1	13.9	13.1	13.1	13.9	13.1
Meadow Creek and EFMC	13.1	7.1	6.8	7.4	15.2	14.0
East Fork SFSR between Meadow Creek and Yellow Pine pit	6.5	5.6	7.8	6.9	7.4	8.1
East Fork SFSR Between Yellow Pine pit and Sugar Creek	1.2	0.5	0.7	0.7	0.7	0.7

The largest decreases of available potential habitat for bull trout and westslope cutthroat trout relative to baseline conditions would occur in the Meadow Creek drainage. During this period, the main activities that contribute to the loss of potential habitat in these areas are the diversion of Meadow Creek around the TSF footprint; the construction of the rock drain on EFMC and the East Fork SFSR tunnel; and

dewatering of the Yellow Pine pit lake, all occurring in Mine Year -1. The length of available habitat in these areas would increase at Mine Year 18 following restoration of Meadow Creek along the TSF, however, there is still potentially usable bull trout habitat with occupancy potential that does get factored into the modeled results.

Mine actions, stream enhancement, and restoration implemented by Mine Year 18 would remove all major fish passage blockages. Any remaining available habitat blockages would occur only in non-enhanced reaches and the Meadow Creek TSF high-gradient areas where fish cannot naturally access the available habitat. The approximately upper 10 km of Meadow Creek would remain blocked in perpetuity due to the high-gradient stream segments flowing off the TSF.

Overall, the SGP is expected to result in minor, permanent, and localized benefits to occupancy probability and the available habitat for occupancy potential for bull trout.

Critical Habitat

Critical Habitat for bull trout in the active mine area would be impacted by various activities including active mining, diversions, barrier removal, and stream restoration. An analysis of designated Critical Habitat currently blocked due to passage barriers indicates that the largest impacts to Critical Habitat for bull trout would come from barrier removal. Nearly 20 km of Critical Habitat are blocked for migratory bull trout above the Yellow Pine pit under baseline conditions but are occupied by non-migratory bull trout. This barrier would be removed before mine operations begin (Mine Year -1) to allow access for fluvial and adfluvial bull trout above these barriers. An existing barrier to bull trout in Meadow Creek upstream from East Fork Meadow Creek would be removed but would be replaced by a pipeline along the TSF during operations and then a gradient barrier post-closure. This barrier would block passage to the headwaters of Meadow Creek, but not eliminate suitable habitat for any bull trout currently present. Overall, the effects of the SGP on bull trout access to Critical Habitat within the mine area would be major, permanent, and localized.

Integration of Effects

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs would affect bull trout in the mine area. Some SGP activities may improve access to habitat from baseline conditions. Despite some improvement to access, there remain some potential effects associated with the 2021 MMP that may cause injury or mortality to individuals and permanent displace bull trout from the analysis area.

Post-closure, a net decrease in quality and quantity of bull trout habitat would occur despite removal of passage barriers and an increase of lake habitat for bull trout including:

- Changes to water chemistry would primarily have minor effects but would have an unknown level of beneficial effects through the reduction of arsenic and antimony.
- The loss of the Yellow Pine pit lake would result in a net long-term impact to bull trout, but a permanent negligible net change once the Stibnite Lake is constructed by Mine Year 11. The construction of the fishway, and subsequent channel restoration of the East Fork SFSR, would

provide volitional access to habitat that was not previously accessible to the adfluvial population, which may provide additional spawning habitat. Additional enhancements to the East Fork SFSR and Meadow Creek would provide additional habitat benefits.

- There would be a net loss in bull trout thermally suitable habitat due to water temperatures exceeding the thermal requirements for spawning, incubation/emergence and rearing, primarily in Meadow Creek.
- Changes in flows would result in a net decrease in bull trout habitat in Meadow Creek and in the East Fork SFSR, but most flows would return to near baseline conditions, particularly in the East Fork SFSR after mine closure and post-closure.
- The removal of barriers would provide access to upstream habitat not previously volitionally accessed. This would result in a benefit to bull trout. A new barrier would be constructed in Meadow Creek along the TSF, which would result in blockage. Overall, there would be a net increase in accessibility to habitat for bull trout.
- There would be a minor net increase in occupancy potential for bull trout.
- There would be a net loss in Critical Habitat for bull trout in upper Meadow Creek because of the diversion around the TSF, and later by the completion of the TSF, which would become a gradient barrier to upstream and downstream fish passage.

Westslope Cutthroat Trout

Westslope cutthroat trout would be affected by the 2021 MMP through changes in water temperature and flow, which affects other factors such as habitat through WUA, occupancy probability, and Critical Habitat. The effects to westslope cutthroat trout are described below.

Water Temperature

The following is a summary of the analysis and potential impacts from water temperature changes in streams at the mine site from ESS 2019a. **Table 4.12-16** presents the length of streams that have positive westslope cutthroat trout occupancy probability that fall within the temperature threshold categories for westslope cutthroat trout life stages. Length of habitat for westslope cutthroat trout egg incubation/emergence and juvenile rearing are based the amount of habitat with suitable thermal conditions using the summer maximum temperatures. The other life stages are outside the summer – fall modeled parameters, and therefore are not included in the analysis.

Table 4.12-16 Length of Stream Habitat that Meets the Optimal Thermal Requirements for Westslope Cutthroat Trout Under the 2021 MMP

Life Stage	Baseline (km)	Mine Year 6 (km)	Mine Year 12 (km)	Mine Year 18 (km)	Mine Year 22 (km)	Mine Year 27 (km)	Mine Year 32 (km)	Mine Year 52 (km)	Mine Year 112 (km)	Change from Baseline to Mine Year 112 (km)
Below Yellow Pine pit										
Incubation/ Emergence	0	0	0	0	0	0	0	0	0	0
Juvenile Rearing	2.01	1.48	1.66	1.66	1.66	1.66	1.66	1.66	1.66	-0.35
Total Available Habitat	2.01	1.48	1.66	1.66	1.66	1.66	1.66	1.66	1.66	-0.35
Above Yellow Pine pit										
Incubation/ Emergence	0.85	0.78	0.78	0.37	0.37	0.37	2.11	2.11	2.11	+1.26
Juvenile Rearing	20.91	17.33	17.69	18.74	19.15	23.40	21.65	21.65	21.65	+0.74
Total Available Habitat	24.20	18.11	18.47	19.52	19.52	23.77	23.77	13.77	23.77	-0.73

As shown in **Table 4.12-16**, there are slight decreases in suitable habitat conditions for egg incubation/emergence during operations, but an increase for post-closure conditions. Relative to baseline conditions:

- There would be a decrease in thermally suitable condition for egg incubation/emergence due to higher water temperatures during operations and the early period of the post-closure, but after Mine Year 27, water temperatures begin to decrease, resulting in a net increase in thermally suitable conditions for egg incubation/emergence upstream from the Yellow Pine pit lake cascade barrier.

- There would be a decrease in thermally suitable rearing habitat during operations and early post-closure, but after Mine Year 22, water temperatures begin to decrease, resulting in a net increase in thermally suitable rearing habitat upstream from the Yellow Pine pit lake cascade barrier.

Based on modeled results, the effects of the SGP on westslope cutthroat trout caused by changes to thermally suitable habitat are expected to be minor, permanent, and localized.

Weighted Usable Area (PHABSIM)

Under the 2021 MMP, the largest impacts on low-flow discharge for the project site would be at Meadow Creek between Mine Year 2 and Mine Year 8. Over this time period, flows are predicted to decrease between 11 percent and 36 percent (**Table 4.12-5**; mean = 18 percent and median = 20 percent). Since Meadow Creek is a small stream, it is comparable to Summit Creek. For Summit Creek, the PHABSIM

results indicated an 87 percent reduction in discharge from 7.8 cfs to 1 cfs which would result in a 99 percent reduction in adult cutthroat trout habitat. Effects on the habitat for the cutthroat spawning life stage were about half as large. The predicted reduction in adult habitat at Summit Creek associated with a reduction in flow from 7.8 cfs to 4.4 cfs (44 percent) was predicted to equate to a 56 percent decline in adult cutthroat habitat. There were no PHABSIM results provided for smaller decreases in discharge at low flows for this stream size. For Meadow Creek, the impacts on cutthroat trout habitat are major, permanent and localized.

For the East Fork SFSR above Sugar Creek site, which is represented by Sugar Creek, flows are predicted to decrease between Mine Year 1 and Mine Year 14 ranging from 7 percent to 25 percent (**Table 4.12-5**; mean = 16 percent and median = 16 percent). For Sugar Creek, the PHABSIM results indicated a 90 percent reduction in discharge from 9.9 cfs to 1.0 cfs which would result in a 99 percent reduction in adult cutthroat trout habitat. Juvenile cutthroat trout habitat loss results were slightly lower, while effects on cutthroat fry habitat were about half as large. The predicted reduction in adult habitat at Sugar Creek associated with a decrease in flow from 9.9 cfs to 5.4 cfs (46 percent) was predicted to equate to a 53 percent decline in adult cutthroat trout habitat. There were no PHABSIM results provided for smaller decreases in discharge at low flows for this stream size. For the East Fork SFSR above Sugar Creek, the impacts on cutthroat trout habitat are major, long-term, and localized.

For the East Fork SFSR at Stibnite site, which is represented by East Fork SFSR Downstream from Sugar Creek, flows are predicted to decrease between Mine Year 2 and Mine Year 8 ranging from 6 percent to 20 percent (**Table 4.12-5**; mean = 10 percent, median = 11 percent). For East Fork SFSR Downstream from Sugar Creek, the PHABSIM results indicated a 60 percent reduction in discharge from 63 cfs to 25 cfs which would result in a 67 percent reduction in adult cutthroat trout habitat. No habitat data were available for juvenile cutthroat trout habitat, but the effects on cutthroat fry habitat were much lower with a 24 percent decrease. The predicted reduction in adult habitat at Sugar Creek associated with a decrease in flow from 63 cfs to 44 cfs (30 percent) was predicted to equate to a 32 percent decline in adult cutthroat trout habitat and only a 6 percent reduction in cutthroat fry habitat. There were no PHABSIM results provided for smaller decreases in discharge at low flows for this stream size or for the cutthroat trout juvenile life stage. For the East Fork SFSR at Stibnite site, the impacts on cutthroat trout habitat are moderate, long-term and localized.

Analysis of relevant PHABSIM modeling from the region indicates the effects of 2021 MMP discharge impacts on physical habitat could be moderate to major, long term, and localized.

Occupancy Probability

Occupancy probability and stream length with occupancy probability was calculated in the same manner for westslope cutthroat trout as described for bull trout.

Stream channel alterations in the East Fork SFSR and Meadow Creek would impact occupancy probabilities for westslope cutthroat trout in the mine area. The largest increase in westslope cutthroat trout occupancy probability occurs in the East Fork SFSR between Sugar Creek and the Yellow Pine pit lake in Mine Year 6 but decrease in Mine Year 12 but increases again by Mine Year 112 (**Table 4.12-17**). The increase in Mine Year 6 in the East Fork SFSR is caused by a decrease in average water temperatures between mid-July and late September. Water temperatures have higher maximums, but also lower

minimums during this period. During this time period, less water from Meadow Creek is flowing into the East Fork SFSR, which affects the daily temperature moderation. As a result, the lower average temperature results in a higher occupancy probability for westslope cutthroat trout in the East Fork SFSR between the Yellow Pine pit lake and Sugar Creek. The East Fork SFSR upstream of the Yellow Pine pit lake and the Meadow Creek drainage all have increased occupancy probabilities for westslope cutthroat trout over time.

Table 4.12-17 Distance Weighted Average Occupancy Probability (in Percent) of Westslope Cutthroat Trout under the 2021 MMP

Stream Reach	Baseline	Mine Year 6	Mine Year 12	Mine Year 18	Mine Year 27	Mine Year 112
East Fork SFSR upstream from Meadow Creek	64.3%	64.4%	64.8%	64.4%	64.4%	64.8%
Meadow Creek and EFMC	63.9%	64.6%	64.6%	65.1%	64.5%	66.3%
East Fork SFSR between Meadow Creek and Yellow Pine pit	64.2%	65.0%	66.5%	65.7%	65.6%	65.4%
East Fork SFSR between Yellow Pine pit and Sugar Creek	68.0%	70.2%	65.5%	65.7%	65.6%	67.7%

With the occupancy probability identified in each system, the length of habitat that has an occupancy probability in each stream was calculated. The length of potential habitat available for westslope cutthroat trout are presented in **Table 4.12-18**.

Table 4.12-18 Length of Available Habitat for Potential Occupancy for Westslope Cutthroat Trout Under the 2021 MMP

Stream Reach	Baseline (km)	Mine Year 6 (km)	Mine Year 12 (km)	Mine Year 18 (km)	Mine Year 27(km)	Mine Year 112 (km)
East Fork SFSR upstream from Meadow Creek	13.1	13.9	13.1	13.1	13.9	13.1
Meadow Creek and EFMC	13.1	7.1	6.8	7.4	15.2	14.0
East Fork SFSR between Meadow Creek and Yellow Pine pit	6.7	5.6	7.8	6.9	7.4	8.1
East Fork SFSR between Yellow Pine pit and Sugar Creek	1.2	0.5	0.7	0.7	0.7	0.7

The largest decreases of available potential habitat for westslope cutthroat trout relative to baseline conditions would occur in the Meadow Creek drainage. During this period, the main activities that contribute to the loss of potential habitat in these areas are the diversion of Meadow Creek around the TSF footprint; the construction of the rock drain on EFMC and the East Fork SFSR tunnel; and

dewatering of the Yellow Pine pit lake, all occurring in Mine Year -1. The length of available habitat in these areas would increase at Mine Year 18 following restoration of Meadow Creek along the TSF.

Mine actions, stream enhancement, and restoration implemented by Mine Year 18 would remove all major fish passage blockages. Any remaining available habitat blockages would occur only in non-enhanced reaches and the Meadow Creek TSF high-gradient areas where fish cannot naturally access the available habitat. The approximately upper 10 km of Meadow Creek would remain blocked in perpetuity due to the high-gradient stream segments flowing off the TSF. Based on the current known extent westslope cutthroat trout occupancy, fish in the upper headwaters of Meadow Creek would remain isolated.

Overall, the SGP is expected to result in minor, permanent, and localized benefits to occupancy probability and the available habitat for occupancy potential for westslope cutthroat trout.

Integration of Effects

The combination of physical stream channel changes, direct effects to individuals, and changes to many of the WCIs would negatively affect westslope cutthroat trout in the analysis area through the loss of suitable habitat. Despite some improvement to access, there remain potential effects which may cause injury or mortality to individuals and/or displacement of westslope cutthroat trout.

Following reclamation, the net effect would be a minor loss of both quantity and quality of habitat for westslope cutthroat trout including:

- Changes to water chemistry would primarily have minor effects but would have an unknown level of beneficial effects through the reduction of arsenic and antimony.
- Habitat enhancements to the East Fork SFSR and Meadow Creek would provide benefits to westslope cutthroat trout habitat.
- The primarily net reduction in water temperatures in the East Fork SFSR and Meadow Creek would provide a net minor benefit for westslope cutthroat trout. There is a slight modeled decrease in temperature-suitable habitat for all life stages.
- Changes in flows would result in a net decrease in westslope cutthroat trout habitat in Meadow Creek, but most flows would return to near baseline conditions in the East Fork SFSR after mine closure and post-closure. Habitat quantified by WUA available to westslope cutthroat trout based on PHABSIM model results show low reductions in WUA post-closure, with a negligible net decrease in westslope cutthroat trout habitat.
- The removal of barriers would have negligible effects on westslope cutthroat trout. A new barrier would be constructed in Meadow Creek along the TSF, which would result in blockage, which may result in isolation of fish in the headwaters.
- There would be a minor net increase in occupancy potential for westslope cutthroat trout.

The 2021 MMP may indirectly impact westslope cutthroat trout individuals but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area.

4.12.2.3 Johnson Creek Route Alternative

Only impacts from the Johnson Creek Route Alternative that differ from the 2021 MMP are discussed below.

Direct Impacts to Individuals

Spill Risk

The potential for surface water quality impacts from accidental fuel or chemical spills along the mine access roads would be comparable between the action alternatives. However, all vehicle trips would traverse the Johnson Creek Route under this alternative, resulting in greater use of the Johnson Creek Route access roads. The potential location and extent of accidental spills would therefore differ compared to the 2021 MMP. The Johnson Creek Route is located in close proximity to streams (i.e., within 100 feet) for 6.5 miles, so the potential for fuel and hazardous chemical spills impacting surface water quality is higher than for travel on the Burntlog Route which is within 100 feet of a stream for 1.69 miles. Overall design features proposed by Perpetua, design features required by the Forest Service, and permit stipulations and regulatory requirements from state and federal agencies (including use of USDOT-certified containers and registered transporters) would reduce the risk of spills and promote effective response should a spill occur. The effects of spills associated with the Johnson Creek Route alternative on surface water and potentially on fish and aquatic habitat would be minor to major, temporary, and localized depending on the spill location.

Impacts to Watershed Condition Indicators

Sediment and Turbidity

The number of streams crossed along the Johnson Creek Route (43) would be reduced compared to the 2021 MMP. However, the Johnson Creek Route would be widened and upgraded under this alternative. Therefore, surface water quality impacts from erosion and sedimentation during access road construction could increase during the construction activities and would require implementation of sediment and erosion BMPs.

Use of the Johnson Creek Route for site access would avoid construction-related impacts from sedimentation at 21 different streams compared to the 2021 MMP. These streams include Burntlog Creek, East Fork Burntlog Creek, the East Fork SFSR, Johnson Creek, Landmark Creek, Peanut Creek, Rabbit Creek, Riordan Creek, Trapper Creek, and 12 unnamed waterbodies.

During mine construction, the number of daily vehicle trips to the SGP would be comparable between the alternatives. The number of daily vehicle trips also would be the same during mine operations and reclamation; however, all vehicle trips would traverse the Johnson Creek Route under this alternative, resulting in greater use of the Johnson Creek Route access roads, and more fugitive dust generation and greater wear and tear on the road surface. In addition, use of the Johnson Creek Route would require two additional years of construction. The resulting surface water quality impacts from erosion and

sedimentation would therefore differ in location and extent compared to the 2021 MMP but would be similar in magnitude.

Prevention of impacts would be achieved through proper road design, construction, grade control, fugitive dust control and, in the winter months, snow removal and "sanding" using gravel and coarse sand with minimal fines to avert slippery conditions and reduce off-site sedimentation during the spring runoff season (**Section 2.4.9**).

Overall, based on identified maintenance activities, design features (**Section 2.4.9**), and permit stipulations from state and federal agencies, traffic-related dust and erosion/sedimentation would be within the normal range of properly maintained NFS roads. The duration for traffic-related dust and erosion/sedimentation would last throughout the entire period of use of the Johnson Creek Route (approximately 40 years); however, the potential for these effects would be incrementally reduced during closure and reclamation. Due to the nature of airborne dust and sediment transport by streams, the geographic extent of the impact could be hundreds of feet to miles, depending on many site- and event-specific factors, but it is expected that effects would be limited to within the subwatersheds of the analysis area.

The effects of the Johnson Creek Route Alternative of sedimentation would be moderate, long-term, and localized.

Chemical Contaminants

The water quality effects of the Johnson Creek Route Alternative are the same as and the 2021 MMP with regard to contact water, water treatment, groundwater chemistry, surface water chemistry, stream temperature, and impaired water bodies. The change in site access does result in some differences in effects of sedimentation and fuels and hazardous chemicals as noted above.

4.12.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. A mitigation measure addressing effects of stream water temperature on fish is described in **Section 4.9.3**.

4.12.4 Irreversible and Irretrievable Commitments of Public Resources

4.12.4.1 No Action Alternative

Under the No Action Alternative there would be no irreversible or irretrievable commitment of fish and aquatic habitat resources.

4.12.4.2 Action Alternatives

Irreversible Commitments – A commitment of resources is irreversible when the impacts of the proposed action or alternatives would limit the future options for use of the resource. This applies

primarily to non-renewable resources or to processes or resources that are renewable over long periods of time.

The direct mortality of fish would be an irreversible impact that could occur under the Action Alternatives. Although fish exclusion barriers and trap and transfer activities would be incorporated to minimize fish mortality, incidental injury or mortality is expected to occur. These "takes" of fish in the mine site would be considered irreversible. Species subject to potential irreversible losses include Chinook salmon, steelhead trout, bull trout, and cutthroat trout.

Irretrievable Commitments – A commitment of resources is irretrievable when the impacts of the action alternatives would result in a loss of production, harvest, or use of renewable resources. An irretrievable commitment of resources occurs when a resource that is renewable over a relatively short period of time is consumed during the life of the SGP and is therefore unavailable for other uses until the use ceases and it is renewed and once again available. It is the temporal loss of resources that is considered irretrievable.

This includes resources that are renewable over a short time, such as riparian vegetation and streams. While the loss of the resource itself is reversible (through mitigation), the temporal loss of the use of the resource or habitat is irretrievable. The SGP would cause a temporal loss of aquatic habitat for fish species inhabiting certain stream reaches.

Portions of Meadow Creek upstream of the southern extent of the TSF would be irretrievable and unavailable to downstream fish within Meadow Creek during construction, operations, and post-closure. The presence of the TSF and TSF Buttress would essentially isolate any populations of bull trout and westslope cutthroat trout which are known to inhabit the upper reaches of Meadow Creek. After closure and reclamation, restoration of Meadow Creek over the TSF/TSF Buttress would restore habitat, but a fish barrier would remain in place and keep the upstream populations isolated.

The loss of existing aquatic habitat in the Yellow Pine pit lake may constitute as an irretrievable commitment of resources.

4.12.5 Short-term Uses versus Long-term Productivity

4.12.5.1 No Action Alternative

Under the No Action Alternative, there would be no open pit mining or removal of legacy waste material at the SGP. Consequently, no short-term use would occur that would affect fisheries resources, and no change in long-term productivity would occur.

4.12.5.2 Action Alternatives

Mining is a short-term land use with its effects on long-term productivity dependent on the success of its closure and reclamation activities. Construction and operation of the proposed mine would result in short-term impacts to fish and associated habitat. During construction and operations, some sections of aquatic habitat would be removed from the footprint of the proposed mine site. Changes to aquatic habitat include diverting the East Fork SFSR around Yellow Pine pit and subsequently backfilling and constructing a stream channel atop the pit at closure. In the long-term restoring fish passage upstream of the Yellow Pine pit would result in an increase in available habitat for anadromous and resident fish in the analysis area.

Short-term changes to aquatic habitat in Meadow Creek include diverting a portion of the creek just south of the proposed Hangar Flats open pit, and the loss of habitat where the TSF and TSF Buttress would be located. The short-term loss of habitat would negatively affect fish populations in Meadow Creek over the life of the mine. Closure and reclamation would restore habitat over time.

4.13 Wildlife and Wildlife Habitat

4.13.1 Impact Definitions and Effects Analysis Indicators and Methodology

Although wildlife and wildlife habitat were 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 on wildlife and wildlife habitat includes the following issues and indicators:

Issue: The SGP may cause changes in wildlife habitat in the analysis area that may affect wildlife species including special-status species (threatened, endangered, proposed, MIS, and sensitive).

Indicators:

- Acres of general wildlife habitat disturbed.
- Acres of special-status wildlife habitat disturbed.
- Acres of disturbance to other high-value habitats such as crucial and or high-value big game ranges, wetlands, and seep and spring areas.
- Change in noise levels (in decibels) in, or in proximity to, wildlife habitat.
- Miles of new roads proposed for the SGP.
- Acres of disturbance for new and upgraded transmission lines.

Issue: The SGP may affect wildlife by introducing barriers to movement, including the mine site, infrastructure, new/existing maintained roads, new transmission line.

Indicators:

- Length of potential movement barriers.

Issue: The SGP may affect wildlife by potentially increasing the risk of direct injury or mortality.

Indicators:

- Amount of increased traffic along the access routes, or acres of ground disturbance for less-mobile species.
- Miles of new roads and transmission lines.
- Miles of existing roads that are not currently plowed that would be plowed.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1**.

Existing habitat conditions for focal wildlife species were developed using habitat models originally designed for the 2003 Payette Forest Plan revision. These wildlife habitat models were recently updated for the PNF using the best available science, including information from models developed for the BNF Wildlife Conservation Strategy (WCS) (Nutt et al. 2010), recent scientific literature, and PNF and BNF wildlife research data and survey reports. A summary of modeling parameters for existing source habitat for each species analyzed is documented in Appendix A of the SGP Project Wildlife and Wildlife Habitat Specialist Report (Forest Service 2022j).

4.13.2 Direct and Indirect Effects

4.13.2.1 No Action Alternative

Threatened, Endangered, Proposed, and Candidate Species

Canada Lynx

There have been no recent observations of Canada lynx in the Operations Area Boundary, existing Utilities Area, and off-site facilities; although, if there are transient Canada lynx in the region, they could potentially use these areas as they have in the past. Because some of the existing roadways in the Canada lynx analysis area bisect potential linkage areas, they also would likely continue to affect transient Canada lynx through habitat fragmentation and potential vehicle-wildlife collisions.

Northern Idaho Ground Squirrel

While modeled habitat for the NIDGS occurs in the region, no NIDGS are known or estimated to occur in the Operations Area Boundary, thus no current impacts are occurring or would occur under the No Action Alternative in this area. Habitat fragmentation and vehicle-wildlife collisions would still be present for NIDGS, if they occur in suitable habitats in the future, due to existing roadways under the No Action Alternative. As depicted by modeled habitat, there is a possibility that NIDGS may occur in existing utility corridors. Because the existing off-site facilities occupy a small area and there would be no new facilities built, there would be no effects on NIDGS from off-site facilities under the No Action Alternative.

Wolverine

Wolverines would likely continue to use the Operations Area Boundary much as they currently do. Existing roads also would continue to affect wolverines through habitat fragmentation and vehicle-wildlife collisions. There would be no new loss of habitat or source of noise and light for wolverines due to utility construction. Depending on the future use of current off-site facilities, wolverines would likely continue to avoid them as they currently do.

Monarch Butterfly

Monarch butterflies would likely continue to use the Operations Area Boundary as they currently do. Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife

collisions and noise, light, and fugitive dust impacts from traffic. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Focal Species, Including Region 4 Sensitive Species

Habitat Family 1 – Low Elevation, Old Forest

White-Headed Woodpecker

There is no modeled habitat near the Operations Area Boundary for white-headed woodpeckers, and they are not expected to occur. Existing roads in close proximity to modeled habitat would continue to affect white-headed woodpeckers through habitat fragmentation and noise, light, and fugitive dust impacts from traffic. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light, or increased risk of collision for woodpeckers. There would be no loss of habitat or new sources of noise and light due to off-site facilities.

Lewis's Woodpecker

Effects to the Lewis's woodpecker would be the same as described for the white-headed woodpecker under the No Action Alternative.

Habitat Family 2 – Broad Elevation, Old Forest

American Three-toed Woodpecker

Effects to the American three-toed woodpecker would be the same as described for the white-headed woodpecker under the No Action Alternative.

Black-Backed Woodpecker

Effects to the black-backed woodpecker would be the same as described for the white-headed woodpecker under the No Action Alternative.

Dusky Grouse (Summer)

Modeled habitat is limited for dusky grouse in the Operations Area Boundary, and they are assumed to occur sporadically. Individuals would likely continue to use the Operations Area Boundary as they currently do. Existing roads would continue to affect dusky grouse through habitat fragmentation, direct mortality through vehicle strikes, and noise, light, or fugitive dust impacts from traffic. No new transmission lines or communication towers would be constructed, so there would be no loss of habitat, sources of noise and light impacts, or increased risk of collision for dusky grouse. There would be no loss of habitat or sources of noise and light impacts due to off-site facilities.

Boreal Owl

Overall, boreal owls would likely continue to use the Operations Area Boundary as they currently do. Existing roads would continue to affect wildlife through habitat fragmentation and the risk of vehicle-wildlife collisions. No new transmission lines or communication towers would be constructed, so there would be no loss of habitat, sources of noise and light, or increased risk of collision for boreal owls. There would be no loss of habitat or sources of noise and light impacts due to off-site facilities.

Fisher

Fishers may use the Operations Area Boundary as they have in limited areas in the past. Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Flammulated Owl

See the boreal owl analysis for effects under the No Action Alternative that also would apply to the flammulated owl.

Great Gray Owl

See the boreal owl analysis for effects under the No Action Alternative that also would apply to the great gray owl.

Northern Goshawk

Overall, northern goshawks would likely continue to use the Operations Area Boundary as they currently do. Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light impacts, or increased risk of collision for northern goshawks. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Pileated Woodpecker

Pileated woodpeckers would likely continue to use the Operations Area Boundary as they currently do, which is believed to be rarely. Existing roads would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions and noise, light, and fugitive dust impacts from traffic. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light impacts, or increased risk of collision for woodpeckers. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Silver-haired Bat

Because there is suitable habitat nearby for silver-haired bat and they are assumed to occur in the Operations Area Boundary (especially the northern portion), individuals would likely continue to use the Operations Area Boundary as they currently do. Existing roads would continue to affect silver-haired bats through habitat fragmentation and disturbance from noise, light, and fugitive dust impacts due to traffic. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light impacts, or increased risk of collision for bats. Individual bats would likely continue to use existing utility corridors for foraging. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Habitat Family 3 – Forest Mosaic

Mountain Quail

Because there is potentially suitable habitat for mountain quail, any individuals would likely continue to use the Operations Area Boundary as they currently do in limited areas. Existing roads would continue to affect wildlife through habitat fragmentation, vehicle-wildlife collisions, and noise, light, and fugitive dust impacts. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Habitat Family 5 – Forest and Range Mosaic

Gray Wolf

Gray wolves would likely continue to use the Operations Area Boundary as they currently do. Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Peregrine Falcon

Peregrine falcons would likely continue to use the Operations Area Boundary as they currently do. Existing roads, especially Johnson Creek Road, would continue to affect falcons through habitat fragmentation and disturbance due to noise and light impacts. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Rocky Mountain Bighorn Sheep

Rocky Mountain bighorn sheep may use the Operations Area Boundary as they have in limited areas in the past. Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions. No new transmission lines or communication towers would be constructed, so there

would be no new loss of habitat or source of noise and light impacts. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Habitat Family 7 – Forests, Woodland, and Sagebrush

Townsend's Big-eared Bat

Townsend's big-eared bats have not been observed, but are assumed to occur in the Operations Area Boundary, and individuals would likely use the Operations Area Boundary much as they currently do. Existing roads also would continue to affect wildlife through habitat fragmentation and noise, light, and fugitive dust impacts. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light impacts, or increased risk of collision for the Townsend's big-eared bat. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Habitat Family 13 – Riverine Riparian and Wetland

Bald Eagle

Because there is potentially suitable habitat for bald eagles and they are assumed to occur in the Operations Area Boundary, individuals would likely continue to use the Operations Area Boundary as they currently do in limited areas. Existing roads also would continue to affect wildlife through habitat fragmentation, particularly along Johnson Creek Road and near Warm Lake where there are known nest sites. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat, source of noise and light impacts, or increased risk of collision for bald eagles. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Columbia Spotted Frog

Columbia spotted frogs would likely continue to use the Operations Area Boundary as they currently do. Existing roads also would continue to affect frogs through habitat fragmentation, direct mortality risks due to vehicle-wildlife collisions, and noise, light, and fugitive dust impacts from vehicles. No new transmission lines or communication towers would be constructed, so there would be no new loss of riparian habitat. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Idaho Species of Greatest Conservation Concern

SGCN would likely continue to use the Operations Area Boundary as they currently do. Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions and noise, light, and fugitive dust impacts from traffic. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

General Wildlife Species

General wildlife species would likely continue to use the Operations Area Boundary as they currently do. Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife

collisions and noise, light, and fugitive dust impacts from traffic. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Big Game Species

Big game species would likely continue to use the Operations Area Boundary they currently do. Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

Migratory Bird Species and Bald and Golden Eagles

Migratory bird species and bald and golden eagles would likely continue to use the Operations Area Boundary as they currently do. Existing roads also would continue to affect wildlife through habitat fragmentation and vehicle-wildlife collisions and noise, light, and fugitive dust impacts from traffic. No new transmission lines or communication towers would be constructed, so there would be no new loss of habitat or source of noise and light impacts. There would be no new loss of habitat or source of noise and light impacts due to off-site facilities.

4.13.2.2 2021 MMP

Threatened, Endangered, Proposed, and Candidate Species

The analysis of direct effects includes the potential take of ESA listed species. Pursuant to the ESA, take is defined as “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” (16 USC 35.1531 et seq.). Take of an individual or population could occur for various reasons such as traffic collisions, change in an individual or population’s habitat use due to noise, other disturbance, or contamination of food or water sources. Direct effects also would include loss of habitat or the encroachments into wildlife migration or travel areas, although no defined corridors have been identified. For all species, habitat loss could be temporary (0 to 3 years); short-term (3 to 15 years); long-term (>15 years); or permanent for land use changes (i.e., pit lakes, TSF, TSF Buttress, transmission line upgrades). The analysis of potential indirect effects on threatened, endangered, proposed, and candidate species includes fragmentation of habitat; increased competition for resources or habitat due to displacement of individuals from the affected area into the territory of other animals; or other effects, such as increased human presence in the species-specific analysis areas (e.g., hunters, trappers, and recreationists) that can cause mortality (i.e., illegal hunting or trapping) or reduced breeding and recruitment in the future population.

<u>Canada Lynx</u>

The 2021 MMP compared to modeled habitat within each LAU is shown on **Figure 3.13-2**. Direct and indirect effects to Canada lynx are analyzed within a 5-mile buffer within the LAUs, to assess all potential impacts, including noise disturbance. This buffer distance was developed using best professional judgment, in coordination with the USFWS, to address potential indirect impacts from anthropogenic

influences and to account for potential impacts to transient Canada lynx potentially moving through the general SGP area. However, based on noise information presented in **Section 4.6**, most indirect impacts would occur within 1 to 2 miles from SGP components.

The percentage of unsuitable habitat in the LAUs is higher than the 30 percent threshold. In several LAUs that are currently not meeting the Forest Plan Standard TEST15 for suitable habitat (Stibnite, Yellowpine, Burntlog, Warm Lake, and Landmark; **Table 4.13-1**), there would be an additional loss of suitable habitat, and these LAUs would continue to not meet the Standard. For the LAUs currently meeting the Standard (East Mountain and West Mountain), the direct impacts from the SGP would not cause the Standard to be exceeded.

Table 4.13-1 shows the acres of suitable habitat that would be directly impacted in each LAU. Direct impacts to Canada lynx habitat across all LAUs would be 194 acres under the 2021 MMP. Using a 5-mile buffer on the SGP components within each LAU, the area of indirect impacts on Canada lynx habitat could total approximately 70,745 acres under the 2021 MMP.

Table 4.13-1 Direct and Indirect Impacts on Canada Lynx Habitat

LAU	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Stibnite	80	20,634
Yellowpine	39	9,107
Burntlog	61	15,507
Warm Lake	2	1,652
Landmark	3	5,736
East Mountain	9	15,969
West Mountain	0	2,140
Total	194	70,745
Johnson Creek Route Alternative		
Stibnite	80	20,649
Yellowpine	9	9,101
Burntlog	69	15,494
Warm Lake	2	1,652
Landmark	6	5,647
East Mountain	9	15,969
West Mountain	0	2,140
Total	175	70,650

Source: Forest Service 2020e.

The Forest Service has preliminarily determined that the mine site, access roads, and utilities would affect, but not adversely affect, Canada lynx utilizing the area or their habitat. The off-site facilities would likely not affect transient Canada lynx under the 2021 MMP. Informal Section 7 ESA consultation is

ongoing with the USFWS. Therefore, based on the impact analysis for the Canada lynx and its habitat, the 2021 MMP would result primarily in localized, long-term, and permanent, minor impacts to the Canada lynx.

Mine Site

Although there is potentially suitable habitat for Canada lynx in the Canada lynx analysis area, there is no designated Critical Habitat on the PNF or BNF. The Operations Area Boundary and associated infrastructure may displace transient Canada lynx around the perimeter of these disturbances. This would be a large area, because the mine site area would measure approximately 6 miles long by 1 mile wide. Ruediger et al. (2000) found that Canada lynx often avoid large developments (e.g., ski resorts, facilities, etc.); therefore, it is likely that the Operations Area Boundary area would be a barrier to lynx movement, which would be a direct effect.

Direct mortality on lynx (e.g., vehicle collisions, destruction of dens, etc.) is not likely because lynx have not been documented in the Canada lynx analysis area; the analysis area does not contain prime denning habitat; and their movements are often nocturnal (Forest Service 2008d) when limited vehicle traffic would occur. Although some denning habitat may exist, the PNF and BNF are considered secondary lynx habitat (Interagency Lynx Biology Team 2013). The lack of denning habitats, on-going activity in the vicinity of the mine site, and absence of known resident individuals, make it unlikely that Canada lynx would be displaced by the 2021 MMP.

Indirect disturbance impacts to Canada lynx due to an increase in noise and light (e.g., blasting, vehicle traffic, operations, etc.) would be long-term. Construction, operation, and closure and reclamation activities at the mine site are likely to disturb any transient Canada lynx in the vicinity. Noise-reduction strategies would be used to reduce indirect effects on sensitive wildlife species. Additionally, light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. The noise and light reduction strategies employed in the SGP area are expected to reduce impacts on transient Canada lynx by minimizing the intensity and duration.

Access Roads

Direct mortality on lynx (e.g., vehicle collisions) is not likely because lynx have not been documented in the Canada lynx analysis area and their movements are often nocturnal (Forest Service 2008d) when limited vehicle traffic would occur. However, the 2021 MMP would include construction of 15 miles of new road between the existing Burnt Log Road (FR 447) to the Thunder Mountain Road (FR 50375) at the mine site, and several smaller segments of realignment and upgrades. Construction and the year-round operation (and plowing in winter), of the Burntlog Route could be a potential source of mortality for transient Canada lynx. During construction (when traffic levels would be highest), the AADT level would be 65. The slow speed limits on the Burntlog Route would likely limit potential mortality or injury for individual Canada lynx by giving drivers more time to react to wildlife occurrences.

Roadways under the 2021 MMP may displace or alter the movement of transient Canada lynx. Linkage areas for Canada lynx have been estimated to occur north to south across Warm Lake Road (CR 10-579) and east to west across the South Fork of the Salmon River (Claar et al. 2004). Construction and use of the new 15-mile-long portion of the Burntlog Route would fragment habitat and could act as a barrier to

movement (Interagency Lynx Biology Team 2013). Increased traffic on Warm Lake Road (CR 10-579), Johnson Creek Road (CR 10-413), and Stibnite Road portion of the McCall-Stibnite Road (CR 50-412) also would discourage lynx from crossing these roads. Ruediger et al. (2000) found that Canada lynx often avoid roadways more as they scale from gravel roads to highways; therefore, it is possible that the access roads could act as a barrier to transient lynx movement, which would be a direct effect.

Additionally, the existing 11-mile groomed OSV trail from Warm Lake to Landmark would be closed under the 2021 MMP, and an approximately 10.4-mile groomed trail would utilize the existing Cabin Creek Road (FR 467). Depending on the area of modeled habitat crossed, this would result in a net gain of 0.6 mile of groomed OSV trail. However, there would also be a 2-acre parking area west of FR 467, and a new 1.5-mile groomed access trail from the Forest Service Warm Lake Project Camp on Paradise Valley Road (FR 488). This trail would cross modeled habitat for Canada lynx, which would cause additional indirect impacts during the winter due to noise from OSVs. During construction, the current OSV trail associated with Johnson Creek Road would be moved to the side of the road, but there would be no expected changes as it is an existing route.

Disturbance impacts to Canada lynx along roadways due to noise and light would be long-term. The noise and light reduction strategies employed along access roads during the SGP may be sufficient to reduce impacts on transient Canada lynx.

Indirect impacts could occur in the form of increased competition for resources, including the competition created by plowing the Burntlog Route, which is currently not plowed for winter use. Currently, access in this area during the winter is limited to predators suited for over-snow travel (i.e., lynx and wolverine). Construction and operation of the Burntlog Route would open new corridors for predators and recreational activities. This could increase the predation on snowshoe hares by other predators (e.g., coyotes) or become a source of mortality for prey species (e.g., snowshoe hare, squirrels, etc.), which could affect food availability for transient Canada lynx. The increased human access and potential increase in hunting and trapping pressure for lynx and prey species in previously undisturbed areas also would be indirect effects.

Upon closure, the new segments of the Burntlog Route would be decommissioned, recontoured, and reclaimed, which would remove impacts associated with traffic or human access in the long-term.

Utilities

Direct impacts on Canada lynx due to construction and operation of the utility corridors, substations, and communication towers are not likely because lynx have not been documented in the Canada lynx analysis area and the construction activities would be temporary. However, transient Canada lynx may occur sporadically. There would be new utility access roads, as well as new transmission lines and upgraded transmission lines. Habitats along utility corridors would be maintained in low structure (e.g., low vegetation) condition, which would widen the ROW effect for Canada lynx (Interagency Lynx Biology Team 2013). The new transmission line between the mine site and Johnson Creek substation would not intersect any modeled habitat. Upon closure, this new segment would be decommissioned and reclaimed. Decommissioning of the transmission line under the 2021 MMP would remove any potential effects in the long term.

Potential disturbance impacts due to noise and light near the substations would be long-term and likely of low impact. However, the impacts from constructing the utility corridors, substations, and communication towers would be temporary but of higher intensity. The noise and light reduction strategies employed along utility corridors and near communication towers would reduce impacts on transient Canada lynx during construction (**Section 2.4.9**).

Off-site Facilities

Direct impacts on Canada lynx from construction of the off-site facilities are unlikely because lynx have not been documented in the Canada lynx analysis area. However, the off-site facilities would impact approximately 4 acres of habitat in the Canada lynx analysis area. Transient Canada lynx individuals would likely avoid the off-site facility locations, but traffic associated with the off-site facilities may increase the potential for vehicle-wildlife collisions. The slow speed limits imposed would likely limit potential mortality or injury for individual Canada lynx.

Disturbance impacts to Canada lynx at the off-site facility locations due to noise and light would mostly occur during construction, but some effects would persist long-term. The noise and light reduction strategies employed at the off-site facilities would likely be sufficient to reduce impacts on transient Canada lynx.

Northern Idaho Ground Squirrel

Figure 3.13-3 shows the components of the 2021 MMP within the NIDGS analysis area compared to modeled habitat. Direct and indirect effects to NIDGS are analyzed within a 1-mile buffer of alternative components. This buffer distance was developed using best professional judgment, in coordination with the USFWS, to encompass the area of potential indirect impacts from anthropogenic influences (e.g., noise, light, human presence) at the mine site and along access roads. Direct impacts to NIDGS modeled habitat across the wildlife analysis area would be approximately 63 acres for the 2021 MMP. Using a 1-mile buffer on SGP components, the indirect area of impacts on modeled NIDGS suitable habitat is approximately 5,248 acres.

The Forest Service has preliminarily determined that the access roads and utilities would affect, a small amount of NIDGS suitable habitat and direct and indirect impacts would be the same. The mine site and off-site facilities would not affect NIDGS habitat. Overall impacts from the SGP would affect, but not adversely affect, NIDGS. Informal Section 7 ESA consultation is ongoing with the USFWS. Therefore, based on the impact analysis for the NIDGS and its habitat, the 2021 MMP would result primarily in localized, temporary, and short-term, minor impacts to the NIDGS.

Mine Site

There are no known observations of NIDGS or modeled habitat in the mine site area. Therefore, mine site activities under all alternatives would not affect NIDGS.

Access Roads

Road maintenance and vehicle traffic could directly impact individual NIDGS, if sites become occupied in the future, where the 2021 MMP components cross modeled habitat. The Burntlog Route would not

cross modeled suitable habitat, and construction would therefore not impact NIDGS habitat. However, Warm Lake Road (CR 10-579) does cross modeled habitat, and the increased traffic could pose a direct risk of mortality due to collisions, particularly during the warmer months when the species is active. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) and the new 7-mile temporary groomed OSV trail along Johnson Creek Road would occur in and near close proximity to modeled habitat for NIDGS but would be unlikely to affect NIDGS due to its seasons (i.e., late fall and winter) of use.

The existing (23 miles of NFS roads and 75 miles of county roads) and new roads (43 miles of Burntlog Route and utility access roads) may act as a barrier to squirrel movement and dispersal, which would be an indirect effect. Increased habitat fragmentation between colonies could indirectly impact dispersal between populations, which could lead to genetic and demographic consequences. However, Yensen and Tarifa (2019, 2018) observed no evidence of NIDGS or their sign at the proposed logistics facility, Trout Creek, or at various private land parcels along the project but there is a possibility that NIDGS may occur in the future at suitable sites. Site buffers and monitoring would be used to avoid or mitigate direct impacts on squirrel populations. If sites are determined to be occupied in the future, mitigation measures, such as seasonal restrictions, site buffers, and monitoring would be used to avoid or mitigate direct impacts on squirrel populations.

Utilities

Construction of the utility corridors, substations, and communication towers, as well as maintenance activities in the ROWs, would likely impact individual NIDGS where the 2021 MMP components overlap modeled habitat known to support populations. However, Yensen and Tarifa (2019, 2018) observed no evidence of NIDGS, or their sign associated with the utility components (e.g., within modeled habitat near the upgraded transmission line and Scott Valley Substation); but there is a possibility that NIDGS may occur in the future at suitable sites. If sites are determined to be occupied in the future, mitigation measures, such as seasonal restrictions, site buffers, and monitoring would be used to avoid or mitigate direct impacts on squirrel populations. Reclamation during closure would reclaim the new transmission line segment, but this area does not overlap modeled habitat and would not likely provide additional modeled habitat.

Off-site Facilities

Construction of new off-site facilities is unlikely to impact individual NIDGS, because the 2021 MMP components do not overlap modeled habitat known to support populations. Yensen and Tarifa (2019, 2018) observed no evidence of NIDGS or their sign at the logistics facility; however, there is a possibility that NIDGS may occur in the future at suitable sites. Site checks and formal surveys would be conducted, as needed, prior to ground-disturbing activities in suitable habitat.

Vehicle traffic associated with the proposed off-site facilities could impact individual NIDGS where the 2021 MMP components cross modeled habitat known to support populations. Surveys of modeled habitat would be required before construction activities occur. All staff and contractors would be trained to reduce wildlife collisions.

Wolverine

Figure 3.13-4 shows the components of the 2021 MMP within the wolverine analysis area compared to modeled habitat. Direct and indirect effects to wolverine are analyzed within a 5-mile buffer of the 2021 MMP components, to assess all potential impacts, including noise disturbance. This buffer distance was developed using best professional judgment, in coordination with the USFWS, to address potential indirect impacts from anthropogenic influences and to account for potential impacts to wolverines moving through the general SGP area.

Persistent snow cover is used to assess impacts to wolverine habitat, particularly denning habitat. **Table 4.13-2** summarizes the areas (in acres) with persistent snow cover in numbers of years (from 1 through 7) impacted by the 2021 MMP. This model depicts the number of years, out of seven, in which snow cover was present in the spring in selected pixels (April 24 – May 15). This time frame generally corresponds to the period of wolverine den abandonment. Most dens were located in areas that were snow covered for 5 to 7 years out of the total 7 years studied, indicating that wolverines select den sites in areas with the highest consistent snow coverage. Thus, the direct impacts on these areas would be a direct effect to wolverines and denning activities.

To be conservative, areas with persistent snow cover for years 5 through 7 indicate higher quality habitat (particularly denning habitat) than years 1 through 4. Indirect impacts were calculated by including all modeled habitat (years 1 through 7) within 5 miles of 2021 MMP components.

Table 4.13-2 Direct and Indirect Impacts on Wolverine Habitat

Persistent Spring Snow Cover Years	Directly Impacted Habitat (acres)	Indirectly Impacted Habitat (acres)
2021 MMP		
1-4	2,149	245,018
5-7	193	97,922
Johnson Creek Route Alternative		
1-4	1,915	228,945
5-7	90	74,171

Source: Forest Service 2020e

Wolverines have been well documented in the wolverine analysis area and several individual wolverines have been captured in and adjacent to the wolverine analysis area (Forest Service 2012a, 2015c; Heinemeyer et al. 2017). The Forest Service has preliminarily determined that the 2021 MMP may directly and indirectly impact wolverine individuals and habitat resulting in adverse impacts but would not jeopardize the continued existence of the species. Informal Section 7 ESA consultation is ongoing with the USFWS. The 2021 MMP would impact the most habitat overall, reduce habitat connectivity, and result in the highest level of displacement (particularly from breeding and winter range), based on direct and indirect impacts. Therefore, based on the impact analysis for the wolverine and its habitat, the 2021 MMP would result in localized and long-term impacts to the wolverine, particularly the local population (part of larger Central Idaho sub-populations).

Mine Site

Direct impacts on wolverines are likely in the mine site area due to habitat loss (approximately 810 acres) and associated habitat fragmentation; year-round vehicle traffic causing disturbance and potential avoidance behavior; and risk of vehicle collisions causing injury or mortality. However, the mine site also contains open water areas and disturbed ground, which would not provide habitat for wolverines. The mine site would measure approximately 6 miles long by 1 mile wide during operations and consist of approximately 881 acres of new disturbance (810 acres of which is wolverine habitat) and approximately 859 acres of redisturbance to historic mining areas. The mine site and associated infrastructure would reduce habitat quality or displace resident and transient wolverines around the perimeter of the mine site, because wolverines typically avoid crossing large openings, such as clear-cuts, roadways, and developed areas (Banci 1994; Luensmann 2008; Scrafford et al. 2018). Because wolverines have been observed in the wolverine analysis area, and several individual wolverines have been captured, collared, and tracked via GPS in the PNF and BNF adjacent to the wolverine analysis area (Forest Service 2012a, 2015e; Heinemeyer et al. 2017), it is likely that wolverines would be directly affected through loss of quality habitat or displacement around the mine site.

Noise and light also could directly disturb potential wolverine foraging or denning behavior throughout the life of the SGP. Sustained levels of human disturbances, especially noise due to operations and helicopter flights to assist with exploratory drilling, is expected to contribute to increased levels of displacement of individual wolverines in the wildlife analysis area. Based on the analysis presented in **Section 4.6**, noise levels would be ambient levels within 1 to 2 miles of the mine site but would attenuate below ambient levels beyond 2 miles. The noise and light reduction strategies employed in the SGP area would reduce impacts on wolverines by minimizing the intensity and duration but would not completely eliminate them.

Access Roads

Direct impacts on wolverines are likely along the access roads due to habitat loss by access road construction, year-round vehicle traffic causing disturbance and potential avoidance behavior, over-snow recreation in the winter and new construction and plowing of the Burntlog Route through potential suitable habitat. Wolverines typically use remote areas that are not fragmented by roadways or other linear disturbances (Scrafford et al. 2018), and they have shown an aversion to crossing roadways with ROWs over 328 feet (100 meters) in width (Luensmann 2008). The Burnt Log (FR 447) and Thunder Mountain (FR 50375) roads would be widened to 26 feet wide, including shoulders, which is significantly narrower than 328 feet. Austin (1998) found that wolverines avoided areas within 100 meters of the Trans-Canada Highway and showed low use of areas within 1,000 meters (i.e., approximately 0.6 mile) of it. Scrafford and Boyce (2014) found that wolverines in northern Alberta tended to avoid areas within 300 meters (i.e., approximately 1,000 feet) of roadways, but regularly crossed paved roads with more than 100 vehicles per day (vpd). Traffic levels on the Burntlog Route would be highest during construction at about 65 vpd. Perpetua would limit their vehicle traffic outside the mine site to between 5:00 am and 7:00 pm resulting in approximately five mine-related vehicles traveling on Burntlog Route per hour during operations. Additionally, Squires et al. (2006) observed that wolverines in southwestern Montana crossed major roadways in areas with the narrowest distance between forest cover on each side. Construction of 15 miles of new road for the Burntlog Route would fragment habitat but may not act as a barrier to

movement due to its width and adjacent tree cover. Upon closure, the new segment of Burntlog Route would be recontoured and reclaimed, which would reduce direct and indirect impacts in the long-term.

An increase in big or small game collision mortality along roadways would be likely as the Burntlog Route segment would be new to the area and would be plowed throughout the winter. Because wolverines are largely scavengers in the winter (particularly on ungulate carrion), this could attract wolverines to roadways. Vehicle-wildlife collisions and habitat fragmentation would likely be the largest impact on the wolverine related to the 2021 MMP. Appropriate speed limits (i.e., generally 30 miles per hour [mph] or less) would be established for the Burntlog Route, mine site haul roads, and light vehicle access roads for the 2021 MMP to reduce the possibility of vehicle-wildlife collisions. All staff and contractors would be trained to reduce wildlife collisions. However, wildlife-vehicle collisions would still be possible. Removing wildlife collision mortality from roadways also could reduce some impacts.

Additionally, Heinemeyer et al. (2017) observed that wolverines responded negatively to increasing intensity of winter recreation in Idaho, Montana, and Wyoming; and that off-road or dispersed recreation triggered a stronger response than recreation concentrated on access roads. Female wolverines showed a stronger avoidance effect to motorized off-road recreation than males, and therefore experienced higher habitat loss (Heinemeyer et al. 2019). Kortello et al. (2019) also documented the negative association of forestry roads and winter recreation on wolverine distribution in the southern Columbia Mountains of Canada. The existing 11-mile groomed OSV trail from Warm Lake to Landmark would be closed under the 2021 MMP, and an approximately 10.4-mile groomed trail would utilize the existing Cabin Creek Road (FR 467). This trail would cross modeled habitat for wolverines, and associated increased recreational activity (e.g., snowmobiling, skiing, etc.) would likely cause indirect impacts to wolverines due to noise from OSVs as this would be a new winter route. Wolverines affected physically (i.e., habitat disturbance due to construction of the Burntlog Route) or behaviorally (i.e., displacement) would likely avoid the areas by moving away from the activities, which could have an impact on denning females. Public use of some roadways would likely also encourage additional backcountry recreational activities and hunting (e.g., big game, small game), which could cause direct mortality (i.e., vehicle collisions or illegal hunting [wolverines do not have a hunting season in Idaho]) or avoidance behavior.

Noise and increased lighting also could disturb potential wolverine foraging or denning habitat throughout the life of the SGP, but the area disturbed would be small relative to equivalent habitat in the contiguous forest area, and relative to the extremely large home range of wolverines (from 49 to 833 square miles; Heinemeyer et al. 2017). However, construction of the access roads would likely produce noise effects at farther distances. For example, as discussed in **Section 4.6**, noise from access road construction would attenuate to the threshold of 55 dBA approximately 0.57 miles from the source of activity based on distance alone; accounting for ground and atmospheric absorption, noise would attenuate to 55 dBA approximately 0.28 mile from the source. Estimated average hourly traffic noise levels would be approximately 48 dBA at 50 feet from the roadway and would attenuate to below ambient noise levels of 40 dBA within 500 feet from the roadway (Forest Service 2022d). Therefore, traffic noise could affect wolverines in the FCRNRW within 500 feet of the roadway during operations. The noise and light reduction employed along access roads would likely reduce impacts on wolverines by minimizing the intensity and duration but may not eliminate them entirely (**Section 2.4.9**).

The year-round maintenance and winter plowing of the Burntlog Route could potentially open new and more remote areas for other predators, such as wolves or coyotes, which could indirectly increase the competition for food resources with wolverines.

Utilities

Direct impacts on wolverines due to the utility corridors, substations, and communication towers are possible, and construction activities may cause wolverines to avoid these areas in the short-term. Some habitat would be removed for these areas along roadways, but they are not considered good habitat for wolverines due to their roadside location. The addition of new utility access roads, as well as new transmission lines and upgraded transmission lines would likely be a threat to individual wolverines. Upon closure, the new transmission line between the mine site and Johnson Creek substation would be decommissioned, removed, and reclaimed, which would reduce long-term impacts under the 2021 MMP.

Noise and light due to construction of utility corridors, substations, and communication towers could temporarily disturb potential wolverine foraging habitat, but the area disturbed would be small relative to equivalent habitat in the contiguous forest area, and relative to the extremely large home range of wolverines (from 49 to 833 square miles; Heinemeyer et al. 2017). For example, noise would attenuate to the threshold of 55 dBA approximately 0.28 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from transmission line construction would attenuate to 55 dBA approximately 0.15 mile from the source of activity (Forest Service 2022d). The noise and light reduction strategies employed along utility corridors and near communication towers would reduce impacts on wolverines but may not entirely eliminate them.

Off-site Facilities

Direct impacts on wolverines due to off-site facilities are possible, as there are known breeding territories in the wolverine analysis area, and they would likely travel throughout the area. Because wolverines typically use remote areas that are not fragmented by roadways or buildings, it is likely that resident or transient wolverine individuals would naturally avoid the off-site facility areas. There could be some displacement and avoidance of more remote facilities (e.g., Landmark Maintenance Facility).

Noise and increased lighting near the off-site facilities may disturb potential wolverine foraging or denning habitat although the area disturbed would be small relative to equivalent habitat in the contiguous forest area, and relative to the extremely large home range of wolverines. It is likely that resident or transient wolverine individuals would avoid the off-site facilities.

Traffic associated with the facilities may increase the potential for vehicle-wildlife collisions. All employees and contractors would be trained to reduce wildlife collisions. Any adverse wildlife encounters would be reported to appropriate state and federal wildlife managers, and in accordance with state and federal laws.

Monarch Butterfly

Direct impacts on the Monarch butterfly could include direct mortality (i.e., wildlife-vehicle collisions) or loss of habitat due to land clearing activities and land use changes. Indirect impacts could include reduced use of foraging habitat or reduced pollinator resources in the analysis area.

The 2021 MMP may directly and indirectly impact Monarch butterflies and habitat. However, due to the low potential for this species to occur in the wildlife analysis area, primarily due to a lack of suitable habitat, the 2021 MMP would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Therefore, based on the impact analysis for the Monarch butterfly and its habitat, the 2021 MMP would result in negligible impacts to the Monarch butterfly.

Mine Site

Direct effects on Monarch butterflies would primarily be due to loss and fragmentation of habitat; direct mortality through vehicle-wildlife collisions; and disturbance from light, noise, and increased human activity under the 2021 MMP. Displaced individuals would likely only be lost to the population if the adjacent environment were at maximum carrying capacity, to the extent that there were not enough available habitats to support them. In such a case, individuals would have to travel further, exposing them to predation, vehicle-wildlife collisions, and energetic loss. Monarch butterflies would likely be displaced around the perimeter of the mine site. Additional roadways in the mine site would expose individuals to direct vehicle collisions or increased predation in the wildlife analysis area.

Light and noise impacts associated with mine site activities are likely to disturb or displace Monarch butterflies. The estimated total average hourly noise levels from the mine site during the operations phase would be 102 dBA with blasting (Forest Service 2022d). Under the blasting scenario, SGP-related noise levels from the mine site during operations would attenuate to well below average ambient sound levels, because the impacts are reduced by vegetation, topography, and distance from the impact sources. Noise-reduction strategies would be used to reduce indirect effects on wildlife. Several terrestrial wildlife species have shown responses to anthropogenic noise levels beginning at 40 dBA (Shannon et al. 2016). However, because the existing (ambient) sound levels vary between 20 and 40 dBA, it is likely that SGP area wildlife, including the Monarch butterfly, would have a higher tolerance for noise. Equipment would have limited external lighting and would employ noise-minimizing practices.

Hazardous materials and chemicals would be transported to the mine site in USDOT-certified containers by trained personnel and would be stored in designated areas employing secondary containment measures. A Hazardous Materials Handling and Emergency Response Plan would address procedures for responding to accidental spills or releases of hazardous materials to minimize environmental effects. Used products would be stored on site in approved containers that would be separate from other trash and garbage products. Therefore, there is little chance of Monarch butterflies being exposed to hazardous materials.

Access Roads

Direct effects on the Monarch butterfly would primarily be due to loss and fragmentation of habitat; direct mortality through vehicle-wildlife collisions; and disturbance from light, noise, fugitive dust, and

increased human activity under the 2021 MMP. Construction of 15 miles of new road for the Burntlog Route would likely fragment habitat for the Monarch butterfly. The new 15-mile-long section of Burntlog Route would be constructed and maintained year-round and have an AADT level of 68 vehicles, which would likely directly disrupt Monarch butterfly movements The intensity of this impact could range from minor displacement to mortality. The duration ranges from temporary road construction to short-term. It is not expected that the increased risk of injury or mortality would become permanent, because the new segment of the Burntlog Route would be reclaimed, and traffic levels on the existing roads would return to current levels. The geographic extent of these impacts would be limited to the vicinity of the access road.

Light, noise, and fugitive dust (potentially high levels depending on phase of the Project) impacts associated with road construction, maintenance, and vehicle traffic are likely to disturb or displace the Monarch butterfly. SGP design features would help reduce these impacts, but not eliminate them. The estimated noise levels from SGP-related traffic on the Burntlog Route during the operations phase would be 49 dBA. The estimated SGP-related noise level from road maintenance activity on the mine access road would range up to 88 dBA during the summer months (Forest Service 2022d).

Utilities

Direct impacts on Monarch butterflies could include loss or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes under the 2021 MMP. The addition of new utility access roads, as well as new transmission lines and upgraded transmission lines, could impact individual Monarch butterflies. Construction impacts would likely displace wildlife but would be temporary. Vegetation would be cleared only in those areas necessary for 2021 MMP activities to preserve natural habitat to the greatest extent practicable. Noise-reduction strategies would be used to reduce indirect effects.

Off-site Facilities

Construction and operation of the off-site facilities under the 2021 MMP are unlikely to disturb Monarch butterflies, because construction activities are not planned to occur in suitable habitat used by them. Noise and lighting reduction strategies would be used to reduce indirect effects on species in the vicinity.

Although construction and operation of the off-site facilities themselves would likely not cause direct mortality to Monarch butterflies, vehicle traffic associated with the facilities could result in mortality.

Focal Species, Including Region 4 Sensitive Species and Management Indicator Species

Habitat Family 1 – Low Elevation, Old Forest

White Headed Woodpecker

Modeled habitat for the White-headed Woodpecker is shown in **Figure 3.13-8** with impacted acreages shown in **Table 4.13-3**.

Mine Site

The white-headed woodpecker is expected to be uncommon in the wildlife analysis area. Modeled habitat for white-headed woodpecker does not occur in the Operations Area Boundary and direct impacts are unlikely.

The 2021 MMP would cause an increase in noise and light in the vicinity of the Operations Area Boundary, which could cause indirect effects to white-headed woodpecker within 0.5 mile of the mine site. Wildlife behaviors that may change as a result of increased noise include nesting (loss of a nest would constitute "take") or foraging changes. Noise-reduction strategies would be used to lower potential indirect effects on woodpeckers.

Table 4.13-3 White-headed Woodpecker Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	0	N/A
Access Roads	4	N/A
Utilities	12	N/A
Off-site Facilities	0	N/A
Total	**16**	**1,473**
Johnson Creek Route Alternative		
Mine Site	0	N/A
Access Roads	17	N/A
Utilities	12	N/A
Off-site Facilities	0	N/A
Total	**29**	**1,485**

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (0.5 mile for woodpeckers) and occur outside of the SGP components.

Access Roads

There is very limited modeled habitat for white-headed woodpecker near the proposed Burntlog Route, so there would be only low direct impacts for the access roads (4 acres; **Table 4.13-3**). The 2021 MMP would cause an increase in noise and light in the wildlife analysis area due to road construction, vehicle traffic, and maintenance. However, most modeled habitat is adjacent to existing roadways (e.g., Warm Lake Road). Wildlife behaviors that may change as a result of increased noise, light, and fugitive dust due to increased traffic include nesting (loss of a nest equals "take") and/or foraging changes. Noise-reduction strategies would be used to lower indirect effects on woodpeckers (**Section 2.4.9**).

Utilities

There is very limited modeled habitat for white-headed woodpecker along the utility areas, so there would be very little direct impacts (approximately 12 acres; **Table 4.13-2**). Direct take of adult birds, nests,

eggs, or young due to construction or operational activities is unlikely, because white-headed woodpeckers are expected to be uncommon.

The 2021 MMP would cause an increase in noise and light in the wildlife analysis area, due to construction, operation, and maintenance of the utilities, particularly along the new transmission line between the mine site and Johnson Creek substation (where some modeled habitat occurs). Wildlife behaviors that may change as a result of increased noise include nesting (loss of a nest equals "take") and/or foraging changes. Noise-reduction strategies would be used to lower indirect effects on woodpeckers.

Off-site Facilities

The 2021 MMP is unlikely to disturb individual white-headed woodpeckers due to clearing and construction activities for off-site facilities, because none are expected to impact modeled habitat. However, indirect effects on woodpeckers could include reduced use of foraging or nesting habitat.

Lewis's Woodpecker

Modeled habitat for the Lewis's Woodpecker is shown in **Figure 3.13-9** with impacted acreages shown in **Table 4.13-4**.

Table 4.13-4 Lewis's Woodpecker Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	0	N/A
Access Roads	5	N/A
Utilities	6	N/A
Off-site Facilities	0	N/A
Total	**11**	**1,340**
Johnson Creek Route Alternative		
Mine Site	0	N/A
Access Roads	19	N/A
Utilities	6	N/A
Off-site Facilities	0	N/A
Total	**25**	**1,345**

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (0.5 mile for woodpeckers) and occur outside of the SGP components.

Mine Site

Effects to the Lewis's woodpecker at the mine site would be similar to the white-headed woodpecker analysis. No modeled habitat would be impacted in the mine site area (**Table 4.13-4**).

Access Roads

Effects to the Lewis's woodpecker along the access roads under the 2021 MMP would be similar to the white-headed woodpecker analysis. Approximately 5 acres of modeled habitat would be impacted along the access roads.

Utilities

Effects to the Lewis's woodpecker associated with the utilities under the 2021 MMP would be similar to the white-headed woodpecker analysis. Approximately 6 acres of modeled habitat would be impacted along the access roads.

Off-site Facilities

There would be no effects to the Lewis's woodpecker due the off-site facilities under the 2021 MMP.

Habitat Family 2 – Broad Elevation, Old Forest

American Three-toe Woodpecker

Modeled habitat for the American three-toed Woodpecker is shown in **Figure 3.13-10** with impacted acreages shown in **Table 4.13-5**.

Table 4.13-5 American Three-toed Woodpecker Direct and Indirect impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	30	N/A
Access Roads	10	N/A
Utilities	17	N/A
Off-site Facilities	0	N/A
Total	**57**	**2,724**
Johnson Creek Route Alternative		
Mine Site	29	N/A
Access Roads	1	N/A
Utilities	17	N/A
Off-site Facilities	1	N/A
Total	**48**	**2,224**

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (0.5 mile for woodpeckers) and occur outside of the SGP components.

The 2021 MMP would cause an increase in noise and light in the woodpecker analysis area, due to construction, operation, and maintenance of the utilities. Wildlife behaviors that may change as a result of increased noise and light include nesting (loss of a nest equals "take") and/or foraging changes. Noise-reduction strategies would be used to reduce indirect effects on woodpeckers.

Mine Site

While there is modeled habitat for American three-toed woodpeckers in the mine site area, there are no documented occurrences, and they are expected to be rare. However, there would be a direct impact of 30 acres of modeled habitat in the mine site area for American three-toed woodpeckers under the 2021 MMP (**Table 4.13-5**). Removal of snag trees would cause a loss of suitable habitat for this species, which would likely displace resident birds. Adjacent areas contain similar habitat types, but individual birds may face more competition for these areas, which would be an indirect effect. Direct take of adult birds due to construction or operational activities is possible, but unlikely, because most individuals are expected to avoid areas of activity and they are rare in the mine site area. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. To the extent practicable, trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although design features would reduce impacts, there would still be a decrease in modeled habitat.

The 2021 MMP would cause an increase in noise and light in the woodpecker analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting (loss of a nest equals “take”) and/or foraging changes. Noise-reduction strategies would be used to reduce indirect effects on woodpeckers.

Access Roads

There would be a direct impact of 10 acres to modeled habitat along the Burntlog Route for American three-toed woodpeckers under the 2021 MMP (**Table 4.13-4**). Removal of snag trees along this roadway would cause a loss of suitable habitat for this species. Direct take of adult birds due to construction or operational activities is unlikely because they are expected to be uncommon. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. To the extent practicable, trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although design features would reduce impacts, there would still be a decrease in habitat.

The 2021 MMP would cause an increase in noise, light, and fugitive dust in the woodpecker analysis area, due to road construction, vehicle traffic, and maintenance. Wildlife behaviors that may change as a result of increased noise include nesting (loss of a nest equals “take”) and/or foraging changes. Noise-reduction strategies would be used to lower indirect effects on woodpeckers. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt American three-toed woodpeckers due to OSV noise.

Utilities

There would be a direct impact of 17 acres of modeled habitat along the utilities for American three-toed woodpeckers under the 2021 MMP (**Table 4.13-5**). Removal of snag trees near utility corridors, substations, and communication towers would cause a loss of suitable habitat for this species, which would likely displace any resident birds. Adjacent areas contain similar habitat types, but individual birds

may face more competition for these areas, which would be an indirect effect. Direct take of adult birds due to construction or operational activities is unlikely because they are expected to be uncommon. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. This could occur along the new transmission line segment between the mine site and Johnson Creek substation or along the upgraded transmission line segments along Johnson Creek Road and Warm Lake Road. To the extent practicable, trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although design features would reduce impacts, there would still be a decrease in habitat.

Off-site Facilities

The 2021 MMP is unlikely to disturb individual American three-toed woodpeckers due to clearing and construction activities for off-site facilities, because none of the facilities are expected to overlap modeled habitat. However, indirect effects on woodpeckers could include reduced use of foraging or nesting habitat within 0.5 mile of the off-site facilities due to noise and light.

Black-backed Woodpecker

Modeled habitat for the black-backed Woodpecker is shown in **Figure 3.13-11** with impacted acreages shown in **Table 4.13-6**.

Table 4.13-6 Black-backed Woodpecker Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	49	N/A
Access Roads	20	N/A
Utilities	20	N/A
Off-site Facilities	0	N/A
Total	**89**	**7,420**
Johnson Creek Route Alternative		
Mine Site	45	N/A
Access Roads	14	N/A
Utilities	20	N/A
Off-site Facilities	1	N/A
Total	**80**	**6,244**

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (0.5 mile for woodpeckers) and occur outside of the SGP components.

Mine Site

Effects to the black-backed woodpecker at the mine site would be similar to the American three-toed woodpecker analysis. However, there would be a direct impact of 49 acres of modeled habitat under the 2021 MMP (**Table 4.13-6**).

Access Roads

Effects to the black-backed woodpecker along the access roads would be similar to the American three-toed woodpecker analysis. The 2021 MMP would have a direct impact of 20 acres (**Table 4.13-5**). This would primarily occur due to construction of the Burntlog Route through modeled habitat. Indirect impacts (due to noise, light, and fugitive dust from construction and increased traffic) would occur within 0.5 mile of the Burntlog Route as well.

Utilities

Effects to the black-backed woodpecker associated with the utilities would be similar to the American three-toed woodpecker analysis.

Off-site Facilities

Effects to the black-backed woodpecker at the off-site facilities under the 2021 MMP would be similar to the American three-toed woodpecker analysis.

Dusky Grouse

Figure 3.13-12 and **Table 4.13-7** shows the components of the 2021 MMP within the wildlife analysis area compared to modeled habitat.

Table 4.13-7 Dusky Grouse (Summer) Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	0	N/A
Access Roads	20	N/A
Utilities	140	N/A
Off-site Facilities	0	N/A
Total	**160**	**9,045**
Johnson Creek Route Alternative		
Mine Site	0	N/A
Access Roads	68	N/A
Utilities	140	N/A
Off-site Facilities	0	N/A
Total	**208**	**9,042**

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (1.0 mile for dusky grouse) from the action alternatives and occur outside of the SGP components.

Mine Site

Modeled summer habitat for dusky grouse is limited and occurs only in the northern portion of the Operations Area Boundary. However, no modeled habitat would be directly impacted by the 2021 MMP in the Operations Area Boundary.

The 2021 MMP would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Dusky grouse behaviors that may change as a result of increased noise and light include changes in nesting (loss of a nest equals "take") and/or foraging patterns that could lead to fragmentation of habitat. Noise-reduction strategies would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Additionally, light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on dusky grouse would differ depending on the specific conditions at each individual 2021 MMP component location based on the density of vegetation and proximity to adjoining hillsides and valleys.

Direct and indirect effects for dusky grouse would likely be exposure to emissions and a reduction in insects due to emissions, which could affect dusky grouse during the brood-rearing season (summer).

Insects and insectivorous birds may be exposed to metals (e.g., mercury) and other elements from atmospheric emissions and tailings piles associated with gold and silver mining activities (Custer et al. 2009; Eagles-Smith et al. 2018; Jones and Miller 2005). Emissions of metals from mine operations and ore processing, in the form of particulate matter and dust, may be deposited directly on local soils and waterways. In addition, rainwater and snow melt may provide a pathway for these elements to leach from tailings piles or be physically transported as solid particles into adjacent waterbodies. These elements may enter the food web through plants and insects and then be consumed by insectivorous wildlife, potentially causing injury if exposure is sufficient, therefore, there would likely be direct and indirect impacts to insectivorous birds like the dusky grouse.

Access Roads

The 2021 MMP could directly disturb dusky grouse in the wildlife analysis area through habitat removal and disturbance. The new segment of the Burntlog Route would be decommissioned and reclaimed during mine closure, but the effects would still be considered permanent due to the long time period. The Burntlog Route does not cross much modeled suitable habitat, but there would still be approximately 20 acres of direct impacts (**Table 4.13-7**). The construction traffic (AADT of 65) and operation traffic (AADT of 50) associated with the workforce, supplies, haulage, and other miscellaneous traffic, including road maintenance on the access roads, could expose individual dusky grouse to vehicle-wildlife collisions.

Also, noise and light disturbance from road construction, road maintenance, and routine vehicle traffic may disturb or displace individual grouse where they occur. Dusky grouse behaviors that may change as a result of increased noise and light include changes in nesting (loss of a nest equals "take") and/or foraging patterns that could lead to fragmentation of habitat.

Another indirect impact to dusky grouse along access roads could include fugitive dust. Dust associated with construction of facilities and roads, road maintenance, and vehicle travel may have indirect impacts on wildlife forage (e.g., plants and insects) (**Section 4.10**). Increased dust deposition could result in negative impacts on wildlife foods ranging from plant metabolic process inhibition, plant mortality, inhibition of pollination, or injury to pollinating insects. For SGP, the potential for dust deposition is likely to be higher in the immediate area of roads and other surface-disturbing actions but would diminish with distance from these actions. Dust impacts on wildlife forage plants and insects would start during

construction and continue through closure and reclamation. Some dust deposition also may occur in the post-closure period where monitoring-related travel on dirt roads would occur; however, this would be negligible. Effects of dust on plants and insects would occur immediately at the time of dust propagating activities and is likely to continue throughout the lifetime of SGP.

Utilities

The 2021 MMP would directly disturb dusky grouse in the wildlife analysis area through habitat loss due to clearing and construction activities for utility corridors, substations, and communication towers. Direct impacts would include 140 acres of modeled habitat along the utility features (**Table 4.13-7**). During operations, the utility ROWs would be maintained in a low vegetation growth stage, which could provide summer nesting or brood-rearing habitat for dusky grouse.

Noise and light disturbance from construction of the utility corridors, substations, and communication towers may temporarily disturb or displace individuals. These indirect effects would be considered temporary during construction. Once the construction is complete, it is expected that dusky grouse would resume use of the area.

Existing substations, structures, and upgraded transmission lines would exist in perpetuity. The new transmission line segment between the mine site and Johnson Creek substation (as well as the substation itself) would be removed and the area recontoured and reclaimed upon closure, which would reduce impacts after the life of the mine.

Off-site Facilities

There would be no direct impacts to modeled habitat due to the off-site facilities under the 2021 MMP. Construction and operation of the off-site facilities is also unlikely to have indirect effects on dusky grouse, as modeled habitat is limited within 1 mile of the off-site facilities.

Boreal Owl

Figure 3.13-13 shows the components of the 2021 MMP within the wildlife analysis area compared to modeled habitat (**Table 4.13-8**).

The 2021 MMP may directly and indirectly impact boreal owl individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. The 2021 MMP would directly impact 37 acres of habitat. Therefore, based on the impact analysis for the boreal owl and its habitat, the 2021 MMP would result primarily in localized, long-term and permanent, minor impacts to the boreal owl.

Mine Site

Boreal owls are known to occur and breed in the mine site area, and modeled habitat occurs as well. The 2021 MMP may directly disturb boreal owls in the wildlife analysis area through habitat loss, disturbance from increased human activity, and helicopter use associated with some exploratory drilling support.

Table 4.13-8 Boreal Owl Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	20	N/A
Access Roads	9	N/A
Utilities	8	N/A
Off-site Facilities	0	N/A
Total	37	9,175
Johnson Creek Route Alternative		
Mine Site	15	N/A
Access Roads	13	N/A
Utilities	8	N/A
Off-site Facilities	0	N/A
Total	36	7,755

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (1.0 mile for owls) and occur outside of the SGP components.

Approximately 20 acres of modeled habitat would be directly impacted or removed at the mine site under the 2021 MMP (**Table 4.13-8**). Direct take of adult birds due to construction or operational activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. To the extent practicable, trees found to contain nests or cavities (often used by boreal owls) would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Timing restrictions would restrict some activities within a certain radius of active nest trees for raptor species, which would help reduce habitat impacts. For example, the Forest Service would require restricting activities between March 1 and July 30 which occur up to 1,500 feet from active boreal owl nest sites, and a 350-foot ground disturbance buffer would be maintained around active nests, with some exceptions (**Section 2.4.9**). Although design features would reduce impacts, there would still be a decrease in modeled habitat.

The boreal owl also could be impacted by direct collision risks with structures at the mine site. Electric transmission line structures to serve 2021 MMP facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted).

The 2021 MMP would cause an increase in noise, light, and emissions in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting (loss of a nest equals “take”) and/or foraging changes. Bright lighting can disrupt feeding activities for many owl species. Noise-reduction strategies would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Therefore, indirect impacts on wildlife

would differ depending on the specific conditions at each individual 2021 MMP component location based on the density of vegetation and proximity to adjoining hillsides and valleys.

A possible indirect effect is that there could be a reduction in insects as prey species near the mine site activities. Any actions resulting in a decrease to insects could impact the boreal owl, including direct removal of foraging habitat (e.g., understory vegetation) or effects from fugitive dust and emissions.

Insects and insectivorous birds may be exposed to metals (e.g., mercury) and other elements from atmospheric emissions and tailings piles associated with gold and silver mining activities (Custer et al. 2009; Eagles-Smith et al. 2018; Jones and Miller 2005). Emissions of metals from mine operations and ore processing, in the form of particulate matter and dust, may be deposited directly on local soils and waterways. In addition, rainwater and snow melt may provide a pathway for these elements to leach from tailings piles or be physically transported as solid particles into adjacent waterbodies. These elements may enter the food web through plants and insects and then be consumed by insectivorous wildlife, potentially causing injury if exposure is sufficient, therefore, there would likely be indirect impacts to insectivorous birds like the boreal owl.

Access Roads

The 2021 MMP could disturb individual boreal owls in the wildlife analysis area through direct habitat loss (9 acres) due to tree clearing, road construction, and increased human activity along the access roads (**Table 4.13-8**). Direct take of adult birds due to these activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. Timing restrictions described for the mine site would be used to reduce impacts.

Additionally, increased vehicle traffic is likely to disturb or displace individuals from roadside habitats. Plowing of the Burntlog Route over the winter would introduce additional noise and disturbance, which could affect wintertime use by boreal owls. Noise-reduction strategies would be used to reduce indirect effects on owls. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt boreal owls due to OSV noise.

Utilities

The 2021 MMP could disturb individual boreal owls in the wildlife analysis area through direct habitat loss (8 acres) due to clearing and construction activities for utility corridors, substations, and communication towers. Direct take of adult birds due to these activities is unlikely because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. Timing restrictions described for the mine site would be used to reduce impacts.

The cell tower, communication tower, repeater sites, and new or upgraded 138-kV transmission line would be a potential source of mortality for boreal owls (APLIC 2012). In the long term, the transmission line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Transmission line structures to serve 2021 MMP facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted). However, the long-term presence of structures and communication towers would pose a

risk of collision and direct mortality. Upon closure, the new segment of transmission line between the mine site and Johnson Creek substation would be reclaimed.

Noise and light from construction of the utility corridors, substations, and cell tower, and repeater sites is likely to disturb or displace individuals. However, construction of these areas would be temporary, and it is not expected to become a barrier to long-term movement or to fragment habitat. Once the construction is complete, it is expected that owls would resume use of the area.

Off-site Facilities

The 2021 MMP would not have any direct impacts on modeled habitat due to clearing and construction activities for off-site facilities. Modeled habitat within 1 mile of the off-site facilities is limited, but the 2021 MMP could disturb individual boreal owls in the wildlife analysis area through noise increases due to construction or operation of the off-site facilities. Noise-reduction strategies would be used to lower indirect effects on the boreal owl. Lighting BMPs would be used to reduce indirect effects on sensitive wildlife species (**Section 2.4.9**). Buildings would have limited external lighting and would employ noise-minimizing practices.

Fisher

Figure 3.13-14 shows the components of the 2021 MMP within the wildlife analysis area compared to modeled habitat (**Table 4.13-9**).

The 2021 MMP may directly and indirectly impact fisher individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Therefore, based on the impact analysis for the fisher and its habitat, the 2021 MMP would result primarily in localized, long-term and permanent, minor impacts to the fisher.

Mine Site

Approximately 30 acres of direct impacts to modeled habitat would occur in the mine site under the 2021 MMP (**Table 4.13-9**). Olson et al. (2014) observed that although fishers are capable of long-distance dispersal movements (e.g., 6.2 miles), large expanses of non-favorable habitat may prevent them from doing so and become a barrier to movement. As the mine site would be approximately 6 miles long by 1 mile wide, it could fragment habitat.

These same effects also could reduce prey availability or redistribute their populations in the wildlife analysis area, causing them to travel further for foraging opportunities, which would indirectly affect the fisher. Noise and light at the mine site could also indirectly impact fishers.

Table 4.13-9 Fisher Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	30	N/A
Access Roads	10	N/A
Utilities	14	N/A
Off-site Facilities	0	N/A
Total	**54**	**5,866**
Johnson Creek Route Alternative		
Mine Site	30	N/A
Access Roads	1	N/A
Utilities	14	N/A
Off-site Facilities	<1	N/A
Total	**45**	**4,767**

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (1.0 mile for fisher) and occur outside of the SGP components.

Access Roads

Approximately 10 acres of direct impacts to modeled habitat would occur along the access roads under the 2021 MMP (**Table 4.13-9**). The new 15-mile-long section of Burntlog Route would be used and plowed year-round; and along with all other access roads and other roads used for the SGP, would likely represent an increased potential for vehicle collisions as this species has been documented at wolverine monitoring stations along the existing Burnt Log Road. All employees and contractors would be trained to reduce wildlife collisions. The AADT for the 2021 MMP would be approximately 65 during construction and 50 during operations. There also is the potential for an increase in trapping, resulting from increased access in remote areas. Restricting public access on the Burntlog Route and removing roadkill from roadways would likely reduce the chance of mortality (**Section 2.4.9**). These same effects also could reduce prey availability in the SGP area, which would indirectly affect the fisher. Upon reclamation, the new section of the Burntlog Route would be decommissioned, re-contoured, and seeded to resemble pre-mining conditions, although the vegetation would likely continue to be dominated by grasses and forbs for many years. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt fishers due to OSV noise.

Utilities

Approximately 14 acres of direct impacts to modeled habitat would occur along the utilities under the 2021 MMP (**Table 4.13-9**). Direct impacts on the fisher would include disturbance or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes. Direct impacts would occur along new transmission lines (between the mine site and Johnson Creek substation) and along upgraded transmission lines (between Johnson Creek Road and the Thunderbolt Tap substation, and along Warm Lake Road). Construction impacts would likely displace individual fishers farther distances but displacement would be temporary. Vegetation would be cleared

only in those areas necessary for the 2021 MMP activities to preserve natural habitat to the greatest extent practicable. During operations, vegetation would be maintained in a low vegetation growth stage, and fishers would likely use the area again.

After mine closure is complete, the 8.5-mile new transmission line between the mine site and Johnson Creek substation would be removed, and fishers could continue to use modeled habitat in the area.

Off-site Facilities

Construction and operation of the off-site facilities for the 2021 MMP are unlikely to disturb the fisher, because construction activities are not planned to occur in modeled habitat. However, noise and light reduction strategies would be used to reduce indirect effects on them, as modeled habitat does occur adjacent to the Landmark Maintenance Facility.

Flammulated Owl

Figure 3.13-15 shows the components of the 2021 MMP and Johnson Creek Route Alternative within the wildlife analysis area compared to modeled habitat (**Table 4.13-10**).

Table 4.13-10 Flammulated Owl Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	1	N/A
Access Roads	3	N/A
Utilities	41	N/A
Off-site Facilities	0	N/A
Total	**45**	**6,507**
Johnson Creek Route Alternative		
Mine Site	1	N/A
Access Roads	22	N/A
Utilities	41	N/A
Off-site Facilities	0	N/A
Total	**64**	**6,507**

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (1.0 mile for owls) and occur outside of the SGP components.

The 2021 MMP may directly and indirectly impact flammulated owl individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Therefore, based on the impact analysis for the flammulated owl and its habitat, the 2021 MMP would result primarily in localized, long-term and permanent, minor impacts to the flammulated owl.

Mine Site

The 2021 MMP could directly disturb 1 acre of modeled habitat in the mine site area (**Table 4.13-10**), as modeled habitat is limited in this area. However, flammulated owls are known to occur in the wildlife analysis area. Direct take of adult birds due to construction or operational activities is unlikely because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. To the extent practicable, trees found to contain nests or cavities (often used by flammulated owls) would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered.

The 2021 MMP would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting (loss of a nest equals "take") and/or foraging changes. Bright lighting can disrupt feeding activities for many owl species. Because flammulated owls are primarily nocturnal, they also could be impacted by direct collision risks with structures at the mine site due to lighting. Transmission line structures to serve facilities under the 2021 MMP would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted).

A likely indirect effect is that there could be a reduction in prey species near the mine site activities and along access routes. Any actions resulting in a decrease to insects could impact the flammulated owl, including direct removal of foraging habitat or effects from fugitive dust and emissions. Flammulated owls are highly migratory and would primarily be impacted during the breeding season (mid-May to mid-August).

Insects and insectivorous birds, such as the flammulated owl, may be exposed to metals (e.g., mercury) and other elements from atmospheric emissions and tailings piles associated with gold and silver mining activities (Custer et al. 2009; Eagles-Smith et al. 2018; Jones and Miller 2005). Emissions of metals from mine operations and ore processing, in the form of particulate matter and dust, may be deposited directly on local soils and waterways. In addition, rainwater and snow melt may provide a pathway for these elements to leach from tailings piles or be physically transported as solid particles into adjacent waterbodies. These elements may enter the food web through plants and insects and then be consumed by insectivorous wildlife, potentially causing injury if exposure is sufficient, therefore, there would likely be indirect impacts to insectivorous birds like the flammulated owl.

Access Roads

The 2021 MMP could disturb individual flammulated owls in the wildlife analysis area through direct habitat loss (3 acres; **Table 4.13-10**) due to tree clearing, road construction, and increased human activity in the access roads. Direct take of adult birds due to these activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is likely that nests, eggs, and young would be directly disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. Additionally, increased vehicle traffic is likely to directly disturb or displace individuals from roadside habitats.

Noise-reduction strategies would be used to reduce indirect effects on owls. Cutting of trees for 2021 MMP activities would avoid avian tree nests, where feasible; and a Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although design features would reduce direct impacts, there would still be a decrease in habitat due to construction of the Burntlog Route.

Another indirect impact to flammulated owls along access roads could include fugitive dust. Dust associated with construction of facilities and roads, road maintenance, and vehicle travel may have indirect impacts on owl prey (**Section 4.10**). Increased dust deposition could result in negative impacts on wildlife foods ranging from plant metabolic process inhibition, plant mortality, inhibition of pollination, or injury to pollinating insects. For SGP, the potential for dust deposition is likely to be higher in the immediate area of roads and other surface-disturbing actions but would diminish with distance from these actions. Dust impacts on wildlife forage plants and insects would start during construction and continue through closure and reclamation. Some dust deposition also may occur in the post-closure period where monitoring-related travel on dirt roads would occur; however, this would be negligible. Effects of dust on plants and insects would occur immediately at the time of dust propagating activities and is likely to continue throughout the lifetime of the SGP.

Utilities

The 2021 MMP could disturb individual flammulated owls in the wildlife analysis area through direct impacts of 41 acres to modeled habitat due to clearing and construction activities for utility corridors, substations, and communication towers. Direct take of adult birds due to these activities is unlikely because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young would be disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. To the extent practicable, trees found to contain nesting cavities would not be disturbed or cut. No trees with active nests would be cut.

The cell tower, communication tower, repeater sites, and new 138-kV transmission line would be a potential source of mortality for flammulated owls (APLIC 2012). The utility line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Electric transmission line structures to serve facilities under the 2021 MMP would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted). However, the long-term presence of structures and communication towers would pose a risk of collision and direct mortality. Upon closure and reclamation, the new transmission line between the mine site and Johnson Creek substation would be removed, which would eliminate these impacts.

Noise and light from construction of the utility corridors, substations, and communication towers is likely to disturb or displace individuals. However, construction of these areas would be temporary and is not expected to become a barrier to long-term movement or to fragment habitat. Once the construction is complete, it is expected that owls would resume use of the area. The noise-reduction strategies described for the mine site and access roads would be employed along utility corridors and near communication towers, which would reduce noise impacts on flammulated owls.

Off-site Facilities

The 2021 MMP are unlikely to impact flammulated owls as there would be no direct impacts to modeled habitat. Additionally, indirect impacts would be unlikely as modeled habitat is very limited within 1 mile of the off-site facilities.

Great Gray Owl

Figure 3.13-16 shows the components of the 2021 MMP within the wildlife analysis area compared to modeled habitat (**Table 4.13-11**).

Table 4.13-11 Great Gray Owl Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	164	N/A
Access Roads	56	N/A
Utilities	50	N/A
Off-site Facilities	0	N/A
Total	270	21,437
Johnson Creek Route Alternative		
Mine Site	160	N/A
Access Roads	13	N/A
Utilities	50	N/A
Off-site Facilities	2	N/A
Total	225	16,305

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (1.0 mile for owls) and occur outside of the SGP components.

Mine Site

Great gray owls are documented in the area and modeled habitat occurs throughout the wildlife analysis area. The 2021 MMP would result in 164 acres of direct impacts to modeled habitat for great gray owl in the mine site area (**Table 4.13-11**). Direct take of adult birds due to construction or operational activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. This resident species occasionally nests early in the season (in the snow). To the extent practicable, trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Timing restrictions would restrict some activities within a certain radius of active nest trees for raptor species, which would help reduce habitat impacts. Although design features would reduce impacts, there would still be a decrease in modeled habitat.

The great gray owl also could be impacted by direct collision risks with structures at the mine site. Electric transmission line structures to serve 2021 MMP facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted).

The 2021 MMP would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting (loss of a nest equals "take") and/or foraging changes. Bright lighting can disrupt feeding activities for many owl species. Noise-reduction strategies would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Therefore, indirect impacts on wildlife would differ depending on the specific conditions at each individual 2021 MMP component location based on the density of vegetation and proximity to adjoining hillsides and valleys.

Access Roads

The 2021 MMP would result in 56 acres of direct impacts to modeled habitat for great gray owl associated with the Burntlog Route (**Table 4.13-11**). Direct take of adult birds due to these activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. Timing restrictions described for the mine site would be used to reduce impacts.

Additionally, increased vehicle traffic is likely to disturb or displace individuals from roadside habitats. Noise-reduction strategies would be used to reduce indirect effects on owls. Also, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt great gray owls due to OSV noise.

Utilities

There would be 50 acres of direct impacts to modeled habitat due to construction of the new substations and new transmission line between the mine site and Johnson Creek substation, in addition to the upgrades to transmission lines and substations between Johnson Creek Road and the Warm Lake substation, and along Warm Lake Road and Johnson Creek Road.

Direct take of adult birds due to these activities is unlikely because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. Timing restrictions described for the mine site would be used to reduce impacts.

The cell tower, communication tower, repeater sites, and new or upgraded transmission lines would be a potential source of mortality for great gray owls (APLIC 2012). In the long-term, the transmission line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Transmission line structures to serve 2021 MMP facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted). However, the long-term presence of structures and communication towers would pose a risk of collision and direct mortality. Upon closure and reclamation, the new transmission line between

the mine site and Johnson Creek substation would be removed, which would eliminate some of these impacts.

Noise and light from construction of the utility corridors, substations, and communication towers is likely to disturb or displace individuals within 1 mile of the SGP components. However, construction of these areas would be temporary, and it is not expected to become a barrier to long-term movement or to fragment habitat. Once the construction is complete, it is expected that owls would resume use of the area.

Off-site Facilities

The 2021 MMP would not have any direct impacts on modeled habitat due to clearing and construction activities for off-site facilities. However, the 2021 MMP could disturb individual great gray owls in the wildlife analysis area through noise pollution due to construction or operation of the off-site facilities. Noise-reduction strategies would be used to reduce indirect effects on the owls. Lighting BMPs would be used to reduce indirect effects on sensitive wildlife species.

Northern Goshawk

Figure 3.13-17 shows the components of the 2021 MMP within the wildlife analysis area compared to modeled habitat (**Table 4.13-12**).

Table 4.13-12 Northern Goshawk Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	49	N/A
Access Roads	20	N/A
Utilities	20	N/A
Off-site Facilities	0	N/A
Total	89	15,113
Johnson Creek Route Alternative		
Mine Site	45	N/A
Access Roads	15	N/A
Utilities	20	N/A
Off-site Facilities	1	N/A
Total	81	12,702

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (1.0 mile for raptors) and occur outside of the SGP components.

The 2021 MMP may directly and indirectly impact northern goshawk individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Based on the impact analysis for the northern goshawk and its habitat, the 2021 MMP would result primarily in localized, long-term and permanent, minor impacts to the northern goshawk.

Mine Site

Northern goshawks have been documented but are expected to be uncommon and there are no known nests in the wildlife analysis area. There would be 49 acres of direct impacts to modeled habitat in the mine site area under the 2021 MMP. Direct take of adult birds or nests, eggs, or young due to construction or operational activities is unlikely, as they are thought to be uncommon. However, to the extent practicable, trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Timing restrictions would restrict some activities within a certain radius of active nest trees for raptor species, which would help reduce habitat impacts. For example, the Forest Service would restrict activities within a 30-acre (650-foot radius) area surrounding active nests, with some exceptions (**Section 2.4.9**). Additionally, drilling operations, roadwork, and helicopter flights would be restricted within a 1,500-foot buffer of active goshawk nests from April 1 to August 15. Although design features would reduce impacts, there would still be a decrease in modeled habitat.

The northern goshawk could also be impacted by direct collision risks with structures at the mine site. Electric transmission line structures to serve 2021 MMP facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted).

The 2021 MMP would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include foraging changes.

Access Roads

The 2021 MMP would result in 20 acres of direct impacts to modeled habitat for northern goshawk associated with the Burntlog Route (**Table 4.13-12**). Direct take of adult birds or nests, eggs, or young due to these activities is unlikely, because most individuals are expected to avoid areas of activity and there are no known nests in the area. However, timing restrictions described for the mine site would be used to reduce potential impacts.

Additionally, increased vehicle traffic is likely to disturb or displace individuals from roadside habitats and would cause indirect impacts on northern goshawk. Noise-reduction strategies would be used to reduce indirect effects on raptor species. The 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt northern goshawks due to OSV noise.

Utilities

There would be 20 acres of direct impacts to modeled habitat due to construction of the new substations and new transmission line between the mine site and Johnson Creek substation, in addition to the upgrades to transmission lines and substations between Johnson Creek Road and the Warm Lake substation, and along Warm Lake Road and Johnson Creek Road. Direct take of adult birds or nests, eggs, or young due to these activities is unlikely because most individuals are expected to avoid areas of activity and they are not known to nest in the area.

The communication towers and new or upgraded transmission lines would be a potential source of mortality for northern goshawk. However, the transmission line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Upon closure and reclamation, the new transmission line between the mine site and Johnson Creek substation would be removed, which would eliminate some of these collision impacts.

Noise and light from construction of the utility corridors, substations, and communication towers could disturb or displace individuals within 1 mile of the SGP components. However, construction of these areas would be temporary, and it is not expected to become a barrier to long-term movement or to fragment habitat. Once the construction is complete, it is expected that northern goshawks would resume use of the area.

Off-site Facilities

The 2021 MMP would not have any direct impacts on modeled habitat due to clearing and construction activities for off-site facilities. Indirect impacts would also be unlikely as modeled habitat is limited within 1 mile of the off-site facilities.

Pileated Woodpecker

Figure 3.13-18 shows the components of the 2021 MMP within the wildlife analysis area compared to modeled habitat (**Table 4-13-13**).

Table 4.13-13 Pileated Woodpecker Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	0	N/A
Access Roads	0.5	N/A
Utilities	0.5	N/A
Off-site Facilities	0	N/A
Total	**1**	**373**
Johnson Creek Route Alternative		
Mine Site	0	N/A
Access Roads	0.5	N/A
Utilities	0.5	N/A
Off-site Facilities	0	N/A
Total	**1**	**374**

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (0.5 mile for woodpeckers) and occur outside of the SGP components.

Although modeled habitat is limited in the wildlife analysis area, individuals are present during the breeding season. The 2021 MMP would likely have no direct impacts on pileated woodpecker modeled habitat but may affect individuals. Therefore, based on the impact analysis for the pileated woodpecker and its habitat, the 2021 MMP would result primarily in localized, long-term and permanent, minor impacts to the pileated woodpecker.

Mine Site

Effects to the pileated woodpecker at the mine site under the 2021 MMP would be similar to the white-headed woodpecker analysis, as pileated woodpeckers and modeled habitat are uncommon in the mine site area. There are some documented occurrences in the Big Creek and Chamberlain areas, and it is possible they may utilize the wildlife analysis area. There would be no direct impacts to pileated woodpecker modeled habitat on the mine site under the 2021 MMP. Indirect impacts could include displacement due to noise or light, and design features described for the white-headed woodpecker would likely reduce those impacts.

Access Roads

Effects to the pileated woodpecker along the access roads under the 2021 MMP would be similar to the white-headed woodpecker analysis, as pileated woodpeckers and modeled habitat are rare along the access roads. There would be 0.5 acre of direct impacts to modeled habitat along the access roads for the 2021 MMP (**Table 4.13-13**). Indirect impacts could include displacement due to noise, light, or fugitive dust and design features described for the white-headed woodpecker would likely reduce those impacts.

Utilities

Effects to the pileated woodpecker associated with the utilities under the 2021 MMP would be similar to the white-headed woodpecker analysis, as pileated woodpeckers and modeled habitat are rare in the utility areas. There would be 0.5 acres of direct impacts to pileated woodpecker modeled habitat along the utilities under the 2021 MMP. Indirect impacts could include displacement due to noise or light, and design features described for the white-headed woodpecker would likely reduce those impacts.

Off-site Facilities

Effects to the pileated woodpecker at the off-site facilities under the 2021 MMP would be similar to the white-headed woodpecker analysis, as pileated woodpeckers and habitat are rare near the off-site facilities. There would be no direct impacts to pileated woodpecker modeled habitat for the off-site facilities under the 2021 MMP. Indirect impacts could include displacement due to noise or light, and design features described for the white-headed woodpecker would likely reduce those impacts.

Silver-haired Bat

Figure 3.13-19 shows the components of the 2021 MMP and Johnson Creek Route Alternative within the wildlife analysis area compared to modeled habitat (**Table 4.13-14**).

Table 4.13-14 Silver-haired Bat Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	44	N/A
Access Roads	30	N/A
Utilities	145	N/A
Off-site Facilities	0	N/A
Total	219	11,446
Johnson Creek Route Alternative		
Mine Site	43	N/A
Access Roads	87	N/A
Utilities	144	N/A
Off-site Facilities	1	N/A
Total	275	10,773

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (1.0 mile from mine site and 0.5 mile from other components for bats) and occur outside of the SGP components.

The 2021 MMP may directly and indirectly impact silver-haired bat individuals and habitat. Therefore, based on the impact analysis for the silver-haired bat and its habitat, the 2021 MMP would result primarily in localized, long-term and permanent, minor impacts to the silver-haired bat.

Mine Site

Silver-haired bats are documented in the wildlife analysis area and FCRNRW. There would be approximately 44 acres of direct impacts to modeled habitat at the mine site under the 2021 MMP (**Table 4.13-14**). Removal of large trees could reduce roosting habitat, while removal of open riparian habitats or small natural openings could reduce foraging habitat.

The 2021 MMP would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Silver-haired bat behaviors that may change as a result of increased noise and light include changes in roosting and foraging patterns that could lead to fragmentation of habitat. Noise-reduction strategies would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices Therefore, indirect impacts on silver-haired bats would differ depending on the specific conditions at each individual 2021 MMP component location based on the density of vegetation and proximity to adjoining hillsides and valleys.

Access Roads

There would be approximately 30 acres of direct impacts to modeled habitat along the access roads under the 2021 MMP, due to construction of the Burntlog Route (**Table 4.13-14**). Removal of large trees in this area could reduce roosting habitat. The new segment of the Burntlog Route would be decommissioned and reclaimed during mine closure, which would reduce impacts to silver-haired bats and potentially

create foraging habitat in the long-term. The operational traffic associated with the workforce, supplies, haulage, and other miscellaneous traffic, including road maintenance on the access roads, could expose individual bats to indirect impacts due to noise, light, and fugitive dust. Bat behaviors that may change as a result of increased noise, light, and fugitive dust include changes in roosting and foraging patterns that could lead to fragmentation of habitat.

Utilities

There would be approximately 145 acres of direct impacts to modeled habitat along the utilities under the 2021 MMP, due to clearing and construction activities for utility corridors, substations, and communication towers (**Table 4.13-14**). Removal of large trees during construction could reduce roosting habitat. The Forest Service would require that known roost sites and hibernacula be avoided during the roosting period whenever possible (**Section 2.4.9**). During operations, the utility ROWs would be maintained in a low vegetation growth stage, which could provide summer foraging habitat for silver-haired bats. Upon closure and reclamation, the new transmission line between the mine site and Johnson Creek substation would be removed and reclaimed, which would reduce habitat impacts.

Noise and light disturbance from construction of the utility corridors, substations, and communication towers may temporarily disturb or displace individual bats. Once the construction is complete, it is expected that silver-haired bats would resume use of the area.

Off-site Facilities

There would be no direct impacts to modeled habitat for silver-haired bat at any of the off-site facilities under the 2021 MMP. Indirect impacts would be unlikely as well, due to modeled habitat being limited around these facilities.

Habitat Family 3 – Forest Mosaic

Mountain Quail

Figure 3.13-20 shows the components of the 2021 MMP within the wildlife analysis area compared to modeled habitat (**Table 4.13-15**).

Mine Site

Mountain quail are believed to be rare in the wildlife analysis area, although modeled habitat is abundant and would be impacted. The 2021 MMP could directly disturb 102 acres of modeled habitat in the mine site area. Mountain quail are ground nesters in shrub-dominated riparian areas and could be at risk of direct nest damage associated with the vegetation clearing and ground disturbance. However, the likelihood of mountain quail nesting in the wildlife analysis area is low because suitable shrub-dominated riparian habitat is sparse in the 2021 MMP disturbance footprint, and the nearest observation of the species is approximately 8 miles west of the mine site (Strobilus Environmental 2017).

Implementation of the 2021 MMP would require removal of vegetation from several habitat types during the life of the mine, some of which would be reclaimed during closure and reclamation. The 2021 MMP would permanently impact a variety of wetlands and perennial and non-perennial streams, which could directly reduce habitat for mountain quail depending on specific riparian areas. Although riparian habitats

would be directly disturbed in the short term, portions of the area would be reclaimed in the long term, including impacted wetlands, stream channels, and associated riparian habitat (Forest Service 2022h).

The 2021 MMP would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Mountain quail behaviors that may change as a result of increased noise and light include modifications in nesting (loss of a nest equals "take") and/or foraging patterns that could lead to fragmentation of habitat. Noise-reduction strategies would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Indirect impacts during the brood-rearing season due to loss of insects from emissions and fugitive dust is discussed in the Dusky Grouse section.

Table 4.13-15 Mountain Quail Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	102	N/A
Access Roads	69	N/A
Utilities	233	N/A
Off-site Facilities	1	N/A
Total	**405**	**23,491**
Johnson Creek Route Alternative		
Mine Site	101	N/A
Access Roads	115	N/A
Utilities	232	N/A
Off-site Facilities	1	N/A
Total	**449**	**21,337**

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (1.0 mile for mountain quail) and occur outside of the SGP components.

The 2021 MMP may directly and indirectly impact mountain quail individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Based on the impact analysis for the mountain quail and its habitat, the 2021 MMP would result primarily in localized, short-term, long-term, and permanent, minor impacts to the mountain quail.

Access Roads

The 2021 MMP could directly disturb 69 acres (**Table 4.13-15**) of modeled habitat along the access roads. The 2021 MMP would also impact a variety of wetlands and perennial and non-perennial streams (Forest Service 2022h) along access roads, which could directly reduce habitat for mountain quail depending on riparian areas. The operational traffic associated with the workforce, supplies, haulage, and other miscellaneous traffic, including road maintenance on the access roads, could expose individual mountain quail to vehicle-wildlife collisions. The new segment of the Burntlog Route would be decommissioned and reclaimed during mine closure, but the effects would be considered long-term.

Noise, light, and fugitive dust disturbance from road construction, road maintenance, and routine vehicle traffic could potentially disturb or displace individual quail. Mountain quail behaviors that may change as a result of increased noise, light, and fugitive dust include modifications in nesting (loss of a nest equals "take") and/or foraging patterns that could lead to fragmentation of habitat. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross modeled habitat, which may disrupt mountain quail due to OSV noise. See the Dusky Grouse section for indirect impacts related to fugitive dust along access roads that could also impact mountain quail.

Utilities

The 2021 MMP could directly disturb 233 acres (**Table 4.13-15**) of modeled habitat due to clearing and construction activities for utility corridors, substations, and communication towers. Utility components under the 2021 MMP would impact a variety of wetlands and perennial and non-perennial streams (Forest Service 2022h). Direct impacts to forested wetlands would likely be permanent as ROW management practices generally do not allow the establishment of woody vegetation. Utility corridors would be maintained in a low vegetation stage during operations, which could disturb modeled habitat as well.

Noise and light disturbance from construction of the utility corridors, substations, and communication towers may temporarily disturb or displace individuals. These indirect impacts would be considered temporary during construction. Once the construction is complete, it is expected that mountain quail would resume use of the area.

Off-site Facilities

The 2021 MMP would directly disturb 1 acre of modeled habitat for the off-site facilities and up to 1 acre of wetlands and associated riparian habitat would be impacted. However, it is expected that most individuals would avoid these areas, and any habitat effects would be minor.

Indirect impacts would be unlikely as modeled habitat is limited near these facilities. However, noise-reduction strategies would be used to reduce any potential indirect impacts on mountain quail. Buildings would have limited external lighting and would employ noise-minimizing practices.

Habitat Family 5 – Forest and Range Mosaic

Gray Wolf

The 2021 MMP may directly and indirectly impact gray wolf individuals and habitat (i.e., general habitat types), but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Therefore, based on the impact analysis for the gray wolf and its habitat, the 2021 MMP would result primarily in localized, short-term, long-term, and permanent, minor impacts to the gray wolf.

Mine Site

Direct impacts on gray wolves would include habitat loss in the wildlife analysis area. Additional indirect impacts on gray wolves would include displacement due to noise and light or increased human activity. These same effects also could reduce prey availability or redistribute their populations in the wildlife analysis area, causing wolves to travel farther for foraging opportunities. This could expose them to

increased competition with other wolf packs as they seek new territory and would be a potential indirect effect.

Access Roads

Several wolf packs occur in the FCRNRW area, which is near the Burntlog Route. Direct impacts on gray wolves would include habitat loss and an increased potential of vehicle-wildlife collisions along the Burntlog Route. Vehicle traffic associated with the access roads could increase the risk of wildlife-vehicle collisions. All employees and contractors would be trained to reduce wildlife collisions. Perpetua would develop a wildlife mortality-reporting procedure and form to be used for reporting accidental 2021 MMP-related wildlife mortality. Any adverse wildlife encounters would be reported to appropriate state and federal wildlife managers, and in accordance with state and federal laws. Restricting public access on the Burntlog Route would likely reduce impacts due to mortality.

Indirect impacts would include displacement due to noise and light or increased human activity. The new road systems and groomed OSV trails could serve as hunting corridors for wolves, changing their movement patterns and indirectly increasing predation of big game species, including elk (Forest Service 2017b). Although additional roadways could expose gray wolves to hunting pressure from humans in the wildlife analysis area, hunting or discharge of firearms during construction and operations in the Operations Area Boundary by SGP employees and contractors would be prohibited. Signs would be posted throughout the mine site and off-site facilities and training would be provided to notify employees that hunting is prohibited, and employees would be prohibited from carrying firearms on any SGP site. Although design features would reduce impacts, there would still be a direct decrease in habitat, and increase in risk of disturbance and injury or mortality. These same effects also could reduce prey availability in the SGP area, causing wolves to range farther. This indirect effect also could expose them to increased competition with other wolf packs as they seek new territory.

Utilities

Direct impacts on gray wolves would include loss or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes. Construction impacts would likely displace wolves farther distances but would be temporary. Vegetation would be cleared only in those areas necessary for 2021 MMP activities to preserve natural habitat to the greatest extent practicable.

Off-site Facilities

Direct impacts on gray wolves would include habitat loss in the wildlife analysis area and could include displacement due to noise and light or increased human activity. These same effects also could reduce prey availability in the SGP area, which would indirectly affect the gray wolf.

Peregrine Falcon

The focal species selected for the WCS for the BNF and PNF represent the appropriate habitat types and are surrogates for many other species, including peregrine falcon. Thus, there are no specific habitat models available for this species.

The 2021 MMP may directly and indirectly impact peregrine falcon individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Therefore, based on the impact analysis for the peregrine falcon and its habitat, the 2021 MMP would result primarily in localized, short-term, long-term, and permanent, minor impacts to the peregrine falcon.

Mine Site

Direct impacts on peregrine falcon would include potential habitat loss in the wildlife analysis area. Indirect impacts would include displacement due to noise and light and increased human activity. These same effects also could reduce avian prey availability or redistribute their populations in the wildlife analysis area, which could indirectly impact falcons.

Access Roads

Direct impacts on peregrine falcon would include habitat loss within and adjacent to breeding territories that are known to occur in the FCRNRW area. Indirect impacts would include displacement due to noise and light from increased human activity and traffic.

Utilities

Direct impacts on peregrine falcons would include loss or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes. Construction impacts would likely displace falcons farther distances but would be temporary. Vegetation would be cleared only in those areas necessary for 2021 MMP activities to preserve natural habitat to the greatest extent practicable.

Off-site Facilities

Direct impacts on peregrine falcons would include habitat loss in the wildlife analysis area and could include displacement due to noise and light or increased human activity.

Rocky Mountain Bighorn Sheep

Figures 3.13-5 and **3.13-6** show the components of the 2021 MMP within the wildlife analysis area compared to modeled habitat (**Table 4.13-16**).

Habitat Impacts

Table 4.13-16 Rocky Mountain Bighorn Sheep Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres) - Summer	Indirectly Impacted Modeled Habitat (acres) - Summer	Directly Impacted Modeled Habitat (acres) - Winter	Indirectly Impacted Modeled Habitat (acres) - Winter
2021 MMP				
Mine Site	501	N/A	104	N/A
Access Roads	62	N/A	10	N/A
Utilities	73	N/A	23	N/A
Off-site Facilities	0	N/A	0	N/A

Project Component	Directly Impacted Modeled Habitat (acres) - Summer	Indirectly Impacted Modeled Habitat (acres) - Summer	Directly Impacted Modeled Habitat (acres) - Winter	Indirectly Impacted Modeled Habitat (acres) - Winter
Total	**636**	**12,673**	**137**	**2,755**
Johnson Creek Route Alternative				
Mine Site	500	N/A	104	N/A
Access Roads	57	N/A	22	N/A
Utilities	72	N/A	23	N/A
Off-site Facilities	0	N/A		N/A
Total	**629**	**10,842**	**149**	**2,668**

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (1.0 mile for bighorn sheep and occur outside of the SGP components.

The 2021 MMP may directly and indirectly impact Rocky Mountain bighorn sheep individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. However, due to their value as a big game species in Idaho, impacts may include potential changes in abundance and distribution of bighorn sheep, and therefore impacts to bighorn sheep hunting opportunities in the surrounding region. More summer habitat would be directly and indirectly impacted than winter habitat. Therefore, based on the impact analysis for the bighorn sheep and its habitat, the 2021 MMP would result primarily in localized, short-term, long-term, and permanent, moderate impacts to the bighorn sheep.

Mine Site

There is more Rocky Mountain bighorn sheep summer habitat in the vicinity of the mine site than winter habitat. As such, there would be approximately 501 acres of direct impacts to summer modeled habitat and 104 acres of winter modeled habitat under the 2021 MMP at the mine site (**Table 4.13-16**). This direct loss of habitat would displace any individuals that occur in the wildlife analysis area, which appears to be limited. The mine site and associated infrastructure may displace sheep around the perimeter of the disturbances. Rocky Mountain bighorn sheep are very mobile and able to avoid localized direct threat of injury or mortality. Although additional roadways near the mine site could expose individuals to direct vehicle collisions and associated mortality. Personnel and contractors traveling in vehicles would be required to observe posted speed limits or state secondary road speed limits, and to drive at speeds appropriate to reduce the possibility of vehicle-wildlife accidents.

Light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on sheep would differ depending on the specific conditions at each 2021 MMP component location, based on the density of vegetation and proximity to adjoining hillsides and valleys. As part of SGP design features, buildings, equipment, and drill rigs would have limited external lighting and use noise-reduction strategies when feasible (**Section 2.4.9**). The result would generally be a reduction in the area of habitat disturbed at most sites.

There would be no hunting or discharge of firearms during construction and operations in the Operations Area Boundary by SGP employees and contractors. Signs would be posted at the SGP area and training

would be provided to notify employees that hunting is prohibited, and employees would be prohibited from carrying firearms on the SGP site. However, illegal harvest of big game species is a potential risk and would be an indirect impact.

Access Roads

Because bighorn sheep are known to occur in the FCRNRW area, they could potentially be affected by loss of potential habitat along the access roads, and direct impacts would include approximately 62 acres of modeled summer habitat and 10 acres of modeled winter habitat. The new 15-mile-long section of

Burntlog Route would be constructed and plowed year-round and have an AADT level of 50 vehicles during operations, which would likely directly disrupt or alter Rocky Mountain bighorn sheep movements. The intensity of this impact could range from minor injury to mortality. The duration ranges from temporary road construction to short-term. It is not expected that the increased risk of injury or mortality would become permanent, because the new segment of the Burntlog Route would be reclaimed upon closure, and traffic levels on the existing roads would return to current levels. The geographic extent of these impacts would be limited to the vicinity of the access road. Additionally, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) would cross Rocky Mountain bighorn sheep winter habitat, which may disrupt them due to OSV noise.

Although additional roadways could expose Rocky Mountain bighorn sheep to increased illegal hunting pressure from humans in the wildlife analysis area, legal hunting is extremely limited in this area of Idaho and IDFG carefully manages Rocky Mountain bighorn sheep populations and regulates the relatively low number of permits issued each year; therefore, additional hunter access is unlikely to appreciably increase hunting pressure on Rocky Mountain bighorn sheep in the SGP area. Additionally, hunting or discharge of firearms during construction and operations in the Operations Area Boundary would be prohibited for SGP employees and contractors. Signs would be posted throughout the SGP area and training would be provided to notify employees that hunting is prohibited, and employees would be prohibited from carrying firearms on the SGP site. Legal public hunting along public access roads would continue to be allowed. Roadways also are used as corridors by predators such as wolves or mountain lions, which could indirectly increase predation on Rocky Mountain bighorn sheep.

Utilities

Direct impacts on Rocky Mountain bighorn sheep could include loss or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes. There would be 73 acres of direct impacts to modeled summer habitat and 23 acres of direct impacts to modeled winter habitat under the 2021 MMP for the utility corridors (**Table 4.13-16**). Construction impacts would likely displace wildlife farther distances, but this would be temporary. Vegetation would be cleared only in those areas necessary for 2021 MMP activities to preserve natural habitat to the greatest extent practicable.

Noise-reduction strategies would be used to reduce indirect effects on sheep. Equipment would have limited external lighting and would employ noise-minimizing practices.

Off-site Facilities

There would be no direct impacts to modeled summer or winter habitat due to construction and operation of the off-site facilities under the 2021 MMP. Indirect impacts would also be unlikely, as modeled habitat is limited within 1 mile of these facilities.

Habitat Family 7 – Forests, Woodland, and Sagebrush

Townsend's Big-eared Bat

The focal species selected for the WCS for the BNF and PNF represent the appropriate habitat types and are surrogates for many other species, including Townsend's big-eared bat. Thus, there are no specific habitat models available for this species.

The 2021 MMP may directly and indirectly impact Townsend's big-eared bat individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Therefore, based on the impact analysis for the Townsend's big-eared bat and its habitat, the 2021 MMP would result primarily in localized, long-term and permanent, minor impacts to the Townsend's big-eared bat.

Mine Site

Direct disturbance to the Townsend's big-eared bat would be possible through habitat loss at the mine site. Although some historic mine workings that may serve as winter hibernacula habitat are present in the wildlife analysis area, there are no known occurrences of the Townsend's big-eared bat. After closure and reclamation, the pit walls of the Hangar Flats and West End pits would be exposed for a long time period, which could potentially create roost sites for them. The Forest Service would require that any potential drill pad sites adjacent to any open mine workings or natural caves should be observed for the presence of bats. If necessary, to maintain key features of habitat or to avoid disruption, activities would be modified in coordination with the Forest Service (**Section 2.4.9**).

The 2021 MMP also would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Bat behaviors that may change as a result of increased noise or light include changes in roosting or foraging patterns that could lead to fragmentation of habitat. The potential effects on wildlife habitat are dependent on geographical conditions because sound propagation is reduced by distance, vegetation, and intervening topography. Noise-reduction strategies would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Refer to the silver-haired bat section, which discusses additional indirect impacts that could likely also impact the Townsend's big-eared bat, including emissions exposure and loss of insects due to air emissions and fugitive dust.

Access Roads Utilities

Disturbance to the Townsend's big-eared bat would be possible due to habitat loss along the access roads, but unlikely because of their limited occurrence in the area. Because they can occupy forested habitats within 15 miles of cave/rock crevices, they could potentially be displaced by the removal of summer roosting habitat.

Disturbance to the Townsend's big-eared bat due to road construction and vehicle traffic along the Burntlog Route also would be possible. Potential effects could include direct disturbance and displacement, although signal masking due to traffic noise is unlikely, because traffic noise does not overlap much with bat echolocation calls (Caltrans 2016). The noise-reduction strategies mentioned above employed along access roads would likely be sufficient to reduce noise impacts on the Townsend's big-eared bat. Refer to the silver-haired bat section, which contains additional indirect impacts that would likely also impact the Townsend's big-eared bat.

Utilities

Direct impacts on the Townsend's big-eared bat could include loss or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes. Construction impacts would likely displace wildlife farther distances but would be temporary. Vegetation would be cleared only in those areas necessary for the 2021 MMP activities to preserve natural habitat to the greatest extent practicable.

Noise and light reduction strategies would be used to reduce indirect effects on the Townsend's big-eared bat. Lighting impacts could alter the Townsend's big-eared bat's natural activities, but construction of these areas would be temporary. Refer to the silver-haired bat section, which contains additional indirect impacts that would likely also impact the Townsend's big-eared bat.

Off-site Facilities

Direct impacts on the Townsend's big-eared bat are unlikely near the off-site facilities, because no construction or infrastructure would impact the habitats used by the Townsend's big-eared bat in the wildlife analysis area. Noise and light reduction strategies would be used to reduce indirect effects on the Townsend's big-eared bat within 1 mile of these facilities. Equipment would have limited external lighting and would employ noise-minimizing practices. Lighting impacts could alter the Townsend's big-eared bat's natural activities, but construction of these areas would be temporary. Refer to the silver-haired bat section, which contains additional indirect impacts that would likely also impact the Townsend's big-eared bat.

Habitat Family 13 – Riverine Riparian and Wetland

Bald Eagle

The focal species selected for the WCS for the BNF and PNF represent the appropriate habitat types and are surrogates for many other species, including bald eagle. Thus, there are no specific habitat models available for this species.

The 2021 MMP may directly and indirectly impact bald eagle individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Therefore, based on the impact analysis for the bald eagle and its habitat, the 2021 MMP would result primarily in localized, long-term and permanent, minor impacts to the bald eagle.

Mine Site

The 2021 MMP could directly disturb bald eagles in the analysis area through habitat loss, disturbance from increased human activity, and helicopter flights. Direct take of adult birds due to construction or operational activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. Trees found to contain nests would not be disturbed or cut. A Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although design features would reduce impacts, there would still be a decrease in habitat.

The 2021 MMP would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting (loss of a nest equals “take”) and/or foraging changes. A likely indirect effect is that there would be a reduction in prey species (i.e., fish) within the mine site.

The bald eagle also could be impacted by direct collision risks with structures at the mine site. Transmission line structures to serve 2021 MMP facilities and the new 138-kV transmission line in the mine site would be a potential source of mortality for raptors (APLIC 2012). However, the utility line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species.

Access Roads

The 2021 MMP could directly disturb bald eagles in the wildlife analysis area through habitat loss due to tree clearing, road construction, and increased human activity along access roads. Direct take of adult birds due to these activities is unlikely, because most individuals are expected to avoid areas of activity. However, there are known eagle nests along Johnson Creek Road and Warm Lake, and it is possible that eagles would be displaced from these territories due to the increased traffic.

Roadkill from 2021 MMP traffic could attract Bald Eagles to roadsides where they also would be exposed to vehicle-wildlife collisions. Perpetua would establish appropriate speed limits (i.e., generally 30 mph or less) for the Burntlog Route, site haul roads, and light vehicle access roads to reduce the possibility of vehicle-wildlife collisions. All staff and contractors would be trained to observe posted speed limits and reduce wildlife collisions. However, wildlife-vehicle collisions are still a possibility. Any adverse wildlife encounters would be reported to appropriate state and federal wildlife managers. Restricting public access on the Burntlog Route and removing roadkill from roadways would likely reduce impacts due to mortality.

Noise-reduction strategies would be used to reduce indirect effects on bald eagles. Although timing restrictions would restrict some activities within a certain radius of active nest trees for raptor species, which would help reduce habitat impacts, some displacement and nest failure could occur. Cutting of trees for 2021 MMP activities would avoid avian tree nests, where feasible, and a Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although design features would reduce direct impacts, there would still be a decrease in habitat.

Utilities

The 2021 MMP could directly disturb bald eagles in the analysis area through habitat loss due to clearing and construction activities for utility corridors, substations, and communication towers. Direct take of adult birds due to these activities is unlikely because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young would be disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. To the extent practicable, trees found to contain nests would not be disturbed or cut. No trees with active nests would be cut.

The cell tower, communication tower, repeater sites, and new 138-kV transmission line would be a potential source of mortality for bald eagles (APLIC 2012). The utility line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Electric transmission line structures to serve 2021 MMP facilities would be designed and constructed to avoid raptor perching (to minimize the risk of being electrocuted). However, the long-term presence of structures and communication towers would pose a risk of collision and direct mortality.

Off-site Facilities

The 2021 MMP is unlikely to directly disturb bald eagles in the analysis area through habitat loss due to clearing and construction activities for off-site facilities.

The 2021 MMP could disturb individual bald eagles in the wildlife analysis area through noise and light due to construction of the off-site facilities. Noise-reduction strategies would be used to reduce indirect effects on bald eagles. Lighting BMPs would be used to reduce indirect effects on sensitive wildlife species. Buildings would have limited external lighting and would employ noise-minimizing practices.

Columbia Spotted Frog

Figure 3.13-7 shows the components of the 2021 MMP within the analysis area compared to the riparian analysis area (**Table 4.13-17**).

The focal species selected for the WCS for the BNF and PNF represent the appropriate habitat types and are surrogates for many other species, including Columbia spotted frog. Thus, there are no specific habitat models available for this species. However, the riparian analysis area has been used for estimating impacts to this amphibian. Indirect impacts are assessed by including any forested wetlands or riparian areas within 0.5 mile of SGP components.

The 2021 MMP may directly and indirectly impact Columbia spotted frog individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Therefore, based on the impact analysis for the Columbia spotted frog and its habitat, the 2021 MMP would result primarily in localized, short-term, long-term, and permanent, minor impacts to the Columbia spotted frog.

Table 4.13-17 Columbia Spotted Frog Direct and Indirect Impacts

Project Component	Directly Impacted Modeled Habitat (acres)	Indirectly Impacted Modeled Habitat (acres)
2021 MMP		
Mine Site	621	N/A
Access Roads	120	N/A
Utilities	302	N/A
Off-site Facilities	6	N/A
Total	**1,049**	**19,294**
Johnson Creek Route Alternative		
Mine Site	618	N/A
Access Roads	126	N/A
Utilities	301	N/A
Off-site Facilities	8	N/A
Total	**1,053**	**15,948**

Source: Forest Service 2020e.
N/A = indirect impacts are calculated by buffer distances (0.5 mile for Columbia spotted frog) and occur outside of the SGP components.

Mine Site

Amphibians are considered reliable indicators of environmental quality (Boyer and Grue 1995). Water quality criteria for frogs and other amphibians do not currently exist. Rather, the following discussion summarizes impacts on fish resources from chemical contaminants associated with SGP (**Section 4.12**), as fish have historically been used as surrogates for amphibians in evaluating chemical impacts in aquatic environments (Glaberman et al. 2019).

Despite analysis area improvements to water quality as a result of the removal and reclamation of legacy mine wastes, exceedances of the most stringent water quality standards (including both human health and aquatic life) for water column antimony, arsenic, copper, and mercury are anticipated to extend indefinitely throughout SGP post-closure. In considering only the aquatic life criteria, which are more relevant for the protection of fish species, impacts due to antimony and arsenic are not anticipated. For copper and mercury, impacts may be minimal but uncertainties in predicting future conditions exist. For copper, the Biotic Ligand Model-based criteria are preliminary and do not encompass the range of monitoring nodes and the range of variability required for Biotic Ligand Model implementation (Brown and Caldwell 2020c). For mercury, while the predicted concentrations do not exceed the aquatic life criterion based on water column, it is uncertain whether incremental change in water column concentrations beyond baseline would cause fish tissue concentrations to exceed the tissue-based criterion.

A Water Management Plan has been developed (Brown and Caldwell 2021b) and the Water Quality section (**Section 4.9**) provides more details regarding changes to water quality. The Fisheries and Aquatic Habitat section (**Section 4.12**) provides an analysis of changes and summary of effects on fish under the 2021 MMP.

The 2021 MMP could directly disturb Columbia spotted frog in the riparian analysis area through permanent impacts to wetlands in the mine site area. Up to 621 acres of direct impacts to this habitat would occur in the mine site (**Table 4.13-17**). Columbia spotted frogs have been observed in the riparian analysis area near the operational areas and open pits along the East Fork SFSR, and their presence is also likely based on habitat (i.e., streams and wetlands). Disturbance of water sources would occur in areas occupied by spotted frogs, placing them at risk of direct mortality or displacement. The presence of traffic in the mine site could expose them to direct mortality from vehicles as well.

The Forest Service would require that potential water sources be surveyed for Columbia spotted frog egg masses and other amphibians after ice melt, and the 2021 MMP would avoid disturbing any water sources with identified egg masses or other species, with some exceptions (**Section 2.4.9**). Construction of a natural stream channel for the East Fork SFSR and reclaimed stream channels, wetlands, and riparian habitat (Forest Service 2022h) upon closure would reclaim some riparian habitat for Columbia spotted frogs in the future.

The 2021 MMP would cause an increase in noise and light in the riparian analysis area, mostly in the vicinity of the mine site. Columbia spotted frogs could be impacted by an interference in communication during breeding activities. Noise-reduction strategies would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices Additionally, light and noise impacts could be reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on wildlife would differ depending on the specific conditions at each individual 2021 MMP component location based on the density of vegetation and proximity to adjoining hillsides and valleys.

Another indirect effect for Columbia spotted frog could occur in wetlands affected by fugitive dust and emissions.

Amphibians and insects may be exposed to metals (e.g., mercury) and other elements from atmospheric emissions and tailings piles associated with gold and silver mining activities (Custer et al. 2009; Eagles-Smith et al. 2018; Jones and Miller 2005). Emissions of metals from mine operations and ore processing, in the form of particulate matter and dust, may be deposited directly on local soils and waterways. In addition, rainwater and snow melt may provide a pathway for these elements to leach from tailings piles or be physically transported as solid particles into adjacent waterbodies. These elements may enter the food web through plants and insects and then be consumed by insectivorous wildlife, potentially causing injury if exposure is sufficient, therefore, there would likely be indirect impacts to amphibians like the Columbia spotted frog.

Access Roads

The 2021 MMP could directly disturb Columbia spotted frog in the riparian analysis area through impacts to wetlands along the access roads, and up to 120 acres of modeled habitat could be impacted along the Burntlog Route. Road construction, culvert installation, disturbance of roadside ditches that contain enough water for egg laying, and increased traffic levels may cause direct mortality. Restricting public access on the Burntlog Route would likely reduce impacts due to mortality. Anurans (including Columbia spotted frogs) are very susceptible to mortality from roadways (Jochimsen et al. 2004) when they cross them or emerge from their eggs in the spring. The new segment of the Burntlog Route would be

decommissioned and reclaimed during mine closure, but the effects would mostly still be considered permanent due to the long time-period. As described for the mine site, potential water sources would be surveyed for Columbia spotted frog egg masses and other amphibians after ice melt, and the 2021 MMP would avoid disturbing any water sources with identified egg masses or other species.

The 2021 MMP would cause an increase in noise and light in the riparian analysis area, which could directly affect frogs along the access roads. These indirect impacts are described in the mine site section. Another indirect impact to amphibians along access roads could include fugitive dust. Dust associated with construction of facilities and roads, road maintenance, and vehicle travel may have indirect impacts on insects. Increased dust deposition could result in negative impacts to pollinating insects. For SGP, the potential for dust deposition is likely to be higher in the immediate area of roads and other surface-disturbing actions but would diminish with distance from these actions. Dust impacts on insects would start during construction and continue through closure and reclamation. Some dust deposition also may occur in the post-closure period where monitoring-related travel on dirt roads would occur; however, this would be negligible. Effects of dust on insects would occur immediately at the time of dust propagating activities and is likely to continue throughout the lifetime of SGP.

Utilities

The 2021 MMP could directly disturb Columbia spotted frogs in the riparian analysis area through impacts to wetlands due to clearing and construction activities for utility corridors, substations, and communication towers. Direct impacts to modeled habitat are estimated to be 302 acres under the 2021 MMP. The effects on wetlands would be considered temporary during construction. However, impacts to forested wetlands would likely be permanent as ROW management practices generally do not allow the establishment of woody vegetation. Construction activities associated with the utilities may cause direct mortality for some frogs.

Potential water sources would be surveyed for Columbia spotted frog egg masses and other amphibians after ice melt, and the 2021 MMP would avoid disturbing any water sources with identified egg masses or other species. The 2021 MMP would cause an increase in noise and light in the riparian analysis area, which could directly affect frogs in the utilities. These indirect impacts are described in the mine site section.

Off-site Facilities

The 2021 MMP would impact 6 acres of modeled habitat for construction of the off-site facilities (**Table 4.13-17**). It is possible that individual frogs could be directly or indirectly impacted from these activities. The operating procedures and design features would be used to reduce impacts where possible.

Idaho Species of Greatest Conservation Concern

Direct impacts on SGCN could include direct mortality (i.e., wildlife-vehicle collisions, removal of nest or roost trees, etc.) or loss of habitat due to land clearing activities and land use changes. Indirect impacts could include reduced use of foraging or breeding habitat or reduced prey resources in the analysis areas. The 2021 MMP may directly and indirectly impact SGCN (including general habitat, riparian, and alpine species) individuals and habitat. Therefore, based on the impact analysis for SGCN and their habitat, the

2021 MMP would result primarily in localized, short-term, long-term, and permanent, minor impacts to SGCN.

General Habitat Species

Mine Site

Direct effects on general habitat SGCN would primarily be due to loss and fragmentation of habitat, and disturbance from light, noise, and increased human activity. There would be a direct loss of habitat in the wildlife analysis area at the mine site under the 2021 MMP. Displaced individuals would likely only be lost to the population if the adjacent environment were at maximum carrying capacity, to the extent that there were not enough available habitats to support them. In such a case, individuals would have to travel farther, exposing them to predation risks and energetic loss.

Light and noise impacts associated with mine site activities are likely to disturb or displace these SGCN. Bird and bat behaviors that may change as a result of increased noise or light including changes in roosting or foraging patterns that could lead to fragmentation of habitat. The estimated total average hourly noise levels from the mine site during the operations phase would be 102 dBA with blasting, which would extend out to 2.2 miles before attenuating to the threshold of 55 dBA (Forest Service 2022d). However, under the blasting scenario, SGP-related noise levels from the mine site during operations would attenuate to well below average ambient sound levels, because the impacts are reduced by vegetation, topography, and distance from the impact sources. Noise-reduction would be used and could reduce indirect effects on wildlife. Equipment would have limited external lighting and would employ noise-minimizing practices. The result would generally be a reduction in the area of habitat disturbed at most sites, but there would be indirect effects regardless. Timing restrictions would restrict some activities (e.g., blasting, drilling, etc.) within 1 mile of active winter hibernacula and summary maternity sites, which would help reduce habitat impacts.

Access Roads

Direct effects on general habitat for SGCN would primarily be due to loss and fragmentation of habitat, and disturbance from light, noise, fugitive dust, and increased human activity under the 2021 MMP. Construction of 15 miles of new road for the Burntlog Route would likely fragment habitat for SGCN and may act as a barrier to movement for some species. The new 15-mile-long section of Burntlog Route would be constructed and plowed year-round and have an AADT level of 50 during operations, which could disturb the bird and bat SGCN. The intensity of this impact could range from minor displacement to mortality. The duration ranges from temporary road construction to short-term. It is not expected that the increased risk of injury or mortality would become permanent, because the new segment of the Burntlog Route would be reclaimed upon closure, and traffic levels on the existing roads would return to current levels. The geographic extent of these impacts would be limited to the vicinity of the access road. Restricting public access on the Burntlog Route would likely reduce impacts due to mortality.

Light, noise, and fugitive dust impacts associated with road construction, maintenance, and vehicle traffic are likely to disturb or displace these birds and bats. SGP design features would help reduce these impacts, but not eliminate them. The estimated noise levels from SGP-related traffic on the Burntlog Route during the operations phase would be 49 dBA. The estimated SGP-related noise level from road

maintenance activity on the mine access road would range from 88 dBA during the summer months to 90 dBA during the winter months, when snow removal is required (Forest Service 2022d).

Utilities

Direct impacts on general habitat for SGCN could include loss or fragmentation of habitat along utility corridors, or at substations and communication towers due to land clearing activities and land use changes under the 2021 MMP. The addition of new utility access roads, as well as new transmission lines and upgraded transmission lines, could impact individual SGCN. Construction impacts would likely displace wildlife, but effects would be temporary. Vegetation would be cleared only in those areas necessary for 2021 MMP activities to preserve natural habitat to the greatest extent practicable. During operations, it is likely that wildlife would use the utility corridors again.

Noise and light reduction strategies would be used to reduce indirect effects on bird and bat SGCN. Equipment would have limited external lighting and would employ noise-minimizing practices.

Off-site Facilities

Direct impacts on general habitat for SGCN due to the off-site facilities would include loss or fragmentation of habitat. Construction and operation of the off-site facilities of the 2021 MMP are unlikely to disturb most species, because construction activities are not planned to occur in suitable habitat used by them. Noise and lighting reduction strategies would be used to reduce indirect effects on them. Buildings would have limited external lighting and would employ noise-minimizing practices.

Riparian species

Mine Site

Direct effects on riparian SGCN would primarily be due to permanent impacts to wetlands in the Operations Area Boundary. Under the 2021 MMP, and approximately 621 acres of direct impacts would occur (**Table 4.13-17**). Construction of a natural stream channel for the East Fork SFSR and reclaimed stream channels, wetlands, and riparian habitat (Forest Service 2022h) upon closure would reclaim some riparian habitat for these species in the future, but the effects would be long-term in these cases.

Implementation of the 2021 MMP would cause an increase in noise and light in the riparian wildlife analysis area, mostly in the vicinity of the mine site. Bird behaviors that may change as a result of increased noise and light include changes in nesting (loss of a nest equals “take”) and/or foraging patterns that could lead to fragmentation of habitat. The noise and light increase may affect western toad breeding activities in the mine site. Noise-reduction strategies would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices. Therefore, indirect impacts on wildlife would differ depending on the specific conditions at each individual 2021 MMP component location, based on the density of vegetation and proximity to adjoining hillsides and valleys.

Access Roads

The 2021 MMP could directly disturb these riparian SGCN in the riparian analysis area through impacts to wetlands (**Table 4.13-17**). Road construction, culvert installation, disturbance of roadside ditches that contain enough water for egg laying, and increased traffic levels may cause direct mortality to the western toad. Anurans (including western toads) are very susceptible to mortality from roadways (Jochimsen et al. 2004) when they cross them or emerge from their eggs in the spring. The Forest Service would require that potential water sources be surveyed for amphibian egg masses after ice melt, and the 2021 MMP would avoid disturbing any water sources with identified egg masses or other species (**Section 2.4.9**). The grebes and sandhill crane would likely be impacted from loss of riparian habitat throughout the life of the mine.

Noise, light, and fugitive dust disturbance from road construction, road maintenance, and routine vehicle traffic are likely to disturb or displace individual birds or toads that do occur in the access road vicinity. Western toads could be impacted by an interference in communication during breeding activities. Noise-reduction strategies would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting and would employ noise-minimizing practices.

Utilities

The 2021 MMP could directly disturb riparian SGCN in the riparian analysis area through direct impacts to wetlands (**Table 4.13-17**) due to clearing and construction activities for utility corridors, substations, and communication towers. Some effects would be considered temporary during. However, impacts to forested wetlands would likely be permanent as ROW management practices generally do not allow the establishment of woody vegetation. Construction activities associated with the utilities may cause direct mortality for some western toads, but likely not for the bird species. Potential water sources would be surveyed for amphibian egg masses, as described for the access roads. During operations, it’s likely that wildlife would use the utility corridors again.

Noise and light disturbance from construction of the utility corridors, substations, and communication towers may temporarily disturb or displace grebes or cranes that use the area. Western toads could be impacted by an interference in communication during breeding activities. Noise-reduction strategies would be used to reduce indirect effects on sensitive wildlife species. Buildings, equipment, and drill rigs would have limited external lighting and would employ noise-minimizing practices.

Off-site Facilities

The 2021 MMP would impact 6 acres of modeled habitat (**Table 4.13-17)** for the off-site facilities, although it is unlikely to directly disturb riparian SGCN in the riparian analysis area, with the possible exception of western toads that may use the affected wetland area.

Alpine Species

Mine Site

Direct impacts on the hoary marmot are possible in the mine site due to habitat loss and associated habitat fragmentation, year-round vehicle traffic causing disturbance and potential avoidance behavior, and a potential risk of vehicle collisions causing injury or mortality under the 2021 MMP. Impacts to persistent snow cover (i.e., wolverine analysis area) are used as a surrogate for marmot habitat. Direct take of these species due to construction or operational activities is possible, but unlikely, because hoary marmots prefer higher elevation meadows or rocky talus slopes where construction activities are unlikely to occur.

The 2021 MMP would cause an increase in noise and light in the wolverine analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include foraging or denning changes. Noise-reduction strategies would be used to reduce indirect effects on this species. Buildings, equipment, and drill rigs would have limited external lighting, and would employ noise-minimizing practices.

Access Roads

There would be a direct habitat loss along the access roads for the hoary marmot under the 2021 MMP. Direct mortality due to construction or operational activities is possible, but unlikely, because hoary marmots are expected to avoid areas of activity.

The 2021 MMP would cause an increase in noise, light, and fugitive dust in the analysis area, due to road construction, vehicle traffic, and maintenance. Noise, light, and fugitive dust design features described for the mine site would likely reduce impacts.

Utilities

There would be a direct habitat loss within the utilities for the hoary marmot under the 2021 MMP. Direct mortality due to construction or operational activities is possible, but unlikely, because the hoary marmot is expected to avoid areas of activity.

The 2021 MMP would cause an increase in noise and light in the analysis area, due to construction, operation, and maintenance of the utilities. Noise and light design features described for the mine site would likely reduce impacts.

Off-site Facilities

The 2021 MMP is unlikely to disturb hoary marmots due to clearing and construction activities for off-site facilities, because a small amount of persistent snow cover years 1 through 7 are expected to be impacted for these facilities. However, indirect effects on them could include reduced use of nearby foraging or denning habitat.

General Wildlife Species

Direct impacts on general wildlife species could include direct mortality (i.e., wildlife-vehicle collisions, removal of nest or roost trees, etc.) or loss of habitat due to land clearing activities and land use changes. Indirect impacts could include reduced use of foraging or breeding habitat or reduced prey resources in the analysis area.

The 2021 MMP may directly and indirectly impact general wildlife species individuals and habitat. Therefore, based on the impact analysis for general wildlife species and their habitat, the 2021 MMP would result primarily in localized, short-term, long-term, and permanent, minor impacts to general wildlife species.

Mine Site

Direct effects on general wildlife species would primarily be due to loss and fragmentation of habitat; direct mortality through vehicle-wildlife collisions; and disturbance from light, noise, and increased human activity under the 2021 MMP. Displaced individuals would likely only be lost to the population if the adjacent environment were at maximum carrying capacity, to the extent that there were not enough available habitats to support them. In such a case, individuals would have to travel farther, exposing them to predation, vehicle-wildlife collisions, and energetic loss.

General wildlife would likely be displaced around the perimeter of the mine site. Additional roadways in the mine site would expose individuals to direct vehicle collisions or increased hunting pressure from humans in the wildlife analysis area. There would be no hunting or discharge of firearms during construction and operations in the Operations Area Boundary by SGP employees and contractors. Signs would be posted at the SGP area and training would be provided to notify employees that hunting is prohibited, and employees would be prohibited from carrying firearms on the SGP site. Legal public hunting along public access roads would continue to be allowed. However, illegal harvest of some species is a potential risk. Employees and contractors traveling in vehicles would be encouraged to observe posted speed limits or state secondary road speed limits, and to drive at speeds appropriate to reduce the possibility of vehicle-wildlife accidents.

Light and noise impacts associated with mine site activities are likely to disturb or displace common wildlife species. The estimated total average hourly noise levels from the mine site during the operations phase would be 102 dBA with blasting, which would extend out to 2.2 miles before attenuating to the threshold of 55 dBA (Forest Service 2022d). However, under the blasting scenario, SGP-related noise levels from the mine site during operations would attenuate to well below average ambient sound levels, because the impacts are reduced by vegetation, topography, and distance from the impact sources. Noise-reduction strategies would be used to reduce indirect effects on wildlife. Several terrestrial wildlife species have shown responses to anthropogenic noise levels beginning at 40 dBA (Shannon et al. 2016). However, because the existing (ambient) sound levels vary between 20 and 40 dBA, it is likely that SGP area wildlife would have a higher tolerance for noise. Equipment would have limited external lighting and would employ noise-minimizing practices. As part of the SGP, buildings, equipment, and drill rigs would have limited external lighting when feasible. The result would generally be a reduction in the area of habitat disturbed at most sites.

Hazardous materials and chemicals would be transported to the Operations Area Boundary in USDOT-certified containers by trained personnel and would be stored in designated areas employing secondary containment measures. A Hazardous Materials Handling and Emergency Response Plan would address procedures for responding to accidental spills or releases of hazardous materials to minimize environmental effects. Used products would be stored on site in approved containers that would be separate from other trash and garbage products. Therefore, there is little chance of wildlife being exposed to hazardous materials.

Access Roads

Direct effects on general wildlife species would primarily be due to loss and fragmentation of habitat; direct mortality through vehicle-wildlife collisions; and disturbance from light, noise, and increased human activity under the 2021 MMP. Construction of 15 miles of new road for the Burntlog Route would likely fragment habitat for general wildlife species and may act as a barrier to movement for some species. The new 15-mile-long section of Burntlog Route would be constructed and plowed year-round and have an AADT level of 50 vehicles, which would likely directly disrupt wildlife movements. The intensity of this impact could range from minor displacement to mortality. The duration ranges from temporary road construction to short-term. It is not expected that the increased risk of injury or mortality would become permanent, because the new segment of the Burntlog Route would be reclaimed, and traffic levels on the existing roads would return to current levels. The geographic extent of these impacts would be limited to the vicinity of the access road.

Although additional roadways could expose general wildlife species to increased hunting pressure from humans in the wildlife analysis area, hunting or discharge of firearms during construction and operations within the Operations Area Boundary by SGP employees and contractors would be prohibited. Legal public hunting along public access roads would continue to be allowed. All staff and contractors would be trained to reduce wildlife collisions. Perpetua would develop a wildlife mortality-reporting procedure and form to be used for reporting accidental 2021 MMP-related wildlife mortality. Any adverse wildlife encounters would be reported to appropriate state and federal wildlife managers, and in accordance with state and federal laws. Roadways also are used as corridors by predators such as wolves, which could indirectly increase predation of some general mammal species.

Light, noise, and fugitive dust impacts associated with road construction, maintenance, and vehicle traffic are likely to disturb or displace common wildlife species. SGP design features would help reduce these impacts, but not eliminate them. The estimated noise levels from SGP-related traffic on the Burntlog Route during the operations phase would be 49 dBA. The estimated SGP-related noise level from road maintenance activity on the mine access road would range from 88 dBA during the summer months to 90 dBA during the winter months, when snow removal is required (Forest Service 2022d).

Utilities

Direct impacts on general wildlife species could include loss or fragmentation of habitat along utility corridors, substations, and communication towers due to land clearing activities and land use changes under the 2021 MMP. The addition of new utility access roads, as well as new transmission lines, and upgraded transmission lines, could impact individual general wildlife species. Construction impacts would likely displace wildlife but would be temporary. Vegetation would be cleared only in those areas

necessary for 2021 MMP activities to preserve natural habitat to the greatest extent practicable. However, impacts to forested wetlands would likely be permanent as ROW management practices generally do not allow the establishment of woody vegetation.

Noise-reduction strategies would be used to reduce indirect effects. Equipment would have limited external lighting and would employ noise-minimizing practices.

Off-site Facilities

Construction and operation of the off-site facilities under the 2021 MMP are unlikely to disturb most general wildlife species, because construction activities are not planned to occur in suitable habitat used by them. Noise and lighting reduction strategies would be used to reduce indirect effects on species in the vicinity. Buildings would have limited external lighting and would employ noise-minimizing practices.

Although construction and operation of the off-site facilities themselves would likely not cause direct mortality to general wildlife species, vehicle traffic associated with the facilities could result in vehicle-wildlife collisions. All staff and contractors would be trained to reduce wildlife collisions.

Big Game Species

Potential effects on big game species would be similar to those discussed for general wildlife species. The discussion below focuses on issues specific to big game species.

The 2021 MMP may directly and indirectly impact big game species individuals and habitat. Therefore, based on the impact analysis for big game species and their habitat, the 2021 MMP would result primarily in localized, short-term, long-term, and permanent, moderate impacts to big game species.

Mine Site

Big game wildlife species are very mobile and generally able to avoid localized direct threat of injury or mortality due to construction. However, big game species would likely be displaced around the perimeter of the mine site disturbances. Additional roadways in the mine site would expose individuals to direct vehicle collisions or increased hunting pressure from humans in the wildlife analysis area.

Although there are no identified wildlife migration corridors between winter and spring ranges, elk are predicted to use the area for calving in the summer, and big game animals likely use the wildlife analysis area to migrate. Elk and deer may be displaced around the perimeter of the mine site and associated infrastructure, which would directly affect high-value seasonal habitat for elk and mule deer. Blum et al. (2015) observed that mule deer tended to avoid disturbed mining areas in Nevada and rerouting around disturbances would increase their energy expenditures during migration, potentially decreasing survival or productivity. However, given the relatively small size of the mine site in context of the region and available habitat, any direct effect on survival or productivity would likely be small.

Access Roads

Roadways also are used as corridors by predators such as wolves, which could indirectly increase predation of elk and mule deer. Plowing the Burntlog Route would increase the access into a previously

less accessible area for wolves and coyotes. Likewise, the 10.4-mile groomed OSV trail along the existing Cabin Creek Road (FR 467) may increase access for predators during the winter.

Although there are no officially designated wildlife migration corridors between winter and spring ranges, big game animals likely use the wildlife analysis area to migrate. Roadways under the 2021 MMP may displace elk and mule deer or increase the possibility of vehicle-wildlife collisions. Under the 2021 MMP, the AADT level during operations would be 50.

If fawning/calving activity is encountered during 2021 MMP activities, the activity would cease and/or be modified in coordination with the Forest Service. Although this and other design features would reduce impacts, there would still be a direct decrease in habitat, and increase in risk of disturbance and injury or mortality.

Utilities

There are no officially designated wildlife migration corridors between winter and spring ranges, or any elk winter range in the wildlife analysis area. Linear utility components (transmission lines) of the 2021 MMP components that may present a barrier to the movement of wildlife, although big game species would likely still use these corridors.

Off-Site Facilities

Although there are no officially designated wildlife migration corridors between winter and spring ranges, big game animals likely use the wildlife analysis area to migrate. The off-site facilities would be unlikely to disrupt or alter big game herd movements, except for displacing them a short distance, which would have a negligible impact.

Migratory Bird Species and Bald and Golden Eagles

Direct impacts on migratory bird species and bald and golden eagles could include direct mortality (i.e., collisions with vehicles, structures, removal of nest trees, etc.) or loss of habitat due to land clearing activities and land use changes. Indirect impacts on these species could include reduced use of foraging or nesting habitat; reduced prey resources (insects and pollinators) in the analysis areas; or disturbance from noise, light, and emissions Effects on migratory birds under the 2021 MMP are similar in nature to the effects discussed for general wildlife. Therefore, this section focuses only on the differences for migratory bird species.

The 2021 MMP may directly and indirectly impact migratory bird species individuals and habitat. Therefore, based on the impact analysis for migratory bird species and their habitat, the 2021 MMP would result primarily in localized, short-term, long-term, and permanent, minor impacts to migratory bird species.

Mine Site

Under the 2021 MMP, direct take of adult birds due to construction or operational activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is possible that nests, eggs, and young could be directly disturbed by vegetation removal (including cutting of trees) during construction if it occurs during the nesting season. Impacts to the priority habitats mentioned in

Table 3.13-8 also may directly affect the migratory bird species found in the analysis areas. The PIF Idaho Bird Conservation Plan (Ritter 2000) contains several goals for the various habitats to reduce impacts on migratory bird species. Implementation of the SGP would require removal of vegetation from several habitat types during the life of the mine but would reclaim several habitats during closure. Although both habitats listed in **Table 3.13-8** (i.e., dry ponderosa pine and riparian habitats) would be directly disturbed in the short term, portions of the area would be reclaimed in the long term, including impacted wetlands, stream channels, and associated riparian habitat (Forest Service 2022h). These activities would accomplish some of the PIF Idaho Bird Conservation Plan goals. Cutting of trees for 2021 MMP activities and removal of snags would avoid avian tree nests, where feasible; and a Forest Service wildlife biologist would be notified of any occupied sensitive species nests or dens encountered. Although design features would reduce impacts, there would still be a decrease in habitat.

Migratory bird species also could be impacted by direct collision risks with structures at the mine site. Electric transmission line structures to serve 2021 MMP facilities and the new 138-kV transmission line in the mine site area would be a potential source of mortality for migratory bird species and raptors (APLIC 2012). However, the utility line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to these species.

The 2021 MMP would cause an increase in noise and light in the wildlife analysis area, mostly in the vicinity of the mine site. Construction and operations, vehicle traffic, and helicopter use are likely to directly disturb or displace individuals. Wildlife behaviors that may change as a result of increased noise include nesting (loss of a nest equals “take”) and/or foraging changes. Chronic noise can interfere with an animal’s ability to detect important sounds, while intermittent noise is often perceived as a threat, which can lead to a reduction in fitness (Francis and Barber 2013). Increased noise levels can mask some lower-frequency bird calls, interrupting mating processes. Additionally, Kleist et al. (2018) observed that anthropogenic noise could disrupt stress hormone signaling and lead to lower survival rates across several bird species (i.e., ash-throated flycatcher, western bluebird, mountain bluebird), which may be similar to migratory bird species in the SGP area. Over time, noise can change the composition of avian communities in favor of more noise-tolerant species, which reduces the number of species. Birds migrating through may avoid the area during noisy periods instead of stopping over during migration. Permanent physical damage to a bird’s ability to hear can occur from short-duration, loud sounds (exceeding 140 dBA for single blasts or 125 dBA for multiple blasts), or from continuous (greater than 72 hours) noise at levels above 110 dBA (Dooling and Popper 2007). The average hourly noise level during construction at the mine site would be 94 dBA (at 50 feet) and 102 dBA (at 50 feet) with blasting during operations (Forest Service 2022d). As such, the SGP would not be expected to result in permanent hearing loss for birds. Additionally, light and noise impacts are reduced by vegetation, topography, and distance from the impact sources. Therefore, indirect impacts on wildlife would differ depending on the specific conditions at each 2021 MMP component location, based on the density of vegetation and proximity to adjoining hillsides and valleys. Bright lighting can confuse birds into becoming active earlier in the day and staying alert throughout the night. It also can attract night-flying or migrating birds, causing them to alter their natural activities or expose them to accidental collisions with structures.

Possible direct and indirect effects are that there could be emission exposure and a reduction in prey species near the mine site activities, due to insects being affected by emissions or fugitive dust.

Insects and insectivorous birds may be exposed to metals (e.g., mercury) and other elements from atmospheric emissions and tailings piles associated with gold and silver mining activities (Custer et al. 2009; Eagles-Smith et al. 2018; Jones and Miller 2005). Emissions of metals from mine operations and ore processing, in the form of particulate matter and dust, may be deposited directly on local soils and waterways. In addition, rainwater and snow melt may provide a pathway for these elements to leach from tailings piles or be physically transported as solid particles into adjacent waterbodies. These elements may enter the food web through plants and insects and then be consumed by insectivorous wildlife, potentially causing injury if exposure is sufficient, therefore, there would likely be indirect impacts to insectivorous migratory birds.

As part of SGP design features, buildings, equipment, and drill rigs would employ noise-minimizing practices and would have limited external lighting when feasible. The result would generally be a reduction in the area of habitat disturbed at most sites. The noise and light reduction strategies employed in the SGP area would reduce noise impacts on migratory birds, but not eliminate them. Timing restrictions would restrict some activities within a certain radius of active nest trees for avian species, which would help reduce habitat impacts.

Access Road

Migratory bird species, including focal species that are migratory, could be directly impacted and disturbed in the wildlife analysis area through vehicle mortality, habitat loss due to tree clearing, road construction, traffic noise and dust, and increased human activity along access roads. Direct take of adult birds due to these activities is possible, but unlikely, because most individuals are expected to avoid areas of activity. However, it is likely that nests, eggs, and young would be directly disturbed by vegetation removal, including cutting of trees, if it occurs during the nesting season. Ground disturbance associated with road construction and upgrades could cause injury or mortality of ground-nesting birds if conducted during the breeding season. Cutting of trees for 2021 MMP activities would avoid avian tree nests, where feasible, and a Forest Service wildlife biologist would be notified of any occupied sensitive species nests encountered. Although design features would reduce direct impacts, there would still be a decrease in habitat. The Burntlog Route may present a barrier to movement for sensitive migratory bird species.

Additionally, noise, light, and fugitive dust from road construction, road maintenance, and routine vehicle traffic is likely to disturb or displace individual migratory bird species or bald and golden eagles from roadside habitats. Increased ambient noise levels can mask some lower-frequency bird calls, interrupting mating processes. Additionally, Kleist et al. (2018) observed that anthropogenic noise could disrupt stress hormone signaling and lead to lower survival rates across several bird species (i.e., ash-throated flycatcher, western bluebird, mountain bluebird), which may be similar to migratory bird species in the SGP area. McClure et al. (2013) observed that simulated traffic noise led to a decline in bird abundance at sites in southern Idaho by about one quarter, and that many migratory bird species may avoid sites with such noise levels. The average hourly noise level during construction for the access roads would be 91 dBA (at 50 feet) and 86 (winter) to 88 (summer) dBA (at 50 feet) during operations (Forest Service 2022d). As such, the SGP would not be expected to result in permanent hearing loss for birds. Bright lighting can attract night-flying or migrating birds, causing them to alter their natural activities or expose them to accidental collisions with structures.

Noise, light, and fugitive dust reduction strategies described for the mine site and for other general wildlife species would be used to reduce indirect effects on migratory bird species.

Utilities

The 2021 MMP could directly disturb migratory bird species in the wildlife analysis area through habitat loss due to clearing and construction activities for utility corridors, substations, and communication towers. Direct take of adult birds due to these activities is unlikely because most individuals are expected to avoid areas of activity. However, it is likely that nests, eggs, and young would be disturbed by vegetation removal, including cutting of trees if it occurs during the nesting season. To the extent practicable, trees found to contain nests would not be disturbed or cut. No trees with active nests would be cut.

The cell tower, communication tower, repeater sites, and new or upgraded 138-kV transmission line would be a potential source of mortality for migratory bird species and raptors through accidental collisions with structures, cell towers, or transmission lines (APLIC 2012). In the long-term, the utility line design would meet APLIC raptor-protection criteria and include insulating or covered apparatus for perch accommodation to reduce risks to raptor species. Electric transmission line structures to serve 2021 MMP facilities would be designed and constructed to avoid raptor perching (for predation purposes and to minimize the risk of being electrocuted). However, the long-term presence of structures and communication towers would pose a risk of collision and direct mortality.

The average hourly noise level during construction for the utilities would be 84 dBA (at 50 feet) without helicopter use and 100 dBA (at 50 feet) with helicopter use and attenuate to 55 dBA approximately 53 feet from the substation during operations (Forest Service 2022d). As such, the SGP would not be expected to result in permanent hearing loss for birds. Noise- and light-reduction strategies described for the mine site and for other general wildlife species would be used to reduce indirect effects on migratory bird species.

Construction effects (i.e., displacement) to these areas would be temporary, but long-term effects could include habitat fragmentation due to the utility corridors. The 2021 MMP components that may present a barrier to the movement of sensitive migratory bird species (i.e., smaller birds or those that use mature interior forest).

Off-Site Facilities

The 2021 MMP is unlikely to directly disturb migratory bird species in the wildlife analysis area, because only approximately 4 acres of habitat would be affected due to clearing and construction activities for off-site facilities. Direct take of adult birds due to these activities is unlikely, because most individuals are expected to avoid areas of activity. It also is unlikely that nests, eggs, and young would be disturbed by vegetation removal because nest sites are most likely not adjacent to roadways where the facilities would be built.

The average hourly noise level during construction for the off-site facilities would be 85 dBA (at 50 feet) and 84 dBA (at 50 feet) due to the borrow area activity during operations (Forest Service 2022d). As such, the SGP would not be expected to result in permanent hearing loss for birds. Noise- and light-

reduction strategies described for the mine site and for other general wildlife species would be used to reduce indirect effects on migratory bird species.

4.13.2.3 Johnson Creek Route Alternative

Impacts under the Johnson Creek Route Alternative for the Operations Area Boundary and utilities would be the same as discussed under the 2021 MMP as there are no changes to these features from the 2021 MMP. Therefore, these features are not discussed further in this section. Under the Johnson Creek Route Alternative, the only difference to off-site facilities is the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus the 2021 MMP. Also, the Burntlog Route would not be constructed and therefore wildlife impacts related to that would not occur. Off-site facilities are only discussed below for species where impacts would be different than the 2021 MMP.

Threatened, Endangered, Proposed, and Candidate Species

Canada Lynx

Under the Johnson Creek Route Alternative, the Johnson Creek Route would be used instead of the Burntlog Route, which would eliminate the disturbance of 15 miles of habitat adjacent to the FCRNRW. This would avoid the impacts of noise, light, and traffic on Canada lynx in the FCRNRW area where suitable current habitat is mapped. However, it is expected that transient Canada lynx would still cross SGP area roadways, including the Johnson Creek Route. Traffic levels on Stibnite Road and Johnson Creek Road (both part of the Johnson Creek Route) would increase by about 167 percent and 71 percent, respectively, during operations. Therefore, there would still be a chance of wildlife mortality under the Johnson Creek Route Alternative.

Table 4.13-1 shows the acres of suitable habitat that would be directly impacted in each LAU. Direct impacts to Canada lynx habitat across all LAUs would be 175 acres under the Johnson Creek Route Alternative. Using a 5-mile buffer on the SGP components within each LAU, the area of indirect impacts on Canada lynx habitat could total approximately 70,652 acres under the Johnson Creek Route Alternative.

The Forest Service has preliminarily determined that the mine site, access roads, and utilities would affect, but not adversely affect, Canada lynx utilizing the area or their habitat. The off-site facilities would likely not affect transient Canada lynx under any action alternative. The Stibnite LAU and Burntlog LAU would have the highest direct impacts to lynx habitat. Informal Section 7 ESA consultation is ongoing with the USFWS. Therefore, based on the impact analysis for the Canada lynx and its habitat, the 2021 MMP would result primarily in localized, long-term, and permanent, minor impacts to the Canada lynx.

Northern Idaho Ground Squirrel

Under the Johnson Creek Route Alternative, the Johnson Creek Route does not cross modeled suitable habitat, although it is in closer proximity to modeled suitable habitat than the Burntlog Route. Construction and operations would not likely impact NIDGS habitat. Direct impacts to NIDGS modeled habitat across the wildlife analysis area would be approximately 63 acres for the Johnson Creek Route

Alternative. Using a 1-mile buffer on SGP components, the indirect area of impacts on modeled NIDGS suitable habitat is approximately 5,248 acres.

The Forest Service has preliminarily determined that the access roads and utilities would affect, a small amount of NIDGS suitable habitat and direct and indirect impacts would be the same. The mine site and off-site facilities would not affect NIDGS habitat. Overall impacts from the SGP would affect, but not adversely affect, NIDGS. Informal Section 7 ESA consultation is ongoing with the USFWS. Therefore, based on the impact analysis for the NIDGS and its habitat, the Johnson Creek Route Alternative would result primarily in localized, temporary, and short-term, minor impacts to the NIDGS.

Wolverine

Under the Johnson Creek Route Alternative, the Johnson Creek Route would be used instead of the Burntlog Route, which would eliminate the disturbance of 15 miles of wolverine habitat adjacent to the FCRNRW. This would avoid the impacts of noise, light, and traffic impacts on wolverines in the FCRNRW area. Additionally, the Johnson Creek Route would mostly avoid areas mapped as persistent spring snow cover, which are areas expected to be used most by wolverines (Table 4.13-2). However, it is expected that wolverines would still cross SGP area roadways, including the Johnson Creek Route. Traffic levels on Stibnite Road and Johnson Creek Road (both part of the Johnson Creek Route) would increase by about 167 percent and 71 percent, respectively, during operations. Therefore, there would still be a chance of wildlife mortality under the Johnson Creek Route Alternative. Under the Johnson Creek Route Alternative, utilities would be constructed and installed using helicopters in IRAs rather than by constructing access roads. This would introduce more noise impacts to wolverines in their vicinity during construction. For example, noise from transmission line construction with helicopter use would attenuate to the threshold of 55 dBA approximately 1.70 miles from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from transmission line construction with helicopter use would attenuate to 55 dBA approximately 0.66 mile from the source of activity (Forest Service 2022d). During operations, the utilities would produce the same noise levels as the 2021 MMP.

The Forest Service has preliminarily determined that the Johnson Creek Route Alternative may directly and indirectly impact wolverine individuals and habitat resulting in adverse impacts but would not jeopardize the continued existence of the species. Informal Section 7 ESA consultation is ongoing with the USFWS. The Johnson Creek Route Alternative would impact the least habitat overall, but still reduce habitat connectivity, and potentially cause displacement (primarily from increased noise), based on direct and indirect impacts. Therefore, based on the impact analysis for the wolverine and its habitat, the Johnson Creek Route Alternative would result in localized and long-term impacts to the wolverine, particularly the local population (part of larger Central Idaho sub-populations).

Monarch Butterfly

Under the Johnson Creek Route Alternative, the Burntlog Route would not be built. This would avoid effects of noise disturbance, fugitive dust, habitat loss, and habitat fragmentation to the Monarch butterfly in the vicinity of Burnt Log Road (FR 447). However, Monarch butterflies that currently utilize habitats along the Johnson Creek Route would likely be more impacted due to increased fugitive dust and noise disturbance from increased traffic.

The Johnson Creek Route Alternative may directly and indirectly impact Monarch butterflies and habitat. However, due to the low potential for this species to occur in the wildlife analysis area, primarily due to a lack of suitable habitat, the Johnson Creek Route Alternative would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Therefore, based on the impact analysis for the Monarch butterfly and its habitat, the Johnson Creek Route Alternative would result in negligible impacts to the Monarch butterfly.

Focal Species, Including Region 4 Sensitive Species and Management Indicator Species

Habitat Family 1 – Low Elevation, Old Forest

White Headed Woodpecker

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed. There is modeled habitat for white-headed woodpecker along the Johnson Creek Route. Because the Stibnite Road and Johnson Creek Road are existing roadways that would be upgraded, there would be approximately 8 acres of direct impacts on white-headed woodpecker habitat (**Table 4.13-3**), and there would be more indirect impacts due to noise, light, and fugitive dust disturbance from increased traffic levels.

Lewis's Woodpecker

Effects to the Lewis's woodpecker along the access roads under the Johnson Creek Route Alternative would be similar to the white-headed woodpecker analysis. Approximately 19 acres of modeled habitat (**Table 4.13-4**) would be impacted along the access roads for the Johnson Creek Route Alternative.

Habitat Family 2 – Broad Elevation, Old Forest

American Three-toe Woodpecker

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed. However, there would be a direct impact of 1 acre of modeled habitat associated with upgrades to the Johnson Creek Route. Additionally, the increased traffic along Stibnite Road, Johnson Creek Road, and Warm Lake Road would cause indirect impacts to woodpeckers using the modeled habitat within 0.5 mile of the roadways due to noise, light, and fugitive dust (**Table 4.13-5**).

Under the Johnson Creek Route Alternative, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus the 2021 MMP and cause a direct impact of about 1 acre. It is not expected that this change would cause effects different from the 2021 MMP.

Black-backed Woodpecker

Effects to the black-backed woodpecker at the mine site would be similar to the American three-toed woodpecker analysis. However, there would be a direct impact of 45 acres of modeled habitat under the Johnson Creek Route Alternative (**Table 3.13-6**).

The Johnson Creek Route Alternative would directly impact 14 acres of modeled habitat, due to shifting the primary access route to the Johnson Creek Route. There would also be indirect impacts along this

route due to an abundance of modeled habitat along Stibnite Road, Johnson Creek Road, and Warm Lake Road.

Dusky Grouse

Under the Johnson Creek Route Alternative, the Burntlog Route would not be built. Most of the modeled dusky grouse habitat is located in proximity to the Johnson Creek Route. As such, dusky grouse could be impacted by the Johnson Creek Route Alternative along the access roads due to direct impacts of 68 acres (**Table 3.13-7**). Indirect impacts for the Johnson Creek Route Alternative would be the same as for the 2021 MMP.

Boreal Owl

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed or used. While 13 acres of modeled habitat (**Table 4.13-8**) would be directly impacted under this alternative, there is modeled suitable habitat located along the Johnson Creek Route that could be indirectly affected by noise and light from increased traffic levels.

The Johnson Creek Route Alternative may directly and indirectly impact boreal owl individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. The Johnson Creek Route Alternative would directly impact 36 acres of habitat. Therefore, based on the impact analysis for the boreal owl and its habitat, the Johnson Creek Route Alternative would result primarily in localized, long-term and permanent, minor impacts to the boreal owl.

Under the Johnson Creek Route Alternative, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus the 2021 MMP. While the facility would be closer to modeled habitat, it is not expected that this change would cause different effects from the 2021 MMP.

Fisher

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed and there would be approximately 1 acre of direct impacts on modeled habitat (**Table 4.13-9**) associated with the Johnson Creek Route. Indirect effects would also be likely within 1 mile of the Johnson Creek Route, as modeled habitat occurs along Stibnite Road, Johnson Creek Road, and Warm Lake Road.

Under the Johnson Creek Route Alternative, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus the 2021 MMP. This would cause less than 1 acre of direct impacts to fisher; however, it is not expected that this change would cause effects different from the 2021 MMP.

Flammulated Owl

Under the Johnson Creek Route Alternative, the Burntlog Route would not be built. Most of the modeled suitable flammulated owl habitat is located in proximity to the Johnson Creek Route Alternative. As such,

there would be 22 acres of direct impacts to modeled habitat associated with the Johnson Creek Route (**Table 4.13-10**). Indirect effects (e.g., noise, light, fugitive dust, emissions) would also be likely due to modeled habitat occurring along the Stibnite Road, Johnson Creek Road, and Warm Lake Road.

Great Gray Owl

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed or used. Direct impacts on modeled habitat would total approximately 13 acres and would be associated with upgrades along the Johnson Creek Route (**Table 4.13-11**). Additionally, there is modeled suitable habitat located along the Johnson Creek Route that could be indirectly affected by noise and light from increased traffic levels.

Under the Johnson Creek Route Alternative, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus the 2021 MMP. While this would result in 2 acres of direct impacts to modeled habitat, it is not expected that this change would cause effects different from the 2021 MMP.

Northern Goshawk

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed or used. Direct impacts on modeled habitat would total approximately 15 acres and would be associated with upgrades along the Johnson Creek Route (**Table 4.13-12**). Additionally, there is modeled habitat located along the Johnson Creek Route that could be indirectly affected by noise and light from increased traffic levels.

The Johnson Creek Route Alternative may directly and indirectly impact northern goshawk individuals and habitat but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. The Johnson Creek Route Alternative would directly and indirectly impact the least amount of habitat. Therefore, based on the impact analysis for the northern goshawk and its habitat, the Johnson Creek Route Alternative would result primarily in localized, long-term and permanent, minor impacts to the northern goshawk.

Under the Johnson Creek Route Alternative, the Landmark Maintenance Facility would be relocated to the southern side of Warm Lake Road, which would shift the footprint slightly versus the 2021 MMP. While this would result in 1 acre of direct impacts to modeled habitat, it is not expected that this change would cause effects different from the 2021 MMP.

Pileated Woodpecker

Effects to the pileated woodpecker along the access roads under the Johnson Creek Route Alternative would be similar to the white-headed woodpecker analysis, as pileated woodpeckers and modeled habitat are rare along the access roads.

There would be 0.5 acre of direct impacts to modeled habitat along the access roads for the Johnson Creek Route Alternative (**Table 4.13-12**). Indirect impacts could include displacement due to noise, light, or fugitive dust, and design features described for the white-headed woodpecker would likely reduce those impacts. Although modeled habitat is limited in the wildlife analysis area, individuals are present

during the breeding season. The Johnson Creek Route Alternative would likely have no direct impacts on pileated woodpecker modeled habitat (e.g., large and very large tree size classes in several different forest stands) but may affect individuals and there would be similar indirect impacts across all the Johnson Creek Route Alternative. Therefore, based on the impact analysis for the pileated woodpecker and its habitat, the Johnson Creek Route Alternative would result primarily in localized, long-term and permanent, minor impacts to the pileated woodpecker.

Silver-haired Bat

Under the Johnson Creek Route Alternative, the Burntlog Route would not be built. While more of the modeled silver-haired bat habitat is located in proximity to the Johnson Creek Route, direct impacts would total approximately 87 acres (**Table 4.13-14**). Due to the modeled habitat along the Johnson Creek Route, there would be indirect impacts due to increased traffic levels (e.g., noise, light, and fugitive dust) and emissions.

Habitat Family 3 – Forest Mosaic

Mountain Quail

Under the Johnson Creek Route Alternative, the Burntlog Route would not be built. There would be 115 acres of direct impacts to modeled habitat, which would be associated with upgrades to the existing Johnson Creek Route (**Table 4.13-15**). Indirect effects due to traffic noise, light, and fugitive dust would be expected within 1 mile of the Johnson Creek Route.

Habitat Family 5 – Forest and Range Mosaic

Gray Wolf

Under the Johnson Creek Route Alternative, the Burntlog Route would not be built, and the Johnson Creek Route would be used instead. This would shift disturbance away from the FCRNRW area, where gray wolf packs are known to occur.

Peregrine Falcon

Under the Johnson Creek Route Alternative, the Burntlog Route would not be built. There are known breeding territories within the FCRNRW area that would not be impacted under the Johnson Creek Route Alternative. However, traffic would be higher along the Johnson Creek Route (Johnson Creek and the East Fork SFSR), where nesting also has been documented, and this would be an indirect impact.

Rocky Mountain Bighorn Sheep

Under the Johnson Creek Route Alternative, the Burntlog Route would not be built. However, there is a comparable amount of modeled suitable habitat adjacent to the Johnson Creek Route as well. There would be 57 acres of direct impacts to modeled summer habitat and 22 acres of direct impacts to modeled winter habitat under the Johnson Creek Route Alternative (**Table 4.13-16**).

Townsend's Big-eared Bat

Under the Johnson Creek Route Alternative, the Burntlog Route would not be built and habitat along that corridor would not be impacted. However, bats along the Johnson Creek Route may be impacted in a similar manner.

Habitat Family 13 – Riverine Riparian and Wetland

Bald Eagle

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed and thus the area associated with the Burntlog Route would not be impacted. However, since there are known nest sites along the Johnson Creek Route, the increased traffic under the Johnson Creek Route Alternative may displace eagles from these territories.

Columbia Spotted Frog

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed and there would be no impacts along the proposed Burntlog Route corridor. There would be 126 acres of direct impacts to modeled habitat under the Johnson Creek Route Alternative (**Table 4.13-17**). Increased traffic along the existing Johnson Creek Route would likely increase direct mortality and indirect impacts (due to noise, light, and fugitive dust) along these roadways.

Idaho Species of Greatest Conservation Concern

Impacts to SGCN are the same as for the 2021 MMP expect as outlined below.

General Habitat Species

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed. All traffic would access the SGP area via the Johnson Creek Route. General habitat SGCN with occurrence along these existing roadways may be impacted from increased traffic levels.

Riparian species

Under the Johnson Creek Route Alternative, there would be no impacts associated with the Burntlog Route as it would not be constructed. However, riparian SGCN along the Johnson Creek Route may be impacted from the increased traffic.

Alpine Species

Under the Johnson Creek Route Alternative, there would be a reduction of impacts due to the Burntlog Route not being built. However, any habitats adjacent to the Johnson Creek Route would be impacted from upgrades and increased traffic levels.

General Wildlife Species

Impacts to general wildlife are the same as for the 2021 MMP expect as outlined below.

Under the Johnson Creek Route Alternative, the Burntlog Route would not be built. This would avoid effects of noise disturbance, fugitive dust, habitat loss, and habitat fragment on wildlife in the vicinity of Burnt Log Road (FR 447). However, general wildlife species that currently utilize habitats along the Johnson Creek Route would likely be more impacted due to increased fugitive dust and noise disturbance from increased traffic.

Big Game Species

Impacts to big game species are the same as for the 2021 MMP expect as outlined below.

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed. Impacts to big game species in the vicinity of Burnt Log Road (FR 447) would likely be avoided. However, big game species that currently utilize habitats along the Johnson Creek Route would be impacted due to increased traffic and noise disturbance associated with only using Johnson Creek Route for the SGP.

Migratory Bird Species and Bald and Golden Eagles

Impacts to migratory birds and bald and golden eagles are the same as for the 2021 MMP expect as outlined below.

- Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed. However, the existing roadways included in the Johnson Creek Route would be upgraded and would likely cause direct and indirect impacts to migratory birds. Due to the increased fugitive dust and noise disturbance from increased traffic, the Johnson Creek Route may present a barrier to movement of sensitive migratory bird species.

4.13.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Wildlife and Wildlife Habitat.

4.13.4 Irreversible and Irretrievable Commitments of Public Resources

4.13.4.1 No Action Alternative

There would be no irreversible and/or irretrievable commitment of resources under the No Action Alternative.

4.13.4.2 Action Alternatives

Although most wildlife species are considered renewable, certain biological resources that would be affected by the 2021 MMP and Johnson Creek Route Alternative are renewable only over long-time spans, including mature vegetation, including snags, seedbanks, and topsoil. Loss of these resources would be considered irreversible. Reclamation of high-value habitats for wildlife species such as Canada lynx, wolverines and migratory bird species may require long periods of time (decades). Impacts to

populations of threatened or endangered species, or species with low populations, such as Canada lynx or wolverine, would be considered irreversible, because recovery may take a long period of time or not occur at all. The direct mortality of wildlife also would be an irreversible impact.

Irretrievable commitments include biological resources that are renewable over a short time, such as vegetation, wetlands, and streams. Although the loss of the resource itself is reversible, the temporal loss of the use of the resource is irretrievable. The 2021 MMP and Johnson Creek Route Alternative activities would cause a temporal loss of habitat for a number of species; both from direct removal of vegetation, and indirectly through avoidance due to human presence. Some species sensitive to human presence, such as Canada lynx and wolverine, may not return to the area for years after the mine is closed.

Injury or mortality of individuals, such as burrow-dwelling species and slow-moving species that are unable to relocate when ground-disturbance activities begin, or through vehicle or transmission line collisions, would result in an irretrievable commitment of these resources. Although most animals displaced from the affected areas are expected to survive relocation, some displaced animals may not survive due to the associated dangers of migration and competition for resources; their loss also would be irretrievable.

Any reduction in habitat functions also would be irretrievable. Once the habitat is reclaimed to its full function, the irretrievable loss would only be the temporal loss of habitat during the period before it was reclaimed. Some vegetation and soil habitats would be lost for future use by wildlife until reclamation could be successfully implemented. Wildlife displaced from the affected habitat may relocate throughout the region, changing the availability of game for hunters and predators. The change could increase or decrease hunting success, but any reduction in game availability would represent an irretrievable loss of opportunity.

Under the Johnson Creek Route Alternative, there would not be improvements or construction of new segments for Burntlog Route, which would be a significant reduction of irretrievable commitments compared to the 2021 MMP. Relocation of the maintenance facility could affect different habitats.

4.13.5 Short-term Uses versus Long-term Productivity

4.13.5.1 No Action Alternative

The No Action Alternative is not expected to affect the long-term productivity of the environment.

4.13.5.2 Action Alternatives

Wildlife resources contribute to biological productivity, and the long-term productivity of these resources provides economic, ecological, and recreational benefits. Construction and operation of the SGP would result in some temporary, short-, mid-, and long-term impacts on wildlife. During construction, wildlife habitat would be removed from the footprint of the proposed Operations Area Boundary and from land associated with off-site facilities, access roads, and utilities. Habitat loss would be short-term in some areas, and long-term in others, depending on the type of vegetative cover. Timbered areas to be cleared would take decades to re-generate, during which a loss of primary and secondary habitat for many species would occur. Natural recovery and reclamation of habitat would take place outside the footprint of the

SGP after construction activities cease. Additional habitat would be lost for the duration of the SGP, because the increase in human activity would cause avoidance of the area by certain sensitive wildlife species. The risk of wildlife injury or mortality also would be increased as a result of the increase in human activity.

These short-term impacts would persist long enough to potentially affect the long-term productivity for some sensitive wildlife species or those with limited habitat. It is possible that some species would not return to the area after being displaced, which would be a long-term impact.

Although there would be construction or operational differences, the Johnson Creek Route Alternative would have short-term effects similar to the 2021 MMP. The exception is that upgrading the Johnson Creek Route would have fewer long-term impacts to many sensitive species and habitats than developing the Burntlog Route under the 2021 MMP.

4.14 Timber Resources

4.14.1 Impact Definitions and Effects Analysis Indicators and Methodology

The analysis of effects to timber resources includes the following issue and indicators:

Issue: The SGP may change the availability of timber resources, including sawtimber and special forest products.

Indicators:

- Volumes and acres of timber resources removed.
- Acres of timberland (including land suited for timber production) converted to other, non-productive land uses.

Timber resources were analyzed using GIS spatial analyses, scientific literature reviews, FSHs and FSMs, Forest Service land and resource management plans, and other information and analysis documented in reports prepared by and for Perpetua.

The assessment of potential effects related to the timber issue and its associated indicators are organized and analyzed for the alternatives by the underlying timber management responsibility (either Forest Service or other federal, state, and private). Where appropriate, the analysis is further organized by merchantable sawtimber versus sub-merchantable timber that could be sold as special forest products (e.g., Christmas trees, post and poles, and live transplants).

Analysis of direct effects on timber resources is limited to the analysis area as defined in **Section 3.14.1**. A qualitative analysis of indirect effects on timberlands also is included. The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1**. The methods used to estimate the quantity and extent of timber resources in the analysis area (AECOM 2020i) and the analysis of impacts on timber resources is summarized below based on the components of each action alternative provided by Perpetua (Perpetua 2021a).

4.14.1.1 Timber Volume

Volume of timber was estimated in the analysis area by extracting sampled vegetation characteristics from the VCMQI mapping for the PNF and BNF, including timber dominance type, tree size, and canopy cover, from the GIS to create a set of unique stand conditions. The resulting 200 stand conditions represent all of the combinations of the eight timber types found in the analysis area, the five tree-size classes in the VCMQI (i.e., seedling, sapling, small, medium, and large); and the five canopy cover classes in the VCMQI (i.e., low, low-medium, medium, medium-high, and high). Only trees greater than 10 inches in diameter at breast height, which corresponds to medium and large trees, are considered merchantable sawtimber; seedling, sapling, and small trees are considered special forest products on the PNF and BNF.

To estimate average volume per acre for each of the 200 stand conditions, generalized forest strata data were combined with available Forest Service inventory data, which provided estimates of trees per acre in each stand type; and estimates of volume per tree, by species and size class (Forest Service 2017h, 2017i). The resulting stand-volume table, containing volume-per-acre estimates for all 200 unique stand conditions, was applied to mapped timberlands in the analysis area. Timber volume was estimated in cubic feet, which is a full-log volume measurement. The board foot is the unit of measure for wood intended for the finished wood product market, and the timber volume unit used in the Payette Forest Plan and Boise Forest Plan. To compare estimates of timber volume to the PNF and BNF timber extraction goals, cubic feet of timber was converted to MBF using Cahill's conversion factor for 16-inch log diameters. The factor is "5.24 cubic meters of wood per thousand board feet," and is based on the Westside Scribner rule with log lengths up to 40 feet and assumes no reduction in volume for defects (Spelter 2004). Timber volumes presented in the discussions are distinguished between sawtimber and sub-merchantable trees; however, a breakdown by species is not provided.

4.14.1.2 Methodology and Assumptions

The following methodology and assumptions were used in the analysis:

- All portions of the analysis area within the PNF and BNF boundaries were characterized by existing VCMQI vegetation dominance types, using spatial data developed by the PNF and BNF, with a minimum polygon size of 5 acres. These data were not developed to characterize timber resources, and therefore the conifer landform was used as a proxy for timberland but has associated limitations. Limitations include: 1) not all areas mapped as coniferous forest lifeform are productive timberlands; 2) many of the sparser conifer stands (10 to 30 percent canopy) may not have been mapped as coniferous forest lifeform, instead many of these fell into various shrubland categories or burned categories (Forest Service 2019j); 3) the minimum mapping unit of 5 acres is not small enough to capture all developed roads and other narrow cleared corridors, and therefore the mapped extent of vegetation may extend across these developed, unvegetated areas; and 4) existing roaded areas fell below the minimum mapping unit and although they do not contain timber, some portions of mapped timber resource polygons include roaded areas devoid of trees.
- Beyond the limitations associated with VCMQI mapping accuracy on NFS lands, these data were not available for portions of the SGP area on private, state, and other federal land. To characterize vegetation in these areas, publicly available vegetation community LANDFIRE data with a 30-

square-meter minimum mapping unit were manually translated ("cross-walked") to the closest corresponding NFS vegetation dominance type. LANDFIRE data are not ground-truthed; therefore, vegetation conditions on private, state, and other federal land may be less accurately represented than conditions on NFS lands.

- Although the Reclamation and Closure Plan (Tetra Tech 2021a) indicates that some portion of forest resources in the analysis area would be used during mine operations, and some portion may be harvested for sale (as timber), Perpetua does not provide an acreage estimate or indicate the location of forest resources intended for each use. In the absence of this information, all forested areas in the analysis area meeting the definition of timber resources were assumed to be harvested for sale during SGP construction and operations.
- In the absence of timber cruises (i.e., a sample measurement of a stand used to estimate the amount of standing timber that the forest contains) for the SGP area, the volume and distribution of sawtimber and special forest products on the landscape can only be approximated from landscape-level vegetation mapping at a minimum mapping unit of 5 acres. Therefore, the data may indicate that some areas contain timber or special forest products, while a timber cruise of the area may reveal different conditions.

Additional analytical assumptions that were made in order to develop a consistent, repeatable analysis for the SGP are detailed in the *Timber Resources Methodology and Impact Analysis Report* (AECOM 2020i) but rerun based on revised SGP components by action alternative (Perpetua 2021a).

4.14.2 Direct and Indirect Effects

The harvest and sale of timber is an intended use of NFS lands; however, to protect multiple uses and promote the sustained yield of timber, the Forest Service provides detailed management direction for how and where harvesting on NFS lands is to occur. The effects of removing timber off NFS lands are examined in the context of how consistent the removal and regeneration methods are, as well as location and volume of timber removed, with NFS timber harvest rules and Forest Plan standards and guidelines. Timber removal from non-NFS lands in the analysis area are viewed in the context of state and local regulations governing removal and sale of wood products. Forest Service timber management guidelines do not apply on these lands.

Direct effects to timber resources on NFS-managed lands ("Forest Service timber") would include timber removal volume, acreage, and/or practices that conflict with Forest Service direction. Specifically, direct impacts would include:

Removal of volume that exceeds annual harvest limits (TSPQ, ASQ, Wood Volume) set by each forest (**Table 3.14-2)**.

Removal of timberland acreage from unsuited areas, or of a quantity that exceeds the acres suited for timber production designated in the Payette or Boise Forest Plans.

Regeneration of timber resources does not achieve adequate restocking within 5 years of final harvest (16 USC 1604(g)(3)(E)(ii)).

Direct effects to timber resources on other federal, state, and private lands may include timber harvest practices on commercial timberlands that conflict with the Idaho Forest Practices Act and associated guidelines. Specifically, direct effects would include:

- Removal of timber from commercial timberlands in ways that conflict with standards for logging operations, soil protection, stream protection, and restocking of stands.
- Timber harvest practices that generally do not maintain and enhance natural resources.

Indirect effects on timber resources could include delayed or prolonged growth and recovery of timber species because of removal of suitable soil, seed bank, and understory conditions during operations. Indirect impacts also could include development of unhealthy timber stands from the introduction of pathogens, including insects and disease, or the reintroduction of genetically unsuitable plantings or seed. Indirect effects would be a function of harvest method and reclamation strategy, which are anticipated to be the same across the entire SGP area. Therefore, indirect effects on timber resources are anticipated in all portions of the SGP area where timber removal would occur.

Direct and indirect effects associated with timber resources during construction and operations are based on management standards, which differ between the Forest Service and the State of Idaho or Valley County; the discussion below is organized to reflect those differences. Effective replanting and regeneration, and achievement of regeneration standards during closure and reclamation could decrease impacts to timber resources from operations and closure. However, inadequate efforts to return timberland to forested vegetation could increase the duration and extent of direct and indirect effects to the resource.

4.14.2.1 No Action Alternative

Under the No Action Alternative, the mining, ore processing, and related SGP activities would not take place and there would be no direct or indirect effects to timber resources and no changes to current conditions for timber resources in the analysis area from the SGP. 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 Mining Law.

Perpetua would continue to implement surface exploration and associated activities that have been previously approved on NFS lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project EA (Forest Service 2015c). These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads) and drilling on both NFS and private lands at and in the vicinity of the mine site. These exploration and subsequent reclamation activities would have only a small direct effect on timber resources, as the disturbance footprint associated with the Golden Meadows EA is limited to the temporary access roads to pads and the exploration drilling holes.

Perpetua would be required to continue to comply with reclamation and monitoring commitments included in the applicable Golden Meadows Exploration Project Plan of Operations and EA, which include reclamation of the drill pads and temporary roads by backfilling, re-contouring, and seeding using

standard reclamation practices, and monitoring to ensure that sediment and stormwater BMPs are in place and effective so that impacts to timber resources are avoided or minimized.

4.14.2.2 2021 MMP

Construction and Operations

Merchantable timber cut during construction and operations may be sold as part of the 2021 MMP. Vegetation clearing for the action alternatives would impact between 595 acres containing 438,243 CF of sawtimber and sub-merchantable product under the 2021 MMP. This would result primarily in localized, long-term and permanent, minor impacts to timber resources. The analysis area under the 2021 MMP contains 54 acres of land suited for timber production, which is associated with the existing transmission line upgrade (within BNF MPC 5.1 and 4.2) and contains 206 MBF of sawtimber. There is no suited timberland in the analysis area on the PNF under either action alternative.

Tables 4.14-1 and **4.14-2** show the area of timber resources and associated volume of wood removed during construction and operations under each of the action alternatives on NFS land as well as other public or private land.

Table 4.14-1 Impacts to Timber Resources by Action Alternative: Volume of Timber Removed (cubic feet)

Land Management	SGP Component	2021 MMP	Johnson Creek Route Alternative
Forest Service	Access Roads	53,522	161,779
Forest Service	Mine Site	166,316	161,012
Forest Service	Off-site Facilities	0	1,884
Forest Service	Utilities	122,604	122,383
Forest Service	All Components, Subtotal	342,442	447,058
Other Federal, State and Private	Access Roads	1,953	10,078
Other Federal, State and Private	Mine Site	36,518	33,516
Other Federal, State and Private	Off-site Facilities	3,952	3,952
Other Federal, State and Private	Utilities	53,378	53,380
Other Federal, State and Private	All Components, Subtotal	95,801	100,926
All Lands	All SGP Components[1]	438,243	547,984

Source: Compiled by AECOM in 2020 from Forest Service vegetation and fire data (Forest Service 2016b, 2016c; 2017a and b); Midas Gold Mine Claim spatial data (Brown and Caldwell 2017b); Perpetua Project components (Perpetua 2021a), and AECOM timber volume formulas (AECOM 2020i).

[1]All quantities have been rounded; therefore, column and row totals may not add up exactly due to rounding performed in source data.

Timber resources would be removed during the construction phase, and the soil surface cleared and grubbed to accommodate roads and infrastructure. Timber resources would be largely prevented from reestablishing through the operations period due to the ongoing need for the underlying ground to accommodate structures, facilities, and access routes. Exceptions to this timeline would occur along

Burntlog Route (under the 2021 MMP), which would remain in use throughout the closure and reclamation phase. Construction and operations would have long-term effects on the availability and extent of timber resources in the analysis area. These effects would be long-term because timber resources would be removed at the start of the 2021 MMP, during the construction period, and the disturbed areas would remain largely unavailable for planting or regrowth for over 15 years. In addition, the 2021 MMP include permanent impacts on the availability and extent of timber resources through the permanent conversion of existing timber resources to other, non-timber uses, including the expanded ROW for the existing transmission line and the permanent, continued use of the Stibnite Road.

Table 4.14-2 Impacts to Timber Resources by Action Alternative: Area of Timber Removed (acres)

Land Management	SGP Component	2021 MMP	Johnson Creek Route Alternative
Forest Service	Access Roads	79	212
Forest Service	Mine Site	146	142
Forest Service	Off-site Facilities	0	5
Forest Service	Utilities	243	242
Forest Service	All Components, Subtotal	468	601
Other Federal, State and Private	Access Roads	3	11
Other Federal, State and Private	Mine Site	31	28
Other Federal, State and Private	Off-site Facilities	5	5
Other Federal, State and Private	Utilities	88	88
Other Federal, State and Private	All Components, Subtotal	127	132
All Lands	All SGP Components[1]	595	733

Source: Compiled from Forest Service vegetation and fire data (Forest Service 2016b, 2016c; 2017a, 2017b); Midas Gold Mine Claim spatial data (Brown and Caldwell 2017b); Perpetua Project components (Perpetua 2021a), and AECOM timber volume formulas (AECOM 2020i).

[1]All quantities have been rounded; therefore, column and row totals may not add up exactly due to rounding performed in source data.

Permanent loss of timber resources would occur on 66 acres under the 2021 MMP. This would result primarily in localized, long-term and permanent, minor impacts to timber resources. Under the 2021 MMP and approximately 11 percent of the permanent loss of timber resources occurs on lands suited to timber production. This would result primarily in localized, long-term and permanent, minor impacts to timber resources.

The removal of timber resources from lands suited to timber production and unsuited lands, and the associated effect upon the PNF and BNF ASQ and TSPQ, are summarized in **Table 4.14-3.** Otherwise, it has an indistinguishable effect on the BNF ASQ and TSPQ from the 2021 MMP, despite removing timber resources from an additional 69 acres of land suited to timber production.

The use and construction of the Burntlog Route under the 2021 MMP would require removal of only 16 acres of timber resources. This would result primarily in localized, long-term and permanent, minor impacts to timber resources.

Table 4.14-3 Comparison of Timber Resource Removal on Forest-Wide ASQ and TSPQ by the 2021 MMP and Johnson Creek Route Alternative

Harvest Metric	2021 MMP Contribution Towards Annual Maximum (MBF), percentage	Johnson Creek Route Alternative Contribution Towards Annual Maximum (MBF), percentage
PNF TSPQ	899 MBF, (2%)	870 MBF (2%)
PNF ASQ	0 MBF (0%)	0 MBF (0%)
BNF TSPQ	952 MBF (2%)	1,546 MBF (4%)
BNF ASQ	206 MBF (1%)	808 MBF (3%)

Source: Compiled from Forest Service vegetation and fire data (Forest Service 2016b, 2016c; 2017a, and 2017b), Brown and Caldwell 2017b; Perpetua Project components (Perpetua 2021a), and AECOM timber volume formulas (AECOM 2020i).
MBF = thousand board feet; TSPQ = total sale program quantity; ASQ = allowable sale quantity

Closure and Reclamation

Reclamation of timber resources begins at the point when the analysis area can support the growth of timber species, the timing of which would vary spatially within the analysis area based on differing operations and closure timelines for different facilities and components. In areas where the ground surface would be cleared, grubbed, and graded during construction and operations, reclamation of timber resources would require the ground to be ripped, augmented with GM, and seeded/planted. In areas where minimal surface disturbance would be anticipated (i.e., the upgraded transmission line and associated tensioning/pulling areas), the removal of infrastructure would constitute the beginning of timber reestablishment. Most reclamation would occur in Mine Years 15 through 20, at which time replanting and site preparation at Yellow Pine pit, TSF Buttress, worker housing facility, and the new transmission line and associated infrastructure from Johnson Creek to the mine site would be initiated. As a result, timber resources would be absent from across the timber resources analysis area for more than 15 years until revegetation activities commence. Approximately 2 acres would be capable of natural regeneration from existing seedstock and seedlings (beneath the new transmission line) under the 2021 MMP, while the remaining 593 acres under the 2021 MMP would require a combination of site preparation techniques to support forest resource re-growth due to the intensity of the disturbance to existing soil and vegetation. Most disturbed areas planned for timber resource reclamation would not be prepared with GM or planted until operations are complete, including the Midnight GMS area, haul roads, the Yellow Pine pit walls, and North Yellow Pine GMS. The duration of impacts to timber resources, including lost timberland productivity, would be expected to persist for more than 15 years under all action alternatives.

To address losses of vegetation, 206 acres would be planted with conifer and other tree species. Areas identified for timber species replanting are entirely within the mine site, where lands would either be treated to regenerate forest conditions (planted at 81 trees per acre) or park-like conditions (planted at 170 trees per acre) under two conditions: cool aspect and general aspect. Planted timber species would include primarily Douglas-fir and lodgepole pine, with the inclusion of Engelman spruce on the cool-aspect sites (Tetra Tech 2021a).

To prepare disturbed sites for timber replanting, upland portions of the mine site would have 6 inches of stockpiled GM applied. Areas with a base of development rock or development rock and tailings (TSF) would have 12 inches of GM applied. Timber productivity generally correlates with soil depth and quality, which implies that the shallow depth of GM (6 inches) applied in most uplands where timber replanting is planned at final reclamation would likely limit native forest production. Productivity varies with other factors that are not equal across a site, such as moisture inputs, therefore an exact correlation between productivity and GM soil depth would not be expected. In addition, underlying "root zone material" influences productivity, because native forest trees may root several feet below the upper soil layers to exploit moisture and nutrients, and provide physical anchoring. In this case, the reclaimed sites over native soils or regolith material are therefore likely to be more productive than sites on development rock, despite the addition of 12 inches of GM on the TSF Buttress. Compared to native soils and regolith, mining substrates derived from deep in the earth present challenges to ecosystem reclamation (Cooke and Johnson 2002). These include physical characteristics of very coarse substrate in waste rock (development rock), and chemistry that is highly variable, but generally deficient in essential nutrients, and potentially high in other elements (metals) that may restrict plant growth.

Of the approximately 206 acres planned for revegetation in conifer species, at most 111 acres fall within the timber resources analysis area (i.e., where existing timber resources are located as well as planned for removal). The remaining areas are on portions of the analysis area that support grasslands, shrublands, and hardwood forest; or that were burned in the past and currently do not support timber resources. **Table 4.14-4** presents the area of timber resources in the analysis areas; the area that would be planted with timber species and other vegetation such as shrub or grassland species according to the Reclamation and Closure Plan (Tetra Tech 2021a); and the portion of each analysis area that would not be replanted (reclaimed). A minimum of 370 acres under the 2021 MMP, would not be replanted under the SGP.

Given the existing disturbed quality of the ground surface in many areas, particularly at the mine site, timber regrowth would not be expected to occur for many years. The Reclamation and Closure Plan does not include reclamation planting plans for disturbed portions of the utility corridor, at the off-site facilities, or along access roads; where 96 acres of timber resources in the analysis area under the 2021 MMP would be removed. According to the Reclamation and Closure Plan, the new road sections of Burntlog Route under the 2021 MMP would be removed and ripped, while the upgraded portions would be narrowed to their current conditions, and the excess width would be reclaimed. However, due to the layout of the upgraded road sections (flatter grades and gentler curves), the post-mining condition would exceed the width of the existing condition, representing a small permanent loss of timber resources. Reclamation of new sections of Burntlog Route under the 2021 MMP would not commence until all final closure/reclamation has been completed at the end of the post-closure phase. In the absence of planting and GM placement, timberland regeneration along new sections of Burntlog Route would depend on natural seeding from adjacent forest and would likely take more than 20 years to establish.

Table 4.14-4 Existing Timber Resource Area and Planned Replanting in the Analysis Areas of the 2021 MMP and Johnson Creek Route Alternative

Action Alternative	Timber Resources in Analysis Area (acres)	Planted with Timber Species (acres)[1]	Planted with Shrub or Grassland Species (acres)[2]	Timber Resources not Reclaimed (acres)	Percent of Analysis Area not reclaimed (acres)
2021 MMP	595	111	114	370	62%
Johnson Creek Route Alternative	733	111	114	508	69%

Source: Compiled from Forest Service vegetation and fire data (Forest Service 2016b, 2016c; 2017a and 2017b), Perpetua Project components (Perpetua 2021a), Tetra Tech 2021a, and Brown and Caldwell 2017b.

[1]The area reclaimed to timber resources is based on the overlap of the analysis area for timber resources and the location of Forested and Parkland planting areas presented in the Reclamation and Closure Plan (Tetra Tech 2021a).

[2]The area reclaimed to shrubs or grassland is based on the overlap of the analysis area for timber resources and the location of Shrubland areas, as well as areas designated for seeding of grasses and herbaceous species presented in the Reclamation and Closure Plan (Tetra Tech 2021a).

Approximately 114 acres in the analysis area would be ripped, and receive other site preparation such as GM placement, but would not be planted with timber species. These areas would not be prevented from supporting timber species; however, the anticipated GM depths and subsurface materials in these locations would potentially be restrictive, particularly at providing rooting depths required by mature trees. Based on planting maps, and GM characteristics and placement plans, it is anticipated that at best, only 20 percent of the analysis area for the action alternatives could be adequately restocked within 5 years after final harvest. In most locations where timber resources would be removed, timber vegetation is not part of the planting plan (approximately 80 percent of the analysis area), and vegetation conditions would resemble either grasslands or shrublands, or remain bare for an extended period following closure and reclamation.

4.14.2.3 Johnson Creek Route Alternative

Construction and Operations

Merchantable timber cut during construction and operations may be sold as part of the Johnson Creek Route Alternative. Vegetation clearing would be completed on 733 acres containing 547,984 CF of sawtimber and sub-merchantable product under the Johnson Creek Route Alternative. This would result primarily in localized, long-term and permanent, minor impacts to timber resources. The Johnson Creek Route Alternative contains 123 acres of lands suited for timber production, which include the 54 acres associated with the transmission line upgrade (within BNF MPC 5.1 and 4.2) plus an additional 69 acres associated with the Johnson Creek Route (within BNF MPC 5.1). The suited timberlands under the Johnson Creek Route Alternative contain 808 MBF of sawtimber. There is no suited timberland in the analysis area on the PNF under either action alternative. **Tables 4.14-1** and **4.14-2** show the area of timber resources and associated volume of wood removed during construction and operations under the Johnson Creek Route Alternative on NFS land as well as other public or private land.

Timber resources under either action alternative would be removed during the construction phase, and the soil surface cleared and grubbed to accommodate roads and infrastructure. Timber resources would be largely prevented from reestablishing through the operations period due to the ongoing need for the underlying ground to accommodate structures, facilities, and access routes. Exceptions to this timeline would occur along Burntlog Route (Under the 2021 MMP), which would remain in use throughout the closure and reclamation phase. Construction and operations under either action alternatives would have long-term effects on the availability and extent of timber resources in the analysis area. These effects would be long-term because timber resources would be removed at the start of the SGP, during the construction period, and the disturbed areas would remain largely unavailable for planting or regrowth for over 15 years. In addition, the action alternatives include permanent impacts on the availability and extent of timber resources through the permanent conversion of existing timber resources to other, non-timber uses, including the expanded ROW for the existing transmission line and the permanent, continued use of the upgraded Johnson Creek and Stibnite roads under the Johnson Creek Route Alternative.

The removal of timber resources from lands suited to timber production and unsuited lands, and the associated effect upon the PNF and BNF ASQ and TSPQ, are summarized in **Table 4.14-3**, which shows the Johnson Creek Route Alternative has a larger effect on the PNF TSPQ. Otherwise, it has an indistinguishable effect on the BNF ASQ and TSPQ between the action alternatives.

The Johnson Creek Route Alternative includes the use of the Johnson Creek Route for mine site access under the Johnson Creek Route Alternative instead of construction and use of the Burntlog Route and additional small differences, such as repeater sites along that route and the public access road through the mine site would also carry mine and supplier traffic to administration and worker housing facilities. Under the Johnson Creek Route Alternative, the use of the Johnson Creek Route for construction, operations, and closure and reclamation and the development of a groomed OSV route would increase the extent of timber resources removal by approximately 119 acres (most of which is on land managed by the Forest Service) over the 2021 MMP. This would result primarily in localized, long-term and permanent, minor impacts to timber resources.

The Johnson Creek Route Alternative includes public access roads through the mine site during construction, operations, and closure and reclamation. In addition, the Johnson Creek Route Alternative public access road also would serve as a mine delivery route. Timber resources removal associated with public access roads through the mine site is approximately 13 acres under the Johnson Creek Route Alternative. This would result primarily in localized, long-term and permanent, minor impacts to timber resources under the Johnson Creek Route Alternative.

All other construction and operations impacts to Timber Resources are as described for the 2021 MMP.

Closure and Reclamation

Up to 731 acres under the Johnson Creek Route Alternative would require a combination of site preparation techniques to support forest resource re-growth due to the intensity of the disturbance to existing soil and vegetation. Up to 508 acres under the Johnson Creek Route Alternative would not be replanted under the SGP (**Table 4.14-4)**. The Johnson Creek Route Alternative timber analysis area would receive the largest replanting effort of all the action alternatives; however, it would involve the smallest timber resource reclamation effort, based upon reclamation area as a percent of disturbed area.

The Reclamation and Closure Plan does not include reclamation planting plans for disturbed portions of the utility corridor, at the off-site facilities, or along access roads where 104 acres of timber resources in the analysis area under the Johnson Creek Route Alternative occurs would be removed. All other closure and reclamation impacts to Timber Resources are as described for the 2021 MMP.

4.14.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Timber Resources.

4.14.4 Irreversible and Irretrievable Commitments of Public Resources

4.14.4.1 No Action Alternative

Under the No Action Alternative, the SGP would not be undertaken. Consequently, no change would occur in the current status of timber resources in the analysis area, and no irretrievable or irreversible commitments of timber resources would occur.

4.14.4.2 Action Alternatives

An irreversible commitment of timber resources and land suited for timber production to other uses would occur in the expanded ROW associated with upgrades to the existing transmission line, which would not be returned to timberland at completion of the SGP. This permanent reduction of timberland would cover approximately 66 acres (2021 MMP) and 282 acres (Johnson Creek Route Alternative) in the analysis area and contain 12 acres (2021 MMP) and 28 acres (Johnson Creek Route Alternative) of land suited for timber production in MPCs 5.1 and 4.2, with approximately 206 MBF (2021 MMP) and 808 MBF (Johnson Creek Route Alternative) of sawtimber.

Although most timber species are considered to be renewable, certain timber resources that would be impacted under the 2021 MMP would be renewable only over long-time spans, including mature sawtimber. Growth of timber species in the analysis area would be affected and their growth particularly slowed, in highly disturbed portions of the mine site due to the loss of native soil resources and the long timespan required for replaced soil resources (GM) to recover productive capacity. In addition, some seedbanks and topsoil may have long recovery periods following the disturbance associated with the 2021 MMP. In most disturbed portions of the analysis area, timber re-growth would be prohibited for the duration of the construction and operations but would be encouraged to resume during the reclamation phase. During this phase, all facilities, structures, new access roads, and other components, excluding the expanded ROW around the transmission line upgrades, would be removed. Limited areas of previously occupied timberland at the mine site would be replanted, while much of the previously occupied timberland would be left to naturally re-seed from adjacent plant sources. Reestablishment of high-value timber resources may require decades or longer to return timber vegetation to the extent of the analysis area from which timber resources would be removed.

The removal of timber resources is an irretrievable commitment because of the long timespan required for timber resources renewal, particularly sawtimber. SGP-related activities throughout the analysis area would remove timber resources for 15 years at a minimum, and likely for as many as 50 years in some places. The removal of sub-merchantable product from the analysis area is an irretrievable commitment because special forest products derived from those sub-merchantable trees would be unavailable during operations and construction, and likely for an additional 5 or more years after replanting. In MPCs 5.1 and 4.2 in the BNF, the 2021 MMP would prohibit (but not permanently prevent) timber production on 4 acres (2021 MMP) and 10 acres (Johnson Creek Route Alternative) of land suited for timber production over approximately 20 years. Sawtimber and special forest product resources in these areas would be irretrievably affected.

4.14.5 Short-term Uses versus Long-term Productivity

4.14.5.1 No Action Alternative

Under the No Action Alternative, SGP activities related to construction, operations, closure and reclamation of the mine site and associated infrastructure would not be undertaken. Consequently, no change would occur in the extent or volume of timber resources or special forest products in the analysis area, and no impacts to productivity would occur.

4.14.5.2 Action Alternatives

Mine operations and connected actions would dominate land use, and predominantly prevent timber resources re-growth, on approximately 370 acres (2021 MMP) and 508 acres (Johnson Creek Route Alternative) of land containing existing timber resources (**Table 4.14-3**). After operations end, land uses affected by the mine, access roads, utilities, and off-site facilities would largely return to pre-SGP uses, except for the expanded ROW associated with the upgraded transmission line, which would be permanently removed from long-term timber productivity. The long-term productivity of most timberlands removed during construction and operations would therefore be temporarily reduced, but then would be facilitated through site preparation, seeding, and planting described in the Reclamation and Closure Plan. The effectiveness of GM reclamation and planting mix, techniques, and maintenance, would determine the long-term productivity of disturbed timber resources in the 2021 MMP analysis area. Based on analyses presented in **Section 4.5.2**, Direct and Indirect Effects to Soils, the long-term productivity of timber resources would be closely tied to the success of soil and GM reclamation. Some portions of the analysis area containing existing timber resources, particularly those in the footprints of the TSF, TSF Buttress, and pits, would likely never return to their pre-SGP productive capacity due to limitation on rooting depth related to the depth of the GM and waste rock that would function as substrate for the foreseeable future.

4.15 Land Use and Land Management

4.15.1 Impact Definitions and Effects Indicators and Methodology

The analysis of effects to land use and land management includes the following issues and indicators:

Issue: The SGP would cause changes in land use or land management.

Indicators:

- Acres of land used for SGP components by land management agency.
- Acres of total and new land disturbance within SGP area.

Issue: The SGP would cause changes in or create new rights-of-way (ROWs) or easements.

Indicators:

- Miles or acres of new or changed ROWs or easements, regardless of jurisdiction.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1**.

4.15.2 Direct and Indirect Effects

4.15.2.1 No Action Alternative

Under the No Action Alternative, the SGP would not be implemented. The reclamation of legacy mining areas associated would not occur under the No Action Alternative. The Golden Meadows Exploration Project would occur near and within the analysis area and would include exploration activities to better define mineral potential in the area. The proposed exploration drilling areas would occur on NFS lands for a period of at least 3 years. No changes to land use or land management would be expected under the No Action Alternative.

4.15.2.2 2021 MMP

The 2021 MMP includes the potential to impact land use and land management through mine development and operations, construction of the Burntlog Route, construction of the SGLF and Burntlog Maintenance Facility, and the upgrade to and new construction of transmission lines. The 2021 MMP components and land management are shown in **Figure 3.15-1**.

Land Management

Under the 2021 MMP, the SGP area would disturb approximately 3,266 acres. NFS lands would comprise approximately 2,372 acres, or 73 percent, of the SGP area, of which 1,439 acres would be PNF-administered lands and 933 acres would be BNF-administered lands. Approximately 819 acres (25 percent) would be private lands, including lands owned by Perpetua, and 62 acres (2 percent) would be administered by the State of Idaho. Approximately 13 acres (less than 1 percent) would be administered by the BOR. **Table 4.15-1** shows land management and acreage by major component.

Table 4.15-1 2021 MMP Disturbance Acreage by Component

Component Subtotal	Private	State	BNF	PNF[3]	BOR	Total Acres
Mine Site Subtotal[1]	505	0	0	1,235	0	1,740
Access Roads Subtotal[1]	6	0	356	123	0	485
Utilities Subtotal[1]	284	62	572	81	12.5	1,012
Off-site Facilities Subtotal[1]	24	0	5	0	0	29
Total[2]	819	62	933	1,439[4]	12.5	3,266

[1] Utilities acreages include upgrades to utilities that are part of the Connected Actions.
[2] Subtotals may not add to totals due to rounding.
[3] Approximately 65 acres associated with surface exploration pads and temporary roads (mine site component) have unknown land management breakdown because the exact locations of these exploration areas are not yet known; however, these are included in the PNF mine site subtotal.
[4] Approximately 14 acres of land listed under the PNF is administered by the PNF but is within the boundary of the Salmon-Challis National Forest.

Land Use

Operations Area Boundary Site

Portions of the Operations Area Boundary have been subject to mining activities for over a century. There are some patented and unpatented mining claims in the Operations Area Boundary which would not be utilized by the SGP while the 2021 MMP construction and operations would take place on approximately 512 acres of patented mining claims, and approximately 1,370 acres of unpatented mining claims (**Table 4.15-2**) on NFS land.

Table 4.15-2 2021 MMP Patented and Unpatented Mining Claims

Mining Claim Type	Quantity
Patented Claims (Acres)	512
% Patented Claims	27%
Unpatented Claims (Acres)	1,370
% Unpatented Claims	73%
Total Area (Acres	1,882

Areas within the Operations Area Boundary are highly disturbed by past mining activities and show evidence of long-term mine operations as a dominant land use. However, development of the mine site has not occurred at the scale proposed for the 2021 MMP, and the mine operating footprint would extend beyond areas that have been previously disturbed from mining activity. Implementation of the 2021 MMP would change the land use from an area that has been intermittently disturbed and partially reclaimed, to an expanded area of industrial development.

Public access to and through the mine site is currently allowed and used for dispersed recreation, as well as access to surrounding areas for recreation. During construction and operation of the 2021 MMP, public use would not be allowed within the Operations Area Boundary; however, there would be a public access

road through the Operations Area Boundary (**Figure 2.4-2**). As discussed in **Section 4.19**, approximately 13,441 acres of NFS lands within the Operations Area Boundary would be inaccessible to dispersed recreation during construction and operation of the 2021 MMP (Forest Service 2022m). Public access to NFS lands within the Operations Area Boundary would be closed for timber harvest and designated tribal uses (**Sections 4.14** and **4.24**).

The 2021 MMP would expand on the past and current land use of mining and mining-related activities and would restrict public access. This land use would be considered a direct impact. The duration of direct impacts to land use would be the approximately 20-year life of the SGP. Following closure and reclamation of the mine, land use would be restored to its current use (except at the TSF and TSF Buttress), with a landscape evident of past mining activity but open for public access for dispersed recreation and access to surrounding areas. Impacts would be localized, long term, and minor to moderate as the NFS lands within the Operations Area Boundary represent a minor portion of the PNF's 2.3 million acres.

Access Roads

During the initial 1- to 2-year construction period, access to the mine site under 2021 MMP would use the Johnson Creek Route until the Burntlog Route is completed. For the remainder of the life of the mine, access would be via the Burntlog Route.

OSV trail opportunities would be maintained during construction through a new temporary groomed OSV trail adjacent to the western side of Johnson Creek Road (CR 10-413) from Landmark to Trout Creek campground. Due to year-round access to the mine site first along Johnson Creek Route during construction and then along the Burntlog Route, an existing, approximately 11-mile groomed OSV route from Warm Lake to Landmark would be closed. In addition, during use of the Johnson Creek Route a 9-mile segment of OSV trail between Trout Creek campground and Wapiti Meadows would be closed. A new public access road would be constructed through the mine site to link the Stibnite Road portion of the McCall-Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) (**Figure 2.4-2**).

Existing Roads

Land use along the Johnson Creek Route, existing segments of the Burntlog Route, and the OSV groomed routes includes roadway uses on private and NFS land. Improvements to existing access roads could indirectly alter land use in areas adjacent to roadways through increased vehicle use and recreational access, beginning during construction.

Temporary closure of the existing 9-mile OSV route from Trout Creek campground to Wapiti Meadows under the 2021 MMP, during use of the Johnson Creek Route while Burntlog Route is constructed, would convert the land use from mainly recreation to mining transportation use for the short term. Impacts land use associated with access roads and OSV trails would be localized, long term, and minor.

New Roads

Construction of the new roads under the 2021 MMP would result in a change in use of approximately 341 acres of currently undisturbed NFS a land. The new public access road through the mine site would result

in a land use change of approximately four acres of NFS and private land. The temporary Johnson Creek groomed OSV trail and Cabin Creek Road groomed OSV trail would result in a change in use of approximately 15 acres and 21 acres of NFS lands, respectively (**Table 4.15-3**).

The new segments of Burntlog Route and the public access road through the mine site may be authorized under either 36 CFR 251 as a special use (if it meets the regulatory criteria) or under 36 CFR 228A as a part of a plan of operations. The new roadway segments are considered a direct effect to land use, resulting in a total change of approximately 341 acres of NFS land, including approximately 301 acres for the Burntlog Route.

The construction and operation of the new road segment for the Burntlog Route would introduce new motorized access to an area where it currently does not exist. Recreational use and recreational special use areas adjacent to new roadway segments outside of the Operations Area Boundary could expand due to increased incidental public access. Collectively, these changes in land use would be considered an indirect impact. These indirect impacts would be experienced during construction, operation, and closure and reclamation of the mine site under the 2021 MMP.

The 16-foot wide, groomed OSV trails would introduce 75 acres (30.7 miles) of recreational uses to the area around Warm Lake (**Table 4.15-3**). Additionally, near Warm Lake, an approximately 2-acre parking area would be established west of South Fork Road on FR 474B These new recreational land uses would be considered a direct impact. Indirect impacts may result if new areas are accessed via these routes. The duration of these impacts would be during construction and operation of the 2021 MMP, and these roadways would be reclaimed following closure of the mine site. Impacts to land use from new roads and OSV trails would be localized, long term, and minor to moderate.

Table 4.15-3 OSV Trails

OSV Trail	Length in miles	Acres of Trail[1]
Trout Creek Campground	9.0	17.2
JCR OSV trail during construction	8.1[2]	15.8
JCR OSV trail during operations	7.8[2]	15.1
Cabin Creek Road OSV trail	10.8	21.0
Cabin Creek to JC OSV connector	0.8	1.6
Warm Lake area OSV connector	0.4	0.8
Parking area to Warm Lake Project Camp OSV Trail	1.9	3.6
Total	**30.7**	**75.1**

[1] OSV Trail width estimated at 16 feet
[2] Operations miles/acres included in total

Utilities

Transmission Lines

The 2021 MMP would include rerouting the transmission line in two locations. Approximately 5.4 miles of the upgraded transmission line would be rerouted to avoid the Thunder Mountain Estates subdivision,

and approximately 0.9 mile of the upgraded transmission line would be rerouted to use an abandoned railroad grade. Approximately 9 miles of new transmission line would be required for the 2021 MMP from the Johnson Creek substation to the mine site.

Transmission Line Upgrade

The upgraded transmission line under the 2021 MMP would impact 373 total acres (**Table 4.15-4**) by expansion of the ROW from 50 to 100 feet. Approximately 64 miles of transmission line would require upgrading. Transmission line upgrades are assumed to require a total ROW width of 100 feet.

Approximately 192 acres of the transmission line ROW associated with the upgrade would be on NFS lands. IPCo's existing transmission line, its ROW, and access roads are currently authorized under the BNF special use permit #CAS400128. Upgrading the transmission line would require the BNF to amend the existing IPCo special use permit.

Approximately 139 acres of the transmission line ROW associated with the upgrade would be on private land in Valley County and would be associated with two Valley County land use designations: rural and city areas of impact. Construction of the transmission line upgrade on private land would require a conditional use permit from Valley County.

Approximately 35 acres of the transmission line ROW associated with the upgrade would be on state land. A new or amended easement would be required for the expansion of the ROW width to accommodate the upgraded transmission line. The existing transmission line is authorized to IPCo, and a portion of this ROW intersects State Endowment Lands. The IDL is responsible for granting or modifying the transmission line ROW on state-owned lands, if required.

Approximately 7 acres of the transmission line ROW associated with the upgrade would be on BOR land. Upgrading the transmission line would require the BOR to amend the existing IPCo special use permit.

As the transmission line already exists, expansion of the ROW from 50 feet to 100 feet in width and upgrade of the transmission line would be a localized, long term, and negligible to minor impact to land use.

New Electric Transmission

Between the new Johnson Creek Substation and the mine site, approximately 9 miles of new 138-kV transmission line would be constructed. The ROW for the new transmission line would be approximately 100 feet wide. The new ROW corridor is considered a direct effect to land use, changing these areas from undeveloped land to a utility use during construction, operation, and closure and reclamation. The ROW required for the new transmission line segment would disturb approximately 101 acres (assuming a final width of 100 feet) of NFS, private, and state land (**Table 4.15-4**).

Approximately 88 acres of the new transmission line ROW would be required on NFS lands. The new ROW on NFS land may be authorized under either 36 CFR 251 as a special use (if it meets the regulatory criteria) or under 36 CFR 228A as a part of a plan of operations. Approximately 13 acres of a new ROW on private lands in Valley County would be associated with one Valley County land use designations: rural.

The authorization of a new transmission line ROW would result in a land use change, as lands are converted from undeveloped forest land to a managed ROW. Recreational use and recreational special use areas adjacent to a new ROW could change due to increased access from new maintenance access roads. Changes in land use because of the new transmission line ROW would result in both direct and indirect impacts to land uses under the 2021 MMP. Direct effects to land use would be approximately 101 acres. Indirect impacts would be experienced through the conversion of undeveloped land that is commonly available for recreational, tribal, and other special uses. Impacts would be localized, long term, and minor.

Table 4.15-4 Transmission Line ROWs Required

Land Management	Transmission Line ROW (Upgrade)	Transmission Line ROW (New)
Private	138.8	13.5
% Private	37%	13%
State	34.9	0
% State	9%	0%
NFS	192.1	87.6
% NFS	52%	87%
BOR	7.1	0
% BOR	2%	0%
Total Area (Acres)[1]	**372.9**	**101.1**

Source: Perpetua 2021b
[1]Subtotals may not add to totals due to rounding.

Electrical Substations

Upgrades to Oxbow, Horse Flat, McCall, and Lake Fork substations would not require any additional land. The Warm Lake Substation upgrade would use an additional 0.3 acres of NFS lands. The Johnson Creek substation would be built near the Johnson Creek airstrip on NFS lands and would provide upgraded electricity to the mine site. The SGLF Scott Valley Substation would be within the footprint of the SGLF, utilizing 0.9 acres of private land. The Thunderbolt Drop Substation would occupy 0.1 acre of NFS land. The Mine Site substation would be constructed at the mine site to step-down voltage for distribution and would be located on private lands (less than 1 acre within the mine site disturbance footprint). The Johnson Creek substation would be on NFS land (1.1 acres during construction, 0.4-acre operations footprint). Construction and operation of the Johnson Creek substation would be managed under a Forest Service Special Use permit. Construction and operation of substations on private land may require a conditional use permit from Valley County. The Cascade switching substation would be located along Warm Lake Road and would utilize 2.6 acres of private land.

Land use would change to accommodate the more industrial land use of the substations. This change in land use is considered a direct impact that would last through construction and operation and would be reclaimed post-closure. Impacts would be localized, long term, and negligible to minor.

Communication Towers and Repeater Sites

Under the 2021 MMP, existing communication facilities would be expanded using a two-way, rapid communication system. The existing microwave relay tower on private land to the east of the mine site would be upgraded, but the area of disturbance would not change. The two-way radio system would be supported by a series of repeaters placed on public and private land. To maintain communications along the entire Burntlog Route, 10-foot-tall, VHF radio repeaters on 3-foot by 3-foot concrete pads would be placed near the existing Meadow Creek Lookout and Thunderbolt Lookout communication sites, the new Burntlog Maintenance Facility, and on private parcels at the mine site, as needed. No additional disturbance for equipment installation or access would be required. Additionally, a cell tower would be installed to facilitate safety and emergency communications. The disturbance area for the tower would be approximately 30 feet by 60 feet, including all required equipment, and would be near the Meadow Creek Lookout, on a summit east of Blowout Creek drainage, or near the proposed transmission line alignment upslope of the proposed Hangar Flats pit.

Although these communication sites would have small disturbance footprints (less than 0.1 acre each), they would be considered changes in land use from undeveloped to utility use. This change in land use is considered a direct impact that would last throughout construction and operation. Upon closure of the mine site, any communication facilities would be decommissioned and removed, and the ground would be contoured to blend into surrounding terrain. Impacts would be localized, long term, and negligible to minor.

Off-site Facilities

The SGLF would be built on private land along Warm Lake Road and would require approximately 25 acres of disturbance. It would alter land use in this area from undeveloped land to developed land. This change in land use would be considered a direct impact of the 2021 MMP. The duration of these impacts would be the life of the SGP (approximately 20 years), and it would be returned to undeveloped land post-reclamation or sold and repurposed.

The Burntlog Maintenance Facility (3.5 acres) would be near Burntlog Route within the disturbance limits of one of the Burntlog Route borrow sources and would not create additional changes to anticipated land use impacts.

Operation of these facilities on NFS lands may be authorized under either 36 CFR 251 as a special use (if it meets the regulatory criteria) or under 36 CFR 228A as a part of a plan of operations. The off-site facilities would be considered a change in land use from open space to developed land. Following mine closure and reclamation, the Burntlog Maintenance Facility buildings and infrastructure would be removed and the area reclaimed. The SGLF could have a “light industry” post-mining land use in which the facility could be maintained by a third party for future use, meaning the facility, located on private land, would not be reclaimed. A new conditional use permit from Valley County would be required prior to use by any other entity. If there is no further use of the site after a two-year time frame, the structures would be removed and the site reclaimed (**Section 2.4.7.11**). Impacts would be localized, long-term, and negligible.

4.15.2.3 Johnson Creek Route Alternative

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed. Other differences from the 2021 MMP would include using Johnson Creek Route throughout the life of the mine and relocating the maintenance facility to a site near Landmark.

Land Management

Under the Johnson Creek Route Alternative, the SGP area would occupy approximately 3,095 acres. Approximately 829 acres (27 percent) would be private lands, including lands owned by Perpetua, and 62 acres (2 percent) would be administered by the State of Idaho. NFS lands would comprise approximately 2,192 acres, or 71 percent, of the disturbance area (1,372 acres on PNF-administered lands and 820 acres on BNF-administered lands). Approximately 12.5 acres (less than 1 percent) would be administered by the BOR. **Table 4.15-5** shows land management and acreage by major component.

Table 4.15-5 Johnson Creek Route Alternative Land Management and Acreage by Component

Component Subtotal	Private	State	BNF	PNF[3]	BOR	Total Acres
Mine Site Subtotal[1]	501	0	0	1,227	0	1,728
Access Roads Subtotal[1]	19	0	245	64	0	328
Utilities Subtotal[1]	284	62	571	81	12.5	1,011
Off-site Facilities Subtotal[1]	24	0	5	0	0	29
Total[2]	828	62	820	1,372	12.5	3,095

[1] Utilities acreages include upgrades to utilities that are part of the Connected Actions.
[2] Subtotals may not add to totals due to rounding.
[3] Approximately 65 acres associated with surface exploration pads and temporary roads (mine site component) have unknown land management breakdown because the exact locations of these exploration areas are not yet known; however, these are included in the PNF mine site subtotal.

Land Use

Operation Area Boundary

The mine site footprint under the Johnson Creek Route Alternative would occupy approximately 1,728 acres. The Johnson Creek Route Alternative would create approximately 881 acres of new disturbance at the SGP. Mining methods as outlined for the 2021 MMP would not change under the Johnson Creek Route Alternative. The mining claim information for the Johnson Creek Route Alternative is also the same as for the 2021 MMP. The difference in acreage between the Johnson Creek Route Alternative at the mine site is due the size and location of the public access road. Compared to the 2021 MMP, the public access road for the Johnson Creek Route Alternative would need to be wider with less steep grade to accommodate mine traffic and heavy vehicles associated with deliveries to the mine, resulting in a larger acreage.

Impacts to land use and during construction, operation, and post-closure under the Johnson Creek Route Alternative would be the same as those discussed under the 2021 MMP.

Access Roads

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed, and the Johnson Creek Route would be used for access during mine construction, operations, closure, and reclamation. Public access would be provided through the mine site similar to that described in the 2021 MMP, although this road would also carry mine traffic and heavy vehicles associated with deliveries to the mine. The closure of the groomed OSV trail from Trout Creek campground to Wapiti Meadows would persist during mine construction, operation, and closure and reclamation (it would only be closed during construction of the Burntlog Route under the 2021 MMP). The other OSV trails would be the same as described under the 2021 MMP. Access for cell tower and VHF repeater sites in IRAs managed for Backcountry /Restoration would be via helicopter under the Johnson Creek Route Alternative.

Existing Roads

Impacts to land use along the Johnson Creek Route and the OSV trails would be the same as described in the 2021 MMP, except major improvements (i.e., widening and upgrading) to the Johnson Creek Route would impact land use on approximately 175 acres of private and NFS lands. This acreage includes development of borrow sources along the Johnson Creek Route for use in upgrading and maintaining the road throughout the life of the mine.

New Roads

Construction of the new roads under the Johnson Creek Route Alternative would result in a land use change of approximately 217 combined acres on NFS and private land. The new public access road through the SGP would result in a change in use of approximately five acres of NFS and private land.

The new ROW for expansion of the Johnson Creek Route and the public access road may be authorized under either 36 CFR 251 as a special use (if it meets the regulatory criteria) or under 36 CFR 228A as a part of a plan of operations. The new ROW corridor is considered a direct effect to NFS land use.

The OSV trail land use impacts would be the same as the 2021 MMP, except the OSV trail from Trout Creek Campground to Wapiti Meadows would be closed for the life of the SGP, a long-term, localized, minor impact.

The duration of these impacts would last through construction and operation of the Johnson Creek Route Alternative. The new roadway segments would be reclaimed following closure of the mine site, except for the Johnson Creek Route which would remain as improved under the Johnson Creek Route Alternative. Indirect impacts to land uses such as motorized access, recreation, and timber harvests would be the same as those described under the 2021 MMP.

Utilities

Transmission Lines

Impacts from transmission line upgrades and construction of a new segment would be the same as that described for the 2021 MMP.

Electrical Substations

Land use impacts from electrical substations in the Johnson Creek Route Alternative would be the same as those described under the 2021 MMP.

Communication Towers and Repeater Sites

Land use impacts from communication towers and repeater sites would be similar to those described under the 2021 MMP, except the repeater sites would be located along Johnson Creek Route.

Off-site Facilities

Land use impacts from the SGLF would be the same as those described under the 2021 MMP. The Landmark Maintenance Facility would be located west of Landmark on the southern side of Warm Lake Road on approximately 3 acres of NFS land. Operation of this facility on NFS lands may be authorized under either 36 CFR 251 as a special use (if it meets the regulatory criteria) or under 36 CFR 228A as a part of a plan of operations. The off-site facilities would be considered a change in land use from open space to developed land. This change in land use would last through construction and operation and would be returned to open space post-reclamation. impacts would be localized, long-term, and negligible.

4.15.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Land Use and Land Management.

4.15.4 Irreversible and Irretrievable Commitments of Public Resources

4.15.4.1 Action Alternatives

Land use would be altered permanently in the mine site. An area that has been historically used for mining would, after the closure of the mine and reclamation of the site, no longer be used for mining; this would be considered an irreversible commitment of land use. Areas where specific land uses for the action alternatives would be converted from their original land uses, such as recreational (including special uses), tribal, and timber harvests, to mining uses would be considered an irretrievable commitment of land use, because these areas would not be available for other land uses during the life of the SGP for any of the action alternatives.

4.15.4.2 No Action Alternative

Under the No Action Alternative, the SGP would not be undertaken. There would be no irretrievable and irreversible commitment of public resources expected under the No Action Alternative.

4.15.5 Short-term Uses versus Long-term Productivity

4.15.5.1 Action Alternatives

Land use would change if either of the action alternatives are implemented. Long-term changes in land use could impact how the area is used for agriculture, fisheries, timber harvests, tribal, recreational, and other uses. However, on reclamation of the action alternatives, it is expected many of the original uses would be restored to areas impacted by the SGP.

4.15.5.2 No Action Alternative

The SGP would not be implemented, and there would not be any impacts from short-term uses on long-term productivity associated with the No Action Alternative.

4.16 Access and Transportation

4.16.1 Impact Definitions and Effects Analysis Indicators and Methodology

The analysis of effects to access and transportation includes the following issues:

Issue: The SGP may affect access to public lands during mine construction, operations, and closure and reclamation.

Indicator:

- Number, location, and description of changes in access due to new and improved roadways.

Issue: The SGP may change the miles of roads, the amount of use, and types of vehicles on each road.

Indicators:

- Miles of new road.
- Change in amount of use.
- Changes in frequency of rail, air, and water transportation.

Issue: The SGP may affect public safety on the roads used by mine vehicles during construction, operations, and closure and reclamation activities via traffic incidents and potentially associated spills.

Indicators:

- Miles of roads used by mine vehicles.
- Change in traffic volume.
- Change in emergency access.

The impacts definitions for intensity, duration (Forest Service 2012c), and context are provided in **Table 4.16-1**.

A traffic management plan, which would include details for traffic management including road closures affecting public and mine traffic access, has been drafted (Perpetua 2021e). Details of traffic management for public access on the routes for construction, operations, and closure and reclamation, including

through the Operations Area Boundary are general and would be finalized before the ROD for the SGP is signed. The traffic management plan also describes commitments that would be made in a Road Maintenance Agreement with Valley County. These agreements would include commitments regarding snow removal and wintertime maintenance on Warm Lake Road plus safety measures including frequent removal of snow from catchment areas, designed ditches for holding snow, and installation of delineators.

Static population growth rate was used to analyze the action alternative impacts to access and transportation. Although Valley County assumes four percent population growth throughout the county in its Master Transportation Plan, Valley County is a rural county with land use designations comprised of rural cities, villages, and tourist hubs (Valley County 2008a). Although the population in the area has been growing rapidly and is predicted to continue at a substantial rate, in general, rural areas have been static, and populations are predicted to remain the same or increase at a slower rate (Forest Service 2010a).

Table 4.16-1 Impact Definitions for Access and Transportation

Attribute	Term	Description
Intensity	Negligible	Effects on traffic conditions and access in the analysis area would either not occur or would be so slight as to not be noticeable. No access restrictions to existing, authorized land uses would occur. There would not be a perceptible impact from traffic generation on current traffic conditions.
Intensity	Minor	Effects on traffic flows and access would be measurable and may be noticeable but would be small and would not adversely impact traffic conditions. Access to existing land uses would be maintained. Applicant-committed EDFs would effectively minimize impacts to the area transportation network.
Intensity	Moderate	Effects on traffic flows and access would be measurable and readily apparent but would not exceed state standards. There would be a readily apparent, measurable traffic increase on access roads, but not the paved highways. Additional mitigation measures beyond applicant-committed EDFs may be required to minimize adverse effects on transportation, but such measures likely would be successful.
Intensity	Major	Effects on traffic flows and access would be measurable and would be readily apparent to all. Mitigation measures beyond applicant-committed EDFs may be required to minimize impacts to transportation, and such measures would have to be monitored to determine their effectiveness.
Duration	Temporary	Impacts are anticipated to last no longer than 1 year.
Duration	Short-Term	Impacts would last up to 3 years.
Duration	Long-Term	Impacts would last longer than 3 years up to 20 years.
Duration	Permanent	Impacts would remain after reclamation.
Context	Localized	Effects on access and transportation would be limited to the analysis area.
Context	Regional	Effects on traffic safety, access, and transportation would extend beyond the analysis area.

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.

4.16.2 Direct and Indirect Effects

4.16.2.1 No Action Alternative

Under the No Action Alternative, no approval would be undertaken for the SGP. Consequently, the current transportation systems would remain as they are under existing conditions and there would not be any SGP-related traffic on the roadways. Traffic associated with the currently authorized Golden Meadows Exploration Project would continue until reclamation is complete. Valley County would continue to maintain the roads under the FRTA easements. Road maintenance activities would include blading and shaping the roadbed, ensuring proper moisture conditions of the road surface, cleaning and repairing drainage facilities, removal of obstructions, dust abatement, and snow removal (Lau 2018).

No direct or indirect effects on access and transportation from SGP-related activities would occur under the No Action Alternative.

4.16.2.2 2021 MMP

Warm Lake Road north of Cascade intersects SH 55, which is a major transportation corridor throughout Valley County. Perpetua would work with the ITD to improve the Warm Lake Road intersection with SH 55 by adding left and right turning lanes. Improvements may include the addition of a northbound right turn lane, a southbound left turn lane, a new southbound through lane or an acceleration lane on SH 55; modified striping to reduce the skew angle to better accommodate heavier vehicles without additional improvements; and relocation of the 35-mph to 50-mph increase in speed limit on SH 55 at Warm Lake Road farther north (Parametrix 2018a). The addition of turning lanes would allow for large trucks carrying equipment and supplies to make turns to/from SH 55 from/onto Warm Lake Road. The improvements also would require approval by Valley County.

The 2021 MMP would need year-round passenger and delivery truck access from the onset of construction through the life of the mine. Warm Lake Road is suitable for this use in its current condition. Wintertime maintenance east of Warm Lake Lodge would be conducted by Perpetua to ensure safe, year-round access to the sole route of ingress/egress to the Operation Area Boundary for all mine support traffic. This would include snow removal and road sanding, as appropriate, to maintain a safe driving surface. Commitments for wintertime maintenance of Warm Lake Road would be documented in a Road Maintenance Agreement with Valley County.

Perpetua wintertime maintenance and use of Warm Lake Road would result in two changes to current traffic conditions, one change would be that Warm Lake Road east of Warm Lake Lodge would not be available as a recreational OSV route from the start of construction through reclamation of the SGP. To replace this recreational use, a dedicated alternative OSV route would be established from the Warm Lake area to Landmark via the Cabin Creek/Trout Creek drainages and adjacent to the Johnson Creek Road. Establishing this replacement OSV route would minimize the interactions between SGP traffic and recreational traffic in the winter. The proposed OSV route is illustrated on **Figure 2.4-4**. The other change in conditions would be expanded wintertime public vehicle access on Warm Lake Road east of Warm Lake Lodge would commingle SGP and public travel.

Changes to the SH 55 and Warm Lake Road intersection would improve access for large trucks carrying equipment and supplies to the Operation Area Boundary and would facilitate turns from SH 55 onto Warm Lake Road and from Warm Lake Road back onto SH 55. Although the intersection of Warm Lake Road and SH 55 would be a localized, permanent, moderate to major change to the roadway, overall impacts to Warm Lake Road under the 2021 MMP would be localized, long term, and minor to moderate as it is suitable for use by large trucks and equipment in its current condition.

Construction

During the initial construction period of the Burntlog Route (approximately 2 to 3 years), mine-related traffic would access the Operations Area Boundary from SH 55, north of the city of Cascade, via Warm Lake Road for approximately 34 miles, then north on Johnson Creek Road for approximately 25 miles to the village of Yellow Pine, and from Yellow Pine east approximately 14 miles to the Operation Area Boundary via the Stibnite Road. The portion of the route that includes Johnson Creek Road and Stibnite Road is known as the Johnson Creek Route.

The Johnson Creek Route (Johnson Creek Road and the Stibnite Road portion of the McCall-Stibnite Road) would be used for year-round access until completion of the Burntlog Route for long-term use during operations. Minor surface improvements (e.g., ditch and culvert repair, adding gravel, winter snow removal, resurfacing if required, and summer dust suppression) would occur on the Johnson Creek Route under the 2021 MMP to reduce sediment runoff and dust generation. However, there would be no road alignment modification or widening of these existing roads along the Johnson Creek Route.

Portions of Johnson Creek Road (i.e., Landmark to Wapiti Meadows) are currently used as a groomed OSV trail during winter and use of the Johnson Creek Route by mine-related construction traffic would conflict with this existing groomed OSV trail. Thus, while the Burntlog Route (described below) is under construction, a temporary 16-foot-wide groomed OSV trail adjacent to Johnson Creek Road between the proposed Cabin Creek Groomed OSV Route and Landmark would be constructed. However, the OSV tail from Trout Creek Campground to Wapiti Meadows would be closed until construction of the Burntlog Route is complete; once mine traffic moves to that route, then the OSV route would return to Johnson Creek Road and would reconnect Landmark with Wapiti Meadows.

Perpetua has an existing agreement with Valley County for maintenance of Johnson Creek and Stibnite roads, appropriate revisions to the road maintenance agreement would be established for use of the Johnson Creek Route as a construction route and to ensure year-round access in accordance with Valley County's public road easement stipulations. Once construction of the Burntlog Route has been completed (2-3 years), the Johnson Creek Route would no longer be used by mine-related traffic.

Approximately 20 miles of existing Burnt Log Road would be widened and improved and approximately 15 miles of new road connecting to Meadow Creek Lookout Road would be constructed within the first 2 years as part of the Burntlog Route. Approximately 1.3 miles of Meadow Creek Lookout Road and approximately two miles of Thunder Mountain Road would also be upgraded. Improvements on Burnt Log Road are anticipated to be completed from May into November, depending upon road and weather conditions. Until the Burntlog Route construction is completed (by the end of the second year), SGP-related traffic would access the Operations Area Boundary via the Johnson Creek Route (**Figure 3.16-1**). Perpetua would establish eight borrow sites along the Burntlog Route as needed to meet road construction

and ongoing maintenance throughout the life of the operation and through closure and reclamation. Signs warning of construction activities would be placed along Burntlog Route.

The Burntlog Route would connect the eastern end of Warm Lake Road (at Landmark) to the Operations Area Boundary (to the northeast) by widening and improving approximately 23 miles of existing roads, including the full length of the existing Burnt Log Road and segments of Meadow Creek Lookout Road and Thunder Mountain Road. The three road segments would be connected with two new road segments totaling approximately 15 miles. Burnt Log Road is currently a native surface road that is open year-round to all vehicles with seasonal restrictions due to snow. The last 0.25 to 0.5 mile of the existing road is closed and motorized traffic prohibited. Meadow Creek Lookout Road is a native surface road, open year-round to all vehicles. The Burntlog Route is primarily situated topographically on mid-slopes and ridgeline.

A segment of new road construction for the Burntlog Route would be located on the south side of the Riordan Creek drainage and cross Riordan Creek north of Black Lake. The approximately 5.3-mile road segment would have 12 stream crossings, three of which cross perennial streams. After construction is completed, public use would be allowed on Burntlog Route when other public access roads are blocked by mine operations.

The connection segment between the end of Burnt Log Road and Meadow Creek Lookout Road is approximately 11 miles and would cross Trapper Creek 0.5 miles east of the intersection of Trapper Creek Road and FR 440A and continue northeast towards Black Lake and on to the Meadow Creek Lookout Road. The second connector between the Meadow Creek Lookout Road and Thunder Mountain Road would be approximately 4 miles and links up with Thunder Mountain Road approximately 2 miles south of the SGP. Minor surface improvements (e.g., blading) would occur on the existing Thunder Mountain Road and Meadow Creek Lookout Road to provide a safe road surface for transportation of construction equipment required to build the Burntlog Route. There would be no road alignment modification or widening of the existing roads.

Primary Operation Area Boundary access would shift from the Johnson Creek Route to the Burntlog Route near the end of the construction phase. The Burntlog Route would be compliant with all related usage and approval requirements included in 36 CFR Section 228, Part A, but may also be approved under 36 CFR 251 as a special use if it meets the regulatory criteria. The Burntlog Route would avoid environmental and human health and safety risks associated with the Johnson Creek Route which passes through identified areas for avalanches, landslides, and floods. This route would provide another route for Operations Area Boundary ingress/egress, would decrease SGP and public traffic interaction with Yellow Pine and Johnson Creek area residents, and would decrease the potential for spill risk adjacent to fish-bearing streams. Upon completion, the Burntlog Route would serve as an alternative public access route to the Thunder Mountain area for the life of the mine until it is decommissioned following mine reclamation and closure.

While the Johnson Creek Route is in use, Perpetua would coordinate with Valley County on the use and maintenance of the route for year-round access in accordance with Valley County's public road FRTA easement stipulations. Impacts to access and transportation from construction would be localized, short term, and minor to major. Major impacts would be primarily associated with the mobilization of materials

and equipment to commence facility construction activities and the road improvement and construction activities for construction of the Burntlog Route.

Traffic Volumes

Table 4.16-2 shows the existing and 2021 MMP AADT for the public roads used during construction. Traffic volumes associated with the 2021 MMP construction would increase approximately 93 percent on Johnson Creek Road and approximately 216 percent on the Stibnite Road portion of McCall-Stibnite Road from Yellow Pine to the Operations Area Boundary. Over a third of the vehicles traveling on these one-lane, native surfaced roads would be comprised of heavy vehicles and would result in slower travel times for non-mine-related traffic and may deter travelers from using these roadways. Travelers may use alternative roadways, including McCall-Stibnite Road and SFSR Road, to access the village of Yellow Pine. Traffic volumes on Burnt Log Road also would increase from existing conditions due to the construction of the Burntlog Route. The roadways that are currently more traveled would have a less noticeable increase in daily traffic; Warm Lake Road traffic would increase by 11.9 percent and SH 55 traffic would increase by only 4.0 percent. Heavy vehicles would comprise less than 2 percent of the total traffic on these two roadways; however, due to the one-lane constraints on both roadways, non-mine-related vehicles may experience slower travel times.

Additionally, reconstruction of the transmission line to the SGP could overlap with the 2021 MMP construction traffic. Construction would occur along the existing alignment and construction crews would be separated throughout the SGP area to minimize construction traffic (HDR 2017o). Reconstruction of the transmission line along Warm Lake Road and Johnson Creek Road to the Operations Area Boundary is estimated to occur in the third and fourth years of construction and would overlap at the end of the 2021 MMP construction period. Therefore, traffic interruption and delays associated with the reconstruction of the transmission line would increase overall SGP-related traffic on Warm Lake and Johnson Creek roads. Reconstruction of the transmission line is planned to occur at several facilities and construction crews would be spread throughout the SGP, which would reduce associated construction traffic.

Table 4.16-2 Existing and 2021 MMP Construction AADT

Name	Existing AADT[1]	Construction AADT (% Increase from Existing) SH 55 to SGLF	% Heavy Vehicles[2] SH 55 to SGLF	Construction AADT (% Increase from Existing) SGLF to SGP	% Heavy Vehicles[2] SGLF to SGP
SGP-related AADT	n/a	198	15	65	69.2
SH 55	4,900	5,135 (4.0)	0.6	n/a	n/a
Warm Lake Road	1,670	1,868 (11.9)	1.6	1,735 (3.9)	2.6
Johnson Creek Road	70	n/a	n/a	135 (93%)	33.3

Name	Existing AADT[1]	Construction AADT (% Increase from Existing) SH 55 to SGLF	% Heavy Vehicles[2] SH 55 to SGLF	Construction AADT (% Increase from Existing) SGLF to SGP	% Heavy Vehicles[2] SGLF to SGP
Stibnite Road (village of Yellow Pine to SGP)	30	n/a	n/a	95 (216%)	47.4
Burnt Log Road	70	n/a	n/a	703	-

Source: HDR 2017l, 2017m; ITD 2017, 2019; Perpetua 2021a

[1]Data was collected in 2015 or 2016 except for Warm Lake Road data collected in 2017. 2019 data from the ITD was available for SH 55, Warm Lake Road, Johnson Creek Road, Stibnite Road, and Burnt Log Road. AADT is calculated by Total Recorded Count/Number of Days Recorded. All figures have been rounded up to whole numbers.

[2]The approximate minimum percentage of SGP-related heavy vehicles occurring on the roads.

[3]Traffic volumes on Burnt Log Road are anticipated to peak at 50 AADT during the operations phase.

There is a seasonal effect of traffic on these roads. Valley County has many summer recreational areas that attract visitors from May through October with peak AADT levels in June, July, and August. Winter weather and driving conditions influence the amount of traffic and result in less AADT during the winter months. Therefore, the seasonal effect of traffic on these roads would show a noticeably greater increase in mine-related winter traffic (i.e., drivers would notice a higher ratio of mine-related traffic to general traffic). The increase in traffic from Warm Lake Road east of the SGLF and over Big Creek summit which includes the Warm Lake recreational area could pose additional risk to the occasional pedestrian or bicyclist in this area.

Perpetua would limit their vehicle traffic outside the Operations Area Boundary to between 5:00 am and 7:00 pm everyday resulting in approximately five mine-related vehicles traveling on the Johnson Creek Route per hour during the 2 years the Burntlog Route is constructed. Non-mine-related vehicles may experience slower travel times as mine-related vehicle transport would occur during the morning and evening peak hours and typical commute or travel times. However, once construction of Burntlog Route is completed, the Johnson Creek Route would no longer be used by mine-related traffic, and the AADT on Johnson Creek and Stibnite Road would return to the baseline AADT traffic volume.

Impacts to traffic volumes during construction would be localized, short-term, and minor to major. Major impacts would be associated primarily with the mobilization of materials and equipment to commence facility construction projects.

Public Access

During construction, the public would continue to have access to the PNF and BNF on NFS roads currently available to the public, including along Johnson Creek Road, Burnt Log Road, and through the SGP on Stibnite Road connecting to Thunder Mountain Road. Road closures from half-day to multiple days may occur during construction on Stibnite Road between the village of Yellow Pine and the Operations Area Boundary, part of Thunder Mountain Road, and Burnt Log Road. Periodic lane restrictions and appropriate signage would be posted to notify travelers of construction activities.

During construction, public access through the Operations Area Boundary on Stibnite Road would be restricted for 1 year or more while a new 4-mile-long, 12-foot-wide gravel road is constructed to provide public access from Stibnite Road (FR 50412) to Thunder Mountain Road (FR 50375).

The through-SGP public access road would provide seasonal access, similar to current conditions. During operations, public access through the SGP would be provided during the snow-free season to all vehicle types. Vehicles passing through the SGP would be required to check-in with mine personnel at the North or South SGP entry points to receive a safety briefing and would also be required to check-out with mine site personnel upon exiting the SGP. For safety purposes, no stopping or deviating from the public access road would be allowed. Operations Area Boundary access would be restricted during road construction and maintenance, blasting, highwall scaling, mining in the immediate area of the road, and similar operations.

Public access would be separated from other SGP roads by berms, security fencing, and an underpass to allow the public road to pass beneath the mine haul road. The public access road would not be plowed in the winter (current county maintenance standards) and static and electronic signage and automated timed stoplights would be present at points of public access to inform the public of seasonal and temporary closures.

The newly constructed Burntlog Route connecting to Thunder Mountain Road would be a temporary road necessary for mining purposes and would meet 36 CFR 228A requirements for environmental protection to assume that mine operations are conducted to minimize adverse environmental impacts to the extent feasible for roads. Accordingly, the road would not be designated for public motor vehicle use under 36 CFR 212.50 on the Motor Vehicle Use Map. Therefore, for public motor vehicle use to be allowed on the road when other public access roads are blocked by mine operations, one of the other exceptions from the prohibitions on motor vehicle use on NFS land at 36 CFR 261.13 must be met. The approved plan of operations would meet the exception for written Forest Service authorization under 36 CFR 261.13(h) by including a provision in the mine plan for public use of the road when other public road access is blocked by mine operations.

Impacts to public access during construction would be localized, short-term, and minor to major. Major impacts would generally be associated with road construction and non-standard maintenance activities plus the mobilization of equipment resulting in over-sized loads.

Operations

Traffic Volumes

Upon completion of Burntlog Route, mine vehicles would travel approximately 71 miles from the intersection of Warm Lake Road and SH 55 to the Operation Area Boundary. Approximately 13.5 miles of new private access roads would be created during the life of the mine. No new NFS roads would be created during the life of the mine. **Table 4.16-3** shows the existing and 2021 MMP AADT for the main roadway segments in the access and transportation analysis area during operations.

Table 4.16-3 Existing and 2021 MMP Operations AADT

Name	Existing AADT[1]	Operations AADT (% Increase from Existing) SH 55 to SGLF	% Heavy Vehicles[2] SH 55 to SGLF	Operations AADT (% Increase from Existing) SGLF to SGP	% Heavy Vehicles[2] SGLF to SGP
SGP-related AADT	n/a	156	16.0	50	66
SH 55	4,900	5,056 (3.2%)	0.5	n/a	n/a
Warm Lake Road	1,670	1,826 (9.3%)	1.4	1,720 (3.0)	1.5
Johnson Creek Road	70	n/a	n/a	70 (0%)	-
Stibnite Road (village of Yellow Pine to SGP)	30	n/a	n/a	30 (0%)	-
Burnt Log Road	70	n/a	n/a	120 (71.4%)	27.5

Source: HDR 2017l, 2017m; ITD 2017, 2019; Perpetua 2021a

[1]Data was collected in 2015 or 2016 except for Warm Lake Road data collected in 2017. 2019 data from the ITD was available for SH 55, Warm Lake Road, Johnson Creek Road, Stibnite Road, and Burnt Log Road. AADT is calculated by Total Recorded Count/Number of Days Recorded. All figures have been rounded up to whole numbers.

[2]The approximate minimum percentage of SGP-related heavy vehicles occurring on the roads.

Traffic volumes associated with the 2021 MMP operations would increase traffic on the Burntlog Route. Specifically, the upgraded Burnt Log Road section of the Burntlog Route would experience a traffic increase of approximately 71.4 percent with approximately 27.5 percent of traffic comprised of heavy vehicles. Overall, there would be less mine-related traffic on the road during operations than during construction; however, the driver experience would still be noticeably different than existing conditions with an increase in mine-related heavy vehicles and slower travel times. The roadways currently more traveled would have a less noticeable increase in daily traffic; Warm Lake Road traffic would increase by 9.3 percent and SH 55 traffic would increase by about 3.2 percent. Perpetua would limit their vehicle traffic outside the Operations Area Boundary to between 5:00 am and 7:00 pm, resulting in approximately four mine-related vehicles traveling on the Burntlog Route per hour. Winter driving conditions influence the amount of traffic and typically result in less AADT. Therefore, the seasonal effect of traffic on these roads would show a noticeably greater increase in mine-related winter traffic (i.e., drivers would notice a higher ratio of mine-related traffic to general traffic). Traffic on Johnson Creek Road and Stibnite Road would return to local and recreation traffic only and baseline AADTs. Similar to traffic increases along Warm Lake Road during construction, the increase in traffic from Warm Lake Road east of the SGLF and over Big Creek summit which includes the Warm Lake recreational area during operations could pose additional risk to the occasional pedestrian or bicyclist in this area.

Impacts to traffic volume on existing roadways during operations would be localized, long-term, and minor to major. Major impacts would be associated primarily with the mobilization of materials and equipment to commence facility construction projects.

Public Access

Public access within the analysis area would be the same as construction once the public access road through the SGP from Stibnite Road to Thunder Mountain Road, was complete. Approximately 13.5 miles of new roads managed by Perpetua, but open to controlled public access, would be created.

There are tribal concerns regarding continued access to usual and accustomed places in which tribes exercise their treaty rights. Currently, there are no tribal access restrictions on the Forest Service lands in the SFSR watershed. There would be a long-term loss of access to land for exercising treaty rights within the Operations Area Boundary while the lands are occupied for mining; however, lands within the Operations Area Boundary have been highly disturbed by past mining activities. Further details on the impacts to Tribal treaty rights and land access are discussed in the SGP Tribal Rights and Interests Specialist Report (Forest Service 2022q) and **Section 4.24**. Impacts to public access during operations would be localized, long term, and minor.

Closure and Reclamation

Mine closure and reclamation activities of recontouring slopes, removing facilities, seeding, and planting areas under the 2021 MMP would require approximately 5 to 7 years during which all access roads to the Operations Area Boundary would be maintained. Any newly constructed roads within the mine operations area would be closed for any long-term use.

The Burntlog Route would be needed until the disturbed area is reclaimed at the SGP. After reclamation work is completed, the Burntlog Route would be decommissioned, and the existing upgraded sections of Burnt Log Road would be narrowed to their pre-mining widths while the new roadway portion of the Burntlog Route would be completely removed and reclaimed. Once all final mine closure, reclamation, and related environmental closure monitoring work has been completed, the 20-foot roadway width of 20 miles of Burnt Log Road, 1.3 miles of Meadow Creek Lookout Road, and 2 miles along Thunder Mountain Road of the upgraded portion of Burntlog Route would be reduced to their approximate pre-mining width of approximately 12 feet.

Monitoring of all facilities and disturbance areas would be conducted following the completion of closure and reclamation to demonstrate compliance with permit requirements and to measure the success of reclamation. Reclamation success monitoring such as erosion and sediment control monitoring would be completed per the Reclamation and Closure Plan upon Forest Service approval. Overall, impacts to access and transportation from closure and reclamation would be localized, short term to long term, and negligible to minor.

Traffic Volumes

Table 4.16-4 shows the existing and 2021 MMP AADT for the main roadway segments in the access and transportation analysis area during closure and reclamation. Traffic volumes associated with the 2021 MMP closure and reclamation would increase traffic on the roads associated with Burntlog Route over existing conditions. Specifically, the upgraded Burnt Log Road section of the Burntlog Route would experience a traffic increase of approximately 38.6 percent, but this would be close to half the traffic of operations. About 15.5 percent of the vehicles traveling this one-lane, native-surfaced road would be heavy vehicles that could result in slower travel times for non-mine-related traffic and may deter travelers

from using this roadway. Perpetua would limit their vehicle traffic outside the Operations Area Boundary to between 5:00 am and 7:00 pm resulting in approximately two mine-related vehicles traveling on the Burntlog Route per hour during closure and reclamation. The more traveled roadways would have a less noticeable change in daily traffic; Warm Lake Road and SH 55 traffic would increase by 1.6 percent or less. Heavy vehicles would comprise less than one percent of the total traffic on these two roadways during closure and reclamation; however, due to the one-lane constraints on both roadways, non-mine-related vehicles may experience slower travel times.

Table 4.16-4 Existing and 2021 MMP Closure and Reclamation AADT

Name	Existing AADT[1]	Closure and Reclamation AADT (% Increase from Existing)	% Heavy Vehicles[2]	Post-Closure AADT (% Increase from Existing)
SGP-related AADT	n/a	27	56	6
SH 55	4,900	4,927 (0.6%)	0.3	4,906 (0.1%)
Warm Lake Road (CR 10-579)	1,670	1,697 (1.6%)	0.9	1,676 (0.5%)
Johnson Creek Road (CR 10-413)	70	70 (0%)	-	76 (8.6%)
Stibnite Road (village of Yellow Pine to SGP)	30	30 (0%)	-	36 (20%)
Burnt Log Road (FR 447)	70	97 (38.6)	15.5	70 (0%)

Source: HDR 2017l, 2017m; ITD 2017, 2019; Perpetua 2021a

[1]Data was collected in 2015 or 2016 except for Warm Lake Road data collected in 2017. 2019 data from the ITD was available for SH 55, Warm Lake Road, Johnson Creek Road, Stibnite Road, and Burnt Log Road. AADT is calculated by Total Recorded Count/Number of Days Recorded. All figures have been rounded up to whole numbers.

[2]The approximate minimum percentage of SGP-related heavy vehicles occurring on the roads.

Closure and reclamation traffic impacts during the winter would be the same as those discussed under construction and operations. Post-closure winter traffic would not be as noticeable, as closure and reclamation traffic heavy vehicle deliveries would not occur, and approximately six mine-related vehicles per day would utilize the accessible roadways in the analysis area for monitoring and maintenance purposes. Impacts to traffic volumes during closure and reclamation would be localized, short-term, and minor.

Public Access

Public access during the closure and reclamation phase would be coordinated with the Forest Service and would involve establishing a permanent service road through the backfilled Yellow Pine pit for public access through the Operations Area Boundary for dispersed recreation uses connecting to Thunder Mountain Road. This would result in a total of approximately 2.2 additional miles of new road that would be accessible for public use following reclamation. Post-closure public access would require revision to the existing FRTA easement with Valley County regarding road maintenance. Impacts to public access during closure and reclamation would be localized, long-term, and negligible.

Safety and Emergency Access

For the duration of the 2021 MMP, the increase in total volume of mine-related vehicles, specifically heavy vehicles or trucks, on the Johnson Creek and Burntlog Routes would result in a greater safety risk for accidents occurring between vehicles due to degradation of the road with more frequent heavy vehicle travel and the one-lane constraints (i.e., no passing lane) that restrict the passing of slower moving vehicles. Mine-related traffic on Warm Lake Road would increase by approximately 11 percent during construction activities and nine percent during operation activities, and traffic volume on construction access (Johnson Creek Road and Stibnite Road) and then operational access (Burntlog Route) would increase substantially (**Tables 4.16-2 and 4.16-3**). More vehicles would be present on Warm Lake Road to the SGLF, where most vehicles would park and employees would be bussed from there to the Operations Area Boundary. Even with the traffic management and safety controls implemented (**Section 2.4.9**), accident rates could increase with additional road usage along with associated transportation-related spills. The procedures outlined in the Emergency Response Plan would be followed to protect the environment, the health of employees and the general public, and to comply with federal and state regulations.

Burnt Log Road would be widened to 26 feet (including 3-foot vegetated shoulders), tight corners would be straightened to allow for improved safety and traffic visibility, grades would be maintained at less than 10 percent in all practicable locations, and placement of sub-base material and surface with gravel would occur to provide a stable long-term roadway and reduce sediment. Side-ditching, culverts, guardrails, and bridges would be installed where necessary. During winter road maintenance, snow would be removed from the Burntlog Route plus its temporary construction access, haul roads at the SGP, and the Johnson Creek Route. Although no road alignment modification or widening would occur to Johnson Creek Road and Stibnite Road as part of the Johnson Creek Route under the 2021 MMP, upgrades, including minor surface improvements (e.g., adding gravel, winter snow removal, and summer dust suppression), would occur to reduce dust generation from vehicles, indirectly improving visibility, and support safer road conditions.

Pilot cars would be used during oversized equipment mobilization and demobilization along the Burntlog Route and portions of the Johnson Creek Route, as needed, to control speed and reduce potential for conflicts or incidents along these narrow access roads leading into the Operations Area Boundary.

The increased heavy vehicle traffic would degrade the existing and proposed transportation system over the duration of the SGP. However, maintenance measures authorized under a cooperative agreement with Valley County and the Forest Service would be performed to repair segments that have deteriorated over time. The continued maintenance and improvements of the road system would help reduce dust and maintain public safety for the duration of the SGP.

Access for emergency response would be maintained throughout the analysis area. Emergency access would be provided on the Johnson Creek Route during the first 2 years of construction and then on Burntlog Route for the remainder of the SGP. In the event of an emergency where road closure would facilitate response or when a threat to human life is identified (e.g., fires), roads would be temporarily closed, as appropriate. In addition, there would be access for helicopters at the maintained helipad at the SGP.

Measures would be implemented that would help reduce the incidence of accidents, including busing and/or van pooling to the Operations Area Boundary, housing workers at the Operations Area Boundary to minimize the frequency of SGP worker vehicle trips, driver training (e.g., use of truck compression brakes on steep sections and along areas where residences are located and familiarity with the travel routes including locations of steep slopes that require downshifting), and equipping staff traveling to and from the Operations Area Boundary with two-way radios to communicate positions, relay information about road conditions, and warn of public vehicles traveling on the Burntlog Route (or Johnson Creek Route during construction). This also would allow for rapid response in the event of an accident.

Perpetua would adhere to EDFs (**Section 2.4.9**), Forest Service-required measures, and permit stipulations, including, but not limited to: ensuring drivers and airplane/helicopter pilots are appropriately licensed; annual inspections of transport vehicles; observing county and state speed limits, road restrictions (e.g., use of tire chains for snow or icy road conditions), and load limits; and coordination with Forest Service (and Valley County as appropriate) on air and road operations to further reduce the incidence of accidents.

The public access route through the Operations Area Boundary would separate public traffic from mine traffic on the road through the SGP thereby reducing potential safety issues.

Safety and emergency access impacts from the SGP would be localized, long-term, and negligible to major. Major impacts would be associated with the roads with largest increases in usage compared to existing conditions, primarily the mine access route upon departing the Warm Lake Road.

Other Modes of Transportation

Air Transportation - Under the 2021 MMP, a helipad would be maintained in an area at the SGP adjacent to the administration offices and warehouse facilities for exploration and Medevac purposes. Helicopters would be used to deliver drill rigs and supplies for remote surface exploration drilling activities on an as needed basis when truck or crawler mounted rigs would be unable to reach the drill site. Helicopter support would only occur during daylight hours. The new substation at Johnson Creek would not impact air traffic use of the Johnson Creek airstrip. Overall air traffic associated with the 2021 MMP would be intermittent, localized, and generate negligible changes in air traffic patterns.

Water Transportation - Under the 2021 MMP, approximately one round trip (two truck trips) of antimony concentrate would be hauled off-site daily in locked shipping containers for shipping out of the area. The Port of Lewiston would be the closest port for transport by commercial barge. The daily shipment of antimony and the potential indirect transport of supplies and materials to and from the Operations Area Boundary would generate minimal to negligible changes in water transportation. The addition of associated impacts to transport by commercial barge from the Port of Lewiston to and from distributors, purchasers, and refineries under the 2021 MMP would be regional, long-term, and negligible, and would blend into the typical traffic associated with this type of goods movement.

Rail Transportation - There are no rail transportation systems in the analysis area. However, there is a potential for trucks to transport antimony concentrate to rail lines located in Boise. Additionally, supplies and materials may be indirectly transported to and from the SGP by trucks originating from rail shipments. Nevertheless, these impacts would generate negligible changes to rail transport during

operation of the 2021 MMP and would not substantially alter the level of service for this mode of transportation.

4.16.2.3 Johnson Creek Route Alternative

Under the Johnson Creek Route Alternative, the Johnson Creek Route would be used to access the SGP during all phases, and the Burntlog Route would not be constructed. Mine vehicles would travel approximately 70 miles from the intersection of Warm Lake Road and SH 55 to Johnson Creek Road and Stibnite Road to the Operations Area Boundary. Road widening and straightening, along with drainage and bridge improvements would be required for the Johnson Creek Road portion of the Johnson Creek Route. The Stibnite Road portion would be improved by straightening curves, bridge improvements, constructing retaining walls, and installing culverts. In addition, the Stibnite Road portion would be improved by widening curves to accommodate 55-foot semi-truck trailers. Approximately 1 mile of road through the village of Yellow Pine would be paved. Construction and improvements to the Johnson Creek Route would require approximately 4 years with a total construction schedule for the SGP of 5 years (2 years more than the Burntlog Route). Only impacts that differ from the 2021 MMP are discussed below.

Construction

Improvements on the Johnson Creek Route would be completed from May into November annually, depending upon road and weather conditions. During the first year of construction, upgrades to Johnson Creek Road would require periodic full road closure throughout the entire season. During years two through four, the Stibnite Road segment would be upgraded. Tight terrain and rock blasting would require daily, full-road closures between 10 am and 4 pm, with the road open for public use each morning and night. The delay in road construction results in a delay to bring in appropriate equipment and materials to complete mine construction which would then occur during year five of construction. Seven aggregate sources along the Johnson Creek Route for construction and maintenance have been identified (**Figure 3.16-1**) with an estimated disturbance of 109 acres.

The portion of Burntlog Route that would connect with Thunder Mountain Road and continue toward the Worker Housing Facility toward the southeast of the SGP would not be plowed in the winter and would not be accessible to the public. During construction, winter snow removal and summer dust suppression would occur under the Johnson Creek Route Alternative, including on Johnson Creek Road. Public access on Johnson Creek Road would be completely restricted for one full year during the first year of construction of the Johnson Creek Route Alternative with improvements to Johnson Creek Road. Impacts to access and transportation from construction would be localized, short term, and minor to major.

<u>Traffic Volume</u>

Traffic volume impacts under the Johnson Creek Route Alternative would be the same as those described under the 2021 MMP for construction (**Table 4.16-2**) as they use the same route. However, the construction phase would be 2 years longer than under the 2021 MMP so construction related traffic impacts would be longer in duration. During road closures, local area residents would need to use SH 55 to Warren Wagon Road then to Warren-Profile Gap Road to access the Edwardsburg/Big Creek area. Impacts to traffic volumes during construction would be localized, short-term, and minor to major.

Public Access

The public would share the Johnson Creek Route with mine-related traffic through construction, operations, and closure and reclamation on Johnson Creek Road and Stibnite Road. During road closures, if there is no alternative route available, the public would be precluded from accessing certain areas during the closure, such as recreational areas along Johnson Creek. Impacts to public access during construction would be localized, short-term, and minor to major.

Operations

Mine-related traffic would include transport of employees to and from the Operations Area Boundary, delivery of supplies, antimony concentrate trucks, and activities associated with road maintenance such as grading, snowplowing, and sanding. Supplies and deliveries for the SGP during construction, operations, and closure and reclamation would use SH 55 to Warm Lake Road to access the SGLF. An estimated two-thirds of all mine related traffic would originate south of Warm Lake Road on SH 55 and the other third of mine-related traffic would originate from the north.

Traffic Volume

Under the Johnson Creek Route Alternative, mine-related traffic would use the Johnson Creek Route for the duration of the SGP. Public traffic and mine traffic would share the road from Landmark to the Operations Area Boundary. Mine vehicles would travel approximately 70 miles from the intersection of Warm Lake Road and SH 55 to the Operations Area Boundary. No new private access roads or NFS roads would be created under the Johnson Creek Route Alternative. **Table 4.16-5** shows the existing and Johnson Creek Route Alternative AADT for the main roadway segments in the access and transportation analysis area during operations.

Table 4.16-5 Existing and Johnson Creek Route Alternative Operations AADT

Name	Existing AADT[1]	Operations AADT (% Increase from Existing) SH 55 to SGLF	% Heavy Vehicles[2] SH 55 to SGLF	Operations AADT (% Increase from Existing) SGLF to SGP	% Heavy Vehicles[2] SGLF to SGP
SGP-related AADT	n/a	156	16.0	50	66
SH 55	4,900	5,056 (3.2%)	0.5	n/a	n/a
Warm Lake Road	1,670	1,826 (9.3%)	1.4	n/a	n/a
Johnson Creek Road	70	n/a	n/a	120 (71.4%)	27.5
Stibnite Road (village of Yellow Pine to SGP)	30	n/a	n/a	80 (166.7%)	41.3

Source: HDR 2017l, 2017m; ITD 2017, 2019

[1]Data was collected in 2015 or 2016 except for Warm Lake Road data collected in 2017. 2019 data from the ITD was available for SH 55, Warm Lake Road, Johnson Creek Road, Stibnite Road, and Burnt Log Road. AADT is calculated by Total Recorded Count/Number of Days Recorded. All figures have been rounded up to whole numbers.

[2]The approximate minimum percentage of SGP-related heavy vehicles occurring on the roads.

Operations under the Johnson Creek Route Alternative would result in increased traffic volumes on the Johnson Creek Route. Specifically, traffic on Johnson Creek Road and Stibnite Road would increase approximately 71 percent (27.5 percent heavy vehicles) and 167 percent (41 percent heavy vehicles), respectively. Heavy vehicles currently use the Johnson Creek Route to access the Operations Area Boundary in the summer; however, the Johnson Creek Route Alternative operational traffic would result in a noticeable change in baseline driver experience and slower drive times on the Johnson Creek Route due to the substantial increase in mine-related vehicles. Even though Johnson Creek Road would be upgraded under the Johnson Creek Route Alternative, the road would still have many curves and slopes, thus requiring slow speeds.

The more traveled roadways would have a less noticeable increase in daily traffic; Warm Lake Road traffic would increase by approximately 9.3 percent and SH 55 traffic would increase by 3 percent. Perpetua would limit their vehicle traffic outside the Operations Area Boundary to between 5:00 am and 7:00 pm, resulting in approximately four mine-related vehicles traveling on the Johnson Creek Route per hour. Impacts to traffic volume during operations would be localized, long-term, and major.

Public Access

Public access through the Operations Area Boundary during operations would be similar to the 2021 MMP. Impacts to Tribal land access would be the same as under the 2021 MMP, except the Burntlog Route would not be constructed. Further details on the impacts to Tribal treaty rights and land access are discussed in the SGP Tribal Rights and Interests Specialist Report (Forest Service 2022q) and **Section 4.24**. Impacts to public access during operations would be localized, long-term, and minor.

Closure and Reclamation

Traffic Volume

Traffic volume impacts under the Johnson Creek Route Alternative would be similar to those described under the 2021 MMP for closure and reclamation, except instead of the Burntlog Route, mine-related traffic would use the Johnson Creek Route during closure, reclamation, and post-closure activities. **Table 4.16-6** shows the existing and the Johnson Creek Route Alternative AADT for the main roadway segments in the access and transportation analysis area during closure and reclamation.

As shown in **Table 4.16-6**, traffic volumes associated with the Johnson Creek Route Alternative closure and reclamation would increase current volumes for the Johnson Creek Route. Specifically, traffic on Johnson Creek Road and Stibnite Road would increase approximately 38.6 percent (approximately 15.5 percent heavy vehicles) and 90 percent (approximately 26 percent heavy vehicles), respectively. Closure and reclamation mine-related traffic would be less than operational traffic with 27 AADT for closure and reclamation versus 50 AADT for operations. The driver experience would still include some heavy vehicles that result in slower drive times, but heavy vehicles would eventually decrease to one or none daily as closure and reclamation is completed. The roadways currently more traveled would have a less noticeable increase in daily traffic; Warm Lake Road traffic would increase by 1.6 percent and SH 55 traffic would only increase by 0.6 percent. Perpetua would limit their vehicle traffic outside the SGP to between 5:00 am and 7:00 pm, resulting in approximately two mine-related vehicles traveling on the Johnson Creek Route per hour during closure/reclamation. Post-reclamation mine-related traffic would

consist of 6 light vehicles on these roads (**Table 4.16-6**). Impacts to traffic volume during closure and reclamation would be localized, long term, and negligible to minor.

Table 4.16-6 Existing and Johnson Creek Route Alternative Closure and Reclamation AADT

Name	Existing AADT[1]	Closure and Reclamation AADT (% Increase from Existing)	% Heavy Vehicles[2]	Post-Closure AADT (% Increase from Existing)
SGP-related AADT	n/a	27	55.6	6
SH 55	4,900	4,927 (0.6%)	0.3	4,906 (0.1%)
Warm Lake Road (CR 10-579)	1,670	1,698 (1.6%)	0.9	1,676 (0.4%)
Johnson Creek Road (CR 10-413)	70	97 (38.6%)	15.5	77 (8.6%)
Stibnite Road (village of Yellow Pine to SGP)	30	57 (90.0%)	26.3	36 (20.0%)
Burnt Log Road (FR 447)	70	70 (0%)	-	70 (0%)

Source: HDR 2017l, 2017m; ITD 2017, 2019

[1]Data was collected in 2015 or 2016 except for Warm Lake Road data collected in 2017. 2019 data from the ITD was available for SH 55, Warm Lake Road, Johnson Creek Road, Stibnite Road, and Burnt Log Road. AADT is calculated by Total Recorded Count/Number of Days Recorded. All figures have been rounded up to whole numbers.

[2]The approximate minimum percentage of SGP-related heavy vehicles occurring on the roads.

Public Access

A new road would be constructed under the Johnson Creek Route Alternative over the backfilled Yellow Pine pit connecting Stibnite Road to Thunder Mountain Road. A total of approximately 2.2 additional miles of new road would remain post closure and would be accessible for public use through the Operations Area Boundary and would require revision to the existing FRTA easement with Valley County. Impacts to public access during closure and reclamation would be localized, long-term, and negligible.

Safety and Emergency Access

The Johnson Creek Route Alternative would have greater safety and emergency impacts than Burntlog Route due to additional safety considerations required to use the Johnson Creek Route exclusively, which is in steeper terrain than the Burntlog Route and subject to avalanches and landslides (DAC 2021). Additionally, access through the Operations Area Boundary under the Johnson Creek Route Alternative would be through a single point of ingress and egress and would require safety considerations for mine deliveries and public access. Also, the steep climb to provide access around the Yellow Pine pit would require a wider road with more switchbacks to accommodate the heavy trucks transporting mine supplies and may increase hazardous driving conditions for crew rotation, emergency responses, and wildfire evacuation.

Under the Johnson Creek Route Alternative, improvements to the Johnson Creek Route would include road widening and straightening, as well as drainage and bridge improvements to the Johnson Creek Road

portion of the Johnson Creek Route. The Stibnite Road portion of the Johnson Creek Route would be improved by straightening curves, retaining walls, and installing culverts. The Johnson Creek Route would require 183 acres of cut and fill in addition to the existing roadways to address traffic safety, geotechnical hazards, landslides, and avalanche zones and may result in periods of road closure, while the Burntlog Route would require 246 acres of cut and fill primarily along a new route. While more acreage would be required for the Burntlog Route in comparison with the Johnson Creek Route, the activity along the Johnson Creek Route would be in proximity to Johnson Creek and the East Fork SFSR, whereas the Burntlog Route location avoids these surface flows. In addition to cut and fill in proximity to these surface flows, any traffic-related spills along the Johnson Creek Route would also occur closer to the streams compared to the Burntlog Route.

The public access route through the Operations Area Boundary would separate public traffic from mine traffic on the road through the Operations Area Boundary thereby reducing potential safety issues. Safety and emergency access impacts from the SGP would be localized, long-term, and minor to major.

4.16.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Access and Transportation.

4.16.4 Irreversible and Irretrievable Commitments of Public Resources

4.16.4.1 No Action Alternative

Under the No Action Alternative, there would be no irreversible and irretrievable commitment of public resources as it relates to access and transportation.

4.16.4.2 Action Alternatives

The SGP would alter the roadway system, transportation and public access within the analysis area under both the 2021 MMP and the Johnson Creek Route Alternative. This would constitute an irretrievable commitment of the public resource as the baseline transportation and public access conditions would be restored when the SGP reclamation is completed.

Consumption of renewable and non-renewable resources would be required for infrastructure development, including metals, aggregate, cement, wood, fuel and other materials, which would be an irreversible commitment of these resources. Funds and labor would be irretrievably committed for project permitting and development.

4.16.5 Short-term Uses versus Long-term Productivity

4.16.5.1 No Action Alternative

Under the No Action Alternative, the public access roads developed for the action alternatives would not create any short-term uses that would affect long-term access and transportation productivity.

4.16.5.2 Action Alternatives

Development of the Action Alternatives would result in short-term SGP transportation uses of the road system within the analysis area that would compete with the baseline traffic and public access conditions. Public access would be expanded from baseline conditions temporarily to additional roads and trails including Burntlog Route, the OHV Connector Trail, Johnson Creek Road temporary OSV route, and the Cabin Creek OSV route; however, the Warm Lake to Landmark groomed OSV route and Johnson Creek Road groomed portion from Landmark to Wapiti Meadows Ranch would be closed for the duration of the 2021 MMP and Johnson Creek Route Alternative. During operations under the 2021 MMP, a public access road would be located through the SGP to connect Stibnite Road to Thunder Mountain Road. When the mine operations are closed and the SGP is reclaimed, the long-term productivity of the baseline local transportation and public access conditions would be restored. Under the Johnson Creek Route Alternative, the new and upgraded portions of Burnt Log Road/Burntlog Route would not be constructed.

4.17 Heritage Resources

4.17.1 Impact Definitions, Effects Analysis Indicators. and Methodology

The issues and indicators for potential impacts to historic properties were developed from general issues identified by public and agency comments during the scoping process, consultation, and through professional research. The indicators are quantitative direct or indirect impacts when the appropriate information is available, or otherwise qualitative. The duration and geographic extent of an impact is the temporal and physical expanse of the impact, respectively. Context refers to the significance of an action within a setting, such as society as a whole (human, national), the affected region (regional), the affected interests, and the locality (local or site-specific). The analysis of effects to historic properties includes the following issues and indicators:

Issue: The SGP would impact historic properties through ground disturbing activities during construction, operation, and closure and reclamation phases.

Indicators:

- Location and acres of ground disturbance.
- Number and location of historic properties, including TCPs and CLs.
- Significance of historic properties that could be displaced, damaged, or destroyed.

Issue: The SGP may impact above-ground historic properties, TCPs, and CLs by introducing visual elements that could diminish solitude experiences that may be associated with TCPs and CLs and the integrity of the resources.

Indicators:

- Locations of tall or massive SGP components in relation to above-ground historic properties, TCPs, and CLs.
- Number and location of above-ground historic properties, TCPs, and CLs that may have altered viewsheds as a result of the SGP activities.

Issue: The SGP would create noise and vibration that could impact the soundscape, solitude experiences, and fragile standing or partially standing historic properties, TCPs, and CLs.

Indicators:

- Vibration causing activities, including very high noise levels, and the locations of activities.
- Number and location of standing or partly standing historic properties, TCPs, and CLs in relation to noise and vibration causing activities.

Issue: The SGP may create increased visibility and recreational use at locations with historic properties through increased public access via new roadways and improvements to existing roads, which could potentially lead to loss or destruction.

Indicators:

- Location of public access roads that would be improved, constructed, and remain in use following mine closure and reclamation.
- Number and location of historic properties, including TCPs and CLs, that may be impacted.

Potential impacts to historic properties are assessed using the "criteria of adverse effect" (36 CFR 800.5[a][1]), as defined in the implementing regulations for the NHPA. "An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association." The analysis of effects using these criteria is limited to those resources that are listed in the NRHP or have been determined eligible. Under NHPA, there are four broad categories of effect:

No Effect: A determination of No Effect indicates that there are no historic properties within the APE and that the undertaking has no potential of affecting historic properties.

No Historic Properties Affected: A "no historic properties affected" determination indicates that there are historic properties in the APE, but the undertaking would not affect these properties (for example, a historic property is within the visual APE, however, has no view of the proposed undertaking).

No Adverse Effect: A "no adverse effect" determination indicates that there would be an impact on the historic property by the undertaking, but the impact does not meet the criteria of adverse impact in 36 CFR 800.5(a)(1) and would not alter any of the characteristics that make it eligible for listing in the NRHP in a manner that would diminish the integrity of the historic property.

Adverse Effect: An adverse effect indicates that the undertaking would alter, directly or indirectly, any of the characteristics that qualify it for inclusion in the NRHP in a manner that would diminish the integrity of the property.

Under the NHPA, there is no distinction among levels of effect. If the integrity of historic properties is affected to such a degree to be considered adverse, then efforts to avoid, minimize, or mitigate the effect are undertaken. However, in the NEPA process, impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are often applied when considering the undertaking's effect to historic properties. The NEPA impacts definitions are provided in **Table 4.17-1**.

Table 4.17-1 Impact Definitions for Heritage Resources

Attribute	Term	Description
Intensity	Negligible	No measurable change to the current condition of historic properties would result from Project construction, operation, or reclamation. There would be no effect to the existing NRHP qualities of individual historic properties.
Intensity	Minor	There would be a small, but measurable change to the current condition of historic properties as a result of Project construction, operation, or reclamation. While a change to a historic property would occur, it would not affect any of the NRHP qualities of individual historic properties, and the eligibility of the property to the NRHP would not be altered.
Intensity	Moderate	An easily discernable and measurable change to the existing NRHP qualities of historic properties would occur as a result of Project construction, operation, or reclamation. While the existing qualities of an NRHP property may be diminished, it would not be to a degree that the properties' NRHP eligibility would be altered.
Intensity	Major	A large, easily measurable change in the current conditions would result in significant impacts to historic properties as a result of Project construction, operation, or reclamation and would substantially alter the NRHP qualities and eligibility status of individual historic properties. This would constitute an adverse effect as defined above.
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 are those impacts lasting beyond 3 years to the end of mine operations and through reclamation, approximately 20 years.
Duration	Permanent	Impacts are those impacts that would remain after reclamation is completed.
Context	Localized	Impacts would occur within the Physical and VAV APEs.
Context	Regional	Impacts would extend beyond the Physical and VAV APEs.

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.

The assessments of potential effects to historic properties are presented in the context of Section 106 of the NHPA and focuses on the potential effects of each alternative on historic properties, which for purposes of this assessment includes those listed on or eligible for listing on the NRHP and those that have not yet been evaluated for listing on the NRHP and located within the defined APEs. Resources associated with the Stibnite/Meadow Creek Historic District (10VY262/85-335; NR Inventory #87001186) have been removed from consideration due to the recent determination that the Stibnite Historic District is no longer eligible for listing on the NRHP.

The Nez Perce Tribe, Shoshone-Bannock Tribes, and the Shoshone-Paiute Tribes have completed cultural studies, also referred to as ethnographies, that discuss the cultural significance of the project's location; travel routes, fishing, gathering, hunting, and other practices; identification of potential TCPs, CLs, resource gathering areas, and sacred sites or places among other areas of concern. The cultural studies also address tribal perspectives toward the impacts of mining activities on heritage resources and other tribal resource interests (Battaglia 2018; Lahren 2020; Walker 2019). Specific descriptive qualitative data and quantitative spatial data for these resources are not currently publicly disclosed and are confidential.

The Forest Service consultation with Native American tribal partners is ongoing to learn more about these locations, and the potential effects activities associated with the SGP may have on potential historic properties that may be TCPs, CLs, travel routes, resource gathering, hunting, and fishing areas, and sacred sites/places.

4.17.2 Direct and Indirect Effects

Effects to historic properties within the Physical APE and VAV APE could take place during all phases of the SGP including construction, operations, exploration, and reclamation. Effects to historic properties during the reclamation phase would likely be avoided because impacts associated with historic properties in the reclaimed areas have already taken place or measures would be in place to avoid impacts to these known historic property locations. The continuation of authorized exploration and CERCLA activities, however, would also not constitute adverse effects to historic properties.

Three categories of heritage resources (NRHP-listed, NRHP-eligible, and NRHP-unevaluated) are considered historic properties for purposes of the assessment of potential effects including physical impact or destruction; or potential visual, vibration, or auditory effects resulting from the construction and operation of the SGP. A GIS-based analysis was utilized to identify those resources that could be reasonably affected; heritage resources that have been determined ineligible for listing on the NRHP were not considered in this analysis.

4.17.2.1 No Action Alternative

Under the No Action Alternative, mining and associated activities at the SGP would not occur. Existing roads would be maintained, but improvements and new road construction would not take place. Noise, vibration, and visual intrusions would not increase in the analysis area from current conditions. Ongoing activities associated with the CERCLA work per the current ASAOC would continue over the next few years would not affect any historic properties.

However, other actions would continue, such as existing and approved exploration activities and reclamation obligations under the Golden Meadows Exploration Project Plan of Operations and EA (Forest Service 2015c). These approved activities include the use of the existing road network, construction of several temporary roads (less than 0.5 mile total) to access drill sites, drill pad construction, and drilling on both NFS and private lands at and near the SGP. The continuation of existing and approved exploration activities at the SGP would result in the continued use of the existing administrative offices, the housing or man camp area, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip (located primarily on patented land).

Traditional cultural uses of the analysis area would continue, including for tribal fishing, hunting, gathering, and spiritual practices. Access to public land in the area would continue as governed by law, regulation, policy, and existing and future landownership constraints.

Under the No Action Alternative, the existing historic properties located in the analysis area would remain in their current states and would be expected to experience natural deterioration over time unless stabilization, rehabilitation, restoration, or preservation measures were applied. Under the No Action

Alternative, there would be no SGP-related permanent ground disturbance or visual, noise, and vibration impacts.

4.17.2.2 2021 MMP

Historic properties could be affected during the construction, operations, exploration, and reclamation phases of the 2021 MMP and the potential for associated activities to effect historic properties is assessed in the following sections. Four major component groups have been identified including the SGP mine site, access routes (including OSV routes), utilities (including the transmission line, VHF repeater sites, and telecommunications site), and off-site facilities.

Mine Site

Physical effects to historic properties within the SGP area would largely be caused by ground disturbance resulting not only from construction and operations, but also related to the increased numbers of people in the SGP area creating the potential for accidental or intentional harm to historic properties by the general public. Auditory and vibratory effects to historic properties could be expected during both the construction and operations phase resulting from increased truck traffic, drilling, and blasting. Visual effects to historic properties may also be anticipated due to the introduction of new infrastructure, lighting, and the alteration of the landscape resulting from the mining activities.

Restricted access to the mine site area during construction, operations, and closure and reclamation would affect tribal access to important sites and resources, some that could be identified as TCPs and CLs. In locations where a sense of solitude, including the soundscapes and viewsheds, is important to the cultural significance, interruptions from noise, vibrations, and alterations in the landscape, could adversely affect a significant aspect of religious and sacred sites or places. Although impacts from construction noise would be temporary and intermittent, these intrusions may potentially disrupt Native American religious and cultural practices. Traditional cultural uses of the area, including tribal fishing, hunting, gathering, and spiritual practices would also be potentially affected by the construction, operation, and reclamation phases of the SGP.

A review of historic properties within the SGP mine area resulted in the identification of one historic property that has been previously recorded within the Operations Area Boundary. Additional heritage resources are present, primarily associated with the Stibnite Historic Mining District which has recently been determined to no longer be eligible for listing on the NRHP due to a loss of integrity (ISHPO 2021). These resources have been determined not individually eligible for listing on the NRHP and would not require further consideration. One site (10VY1488, the Stibnite Lithics site) could be adversely affected by the mine construction and operations. However, if the site could be avoided through siting redesign measures, the effect to the site would not be adverse. Construction and operation of the SGP; however, would have the potential to adversely affect historic properties including TCPs or CLs if avoidance or minimization of potential effects could not be achieved.

Access Routes

The potential effects to historic properties resulting from the access routes associated with the mine must be assessed in two phases: construction and operations; and also, from the perspective of the activities associated with each route and each phase. During construction of the Burntlog Route and mine related

features, the primary access for mine-related traffic would be along Johnson Creek and Stibnite roads. Neither of these roads would require improvements outside of the existing road prisms. Therefore, the potential for physical impacts to historic properties would be minimal. Should historic properties be identified within proximity to or within the existing road prism, care should be taken to avoid impacts to these resources, or provide accommodations for them in the PA. Conversely, the potential for effects related to noise, vibration, or changes in viewshed would exist for historic properties within close proximity to the road corridors. Increased traffic would lead to increases in noise and vibration. Visual effects would not likely be considered adverse as there would be no substantial improvements made to these existing road corridors.

In the context of the Burntlog Route and its construction and use, potential effects to historic properties resulting from the road realignments, new road construction, borrow pits, and staging areas would be anticipated. Physical effects to historic properties resulting in significant damage or destruction could take place and the potential for noise, vibration, and visual effects would also be present both during construction of and use of this route. Additionally, the Burntlog Route would connect to a portion of the historic Old Thunder Mountain Road (FR 440). Included in this route is the road connector to the Meadow Creek Lookout where VHF repeater site installation would occur which would have the potential to affect historic properties.

The proposed groomed OSV route on the west side of Johnson Creek Road between Warm Lake Road and Cabin Creek Road would require tree removal, which could potentially adversely affect culturally modified trees that may be present. This type of heritage resource is known to exist in other areas adjacent to Johnson Creek Road. Mitigation measures for effects to these resources would be stipulated in the PA.

Upgrades to roads could lead to an increase in public usage, and this could increase access to and vulnerability of heritage resources within the analysis area. These activities plus construction noise also could potentially impact TCPs or CLs not yet identified along the access road alignments.

Restricted or altered access to the mine site area during construction and operations closures would affect tribal access to important sites, some that could be identified as TCPs and CLs. The Stibnite and Thunder Mountain roads through the Operations Area Boundary would be closed during the mine operations, potentially restricting access to important tribal resources and sites, although another public access route would be provided. In locations where a sense of solitude including the soundscapes and viewsheds is important to the cultural significance, interruptions from noise, vibrations, and alterations in the landscape, could adversely affect a significant aspect of religious and sacred sites. Although impacts from construction noise would be temporary and intermittent, these intrusions may potentially disrupt Native American religious and cultural practices. Traditional cultural uses of the area, including tribal fishing, hunting, gathering, and spiritual practices would also be potentially affected by the construction, operation, and reclamation phases of the SGP.

During the reclamation period, access roads would again be altered as the mine operations were closed down. During the reclamation period, a new public access road would be constructed over the backfilled Yellow Pine pit, once again connecting Stibnite Road to Thunder Mountain Road through the Operations Area Boundary. The construction of and use of this road would not likely constitute an adverse effect to historic properties. The road would utilize reclaimed mine land. While increased traffic through the

Operations Area Boundary would occur as a result of the road construction, the impacts would be minimal. Along the Burntlog Route, segments constructed for the SGP would be reclaimed and existing portions of the road would be returned to their pre-mining width.

A total of 43 historic properties as defined for this assessment are located within the APEs for the access routes associated with the SGP, including the Burntlog Route and Johnson Creek Road. None of the identified archaeological sites are within the Physical APE. Additionally, the Burntlog Route does utilize a portion of the NRHP-eligible Thunder Mountain Road. Physical impacts to archaeological sites would not be anticipated, however potential visual, auditory, or vibratory effects associated with the construction and use of the Burntlog Route and associated access roads may occur for historic properties in close proximity to the proposed route.

There would be limited potential for physical effects to historic properties along the Johnson Creek Route during construction since there would be no improvements outside the current road prism. However, consideration for potential auditory and vibratory effects resulting from road use during construction are possible. A review of the location of the historic properties, indicates that most are over 700 feet from the limits of the current road prism for the Johnson Creek Route during construction and the Burntlog Route during construction, operations, and closure/reclamation, and would not likely be adversely affected. However, it should be noted that access road construction and use could adversely affect potential TCPs or CLs within the analysis area.

Utilities

Potential effects to historic properties associated with the utility infrastructure would include potential physical effects resulting from ground disturbing activities associated with the replacement of existing transmission line structures with new ones, clearing and installation of new transmission structures on the new alignment, and ground disturbance associated with construction or upgrade of substations and the preparation of the VHF repeater and communication tower sites.

Two historic properties, including Site 10VY1488 (Stibnite Lithics Site) and the Meadow Creek Lookout Site (10VY365) may be physically or visually impacted by components associated with communications and the transmission line. The Stibnite Lithic Site (10VY1488) would potentially be physically and visually impacted; however, physical adverse effects to the Stibnite Lithic Site could be avoided through design and avoidance measures. Visual impacts may also adversely affect the Stibnite Lithic Site. Communications enhancements in the vicinity of the Meadow Creek Lookout, which is currently the location of an existing telecommunications facility, may adversely affect this resource. Although the resource would not be physically impacted, the addition of communications equipment could create an adverse visual effect. Similarly, a VHF repeater site is planned in proximity to the Thunderbolt Lookout, which has been recommended as a historic property by the Forest Service and treated as such and could result in an adverse visual effect to this resource. It should also be noted that the addition of the communications facilities could cause ground disturbance that could affect potential TCPs and CLs. Additionally, a change in the visual landscape also has the potential to affect TCPs of CLs as the introduction of new infrastructure may alter the landscape in such a way as to detract from the cultural significance.

Although the existing transmission line, IPCo Line 328, is historic and has been determined as eligible for listing on the NRHP, maintenance or upgrade of such infrastructure is expected. The line is in use, is maintained, and derives its primary significance from its association with mining in Valley County. Maintenance and upgrade activities would be considered acceptable and would not constitute an adverse effect to the transmission line. Consideration for the impacts to the historic significance of the line and the criteria for which it is considered eligible would be addressed in the PA and provisions for mitigation would be documented should an adverse effect be identified.

A total of 89 historic properties, as defined for this assessment, are located within the APEs for the transmission line and its access roads. An additional seven historic properties are located adjacent to or within a portion of the transmission line, paralleling SH 55 in the vicinity of Donnelly and at the northern end of the transmission line corridor. Twelve of the total number of historic properties are located within the transmission line corridor footprint and include primarily archaeological sites, the transmission line itself, a canal, and several historic roads. It is anticipated that none of these resources would be adversely affected by the proposed improvements if the sites are avoided or potential impacts were minimized through protective measures and redesign opportunities. It is assumed that in many cases, resources in the footprint or construction area would be avoided or spanned. The improvements associated with the transmission line upgrades would also not likely constitute an adverse effect to historic properties located within the VAV. Although viewsheds may be altered by the installation of new taller transmission line structures, distance, wooded conditions, and topography would likely minimize any adverse visual effect. However, it should be noted that access road construction and use could adversely affect potential TCPs or CLs within the APE.

Off-Site Facilities

The potential effects to historic properties resulting from the off-site facilities would include physical effects as well as potential visual, auditory, and vibratory effects. Vibratory effects would likely be temporary and identified during the construction phase as would noise. Visual effects, however, should be considered due to the introduction of new facilities on the landscape which could alter the significant characteristics of historic properties including potential TCPs and CLs.

A survey conducted for the SGLF which is proposed to be sited off SH 55 determined that there would be no effect to historic properties if constructed in its current location. There are no above-ground historic properties located within the VAV in proximity to the SGLF. However, the potential effects to potential TCPs and CLs should be evaluated if such historic properties are identified through future consultations with tribal partners.

The second off-site facility, the Burntlog Route Maintenance Facility is located along the Burntlog Route north and east of its intersection with Warm Lake Road. There are no historic properties identified within the physical or VAV APEs for the Burntlog Route Maintenance Facility. However, it should be noted that potential adverse physical and visual effects to currently unidentified historic properties could occur including potential TCPs and CLs. The potential effects to historic properties in these locations, however, would be anticipated to be minimal.

Summary

In summary, under the 2021 MMP, 46 historic properties would be within the physical and VAV APEs and an additional 97 historic properties within the VAV APE. Of those there is potential for 19 to have physical impacts, 68 could experience visual effects, 15 may be susceptible to vibratory effects, and 16 whose integrity could be affected by noise. Additional details on each site and the potential impacts are provided in the Heritage Resources Specialist Report (Forest Service 2022l). Impacts to heritage resources would be short term to permanent, localized, and minor to moderate depending on avoidance and mitigation. In addition, potential adverse physical and visual effects to currently unidentified historic properties could occur including potential TCPs and CLs.

4.17.2.3 Johnson Creek Route Alternative

The mining portion of the Johnson Creek Route Alternative would be the same as under the 2021 MMP. The primary focus of the Johnson Creek Route Alternative would be alterations in the mine access plans during operations and reclamation. The Johnson Creek Route Alternative eliminates the construction of the Burntlog Route as presented under the 2021 MMP but would require extensive upgrades to both Johnson Creek Road and Stibnite Road during the construction phase. This alternative would utilize the same off-site facilities as the 2021 MMP except the Landmark Maintenance Facility which would be located on the southwest side of the junction of Warm Lake Road at Johnson Creek Road and the two VHF repeater sites would be located along Johnson Creek Road. The following assessment of potential effects to historic properties resulting from the Johnson Creek Route Alternative utilizes the same major component groups – SGP, Access Routes, Utilities, and Off-Site Facilities – as those identified from the 2021 MMP. In total, under the Johnson Creek Route Alternative, 44 NRHP-eligible or unevaluated heritage resources would be within the physical APE and an additional 86 within the VAV APE. However, it should be noted that potential adverse physical and visual effects to currently unidentified historic properties could occur including potential TCPs and CLs. Additional details on each site and the potential impacts are provided in the Heritage Resources Specialist Report (Forest Service 2022l).

Mine Site

Impacts associated within the Operations Area Boundary would be the same as those described under the 2021 MMP.

Access Routes

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed; there would not be any upgraded or newly constructed roads along that route and access to the mine would solely utilize the Johnson Creek Route. The Johnson Creek Route would utilize Johnson Creek Road to Yellow Pine, and then Stibnite Road (FR 50142) from Yellow Pine to the mine. This route would be utilized for the entire life of the SGP and would require major upgrades along both Johnson Creek Road and Stibnite Road. Similar to the 2021 MMP, seven borrow areas would be created and utilized along the route.

The potential for impacts to historic properties associated with the Johnson Creek Route Alternative includes physical impacts to those historic properties that would be impacted by ground disturbance associated with the necessary cut and fill episodes for road upgrades and the excavation and use of the borrow pit areas. Major improvements would be required for both Johnson Creek Road and Stibnite Road

that could physically affect historic properties. Other impacts could include visual intrusions, particularly during the construction phase and road upgrades, but these would be considered short term. Once the road improvements are completed, the visual change on the landscape would be minimal. Vibratory and auditory effects could also be anticipated during construction and operation due primarily to increased traffic along the route which would include large trucks, mine traffic, and increase public access.

A total of 16 historic properties as defined for this assessment are located within the APEs for the Johnson Creek Route. Construction and operation activities would have the potential to adversely affect these resources if avoidance or minimization of potential effects could not be achieved. A review of the historic properties within the physical APE along the Johnson Creek Route identified four historic properties which may fall within the construction footprint and could be adversely affected by ground disturbing activities and/or destruction. Additional historic properties are within the VAV APE for the Johnson Creek route including the Landmark Ranger Station. Temporary adverse effects to the Landmark Ranger Station may occur during road construction, however once the construction is complete, it is not anticipated that long term visual, auditory, or vibratory adverse effects from the Johnson Creek Route upgrade would occur. However, it should be noted that potential adverse physical and visual effects to currently unidentified historic properties could occur including potential TCPs and CLs, if present.

Utilities

Impacts would be the same as those described under the 2021 MMP with the exception of the VHF repeater sites which would be located along Johnson Creek Road. The Johnson Creek Route Alternative would include VHF repeater site construction and maintenance via helicopter to reduce access road needs within IRAs managed for backcountry restoration. Helicopter use could increase noise levels in the vicinity of some historic properties intermittently and short-term during construction and then maintenance.

Off-Site Facilities

Impacts related to the SGLF would be the same as those described under the 2021 MMP. The construction of the Landmark Maintenance Facility could pose potential physical and visual effects to historic properties. The location is adjacent to the historic Landmark Ranger Station and the introduction of a modern facility would likely alter the viewshed for the Landmark Ranger Station. It is anticipated the Landmark Maintenance Facility would adversely visually affect the Landmark Ranger Station. Consideration for the potential adverse impacts to previously unidentified historic properties, including TCPs and CLs would take place as consultation continues and under the stipulations of the PA.

Summary

A total of 44 historic properties are located within the physical and VAV APE and an additional 86 historic properties are located only within the VAV APE. Of those there is potential for 18 to have physical impacts, 66 could experience visual effects, 14 may be susceptible to vibratory effects, and 15 whose integrity could be affected by noise. Impacts to historic properties would be short term to permanent, localized, and minor to moderate depending on avoidance and mitigation. In addition, potential adverse physical and visual effects to currently unidentified historic properties could occur including potential TCPs and CLs.

4.17.3 Mitigation Measures

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. The mitigation measures described below are in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis.

For this Project, the Forest Service determined that a PA would be required to ensure compliance with the NHPA and 36 CFR 800. The PA is being drafted to include provisions for identification of historic properties, mitigation for adverse effects to historic properties, the preparation of a Historic Properties Management Plan (HPMP), and subsequent Historic Properties Treatment Plans (HPTPs) to address effects to historic properties over the life of the SGP.

The HPMP applies to both public and private lands within the SGP's APEs and is designed to address the process by which previously unknown historic resources would be identified, evaluated, and assessed for potential effects pursuant to the requirements of Section 106 of the NHPA. The HPMP would also address the process by which previously identified sites in uninventoried areas within the physical APE would be re-identified, evaluated, and assessed for potential effects. The goal of the HPMP is to incorporate the management of historic properties with the management and operation of the SGP, without unnecessary delays and in a manner that addresses the historic properties within the APE in accordance with applicable legal requirements. Management options are designed to ensure that effects on historic properties are avoided and include preservation in place, ongoing use, monitoring, public and company education, closure or isolation of specific properties, and stabilization. This HPMP attempts to protect resources, provide positive benefits for the preservation of cultural values, and recognize consideration of the effects on historic properties. The HPMP is intended to:

- Comply with stipulations developed jointly by the Signatory, Invited Signatory, and Concurring Parties as outlined in the PA;
- Summarize the results of previously conducted cultural resources surveys and the identification of historic properties, including any TCP in the APE;
- Develop a process for phased identification efforts for previously uninventoried portions of the SGP APEs and incorporating design changes to the SGP to avoid or minimize adverse effects on historic properties;
- Describe a process for evaluation of heritage resources for eligibility for inclusion on the NRHP;
- Address the assessment of effects and how adverse effects to historic properties would be resolved in consultation with Perpetua and other consulting parties;
- Develop ways to avoid, minimize, or mitigate adverse effects on historic properties;
- Define impact/adverse effect avoidance measures for performing operations and maintenance activities;
- Determine the curation process for all recovered heritage resource materials as a result of the SGP;
- Establish the process for managing unanticipated discoveries; and
- Confirm the process for managing discovery of human remains taking into account applicable state laws, local laws, and the NAGPRA (U.S.C. § 3001) on federal lands.

In tandem with the HPMP, a HPTP would be prepared to address mitigation of adverse effects to known historic properties at the time the PA is executed. Subsequent HPTPs would also be prepared to address mitigation for adverse effects to currently unidentified historic properties as determined necessary by the Forest Service over the life of the SGP. The purpose of the HPTP would be to streamline the resolution of adverse effects to historic properties located within the SGP and would be prepared in accordance with the stipulations set forth in the PA.

4.17.4 Irreversible and Irretrievable Commitments of Public Resources

Historic properties are considered a public resource, and their destruction (partial or complete) is a permanent and irreversible effect. They are non-renewable resources. Uses of historic properties include recreational destinations, public displays, research by universities and cultural resource professionals, and tribal use of TCPs or CLs. If historic properties are disturbed, damaged, or destroyed by ground disturbance or restricted access due to implementation of the SGP, these uses becomes permanently unavailable. If traditional use areas become unavailable for use for the foreseeable future by tribes in the SGP area, this would constitute an irretrievable commitment of resources (Forest Service 2022q).

The consequences associated with irreversible and irretrievable commitments may include significant loss of tribally significant resources and the inability of tribal members to utilize traditionally important resources or access traditionally important places.

4.17.4.1 No Action Alternative

Under the No Action Alternative, the SGP would not be undertaken. Consequently, there would be no irreversible and irretrievable commitment of historic properties beyond that currently occurring.

4.17.4.2 Action Alternatives

Historic properties that could be impacted by the SGP constitute an irreversible commitment, regardless of mitigation. Once gone, only the data collected remains; the resources cannot be used for any additional purposes.

The restriction of public access in the Operations Area Boundary would remove the land from other uses while the SGP is in operation, but the use would eventually be reversed through removal of the exclusion area and reclamation. Lack of access to TCPs and CLs by tribes would be an irretrievable commitment of resources because a generation of tribal members is likely to lose traditional knowledge of these places; this is an impact to tribal rights and interests (Forest Service 2022q).

Implementation of any action alternatives could result in an irretrievable commitment of historic properties if avoidance and mitigation measures of the SGP are not implemented.

4.17.5 Short-term Uses versus Long-term Productivity

The resilience of historic properties is very low in comparison to other social or biological resources because actions associated with the SGP that may affect historic properties would be permanent. Once a historic property is disturbed or possibly damaged or destroyed through ground disturbance or through increased public use of the area, which can lead to ground disturbance, it cannot be replaced. The duration of the use is not important, because the damage to a historic property, such as a precontact archaeological

site, can occur immediately. Additionally, restricted access in the Operations Area Boundary for the duration of the SGP would adversely affect long-term productivity, because, over the life of the mine, a generation of tribal members would experience loss of traditional knowledge and use of culturally significant resources and places. Short-term uses and uses such as temporary staging areas for reclamation material or access roads that would later be returned to their pre-construction state have the potential to permanently impact historic properties. There is the potential for the loss of long-term productivity to any historic properties subjected to short-term use.

4.17.5.1 No Action Alternative

Under the No Action Alternative, the SGP would not be undertaken. Consequently, there would be no short-term use that would affect historic properties and no effect on long-term productivity.

4.17.5.2 Action Alternatives

Under either action alternative, all short-term direct impacts to historic properties would lead to a loss of long-term productivity. Some short-term protection measures could lead to long-term productivity (use of a historic property for data, interpretive, or cultural purposes) of resources. If TCPs or CLs are identified, short-term use may be denied while protecting long-term productivity.

4.18 Public Health and Safety

4.18.1 Impacts Definitions and Effects Indicators and Methodology

The analysis of effects to public health and safety from the SGP includes the following issues and indicators:

Issue: The SGP may affect public safety on the roads used by mine vehicles during construction, operation, and closure activities.

Indicators:

- Number of SGP-related vehicles trips on public roads.

Issue: The SGP may affect human health or exposure to hazards (e.g., via ingestion or inhalation of soil, air, fish, and water).

Indicators:

- Change in public health statistics.
- Changes in health metrics such as soil, air, and water quality.
- Quantity of hazardous materials transported on access roads.
- Risk of natural hazards (wildfire, avalanche, landslide).

Issue: The SGP may affect infrastructure and services as related to emergency services, medical services, utilities, sanitation, and wastewater treatment.

Indicators:

- Capacity of existing infrastructure and services to meet anticipated increased use.

Issue: The SGP may cause public health effects related to changing environmental conditions.

Indicators:

- Changes in soil, air, and water quality.
- Disruption at recreational areas during construction, operation, and closure and reclamation.
- Psychological effects due to noise.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1**.

Public health and safety was analyzed using baseline health statistics obtained from federal, state, and local government agencies, scientific literature reviews, and information and analysis documented in reports prepared for the SGP. The evaluation of public health and safety effects relies heavily on the analyses conducted for other resources as they relate to public health impacts.

In assessing the potential for health impacts due to the SGP, the types of health impacts (e.g., chronic disease, injury, well-being, etc.) selected and described in the affected environment discussion in **Section 3.18** are evaluated and the magnitude of the health impact is assessed. In assessing the magnitude of the impact (high, medium, low, or none), the following factors are evaluated: the actual consequence (e.g., minor injury/illness or severe injury or death), the duration of the exposure, and the number of people potentially affected. In addition to categorizing the magnitude of the impacts, effects are categorized as positive or negative, with information on potential mitigation provided (**Table 4.18-1**).

Table 4.18-1 Definitions of Magnitudes Measure of Health Impacts

Magnitude of Health Impact	Positive Effect	Negative Effect	Mitigation
None	No discernible or measurable impacts	No discernible or measurable impacts	None
Low	Low level quality-of-life impacts, low/short exposures, limited area/people affected	Low level quality of life impacts, low/short exposures, limited area/people affected	Mitigation measures possible
Medium	Significant quality-of-life enhancement, or reduced exacerbation of existing illness, or reduced disease incidence; Moderate, intermittent, exposures, relatively localized	Exacerbations of existing illness, reduction in quality of life (e.g., increase in “nuisance” factors such as noise/odors); Moderate, intermittent, exposures, relatively localized	Mitigation measures possible, but minor residual negative effects may remain
High	Prevent deaths/prolong life	Increase deaths, increase chronic or acute diseases, increase mental illness; High/long duration exposures, over a wide area	Mitigation measures possible, but residual negative effects may remain

Source: International Council on Mining and Metals (ICMM) 2010

As described in the Good Practice Guidance on Health Impact Assessments (ICMM 2010), when analyzing the overall public health impact, the magnitude of the consequence is combined with the possibility that the consequence would occur. There is no universally agreed upon formula for assessing overall public health impact (ICMM 2010). Characterization of public health effects relies on qualitative and quantitative evidence (National Resource Council of the National Academies [NRC] 2011) and the assessments of the magnitude of the impact or possibility of occurrence are often based on a subjective judgement (ICMM 2010) and utilize a matrix approach (**Table 4.18-2**).

Table 4.18-2 Public Health Impact Rating Matrix

Magnitude of Health Impact	Low Possibility of Health Impact Occurrence (unlikely to occur)	Medium Possibility of Health Impact Occurrence (likely to occur sometimes)	High Possibility of Health Impact Occurrence (likely to occur often)
None	Negligible	Negligible	Negligible
Low	Negligible	Minor	Moderate
Medium	Minor	Moderate	Major
High	Moderate	Major	Major

Source: ICMM 2010; NRC 2011

4.18.2 Direct and Indirect Effects

This analysis evaluates the magnitude of the potential health issues (both positive and negative) on the potentially affected local population of Valley County, as well as recreational visitors to the area. The scope of this analysis is limited to affected communities outside of the SGP and associated facilities and does not include a direct evaluation of the anticipated workforce safety and health issues that could occur at the mine site, because the action alternatives would be governed by OSHA and MSHA.

4.18.2.1 No Action Alternative

No impacts are anticipated to Public Health and Safety from the No Action Alternative as related to air quality, ground water, terrain, economy, public services and infrastructure, and demographics.

Soil Quality - Legacy soil impacts from historical mining would continue to exist under the No Action Alternative (Soils Specialist Report, Forest Service 2022c). Public health impacts under the No Action Alternative related to soil quality would be localized, long term, and negligible.

Surface Water Quality - The inventoried waterbodies at the Operations Area Boundary would continue to be listed as impaired (except for West End Creek) for specific uses in accordance with CWA Section 303(d) due to arsenic (plus antimony and mercury at some locations) for exceedances of Idaho's human health criterion for consumption of water and organisms (Water Quality Specialist Report, Forest Service 2022f). The existing conditions of these waterbodies is expected to be maintained under the No Action Alternative until the CERCLA actions under ASAOC take place at which time the conditions of the surface water are expected to improve. The IDEQ may also identify goals towards developing a water quality improvement plan/total maximum daily loads for the East Fork SFSR. Public health impacts under the No Action Alternative related to surface water would be localized, long term, and negligible.

4.18.2.2 2021 MMP

The 2021 MMP has the potential to result in direct and indirect effects to public health and safety through alterations in environmental conditions; economic conditions; local public services and infrastructure; and land use and demographics. **Table 4.18-3** summarizes the assessed impacts described in the following sections and presents the overall public health impact rating of each impact.

Air Quality

Health impacts associated with air emissions can result from inhalation of criteria air pollutants, such as $PM_{2.5}$ and nitrogen oxides (NO_X), as well as inhalation of hazardous air pollutants (e.g., metals, polycyclic aromatic hydrocarbons). Potential impacts to air quality associated with the 2021 MMP assume that the SGP would be designed, constructed, and operated in compliance with appropriate air pollution controls to comply with applicable regulations and any air quality permits issued by the IDEQ with dust control, dust suppression, and/or dust abatement measures implemented. Air emissions were estimated for each activity and process source included in the 2021 MMP for all phases of the SGP. The highest combined pollutant annual emissions (including fugitive dust) were predicted to occur in Mine Year 7 (after up to 3 years of construction and pre-production activities and during the 4th year of mining). The predicted emissions of PM_{10} and $PM_{2.5}$, along the Operations Area Boundary or within one mile of the boundary, were also largest in Mine Year 7 (Air Quality Specialist Report, Forest Service 2022a).

Predicted ambient air concentrations for critical air pollutants (carbon monoxide, NO_X, $PM_{2.5}$, PM_{10}, sulfur dioxide, and ozone) at the Operations Area Boundary, where the public is not restricted, were shown to be below the NAAQS. The NAAQS (**Section 3.3**) are allowable air concentration limits adopted by the State of Idaho into the Rules for the Control of Air Pollution in Idaho and are considered protective of public health. Also, the results of the Class II near field air quality analysis show that predicted ambient concentrations of the criteria pollutants are below the Class II Prevention of Significant Deterioration increments. This comparison was performed to examine air quality conditions in proximity to the FCRNRW and Nez Perce Tribal Land.

The NAAQS are set at a level expected to protect public health with an adequate margin of safety, taking into consideration effects on susceptible populations (EPA 2012). Because individual thresholds vary from person to person due to individual differences in susceptibility and pre-existing disease conditions (e.g., asthma or reactive airway disease), there may be some health effects associated with $PM_{2.5}$ for sensitive susceptible individuals even if ambient $PM_{2.5}$ levels meet the air quality criteria (EPA 2009, 2012). Levy et al. (2002) estimated that a 1 $\mu g/m^3$ increase in daily $PM_{2.5}$ concentration could result in a 1 percent increase in asthma-related emergency room visits.

Health impacts associated with air quality would be localized, long term, and negligible.

Table 4.18-3 Summary of Public Health Impacts for the 2021 MMP

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Environment	Air	Localized impacts to air quality from fugitive dust and particulate emissions during mine operations; diesel emissions from vehicle traffic and machinery	Inhalation of pollutant emissions	Chronic Disease -Well-Being/ Psychosocial	Negative	Direct – Pollutant Inhalation	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Negligible Closure and Reclamation: Negligible
Environment	Soil	Deposition impacts to soil from proposed mine operations	Direct contact with hazardous pollutants	Chronic Disease-Well-Being/ Psychosocial	Negative	Direct - Contact	Construction and Operations: Medium Closure and Reclamation: Low	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Minor Closure and Reclamation: Negligible
Environment	Groundwater	Leaching of contaminants to groundwater from proposed mine operations	Degraded environmental quality	Well-Being/ Psychosocial	Negative	Indirect	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Negligible Closure and Reclamation: Negligible

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Environment	Soil	Reclamation of legacy mining materials	Minimizes direct contact with hazardous pollutants Improved environmental quality	Chronic Disease Well-Being/ Psychosocial	Positive	Direct - Contact	Closure and Reclamation: Medium	Closure and Reclamation: High	Closure and Reclamation: Moderate
Environment	Soil	Uptake of contaminants from soil into subsistence foods (berries and plants)	Ingestion of contaminants from edible plants and berries	Chronic Disease Nutrition Well-Being/ Psychosocial	Negative	Indirect - Bioaccumulation	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Negligible Closure and Reclamation: Negligible
Environment	Surface Water	Direct contact with hazardous pollutants released to surface water	Direct contact with hazardous pollutants Ingestion of hazardous pollutants in fish harvested from local waterbodies	Chronic Disease Nutrition Well-Being/ Psychosocial	Negative	Direct	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Negligible Closure and Reclamation: Negligible

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Environment	Surface Water	Reclamation of surface conditions, re-vegetation to reduce run-off of hazardous pollutants to streams and rivers	Minimization of direct contact with hazardous pollutants Reduction of hazardous pollutants in fish harvested from local waterbodies Improved environmental quality	Chronic Disease Nutrition Well-Being/ Psychosocial	Positive	Direct and Indirect	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Negligible Closure and Reclamation: Negligible
Environment	Terrain	Disturbance of existing terrain and features	Injury due to natural hazards: avalanche, land slide, flash flooding and water hazards, wildfires	Injury Well-Being/ Psychosocial	Negative	Direct - Injury	Construction and Operations: High Closure and Reclamation: High	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Moderate Closure and Reclamation: Moderate
Economy	Personal (income, employment)	Increase in local employment	Increased income Increased food security/ improved nutrition Increased access to health care through employee benefits, including insurance	Chronic Disease Well-Being/ Psychosocial	Positive	Indirect	Construction and Operations: Medium	Construction and Operations: High	Construction and Operations: Major

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Economy	Personal (income, employment)	Decrease in local employment	"boom and bust" impact reduced demand for private and public goods and services reduction in demand for labor	Chronic Disease Well-Being/ Psychosocial	Negative	Indirect	Closure and Reclamation: Medium	Closure and Reclamation: Medium	Closure and Reclamation: Moderate
Public Services and Infrastructure	Need for new infrastructure	Worker Housing Facility	Increased access to health care and emergency service support Increased emergency services in remote area	Chronic Disease Infectious Disease Injury Well-Being/ Psychosocial	Positive	Indirect	Construction and Operations: Medium Closure and Reclamation: Medium	Construction and Operations: Medium Closure and Reclamation: Medium	Construction and Operations: Moderate Closure and Reclamation: Moderate
Public Services and Infrastructure	Need for new infrastructure	Worker Housing Facility	Potential transmission of infectious disease	Infectious Disease	Negative	Indirect	Construction and Operations: Medium Closure and Reclamation: Medium	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Minor Closure and Reclamation: Minor
Public Services and Infrastructure	Roads	Construction of improved mine access road	Improved access to remote area for emergency responders	Injury Well-Being/ Psychosocial	Positive	Indirect	Construction and Operations: Medium Closure and Reclamation: Medium	Construction and Operations: Medium Closure and Reclamation: Medium	Construction and Operations: Moderate Closure and Reclamation: Moderate

Category Relevant to Public Health	Potentially Affected Resources	SGP Specifics	Impact Relevant to Public Health and Safety	Possible Health Impact	Positive or Negative Health Impact?	Pathway of Health Impact	Magnitude of Impact	Possibility of Impact	Overall Impact on Public Health (Magnitude x Possibility)
Public Services and Infrastructure	Roads	Construction of improved mine access road, Increased trucking traffic on mine access routes	Increased potential for hazardous waste spill Increased potential for traffic accidents	Injury Well-Being/ Psychosocial	Negative	Direct	Construction and Operations: High Closure and Reclamation: High	Construction and Operations: Medium Closure and Reclamation: Medium	Construction and Operations: Major Closure and Reclamation: Major
Public Services and Infrastructure	Transmission Lines	Increased power demand to support mine operations	Increased exposure to electro-magnetic field (EMF) along transmission lines	Chronic Disease Injury Well-Being/ Psychosocial	Negative	Direct	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Negligible Closure and Reclamation: Negligible
Demographics	Land use	Disturbance of current recreational land use	Alteration or elimination of recreational sites	Well-Being/ Psychosocial	Negative	Indirect	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Negligible Closure and Reclamation: Negligible
Demographics	Land use	Noise disturbances during mine blasting and vehicle noise along access routes	Psychological effects due to noise	Well-Being/ Psychosocial	Negative	Indirect	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Low Closure and Reclamation: Low	Construction and Operations: Negligible Closure and Reclamation: Negligible

Soil Quality

Legacy soil impacts from historical mining plus significant soil disturbance is expected under the 2021 MMP (Soils Specialist Report, Forest Service 2022c). Thus, additional soil contaminants may be exposed during the construction and operation phases of the SGP. However, these soil impacts would be limited to the active mining areas, with restricted public access.

Releases of hazardous materials could range from a minor to large spills within the Operations Area Boundary or the off-site facilities, or along access routes. Depending on the nature of the spill and the effectiveness of spill responses, a release could potentially lead to exposures to contaminants in soil. The direct and indirect effects of a spill may range from negligible to major depending on the spill incident but based on the planned infrastructure specifically designed for the storage and management of hazardous materials, a large release to the environment within the Operations Area Boundary or off-site facilities would not likely occur. In the event a release was to occur, it would likely be relatively small in volume based on estimated container volumes and would be addressed promptly as per the SPCC Plan and Spill Response Plan. The SPCC Plan would address site-specific spill prevention measures, fuel haul guidelines, fuel unloading procedures, inspections, secondary containment of all on-site fuel storage tanks, and staff training. The Solid and Hazardous Materials Handling and Emergency Response Plan would address response and cleanup for any spill of hazardous materials, including concentrate, on all transport routes. The plan would include a sampling plan to assure that all spilled material is cleaned up and would include contingency plans for remediation of potential impacts to soil, wetlands/riparian, and water resources.

In the event that large quantities of hazardous materials are spilled into the environment from a transportation incident, or in the event that a spill is not immediately discovered or addressed, the impact could be more substantial. For these reasons, the magnitude of the health impact related to soil quality is rated as “medium” on **Table 4.18-3**, because some exposure of legacy contamination and/or a release of hazardous materials (ranging from small to large quantities) is possible. However, the possibility of the impacts on public health is rated as “low,” because the public access is restricted in the active mining area, public access would be limited during response actions along access routes, and the probability of a large spill is low.

During closure and reclamation, RCM would be used as surface material to support vegetation growth and slope stability. The Reclamation and Closure Plan includes appropriate types and concentrations of material that would be protective of human receptors when identifying suitable RCM. The reclamation process is expected to lead to an overall reduction in chemical impacts to surface soil by removing potential sources of metals leaching into the soils, removing sources of erosion and sedimentation, reducing erosion of soils and sedimentation, and reducing downstream sediment transport. Thus, potential negative impacts to soil due to mining disturbance would be largely offset by positive impacts from reclamation of legacy contamination. Therefore, the evaluation of the potential public health and safety impacts associated with exposure to contaminants in soil during the closure and reclamation phase would be negligible (**Table 4.18-3**).

Idaho Department of Health and Welfare (IDHW) reviewed available information from the proposed Reclamation and Closure Plan for the SGP to consider whether potential health risks from metals in soils

exist for future site users. The IDHW Letter Health Consultation stated that based on information available in the Reclamation and Closure Plan, concentrations of arsenic and antimony in surface soil adjacent to the site may exceed the health-based screening values. The IDHW included recommendations for additional characterization to adequately assess risks to public health and recommended that potential human exposure following closure and reclamation should be considered when identifying RCM to ensure protection of recreational receptors (IDHW 2019).

Soils used for reclamation would be screened based on their concentrations of arsenic, antimony, and mercury to exclude materials with metal concentrations outside the range of natural baseline conditions or with metal leaching potential. While natural baseline metal concentrations at times exceed health-based screening values, the reclaimed site would not pose an increased human health risk compared to the existing site conditions. The exposure risk associated with existing site conditions is not expected to result in any adverse effects (ATSDR 2003). Exposure risk could be further reduced through administrative controls such as exclusion of the public from private land portions of the reclaimed site and enforcement of PNF camping stay limits on public lands.

Surface Water Quality

The inventoried waterbodies at the mine site have designated beneficial uses of “cold water communities,” “salmonid spawning,” and “primary contact recreation.” All waterbodies except Sugar Creek have additional designated beneficial uses of “drinking water supply” and presumed beneficial uses of “secondary contact recreation.” Sugar Creek has additional beneficial uses of “agricultural water supply” and “wildlife habitat.” However, under existing conditions, each of these inventoried waterbodies (except for West End Creek) are listed as impaired for specific uses in accordance with CWA Section 303(d). The causes for listing of these waters are associated with arsenic (plus antimony and mercury at some locations) for exceedances of Idaho's human health criterion for consumption of water and organisms (Water Quality Specialist Report, Forest Service 2022f). Operational and post-closure concentrations of these elements in the East Fork SFSR are predicted to be comparable to or less than the existing conditions. The IDEQ may also identify goals towards developing a water quality improvement plan/total maximum daily loads for the East Fork SFSR.

Groundwater Quality

Groundwater analyte concentrations beneath the mine site, particularly in the vicinity of the TSF, TSF Buttress, Hangar Flats pit backfill, and Yellow Pine pit backfill, are expected to increase in response to constituent leaching from development rock. However, existing groundwater in those areas typically does not meet regulatory criteria for use as drinking water due primarily to arsenic and antimony concentrations (Water Quality Specialist Report, Forest Service 2022f).

There are three permitted wells on the mine site which are controlled by Perpetua: the Gestrin Airstrip mining well, the original temporary camp water supply well, and the new camp water supply well. Use of these wells for drinking water supply would require water treatment for arsenic and antimony removal. There are no active domestic groundwater wells used for residential drinking water within 15 miles of the SGP. Yellow Pine’s public water system uses surface water from Boulder Creek, which is located approximately 15 miles downstream of Yellow Pine. Because groundwater is not currently used as a public drinking water source at the SGP and is assumed to be unlikely to be used as a drinking water

source in the future, the ATSDR Public Health Assessment conducted for the existing mine site eliminated the groundwater as drinking water pathway from consideration as a public health concern (ATSDR 2003). The IDEQ would further regulate groundwater quality standards under its IPDES permit.

Public health impacts related to groundwater would be localized, long term, and negligible.

Terrain

Potential public health and safety impacts can result from hazards associated with disturbance of existing terrain and features, including flash flood, wildfires, avalanches, and landslides. Steep slopes and uneven terrain also present potential hazards for recreational visitors. The SGP is not expected to exacerbate any of these existing hazards, but could increase the risk of damage, injury, or loss of life from the hazards due to the increased number of people traveling through the area to the SGP.

In particular, existing avalanche hazards on the Stibnite Road portion of the Johnson Creek Route would persist and could impact travel along this route during the construction period. Construction of the SGP would not increase the avalanche hazard but increased construction period road use would increase the risk of damage, injury, or loss of life from existing avalanche hazards temporarily followed by a risk decrease upon transition to use of the Burntlog Route for operational access (Access and Transportation Specialist Report, Forest Service 2022k). Conversely, the risks from existing avalanche hazards along the Burntlog Route would increase due to increased vehicular traffic during mine operations and closure/reclamation activities.

Public safety impacts related to terrain would be localized, long term, and moderate.

Economy

Potential positive health impacts associated with the 2021 MMP on local economic conditions are indicated in **Table 4.18-3**. The 2021 MMP would make a significant contribution to the Valley County economy in terms of direct and indirect employment and wages during the life of the SGP (Social and Economic Conditions Specialist Report, Forest Service 2022o). In addition, the 2021 MMP would generate significant tax revenues for various levels of government. The economic benefits associated with increased employment opportunities and tax revenues could lead to continued or improved access to health services, better nutrition, and better overall well-being for the local community. Also, if the new fulltime positions include health insurance and improved access to health care, this may have a positive effect on chronic and infectious disease and injury categories for both the employees and their families.

Conversely, the “boom and bust” related decrease in mine-closure related local employment and labor income also could have significant adverse effects on the local economy. While there could be some residual economic benefit to the community following closure and reclamation, there also could be an indirect or induced negative impact associated with the reduction in work force resulting from mine closure with reduced economic activity indirectly impacting public health through loss of income and/or services.

Public health impacts related to the economy would be beneficial, regional, long term, and major during construction and operations. During and after reclamation and closure, impacts (i.e., decrease in employment and services) would be negative, regional, and moderate.

Public Services and Infrastructure

The 2021 MMP would add traffic volumes to various roadways in the analysis area during construction, operation, reclamation, and closure. During construction, Warm Lake (CR 10-579), Johnson Creek (CR 10-413), and the Stibnite segment of the McCall-Stibnite (CR 50-412) roads would be affected during the first 3 years of the SGP by construction activities until the Burntlog Route is completed. Once Burntlog Route is completed, the substantial increase in traffic volume would shift to exclusively Warm Lake and Burnt Log (FR 447) roads as they are parts of the Burntlog Route.

Existing traffic volumes on Warm Lake Road are at least 15 times greater than the other access roads. Mine-related traffic on Warm Lake Road would increase by approximately 5 percent during construction and operation activities, and traffic volume on Burntlog Route would more than triple during the operation phase (Access and Transportation Specialist Report, Forest Service 2022k). While increases in traffic volume are expected due to SGP-related activities, overall traffic volume on these access roads would still be low due to the remote location and low-density population in the area. While the potential for accidents could increase due to the increased SGP-related traffic volume, the predicted 5 percent increase in traffic volume due to SGP activities on Warm Lake Road is minimal.

Upon completion of the Burntlog Route, the public could access Thunder Mountain Road (FR 50375) using the Burntlog Route as an alternative to access from Stibnite Road (CR 50-412). This could provide improved access to remote recreational areas and better access for emergency responders, which could result in positive impacts to public health and safety. Thus, the magnitude of impact of the Burntlog Route shown on **Table 4.18-3** is “medium” and positive and the possibility is rated as “high,” with an overall public health rating of “moderate” positive. Public health and safety impacts related to improved access would be localized, long term, and moderate.

The 2021 MMP would require upgrades to an existing 69-kV transmission line to 138-kV to support mine operations. Local communities may indirectly benefit from improved utilities, such as upgraded transmission lines, that could indirectly lead to positive public health impacts, which could offset any negative public health concerns related to these upgrades.

The EMF generated by a power line depends on both the current in the line and the distance from it. When the voltage of a line is increased, it requires greater clearance and, thus, must be installed at a greater distance from the ground. When voltage is doubled, as in this case, the current drops by half. When combined with the increased distance, the EMF at ground level is reduced by two-thirds (IPCo 2013). Public health impacts related to EMF would be localized, long term, and negligible.

On-site facilities in the Operations Boundary Area would include a worker housing facility with recreation resources, water storage and distribution facilities, fuel storage and dispensing facilities, communication infrastructure, and sewage disposal facilities (Midas Gold 2016a). In addition, on-site facilities would include a safety department with the primary function of ensuring worker safety and training. Emergency medical technicians and emergency equipment and supplies would be on-site, including an ambulance, first aid, and medical supplies. These facilities would minimize the demand on the local services and provide medical services for workers and site-visitors in an otherwise remote area. There could be an indirect positive benefit for the local communities because employees from the local community could use the SGP services; SGP employees not relying on the existing infrastructure or local

services could indirectly allow more local access. Public health and safety impacts related to health services would be localized, long term, and moderate.

However, with 500 or more employees living and dining in relatively close quarters, the potential for transmission of infectious diseases exists. Employees from the local community who lodge at the on-site facility could potentially transmit infectious diseases to the local communities upon return from the on-site housing facility. However, worker safety protocols include basic measures for good hygiene and protection of infectious disease transmission; and on-site health care services would provide basic treatments for worker illnesses. In addition, while dining and recreational areas would be common spaces, the personal spaces/sleeping quarters would be designed for individual employees (Midas Gold 2016a). Thus, while the magnitude of possible infectious disease transmission would be "medium," the possibility of occurrence would be "low" due to worker health and safety protocols, on-site health services, and single-employee personal spaces/sleeping quarters. Public health impacts related to transmission of infectious diseases would be localized, long term, and minor.

Demographics

The closest (non-SGP) occupied residence is in Yellow Pine, approximately 14 miles west of the mine site. Most of the SGP area is currently open to the public, as most of the land is public land managed by the Forest Service. Common users of the Operations Area Boundary area include Forest Service employees, Perpetua employees and contractors, residents of Yellow Pine, and recreationists. Participation in recreational activities can result in positive effects on physical and mental health. The 2021 MMP could directly or indirectly impact the access, use, and quality of the recreational sites in the SGP area (Recreation Specialist Report, Forest Service 2022m). While no direct health impacts would be anticipated from impacts to recreation sites, it is possible that there could be emotional stress associated with displacement that could occur for some recreationists, affecting the overall well-being of those individuals. Loss of recreational sites could result in less opportunity for the local community to engage in recreational activities, which could reduce positive health benefits. However, there are other nearby recreational sites that would be unimpacted by the 2021 MMP. In addition, improved road conditions and some of the road re-alignments could result in increased access to additional recreational activities. Thus, the magnitude of impact on recreation as it relates to public health is "low" and the possibility is rated as "low."

Activities in the Operations Area Boundary area related to nutrition include fishing, hunting, or gathering of berries (or other edible vegetation). Contaminants in surface water could potentially bioaccumulate in the edible tissues of fish in impacted surface water or in wildlife that drink impacted surface water. Likewise, contaminants in soil could potentially bioaccumulate in plants growing in impacted soils. As discussed above, implementation of controls and surface water management during mine operations and the closure and reclamation activities would likely decrease concentrations of contaminants in soil and surface water relative to existing conditions. Public health and safety impacts related to consumption of fish, wildlife, or plants would be localized, long term, and negligible.

Noise at the mine site and access roads would consist of an assortment of sounds at varying frequencies from typical operations, as well as noise associated with road construction and SGP-related traffic (Noise Specialist Report, Forest Service 2022d). Noise levels were predicted for anticipated noise sources during

the construction, operations, and closure and reclamation phases of the SGP at 12 noise receptor locations in the SGP area, as well as at various locations in the FCRNRW Area at a range of distances from the SGP access road (Burntlog Route). Of these noise receptor locations, the Miller Residence and the locations in the FCRNRW Area are the most relevant to the public health evaluation. During the construction phase, the 2021 MMP would have a temporary impact on the noise environment at the Miller Residence, while transmission line work is occurring in the immediate vicinity of the residence. Absent transmission line work, the estimated daytime noise levels at the Miller Residence would be 41 dBA and average day-night noise levels would be 39 dBA during the construction phase, below the outdoor threshold of 55 dBA.

During the construction phase, borrow area activities along the Burntlog Route would result in noise level increases above ambient noise levels within approximately 1,000 feet of a borrow area. Resulting noise levels would be at or above the recommended noise level of 55 dBA for outdoor use areas within 500 feet of a borrow area, but below this level farther way. Resulting noise levels approximately 3,000 feet from the roadway would be below the recommended noise level of 55 dBA for outdoor use areas. Direct effects on recreationists within 1,000 to 2,000 feet of borrow areas could include general annoyance or sleep disturbance at campsites in wilderness areas. Indirect effects could include a reduction in the overall quality of the remote wilderness experience. Overall, the potential noise impact on recreationists from borrow areas would be limited to a discrete area within approximately 1,000 to 2,000 feet of borrow areas located along the Burntlog Route where it closely borders the adjacent wilderness area. Noise from these borrow areas would likely be periodic or intermittent, but ongoing throughout the construction phase. Although there would be small increases of noise during the construction phase, they would be temporary and intermittent. Therefore, the magnitude of impact on public health as it relates to noise is “low,” and the possibility is rated as “low.”

During the operations or closure and reclamation phases, the 2021 MMP would have negligible to no effect on the noise environment at the Miller Residence or the various locations in the FCRNRW Area. For these reasons, the magnitude of impact on public health as it relates to noise is “low” and the possibility is rated as “low.”

Public health and safety impacts related to recreational displacement and noise would be localized, long term, and negligible.

4.18.2.3 Johnson Creek Route Alternative

Health and safety effects of the Johnson Creek Route Alternative would be similar to those for the 2021 MMP with the exception of effects of the Johnson Creek Route use as the primary access throughout the project. Use of Johnson Creek (CR 10-413) and Stibnite (CR 50-412) roads as the primary route to the Operational Area Boundary during construction, operations, and closure and reclamation would result in increased noise, traffic, and safety-related issues from SGP-related traffic along the route. The Johnson Creek Route Alternative would route all mine-related traffic through the Village of Yellow Pine and public traffic and mine traffic would share the same road from Landmark to the SGP. Additionally, the Johnson Creek Route Alternative would result in one point of entry to the SGP, effectively combining public access with SGP traffic for the life of the mine. This limited ingress/egress to the SGP site would impact emergency vehicle access during periods of road blockage.

The Johnson Creek Route Alternative would lead to greater road-related and traffic-related public health and safety impacts compared to the 2021 MMP. The possibility of impacts to public safety due to sole use of the Johnson Creek Route increased from “medium” to “high” and if a wildfire, avalanche, or landslide were to occur, the potential effects due to an injury to an individual could be more severe compared to the 2021 MMP and its two access routes.

4.18.3 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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis.

4.18.4 Irreversible and Irretrievable Commitments of Public Resources

4.18.4.1 No Action Alternative

No irreversible and irretrievable commitments of public resources would occur to the health and safety of the local community as a result of the No Action Alternative.

4.18.4.2 Action Alternatives

No irreversible and irretrievable commitments of public resources would occur to the health and safety of the local community as a result of the 2021 MMP or Johnson Creek Route Alternative.

4.18.5 Short-term Uses versus Long-term Productivity

4.18.5.1 No Action Alternative

No short-term uses of public resources would occur to the health and safety of the local community as a result of the No Action Alternative beyond those already present from the legacy mine operation. Long-term positive impacts due to activities required under the ASAOC would provide some environmental improvement of long-term productivity.

4.18.5.2 Action Alternatives

The 2021 MMP and Johnson Creek Route Alternative would reclaim historically damaged stream habitat, mitigate slope stability hazards, and perform post-mining reclamation. It also would improve access to remote recreational areas. In addition, both action alternatives would make a large contribution to the Valley County economy in terms of direct and indirect employment and wages during the life of the SGP. The SGP would generate tax revenues for various levels of government. The economic benefits associated with increased employment opportunities and tax revenues could lead to continued or improved access to health services, better nutrition, and better overall well-being for the local community.

4.19 Recreation Resources

4.19.1 Impact Definitions and Effects Analysis Indicators and Methodology

Although recreation 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 to recreation includes the following issue and indicators:

Issue: The SGP may cause changes to recreation setting, access, facilities, and/or opportunities.

Indicators:

- Changes in motorized access (including restrictions and/or changes in maintenance) to recreation opportunities.
- Changes in recreation physical setting characteristics and related ROS class (by season) measured in acres.
- Changes in recreation facilities (trails, campgrounds, trailheads), including the level of development and setting.
- Changes in recreation use.
- Changes in recreation opportunities available.
- Changes in the ability to participate in recreation opportunities.

For special use permits, the IOGLB website provided information regarding permitted outfitters for each IDFG, GMU, in the analysis area (the analysis area is defined in **Section 3.19.2** and depicted on **Figure 3.19-1**).

A complete description of the assumptions made in the evaluation of the environmental consequences related to recreation is provided in the Recreation Specialist Report (Forest Service 2022m), and the environmental consequences are summarized in this chapter.

Because there are no specific recreational use and demand estimates for the analysis area, the discussion of changes to recreational use is qualitative, and describes potential changes in recreational use due to displacement, increased access, reduced acreage for recreation, and changes in the recreation setting.

Figures of existing recreation facilities under operational conditions in both the summer and winter for each alternative and routes available in both the winter and summer for the action alternatives are provided in the Recreation Specialist Report (Forest Service 2022m).

Effects on the physical ROS in the analysis area focus on two impacts: (1) identified inconsistencies with the existing designated ROS classes due primarily to changes in where motorized use would be allowed, or increased development/landscape modification with implementation of the action alternative; and (2) impacts to the estimated ROS physical setting. Almost all impacts to designated ROS classes and the estimated ROS physical setting would occur from construction through closure and reclamation. Impacts after reclamation are described for those components that may have such impacts. Impacts that would only occur during construction are noted as well.

The impacts of the SGP to recreation special use permits approved for the analysis area are also described.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1**.

4.19.2 Direct and Indirect Effects

4.19.2.1 No Action Alternative

Under the No Action Alternative, no construction, operation, or reclamation of the SGP components would occur. Previously approved surface exploration and associated activities on NFS lands would continue. There would be no surface (open pit) mining or ore processing to extract gold, silver, or antimony; and no underground exploration, sampling, or related operations and facilities on NFS lands. Current uses on Perpetua patented mine/mill site claims would continue, which include mineral exploration and dispersed recreation.

Perpetua would continue to implement surface exploration and associated activities that have been previously approved on NFS lands as part of the Golden Meadows Exploration Project (Forest Service 2015c). These approved activities include construction of several temporary roads (approximately 0.32 mile of temporary roads) to access drill sites (total of 28 drill sites), drill pad construction (total of 182 drill pads) and drilling on both NFS and private lands at and in the vicinity of the SGP. The continuation of approved exploration activities at the SGP by Perpetua would result in the continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip.

In January 2021, Perpetua entered into an ASAOC with the Forest Service and EPA 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 East Fork SFSR 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. Following these construction activities, the disturbed areas would be reclaimed with growth medium and revegetated to stabilize the sites. This work is planned to occur between 2022 and 2024.

Recreation Opportunities, Facilities, Access, and Use

Current access to the area via Johnson Creek Road and Stibnite Road would remain unimpeded. Apart from the Operations Area Boundary, existing recreation opportunities, access, and use would continue in the existing recreation setting. In the Operations Area Boundary, continued exploration and construction of the ASAOC Phase 1 remedial actions may alter the recreation setting in the immediate SGP area to have a more elevated level of the sights and sounds of humans. Some unauthorized motorized use may continue to occur off existing roads and motorized trails but would likely continue to be fairly limited in extent. In general, areas that are inaccessible to motorized vehicles would continue to be inaccessible to vehicles or certain vehicle types in summer, both limiting the motorized recreation opportunities available in some areas and preserving the setting for non-motorized recreation opportunities in these areas. Motorized winter use has expanded in recent years, and may continue to expand in the future, resulting in

additional OSV routes, winter recreation opportunities, and additional areas receiving winter motorized use.

Designated ROS Classes and Physical Setting

Overall, impacts to recreation under the No Action Alternative would include modifications to the recreation setting in the Operations Area Boundary from continued surface exploration and construction equipment operation, continued low level of unauthorized motorized use, and increased winter motorized access and use. These impacts could lead to changes in the designated ROS class and/or estimated ROS physical setting (towards Semi-Primitive Motorized or Roaded Natural from Semi-Primitive Non-Motorized) of some areas due to additional motorized use both in the summer and winter. Under the No Action Alternative there would be minimal changes to the existing environment; therefore, no changes to the ROS classes and physical setting are anticipated.

Recreation Use and Users

Recreation activities and uses allowed under the No Action Alternative would be as described in **Section 3.19.4**.

Recreation Special Use Permits

Activities, facilities, and uses allowed under current recreation-related special use permits would continue until the end of the permit term. Changes to the recreation setting due to additional motorized use may result in shifts in the use areas for permittees, particularly for non-motorized uses such as trail rides, fishing, hunting, etc.

4.19.2.2 2021 MMP

Recreation Opportunities, Facilities, Access, and Use

Construction and Operations

Operations Area Boundary Facilities

Public use would be restricted within the Operations Area Boundary during construction, operations, and closure and reclamation by fencing near the security-monitored gates, and signs warning the public against entry into the Operations Area Boundary. Beginning at construction, approximately 13,441 acres of NFS lands (and approximately 780 acres of private patented lands within the Operations Area Boundary) would be inaccessible to dispersed recreation. For safety reasons, there would be no hunting allowed within areas posted or fenced during construction or mine operation to ensure worker safety; however, hunting may continue on public lands outside of fenced or posted Operations Area Boundary area in accordance with applicable regulations. Existing dispersed recreational use and opportunities that occur in this area would be displaced to other locations in or adjacent to the analysis area. Construction at the Operations Area Boundary would result in moderate visual contrast primarily due to the expansion of disturbance; therefore, the recreation setting would be less-natural looking compared to the existing recreation setting, especially at night. Construction noise could be heard up to 1.2 miles from the Operations Area Boundary based on noise modeling (AECOM 2019c) of the distance at which noise levels could be above 40 dBA (i.e., the lower end of the assumed baseline ambient level for wilderness

areas as discussed in **Section 3.6**). The distance of 1.2 miles would not extend beyond the Operations Area Boundary and would be unlikely to reduce recreation opportunities outside the Operations Area Boundary. Wildlife in the analysis area would be affected by construction noise, traffic, and activities likely resulting in displacement of wildlife to areas away from the analysis area; therefore, opportunities to participate in hunting, fishing, wildlife, and bird watching would be displaced as well, relocating use related to these activities to locations away from the Operations Area Boundary within the analysis area, or possibly outside of the analysis area. Impacts to recreation from the construction of the SGP would be major, long-term, and localized.

Helicopters used during drilling and other construction-related activities may be visible and/or audible from nearby recreation areas, including the FCRNRW, which would impact the recreation setting, particularly for wilderness users. The presence of helicopters nearby would reduce feelings of remoteness and solitude in the wilderness, potentially impacting the recreation experience of wilderness visitors. Although helicopter use would be intermittent, exploration would be ongoing; impacts would be negligible to minor, long-term, and localized.

Impacts related to reduction in acreage for recreation, described under construction for Operations Area Boundary facilities, also would apply to SGP operations, because the same lands within the Operations Area Boundary would remain inaccessible to the public during SGP operations. Impacts to recreation from SGP operations would be major, long-term, and localized.

Operation of the mine also would likely reduce recreation opportunities for the area adjacent to the Operations Area Boundary due to a change in recreation setting from increased development and noise. Operations would result in a less-natural looking and sounding recreation setting compared to the existing recreation setting and would have substantially more man-made development and activity within the Operations Area Boundary. The SGP would introduce additional modifications to the landscape similar to those present, which would further reduce the scenic integrity of the area. The SGP also would change the landscape character of the night sky by increasing sky glow or light pollution. Activities at the SGP would be visible from several recreation areas, roads, and trails including Thunder Mountain Road, Meadow Creek Lookout Road, the Meadow Creek/Summit Trailhead, and Meadow Creek Lookout. Given the closeness of the SGP to the FCRNRW boundary, portions of the FCRNRW would have unobstructed views of the SGP, including nighttime lighting, at superior viewing locations such as mountain tops or ridgelines. Based on modeling results (Forest Service 2022a), an emissions plume would be visible within the FCRNRW for up to 0.02 percent of annual daytime hours, with greater potential for plume visibility at times of low sun angle and with terrain as the viewing background, compared to sky as the background. The plume also would be visible for 2.3 to 2.9 percent of post-sunset nighttime hours (Forest Service 2022a). Presumably, if the plume would be visible within the FCRNRW, it also would be visible from other nearby NFS lands outside the Operations Area Boundary, thus affecting the recreation setting for both wilderness and non-wilderness users. Visual impacts for recreation would be negligible to minor, long-term, and regional.

Operational noise would attenuate to the threshold of 55 dBA at approximately 1.5 miles based on distance alone (blasting up to 2.2 miles) (**Section 4.6**), which would slightly extend past the Operations Area Boundary mainly on the east side. Wildlife in the analysis area also would be affected by operational noise, traffic, and activities, likely resulting in displacement of wildlife away from the analysis area.

Noise-related impacts from SGP operations would be moderate, long-term, and localized for normal operations, and regional for blasting.

Due to the changes in the recreation setting from SGP operations, some visitors may choose to participate in recreation opportunities elsewhere in the analysis area or the surrounding management areas where SGP operations would not be visible or audible. Impacts on recreation opportunities at and around the SGP would begin during construction and continue until the mine was decommissioned and the area reopened to dispersed recreation use. Some visitors may choose to remain at their displacement location rather than return to the SGP area due to permanent changes in the recreation setting within the Operations Area Boundary.

Burntlog Route

The segment of Burntlog Route near Riordan Creek and Black Lake would be within 0.5-miles of the FCRNRW border (shown on Figure 7-2d of the Recreation Specialist Report [Forest Service 2022m]). These activities may require temporary road closures and/or detours along these roads, thereby temporarily reducing access along these roadways to both sites/areas along the roadway as well as trails/areas accessed from these roads and roads/trails that cross these roadways. This temporary reduction in access also may temporarily reduce recreation opportunities along Burnt Log Road, including at the Mud Lake and Burntlog dispersed camping areas, as well as on roads/trails and in the areas accessed from Burnt Log Road, including the Pistol Lake Trailhead into the FCRNRW.

Activities related to construction of the new sections of Burntlog Route (approximately 14.9 miles) including noise, use of borrow and staging areas, temporary trailer camps, vegetation clearing, road building, and traffic, may affect the recreation setting for users within visual (2 to 3 miles east and less than 1 mile west) and audible (1 mile) distance of construction activities and facilities, including the Mud Lake dispersed camping area, Burntlog dispersed camping area, Thunder Mountain/Riordan Trailhead, Meadow Creek/Summit Trailhead, Meadow Creek Lookout, and Landmark.

Changes in the recreation setting along the Burntlog Route construction corridor (road corridor and surrounding areas) could lead to displacement of dispersed recreational use, particularly related to non-motorized activities, wilderness activities, wildlife-related recreation activities (due to wildlife displacement), and dispersed recreation camping at the Mud Lake and Burnt Log dispersed camping areas, which currently typically occur in a quieter, less-developed setting. Camping at Mud Lake would be particularly affected as construction activity would be located within 100 feet of the camping area. Construction impacts would be moderate, long-term, and localized to the Burntlog Route area and recreation facilities/areas currently accessed from the Burnt Log Road.

Year-Round

Use of the Burntlog Route as the primary route to the SGP during operations could result in potential displacement of motorized recreational use in the summer and winter from the existing Burnt Log Road to other roads due to the increased traffic on Burnt Log Road, and potential traffic delays and safety-related issues from mine-related traffic along the Burntlog Route. Traffic impacts are discussed in **Section 4.16**. Motorized public use (not including special use permit holders) of the Burntlog Route would be allowed

when the public access route through the SGP is closed, which would occur during some mining activities that would be considered public safety hazards (e.g., high wall scaling, blasting).

Use of the Burntlog Route from mine-related traffic and borrow source areas would result in increased noise and development along this route. Traffic and development would reduce opportunities for some recreation activities, particularly wildlife-based recreation activities, because wildlife would likely be displaced from the roadway area. In addition, the presence of a roadway in a previously roadless area would reduce opportunities for non-motorized activities for users that specifically prefer a roadless and/or quiet and undeveloped environment. Due to the potential increase in dispersed recreational use along the route and/or use of the Burntlog Route for mine traffic, as well as the less-natural looking and sounding recreation setting along the Burntlog Route (including nighttime lighting), some dispersed recreational users, particularly non-motorized users, may be displaced to other locations that are less noisy, used, accessible, and modified visually. Noise and visual impacts are described in **Sections 4.6** and **4.20**, respectively. The route would result in a moderate to strong level of visual changes, particularly for the Mud Lake and Burntlog dispersed camping areas, which would be located very close to the roadway. Impacts from noise increase and visual modifications would be major, long-term, and localized.

Wilderness users may be particularly affected by the Burntlog Route because the recreation setting, including the nighttime setting, is of great importance for wilderness experiences and the primitive recreation opportunities provided by the FCRNRW. The miles of road adjacent to the FCRNRW would increase, the setting would be altered, requiring users to penetrate farther into the wilderness to achieve a primitive setting. The portion of Burntlog Route near Riordan Creek could provide more extensive changes in the recreation setting for wilderness activities compared to existing conditions as it would be close to the FCRNRW border. This segment also could induce increased recreation use in the Black Lake area compared to existing conditions, because the roadway would be very close to this lake. Similarly, the new segment of the Burntlog Route passes very close to the FCRNRW border and may induce increased use of the wilderness area, and potentially unauthorized motorized use due to the very close proximity of the roadway to the wilderness boundary. Impacts would be moderate, long-term, and localized.

Fish adjacent to the Burntlog Route may be affected by increased sediment and could be affected if a spill were to occur (**Section 4.12**); therefore, there may be decreased recreational fishing success immediately along the Burntlog Route, but there would continue to be opportunities for fishing within the creeks crossed by the Burntlog Route. Operational impacts from the Burntlog Route to fishing recreation would be minor, long-term, and localized.

The 13.5 miles of the Burntlog Route would increase the area with a semi-primitive motorized recreation setting, which could increase dispersed recreation use in some areas along Burntlog Route. However, mine-related traffic could displace recreation to other locations in or adjacent to the analysis area. The Burntlog Route operational impacts to road recreation would be moderate, long-term, and localized.

Summer

The Burntlog Route would result in direct impacts to recreation access due to the use of a new access route. The Burntlog Route would be open to the public when other public access routes are closed. Direct impacts to recreation would include a new access route; improved access to the existing Burnt Log Road and adjacent recreation areas/facilities, including the FCRNRW and Burnt Log IRA, for a wider variety

of vehicle types, particularly low-clearance passenger vehicles; and access to areas that were previously not accessible to motorized vehicles. The Burntlog Route would increase recreation opportunities for both motorized and non-motorized uses in areas where recreation opportunities are currently limited due to limited access. The Burntlog Route also would alter recreational use in the analysis area by offering alternate locations for visitors who are displaced from the Operations Area Boundary and areas accessed off Stibnite and Thunder Mountain Roads. These impacts would primarily affect recreationists originating from Yellow Pine, and recreationists using the FCRNRW and recreation areas along the existing Burnt Log Road and new Burntlog Route. The impacts to summer recreation along the Burntlog Route would be major, long-term, and localized.

Winter

During construction, the Johnson Creek route would be plowed until the Burntlog Route was fully constructed. Backcountry skiers and OSV riders using Johnson Creek Road to access different areas would experience increased traffic and may be displaced. There would be a temporary groomed OSV route on the west side of Johnson Creek from Trout Creek campground to Landmark while the Burntlog Route is constructed (about 8 miles). The OSV trail on the west side of Johnson Creek from Wapiti Meadows to Trout Creek campground would be closed during construction (9 miles). To replace the Warm Lake to Landmark OSV route that would be closed from construction through reclamation, there would be a groomed OSV trail from Cabin Creek, near the Knox Ranch parking area, to the Trout Creek campground (11 miles). OSV riders would then use the route on the west side of Johnson Creek to head south to Landmark. The distance from Warm Lake to Landmark for OSV riders would increase from 8.5 miles along the Warm Lake Road route to about 19 miles. The OSV reroute adds approximately 10.5 miles to the trip from Warm Lake to Landmark.

Access would be restricted on roads and OSV routes during avalanche control. Avalanche control may make slopes in the area attractive to skiers and OSV riders due to the perception of lower risk. These paths could become more popular as ski zones if they are controlled. This could add an uncontrolled random factor into highway safety programs.

Once completed, Burntlog Route would be plowed in the winter, potentially providing additional opportunities and access for winter motorized recreation, which may result in increased winter recreational use along the Burntlog Route corridor.

Plowing of the approximately 38-mile Burntlog Route would result in the loss of 9.8 miles of infrequently groomed OSV route along the existing Burnt Log Road. Plowing of the Burntlog Route and Warm Lake Road would cutoff direct OSV access to the Horn Creek Road, Sand Creek Road, and Warm Lake Road (east/south of Landmark) OSV routes from Johnson Creek Road, which would be the only publicly available winter route to the Landmark area as Warm Lake Road would be closed to public winter use. Direct OSV access to other OSV routes could be cut off because any overland travel or OSV travel across or on the plowed Warm Lake Road and Burntlog Route would have to share the roadway with mine operation traffic also using this roadway. Therefore, it would be difficult for OSVs to connect to these OSV routes, which would limit access for OSVs, and reduce OSV opportunities and use. Lack of access to the Warm Lake Road OSV route south of Landmark also would affect access to the North Fork Sulphur Creek Road OSV route. Until the decommissioning of the Burntlog Route and reverting the

remaining road back to a groomed OSV route, winter impacts to OSV use along the Burntlog Route would be major, long-term, and localized.

Operational traffic noise and road maintenance noise in the winter would not be above ambient levels at the Thunder Mountain/Riordan Trailhead (AECOM 2019c) because the new segment of the Burntlog Route would be farther east adjacent to the wilderness boundary. Noise-related impacts would be minor, long-term, and localized.

Impacts to winter recreation opportunities, facilities, use, and access from use of the Burntlog Route during operations would focus on the Burntlog Route corridor and connecting OSV routes and would continue until the Burntlog Route was decommissioned (and therefore no longer plowed); Burnt Log Road returned to a groomed OSV route; and public access to Stibnite Road was reopened. The impacts would be major, long-term, and localized.

Johnson Creek Route

Summer

Use of Johnson Creek Road and the Stibnite Road portion of the McCall-Stibnite Road as the primary route to the SGP during the construction of the Burntlog Route could result in short-term impacts (1 to 2 years) to motorized recreation access due to potential delays, traffic, and safety-related issues from mine construction-related traffic (Forest Service 2020h; Forest Service 2022k). Access delays and traffic would affect recreation sites/areas along these roads, as well as sites and areas accessed from these roadways, including the Big Creek area. The increase in traffic and noise along these roadways also may affect the recreation setting for recreation sites and areas along these roadways, leading to a change in recreation experience for some visitors. Traffic impacts are discussed in **Section 4.16**. Recreation facilities potentially impacted by increased traffic and related noise along the Johnson Creek Route would include Quartz Creek and Burntlog Trailheads; Buck Mountain, Trout Creek, Ice Hole, Golden Gate, and Yellow Pine Campgrounds; Twin Bridges dispersed camping area; and Johnson Creek Cabin; therefore, the recreation setting of these facilities may be altered to a more developed setting due to a large increase in the sights and sounds of humans.

Recreationists may be displaced to avoid noise associated with construction activities and/or construction traffic along Johnson Creek and Stibnite Roads, particularly recreationists participating in non-motorized activities, as the noise of a passing heavy truck could be heard up to 0.5 mile from the road (AECOM 2019c). Wildlife-related recreation opportunities also may decrease along these roadways due to wildlife displacement from construction traffic and noise. Any displacement of dispersed recreation, reduction in recreation opportunities, or access delays would be temporary along Johnson Creek Road and Stibnite Road until construction of the Burntlog Route is completed. Due to these roads experiencing a seasonal effect which results in noticeable traffic differences, Operations Area Boundary access during construction via the Johnson Creek Route would be more impactful on summer recreational traffic on established roads. Summer construction impacts for the Johnson Creek Route would be moderate, short-term, and localized.

Winter

Currently, Johnson Creek Road is plowed 8.6 miles from Yellow Pine south to Wapiti Meadow Ranch. The remaining section of Johnson Creek Road to Landmark is a groomed OSV route, approximately 17 miles. During construction of the Burntlog Route, Johnson Creek Road would be plowed from Yellow Pine to Landmark; therefore, this road could not be used as a groomed OSV route from Wapiti Meadow Ranch south to Landmark. Plowing Johnson Creek Road would reduce the miles of groomed OSV facilities for 1 to 2 years and disrupt connections between OSV routes. To continue providing OSV access to Landmark during Burntlog Route construction, a groomed OSV route would be created adjacent to the western side of Johnson Creek Road between the proposed Cabin Creek Road groomed OSV route and Landmark and maintained until construction activities are completed.

Once the Burntlog Route is constructed, Johnson Creek Road would revert to a groomed OSV route from Wapiti Meadow Ranch to Landmark. The change in location of the groomed OSV route along Johnson Creek Road from the roadway to the western side of the road for approximately seven miles would not be expected to alter recreational use of this route, although temporary use of Johnson Creek Road for mine access during construction of the Burntlog Route may alter recreation experiences for motorized users due to increased traffic along the roadway, leading to displacement of some users.

The plowing of Johnson Creek Road would provide additional motorized access and winter recreation opportunities along this road, thereby potentially increasing winter recreational use along this road. However, plowing and construction traffic on Johnson Creek Road and Warm Lake Road (described below) and the location of the temporary groomed OSV route along the western side of Johnson Creek Road may make it difficult and/or unsafe for OSV's to cross Johnson Creek Road or Warm Lake Road to reach other OSV routes in the Landmark area, resulting in reduced OSV opportunities and use. Impacts would be focused on the Johnson Creek Road corridor and would cease when the Burntlog Route is completed and plowing of Johnson Creek Road has ceased.

Due to the plowing of Johnson Creek Road during the construction of the Burntlog Route, OSV access to Ditch Creek Road would not be feasible on Johnson Creek Road from the south; therefore, access and use of the two-mile Ditch Creek Road OSV route would be greatly reduced, because the route would be cut off from other OSV routes until construction of the Burntlog Route was completed, and Johnson Creek Road reverted to a groomed OSV route. Impacts would begin with construction and end with completion of the Burntlog Route and plowing of Johnson Creek Road has ceased.

Winter driving conditions influence the amount of traffic on Johnson Creek Road and result in lower AADT levels during the winter months. The seasonal effect of traffic on this road would show a noticeably greater increase in mine-related winter traffic (i.e., drivers would notice a higher ratio of mine-related traffic to general traffic) during construction which could impact user experience. Winter construction impacts for the Johnson Creek Route would be minor, short term, and localized.

Warm Lake Road

Summer

Impacts to recreation access, opportunities, settings, experiences and use from mine construction traffic use of Warm Lake Road would be similar to those described above for the Johnson Creek Route;

however, Warm Lake Road would have a less substantial increase in traffic compared to Johnson Creek Road (discussed further in **Section 4.16**). Recreation facilities potentially impacted by increased traffic and related noise along Warm Lake Road include Big Creek Summit and Bear Creek/Warm Lake trailheads, as well as Summit Lake, Warm Lake, and SFSR campgrounds. Impacts to recreation access, opportunities, settings, experiences and use along Warm Lake Road would begin during construction and would continue due to increased traffic through operations and closure/reclamation. Summer construction impacts to Warm Lake Road would be minor, short term, and localized.

Winter

Approximately 11 miles of existing groomed OSV route from Warm Lake to Landmark on Warm Lake Road would be closed during construction due to plowing of Warm Lake Road as an Operations Area Boundary access road. To continue providing OSV access to Landmark, a 10.4-mile groomed OSV route between Warm Lake and Trout Creek Campground on Cabin Creek Road would be created along with a parking area, resulting in a new winter access facility that would be maintained by Valley County. This route has greater potential (40 percent higher) for avalanche hazards than the currently used OSV route between Warm Lake to Landmark (DAC 2021). From Trout Creek Campground, OSV users could continue down Johnson Creek Road to Landmark on a groomed OSV route. The new 10.4-mile groomed OSV route along Cabin Creek Road may lead to dispersed winter recreational use along this new route because the route would provide winter recreation opportunities in an area that currently does not have many due to lack of access. The new Cabin Creek OSV route would be the only available easterly OSV route to Landmark; however, the portion of Warm Lake Road that would be plowed to Landmark would be open to the public year-round, allowing recreationists greater vehicular access east of Warm Lake. Impacts to winter recreation access, opportunities, and use would be focused on Warm Lake Road (existing OSV route portion); the new OSV route corridor along Cabin Creek Road; and the Landmark area. Winter recreation impacts to Warm Lake Road during construction would be minor, short term, and localized.

Public Access

During construction (prior to the completion of the Burntlog Route) access through the Operations Area Boundary would continue, but there may be half-day to multiple day road closures of Stibnite Road and Thunder Mountain Road. Impacts to recreation along Stibnite Road and Thunder Mountain Road through the Operations Area Boundary would begin at the start of construction and continue until a public access road is constructed. During the summer, temporary closure of these roads could increase travel time to access recreation areas and sites farther east on Thunder Mountain Road. Change in access to Thunder Mountain Road would change how recreationists access recreation facilities, including the Monumental Summit Interpretive Site, the Monumental Trailhead, the Lookout Mountain/Thunder Mountain Trailhead, the Idaho Centennial Trail, other dispersed recreation areas in the FCRNRW, and portions of the Meadow Creek, Sugar Mountain, and Horse Heaven IRAs via Stibnite Road. Recreational use and opportunities in these areas/sites would be reduced in the summer due to reduced access during road closures. Impacts would be moderate, temporary, and localized to Stibnite Road, Thunder Mountain Road, and areas/sites accessed from these roads. Closure of Stibnite and Thunder Mountain roads would affect recreationists that typically access areas/sites via roads near the village of Yellow Pine, and recreationists that use these roads/areas in the winter. Impacts to recreation access, use, and opportunities

along Thunder Mountain Road would begin during construction and continue until a new public access road through the SGP was constructed.

Secure areas within the Operations Area Boundary would be restricted from general public access and would be off limits to hunting by employees, thereby closing some areas to hunting and recreational shooting; however, the area is currently rarely used by hunters and recreational shooters. Impacts would be negligible, long term, and localized within the Operations Area Boundary.

After construction of the Burntlog Route and as part of public access control within and in the vicinity of the Operations Area Boundary, about 4.7 miles of Stibnite Road and 5.4 miles of Thunder Mountain Road would be closed to public use, but a new public access road through the Operations Area Boundary would be constructed. However, the public would not be able to reach the Stibnite Mining District Interpretive Site within the Operations Area Boundary, effectively closing this site to the public throughout operations. Impacts would be localized to just the interpretive site and would begin with the completion of Burntlog Route and conclude after closure and reclamation. These impacts are anticipated to be minor, long term, and localized.

During periodic closures of the road through the Operations Area Boundary, recreation areas and sites beyond the Operations Area Boundary accessed from Stibnite and Thunder Mountain roads would be available via the new Burntlog Route. Using the Burntlog Route would result in a long detour for recreationists traveling from Yellow Pine to Monumental Summit, Thunder Mountain Road, and Meadow Creek lookout. There could be a decrease in summer and winter use of the impacted sites/areas, even with the Burntlog Route, if displaced recreationists decide to forego visiting these destinations due to added travel time. Impacts are anticipated to be moderate, long term, and localized.

During mine operations, public access would be allowed through the Operations Area Boundary via a 12-foot gravel road that connects Stibnite Road to Thunder Mountain Road. This road would be open to all vehicles year-round but would not be plowed during the winter. Because the road would be within the Operations Area Boundary, there would be no public use allowed off the road; the road would be for public access to the recreation sites/areas accessed via Thunder Mountain Road. The public access road through the Operations Area Boundary would return access to these recreation sites/areas after Stibnite Road is no longer available. In addition, the public access road would allow visitors from Yellow Pine to reach the Thunder Mountain Road sites/areas substantially faster than taking the Burntlog Route, which may result in less displacement of use at these sites/areas during operations. For visitors that pass through the Operations Area Boundary on the public access road, the recreation setting would be very developed and substantially modified; however, this would likely be expected, because the road would be passing through the active Operations Area Boundary. Although the public access road would return access to recreation sites/areas accessed via Thunder Mountain Road, there would be temporary closures of this route during some mining activities that would be considered public safety hazards (e.g., highwall scaling, blasting). When such road closures would occur, the closures would result in reduced access to recreation sites/areas off Thunder Mountain Road; reduced recreation opportunities and use due to a lack of access; and impacts to recreation experiences due to visitor expectations regarding site/area availability. Impacts from road closures would affect recreation sites/areas off Thunder Mountain Road and may ultimately lead to continued displacement of visitors from the Thunder Mountain Road sites/areas. Impacts would persist throughout operations and closure and reclamation until a relocated Stibnite Road was available to

the public, and the mine access road was decommissioned. Impacts are anticipated to be moderate, short term, and localized.

Burntlog Maintenance Facility

Construction of the maintenance facility may require temporary road closures and/or detours along Burnt Log Road, thereby temporarily reducing access to recreation sites and areas along this roadway and trails/areas accessed from this road. Impacts from construction of the Burntlog maintenance facility would be localized, temporary, and minor.

Noise associated with construction activities could reduce opportunities for noise-sensitive recreation activities at and around the maintenance facility location, including wildlife-related recreation activities, because wildlife may be displaced. Noise from construction activities related to the Burntlog Maintenance Facility would be above ambient levels (40 dBA) at the Mud Lake dispersed camping area (AECOM 2019c); some recreationists may choose to visit other areas or sites to avoid delays or noise from construction activities. Any reduction in recreation opportunities, displacement of dispersed recreational use, or changes in access would be temporary until maintenance facility construction was completed. Impacts would be moderate, temporary, and localized to the area surrounding the maintenance facility and the roads/trails accessed from Burnt Log Road.

Development of the Burntlog Maintenance Facility would reduce recreation opportunities due to physical removal of acreage for the facility (3.5 acres). Impacts from operational traffic and road maintenance activities, and associated noise, are included in the impacts from the Burntlog Route, which would occur immediately adjacent to this facility. Operational noise at the maintenance facility itself could reduce opportunities for some recreation activities in this area, particularly wildlife-related recreation activities because wildlife may be displaced from the area. The maintenance facility would increase man-made effects in the area surrounding the facility, including nighttime lighting. These changes may affect the recreation setting of this general area by decreasing the feeling of remoteness, thereby affecting the recreation experience for visitors. Impacts would generally be limited to the area within visual and audible distance of the maintenance facility, would begin once the facility was operational and conclude once the facility was closed and reclaimed. Impacts are anticipated to be minor, long term, and localized.

Communications Facilities

A 60-foot-tall cell tower site would be constructed within the Operations Area Boundary but would not result in additional recreation-related impacts besides those discussed above for construction of Operations Area Boundary facilities. Impacts would begin during construction and would conclude with construction of the cell tower; impacts to recreation would be negligible, temporary, and localized.

The cell tower would not be visible to recreationists in the FCRNRW but would be visible from portions of Thunder Mountain Road. New cellular coverage along the Burntlog Route and on other NFS lands in the analysis area would increase visitor safety; however, additional cellular coverage would detract from primitive recreation experiences. Impacts would begin once the cell tower was constructed and would conclude with closure and reclamation of the site. Impacts are anticipated to be minor, long term, and localized.

In addition, a series of 10-foot-tall repeaters would be constructed on 3-foot by 3-foot concrete pads. Sites within the Operations Area Boundary would not result in additional construction impacts besides those discussed above for construction of the Operations Area Boundary facilities. Construction of repeaters at the Burntlog Maintenance Facility would not result in additional construction impacts besides those discussed above for the Burntlog Maintenance Facility. Construction of the repeaters at the Meadow Creek and Thunderbolt Lookouts could interfere with hiking use in the lookout area and construction activities may affect the recreation setting for users within visual and audible distance of construction activities and facilities. Given their locations at existing or proposed facilities, no additional disturbance for equipment installation or access would be required for their construction and maintenance. Impacts to recreation from the construction of these pad sites would be minor, temporary, and localized.

Changes in the recreation setting along access routes and repeater sites could lead to displacement of dispersed recreational use, particularly related to non-motorized activities, and wildlife-related recreation activities (due to wildlife displacement), which typically occur in a quieter, less-developed, and non-motorized setting. Impacts would be minor, temporary, and localized to the access route and repeater site and would begin during construction and conclude once construction is completed.

Due to the small size of the repeater sites, locations within the Operations Area Boundary would not be visible to recreation areas outside the boundary, including the FCRNRW, and therefore would not affect the recreation setting. Repeaters at the Burntlog Maintenance Facility would be included in the general recreation setting impacts described above for the maintenance facility. Repeater sites at the Meadow Creek and Thunderbolt Lookouts could interfere with hiking use in the lookout area and may affect the recreation setting for users within visual distance of them. Repeater facilities would assist with reducing the risk of vehicle collisions on the Burntlog Route by providing increased communications, and may accelerate accident response, which would provide benefits to recreation visitors along the Burntlog Route. Impacts would begin once the repeaters were constructed and would conclude with closure and reclamation of these sites. Impacts are anticipated to be minor, long term, and localized.

Transmission Line and Associated Facilities

Transmission line upgrades along Warm Lake Road, Johnson Creek Road, and Cabin Creek Road could result in temporary road detours or delays as a result of construction activities and traffic along these roads. There could be temporary delays in accessing other roads, trails, and facilities along these roadways, which could adversely affect the recreation experience for some recreationists. Impacts from construction would be minor, short term, and localized.

A portion of the transmission line would be re-routed near Thunder Mountain Estates to be along the Warm Lake Road ROW and the edge of NFS and State lands. The re-routed portion along the road would not be in a recreation area. Noise associated with construction of the portion along the NFS and State lands could reduce opportunities for more noise-sensitive recreation activities along the corridor, including wildlife-related recreation activities, because wildlife may be displaced. Impacts would be minor, temporary, and localized.

A motorcycle trail (Eagle Nest) on the NFS lands intersects the re-routed location of the upgraded transmission line. Construction of the upgraded transmission line in this location may result in delays or

detours accessing this trail. The re-routed segment of the transmission line could adversely affect the recreation experience for users of this trail compared to existing conditions. Some recreationists may choose to visit other areas or trails to avoid delays or noise from construction activities. Any reduction in recreation opportunities, displacement of dispersed recreation use, or changes in access would be temporary until the transmission line was completed. Impacts would be minor, temporary, and localized to the Thunder Mountain Estates re-route section of the transmission line.

Noise from transmission line upgrade construction activities and/or utility access spur road construction activities may be above ambient levels (above 40 dBA) at the Big Creek Summit Trailhead, Cabin Creek/Thunderbolt Trailhead, Trout Creek/Thunderbolt Trailhead, Trout Creek Campground, Twin Bridges dispersed camping area, Ice Hole Campground, and SFSR Campground (AECOM 2019c). The Ice Hole and Trout Creek Campgrounds in particular would have more construction noise impacts due to their close proximity to the transmission line. Impacts from construction-related noise would be moderate, temporary, and localized to the campgrounds.

Construction activities would not occur at night, and therefore would not affect overnight camping, but may affect the setting of campgrounds during the day, particularly at the Ice Hole and Trout Creek campgrounds, and Twin Bridges dispersed camping area where construction activities would be visually or audibly evident. Some recreationists may choose to visit other areas or roads, or access facilities/trailheads from other roads to avoid delays or noise from construction activities. Impacts from a reduction in recreation opportunities, displacement of dispersed recreational use, or changes in access would be moderate, short erm, and localized until transmission line upgrades are completed.

Transmission line upgrades between Cascade and Donnelly also may lead to short-term road detours or delays at Stonebreaker Lane and Loomis Lane, which provide access to Sugarloaf Campground and Boulder Creek Day Use Area, respectively, at Lake Cascade. Such delays could adversely affect the recreation experience for some recreationists. Both recreation sites are over 0.5 mile from the transmission line and, therefore, would likely not be affected by construction noise or visibility of construction activities; however, road delays or detours may result in some recreationists choosing to visit other recreation sites at the lake. Impacts to recreation during the transmission line upgrades, particularly as a result of road delays and detours between Cascade and Donnelly would be moderate, short term, and localized.

The upgraded transmission line would be wider and taller (by 30 feet) with an expanded ROW and may become more noticeable in the recreation setting, particularly for recreationists at campgrounds along Johnson Creek Road and at the SFSR Campground near Warm Lake Road, due to the static views of recreationists from these locations. The recreation setting of the SFSR, Trout Creek, and Ice Hole Campgrounds, and Twin Bridges dispersed camping area could be affected by the upgraded transmission line. In addition, the re-routed portion of the transmission line along the NFS and State lands around the Thunder Mountain Estates, would alter the recreation setting of these lands, and the motorcycle trail that leaves from Warm Lake Road on the NFS lands in this area. The new transmission line in this area would result in a more developed recreation setting for these lands, trails, and camping facilities; however, dispersed users and motorcyclists would generally be able to move away from the transmission line and this change in the recreation setting may not greatly influence their recreation experience. This change in recreation setting would affect recreation experiences and may result in some recreationists choosing to

visit other campgrounds or dispersed camping areas with a less-developed setting either within the analysis area or adjacent to the analysis area. The larger transmission line facilities also would affect the recreation setting for dispersed recreation areas along Warm Lake Road, Johnson Creek Road, and Cabin Creek Road. Dispersed recreation users, including those at trail and trailhead facilities from which the upgraded transmission line would be visible, would be able to move away from the transmission line; therefore, this change in the recreation setting may not influence their recreation experience to the same extent. Impacts would be negligible to moderate, permanent, and localized.

Transmission line construction activities may result in temporary road detours or delays in accessing other trails/areas from Horse Heaven Road. Such delays could adversely affect the recreation experience for some recreationists, specifically, access to and use of the Riordan Trailhead on Horse Heaven Road that provides access to FT 097, which leads to Riordan Lake, a popular fishing location. Impacts to this trailhead could result in a reduction in recreation opportunities from this trailhead and temporary decrease in use of this trailhead. Noise associated with construction activities could reduce opportunities for noise-sensitive recreation activities along the transmission line corridor (for a distance of 0.6 to 1 mile) (AECOM 2019c), including wildlife-related recreation activities, because wildlife may be displaced. Noise from transmission line construction activities may be above ambient levels (above 40 dBA) at the Meadow Creek Lookout and Riordan Trailhead (AECOM 2019c); therefore, some recreationists may choose to visit other areas or trails to avoid delays or noise from construction activities. Displacement of dispersed recreational use, reduction in recreation opportunities, or changes in access would be until the transmission line was constructed. These impacts would be minor, temporary to short term, and localized to the transmission line corridor.

The new transmission line to the Operations Area Boundary would reduce recreation opportunities due to physical removal of acreage for transmission line facilities (approximately 101 acres). Although recreation could still occur underneath the transmission line, the recreation setting would change due to the increased presence of man-made development and the clearing of existing vegetation along the ROW. Trail FT 233 would be upgraded for use as a transmission line access road, which would make the trail passable for a wider range of vehicles, resulting in impacts to recreation access, and potentially new recreation opportunities and use, due to increased access. The upgraded FT 233 would connect to trail FT 097 and Horse Heaven Road. Impacts from the transmission line and associated access roads would begin when the portion of the transmission line road on FT 233 was open to the public, and end with closure and reclamation of the transmission line and access road, and FT 233 improvements were removed. These impacts are anticipated to be moderate, long term, and localized.

The Johnson Creek substation would be located along Johnson Creek Road approximately 0.8 mile south of the Johnson Creek airstrip. Construction of the substation would result in impacts similar to those described for transmission line upgrades, including potential delays accessing Johnson Creek Road and the areas and sites along this road, which could affect the recreation experience for some users. Noise associated with construction of the substation could reduce opportunities for noise-sensitive recreation activities, including wildlife-related activities, because wildlife may be displaced from the area around the substation. Construction activities at the substation would not be expected to affect physical use (landing/taking off) at the airstrip; however, construction noise may affect the recreation experience for some users. These impacts would be minor, temporary to short term until construction of the substation is complete, and localized.

The Johnson Creek substation would reduce recreation opportunities due to physical removal of acreage for the substation (1.1 acre); therefore, dispersed recreational use that may occur at this location would be displaced to other locations in the analysis area. The substation also would increase man-made development in this area of Johnson Creek Road and may affect the recreation setting of the nearby Johnson Creek airstrip, because flyers could see the substation as they approach the airstrip. This may decrease the feeling of remoteness when flying into the airstrip, thereby affecting the recreation experience for airstrip visitors. Impacts would be limited to the area within visual distance of the substation and would begin once the substation was constructed. Impacts are anticipated to be minor, long term, and localized.

Closure and Reclamation

Operations Area Boundary Facilities

Impacts to recreation during closure and reclamation of the mine would be the same as those described for construction.

If wildlife does not re-populate the Operations Area Boundary after reclamation, there would be a reduction in wildlife-related recreation opportunities. Fish species composition and/or relative populations within the creeks in the SGP area may change after reclamation, as anticipated habitat may favor steelhead over Chinook salmon, and there would be a decrease in habitat for bull trout and westslope cutthroat trout and Chinook salmon. Therefore, fishing opportunities may be altered after reclamation as well (**Section 4.12**).

Though nighttime lighting would cease post-mine reclamation, the Operations Area Boundary would have a less natural looking recreation setting compared to the existing recreation setting and would have substantially more man-made development present that would be noticeable to visitors because the Operations Area Boundary access road would require visitors to pass over and next to former Operations Area Boundary facilities that would dominate the setting. Reclaimed facilities would be visible from portions of the FCRNRW at superior viewing locations, such as mountain tops or ridgelines, as well as from the Meadow Creek/Summit Trailhead and Meadow Creek Lookout. It would take a long time for the Operations Area Boundary to fully revegetate and vegetation that grows may not resemble the structure and density of existing vegetation (e.g., timber), and the landscape for humans may never return to existing levels, permanently altering the recreation setting of the Operations Area Boundary. Although some dispersed recreation use may return to the Operations Area Boundary after reclamation, due to the changes in the recreation setting, some visitors may choose to participate in recreation opportunities elsewhere in the analysis area or the surrounding management areas where the recreation setting is more natural. Overall, impacts to recreation would occur during closure/reclamation, and would continue after reclamation was completed and would be long term to permanent, localized, and minor.

Burntlog Route

Impacts during the two-year decommissioning of the Burntlog Route would be the same as those described for construction. In addition, there could be substantial traffic on the Burntlog Route until decommissioning, resulting in traffic-related impacts to recreation described under Operations. Noise from decommissioning of the Burntlog Route would be above ambient levels (40 dBA) within portions of

the FCRNRW and at Mud Lake and Burntlog dispersed camping areas, Thunder Mountain/Riordan Trailhead, Meadow Creek/Summit Trailhead, Meadow Creek Lookout and Landmark (AECOM 2019c). Impacts are anticipated to be minor, long term, and localized.

Once decommissioned, year-round operational impacts from the route would cease. Impacts from reclamation are anticipated to return to the baseline conditions.

Although the width of 20 miles of Burnt Log Road would be reduced, the retention of flatter grades and gentler curves may allow continued access on this road by a wider variety of vehicle types. Therefore, impacts to access on Burnt Log Road may continue after decommissioning. Related increased recreational use of existing recreation facilities and areas along this road (e.g., trails, trailheads, Mud Lake dispersed camping area, Burntlog dispersed camping area) also may continue past decommissioning. Although the new roadway would be recontoured and seeded, it would take many years for trees (20 or more years) to appear as natural vegetation in these areas. In addition, 1.5 miles of soil nail walls would remain for stabilization purposes along the roadway after decommissioning. Therefore, the recreation setting in this area would likely appear disturbed for a long time. Due to the closeness of the FCRNRW to the Burntlog Route new roadway, this modified recreation setting could detract from the recreation setting for some forest visitors and require users to go farther to achieve a semi-primitive non-motorized or primitive recreation setting. Potential impacts to recreation from the reclamation activities are moderate, long term, and localized.

Public Access After Reclamation

Public access through the Operations Area Boundary after reclamation/closure would be on a reopened Stibnite Road, which would include a permanent road through the backfilled Yellow Pine pit. Access to recreation sites/areas off Stibnite Road and Thunder Mountain Road would no longer be via the Burntlog Route, which would be decommissioned, but would be via a reopened and reclaimed Stibnite Road. Reopening Stibnite Road would reverse the impacts described under operations. Impacts to recreation access, opportunities, and use from public access through the Operations Area Boundary via a reopened Stibnite Road would continue beyond closure and reclamation and are anticipated to be moderate, long term to permanent, and localized.

Burntlog Maintenance Facility

As part of closure and reclamation, the Burntlog Maintenance Facility would be removed, the site graded, and drainage would be reestablished. The site would be seeded and become available for public recreational use following reclamation. Impacts to recreation during decommissioning would be the same as those described for construction. Once the facility was closed and the site was reclaimed by vegetation, operational impacts related to loss of acreage for recreation and changes to the recreation setting of the general area surrounding the facility would cease. These impacts would be minor, temporary, and localized to the area surrounding the maintenance facility, and the roads/trails accessed from Burnt Log Road.

Communications Facilities

Impacts from closure and reclamation of the cell tower site would not result in additional impacts besides those discussed above for closure and reclamation of Operations Area Boundary facilities. The reduction in cellular coverage in portions of the analysis area near the SGP area and along the Burntlog Route would be the same as existing conditions after the cell tower is removed. The loss of cellular coverage would aid in returning primitive recreation experiences to the FCRNRW areas adjacent to the Burntlog Route and the Operations Area Boundary. Impacts after reclamation and closure would return to the pre-mining conditions.

Reclamation of repeater sites would not result in additional impacts besides those discussed above for closure and reclamation of Operations Area Boundary facilities. Reclamation of repeaters at the Burntlog Maintenance Facility would not result in additional impacts besides those discussed above for the Burntlog Maintenance Facility. Reclamation of repeater sites at the Meadow Creek and Thunderbolt Lookouts would result in the same impacts as those described for construction and are anticipated to be permanent, localized, and negligible.

Transmission Line and Associated Facilities

The upgraded transmission line from Lake Fork to Johnson Creek substation would be retained and used by IPCo. The associated facilities along the upgraded transmission line (i.e., switching station, substations) would remain in place and would not be decommissioned; impacts described under Operations for the upgraded transmission line would remain after mine closure, which include impacts to the recreation setting and recreation experiences.

The new transmission line, transmission line access roads, and metering station at the Operations Area Boundary would be decommissioned. Impacts during decommissioning would be the same as those described for construction. Once the transmission line is removed, operational impacts would cease, including loss of physical acreage for recreation, and trail access, use, and opportunities for a wider range of vehicles due to road improvements.

Designated ROS Classes and Physical Setting

Operations Area Boundary Facilities

During construction, operations, and closure/reclamation, public recreation would not be allowed within the Operations Area Boundary. Public closure of this area would not result in inconsistencies with the existing ROS designation classes within the Operations Area Boundary during construction, operations, and reclamation/closure. **Figures 3.19-2** and **3.19-3** show the Estimated Physical Setting for summer and winter under the 2021 MMP and additional discussion is provided in the Recreation Specialist Report (Forest Service 2022m). The anticipated acres of disturbance within each ROS physical setting are also provided in the Recreation Specialist Report (Forest Service 2022m). Due to setting alterations during construction, operation and mine closure and reclamation, the Operations Area Boundary post-reclamation may be inconsistent with Roaded Natural and Semi-Primitive Non-Motorized designations and could be more consistent with a Roaded Modified designation; therefore, impacts are anticipated to be moderate, long term, and localized.

The recreation setting would be changed from construction, mine operations, and closure/reclamation. The existing estimated ROS physical setting class within the Operations Area Boundary would be altered to Roaded Natural but would be consistent with the existing estimated ROS physical settings of Rural and Roaded Natural; therefore, no impact to the ROS designations is anticipated.

Public Access After Reclamation

Public access through the Operations Area Boundary would be located in an area currently designated as Roaded Natural, which allows for some landscape modification from roads, and a ROS physical setting of Rural, which allows for strong evidence of designed roads; therefore, public access through the Operations Area Boundary after closure and reclamation would not result in inconsistencies with the existing ROS designation or the estimated ROS physical setting. No impacts to the ROS designations are anticipated.

Burntlog Route

Summer

The Burntlog Route would decrease remoteness and increase the evidence of humans along the roadway; in particular, along the new roadway segments. The Burntlog Route in areas designated as Roaded Modified and Roaded Natural would not result in inconsistencies with the existing ROS designation classes because they already account for landscape modification from roads. An approximately 10-acre portion of the Burntlog Route is currently designated as Semi-Primitive Non-Motorized so it would be more consistent with a designation of Roaded Natural. This impact would occur from construction and would continue after closure and reclamation of the road due to the length of time it would take for the road to return to a natural-appearing condition. Therefore, impacts are anticipated to be minor, long term to permanent, and localized.

The existing estimated ROS physical settings of Semi-Primitive Motorized and Semi-Primitive Non-Motorized along the Burntlog Route (**Figure 3.19-2**) would be altered to Roaded Natural. The Burntlog Route would increase the evidence of humans along the route due to the large amount of mine traffic that would be present on the road. There are a few areas where presence of the new roadway would alter an area near the roadway from an existing estimated ROS physical setting of Semi-Primitive Non-Motorized to Semi-Primitive Motorized or Primitive to Semi-Primitive Non-Motorized due to a decrease in remoteness. The Burntlog Route in areas with an existing estimated ROS physical setting of Roaded Natural would not result in inconsistencies with this setting; therefore no, impact to the ROS designations is anticipated.

Winter

The Burntlog Route would be plowed, and the area surrounding plowed roads is typically designated as Roaded Natural or Rural in the winter. The Burntlog Route alignment including the existing Burnt Log Road and unroaded areas is currently designated as Semi-Primitive Motorized in the winter; therefore, plowing the Burntlog Route including the 9.8 miles of infrequently groomed OSV route would be more consistent with a designation of Roaded Natural. This impact would occur from construction through closure and reclamation. After closure and reclamation of the route, plowing would end; therefore, the

route would not continue to be inconsistent with the existing ROS designation and impacts would no longer be anticipated.

In the winter, the Burntlog Route area has an existing estimated ROS physical setting of Semi-Primitive Motorized (**Figure 3.19-3**). Although the setting of the route would become less remote and the evidence of humans would be more noticeable, the road would still be in a fairly remote area away from other plowed routes or groomed snowmobile routes. The setting would not change enough to be considered Rural and impacts are anticipated to be negligible, long term, and localized.

Johnson Creek Route

Summer

The areas surrounding roads that would be used as part of the Johnson Creek Route are currently designated as Roaded Natural with an existing estimated ROS physical setting of Roaded Natural and Rural (**Figure 3.19-2**); therefore, increased traffic on these roads as part of construction would not result in inconsistencies with the existing ROS designation surrounding the roads. No impact to the ROS designations is anticipated.

Winter

During construction of the Burntlog Route, Johnson Creek Road from Wapiti Meadow Ranch to Landmark would be plowed and as currently occurs, Stibnite Road from Yellow Pine to the Operations Area Boundary would be plowed. The area surrounding plowed roads is typically designated as Roaded Natural or Rural in the winter, with an estimated physical ROS setting of Roaded Natural (**Figure 3.19-3**). The area along Johnson Creek Road south of Wapiti Meadow Ranch is currently designated as Semi-Primitive Motorized in the winter. In the winter, the area along Stibnite Road is designated as Semi-Primitive Non-Motorized, Semi-Primitive Motorized, Roaded Modified and Roaded Natural. Therefore, plowing 6.7 miles of Johnson Creek Road and existing and continued plowing of Stibnite Road would be more consistent with a designation of Roaded Natural and the physical setting of the area surrounding this road would be altered to Rural due to closeness to other plowed routes (only during the winter months). This impact would end once the Burntlog Route was operational. Creating a temporary groomed OSV route just west of Johnson Creek Road (due to the plowing of the road) would not be inconsistent with the existing winter ROS designation of Semi-Primitive Motorized surrounding Johnson Creek Road. No impact to the ROS designations is anticipated. Impacts to the estimated physical ROS setting are anticipated to be minor, short term, and localized.

Warm Lake Road

Summer

The area surrounding Warm Lake Road is currently designated as Roaded Natural and Rural with an existing estimated ROS physical setting of Rural (**Figure 3.19-2**); therefore, increased traffic on this road would not result in inconsistencies with the existing ROS designations. No impact to the ROS designations is anticipated.

Winter

Warm Lake Road from Warm Lake to Landmark would be plowed; however, this section of road is currently a groomed OSV route and is in an area designated as Semi-Primitive Motorized in the winter. Plowing Warm Lake Road from Warm Lake to Landmark would be more consistent with a designation of Roaded Natural and is within an area with an estimated ROS physical setting of Semi-Primitive Motorized (**Figure 3.19-3**). Plowing this portion of Warm Lake Road would alter the estimated ROS physical setting of the area surrounding this portion to Rural in the winter because it would be adjacent to other plowed routes. Impacts to ROS designations would occur from construction through closure and reclamation and are anticipated to be minor, long term, and localized.

A new groomed OSV route along Cabin Creek Road from Warm Lake to Trout Creek Campground would be created along with a parking area in the Warm Lake area and would be in an area currently designated as Semi-Primitive Motorized in the winter, which is typically what the area around a groomed OSV trails is designated; therefore, the new groomed OSV route would not result in inconsistencies with the existing ROS designation class. The parking area would be located in an area currently designated as Roaded Natural and an estimated ROS physical setting of Rural; therefore, there would be no inconsistencies with the existing ROS designation class and no alterations of the estimated ROS physical setting. No impact to the ROS designations is anticipated.

Closure of Stibnite and Thunder Mountain Roads Through the Operations Area Boundary

Closure of these road portions during construction would not result in inconsistencies with the existing ROS designation class or the estimated ROS physical setting (Rural and Roaded Natural) of the area surrounding either road; therefore, no impact to the ROS designations is anticipated.

Road Through Operations Area Boundary

Public access through the Operations Area Boundary would be located in an area currently designated as Roaded Natural and an existing estimated ROS physical setting of Rural. These designations allow for some landscape modification from roads and strong evidence of designed roads, respectively; therefore, public access through the Operations Area Boundary would not result in inconsistencies with the existing ROS designation or estimated ROS physical settings. No impacts to the ROS designations are anticipated.

Burntlog Maintenance Facility

The Burntlog Maintenance Facility would be in an area currently designated as Roaded Modified, which can have modifications that are visually subordinate to viewers, and an existing estimated ROS physical setting of Rural; therefore, the maintenance facility in this area would not result in inconsistencies with the existing ROS designation class or estimated ROS physical setting during use or after reclamation. Impacts are not anticipated.

Communications Facilities

Impacts to existing ROS designations at the Operations Area Boundary are discussed above and would be the same for the cell tower and several of the repeater sites. impacts to the existing ROS designation from adding a repeater site at the Burntlog Maintenance Facility would be the same as described above

for such facility. A repeater site at the existing Meadow Creek Lookout or the old Thunderbolt Lookout would not result in inconsistencies with the existing ROS designation classes (Roaded Natural and Roaded Modified) or the estimated ROS physical setting (Roaded Natural) for these areas as modifications are allowed during use and after reclamation. A repeater site at the Trapper Creek/Burnt Log Road intersection, currently with a ROS designation class of Roaded Modified and an estimated ROS physical setting of Roaded Natural, would not result in inconsistency with the existing ROS designations during use or after reclamation as some landscape modification is allowed. Impacts are not anticipated.

Transmission Line and Associated Facilities

The transmission lines to be upgraded along Warm Lake Road, Cabin Creek Road, and Johnson Creek Road are in areas currently with ROS designations of Roaded Modified and Roaded Natural and estimated ROS physical settings of Rural, Semi-Primitive Motorized, and Roaded Natural, respectively. Upgrades to these transmission lines would not result in inconsistencies with the existing ROS designation classes or the estimated ROS physical settings in the transmission line ROWs because these classifications allow moderate evidence of the sights and sounds of man; therefore, impacts are not anticipated.

The new transmission line and access road in PNF MA 13 would be in an area with a ROS designation of Semi-Primitive Non-Motorized and an estimated ROS physical setting of Semi-Primitive Motorized and Semi-Primitive Non-Motorized. Allowing motorized use for transmission line construction and maintenance along the new access roads would be more consistent with a long-term designation of Semi-Primitive Motorized or Roaded Natural until the transmission line is decommissioned. The potential change of designation from Semi-Primitive Non-Motorized to Semi-Primitive Motorized or Roaded Natural would affect an area of approximately 47 acres. Impacts are anticipated to be minor, long term, and localized.

The new transmission line and access road in BNF MA 21 would be in areas currently designated as Roaded Modified, which is a subclassification of Roaded Natural, where there is more landscape modification (i.e., roads, management activities) than under Roaded Natural, but not enough modification to qualify as Rural. Creation of the transmission line and associated road in this classification would not result in inconsistencies with the existing ROS designation class for the transmission line ROW in BNF MA 21 and impacts are not anticipated.

The new substation would be located in an area along Johnson Creek Road currently with a ROS designation as Roaded Modified and an existing estimated ROS physical setting of Roaded Natural and would not result in inconsistencies with the existing ROS designations as the existing class and physical setting allows for moderate evidence of the sights and sounds of man. Impacts are not anticipated.

Recreation Use and Users

Impacts to Developed Recreation sites are discussed above for Recreation Opportunities, Facilities, Access, and Use. Dispersed recreation would continue to occur throughout the analysis area. Potential impacts to dispersed recreation including hunting, fishing, mountain biking, recreational river use, horseback riding, hiking, and winter use would include potential access delays to areas from construction and mine traffic. These potential delays would be minor, short term to-long term, and localized. In

addition, approximately 13,441 acres of NFS lands and approximately 780 acres of private patented lands within the Operations Area Boundary would remain inaccessible to the public during construction and operations and would result in minor long term, and localized impacts. Use-specific impacts are outlined below.

Hunting

There could be potential access delays to areas utilized by the hunting community from construction and mine traffic, which would be minor, short-term to long-term, and localized. In addition, approximately 13,452 acres of NFS lands and approximately 775 acres of private patented lands within the Operations Area Boundary would remain inaccessible to hunters during operations, resulting in minor, long term, and localized impacts.

Fishing

There is potential for changes in water quality, water temperature, and streamflow to occur in streams within the analysis area, during construction through reclamation, all of which could impact fish and local habitat potential for fish. Fishing access to the streams within the Operations Area Boundary would also be restricted until reclamation is completed. Long term, the reclamation activities should improve the quality of the aquatic habitat and sport fishing compared to the current conditions. There would be no stream flow changes to streams along either the Johnson Creek Route or the Burntlog Route but there is potential for sediment and contaminants from roadway construction, vehicle traffic, and maintenance along these streams. Any reduction in fish populations could affect the success and experience of the recreational fisherman. Impacts to fish and fish habitat are discussed in **Section 4.12** and additional detail provided in the Fish Resources and Fish Habitat Specialist Report (Forest Service 2022i). Impacts to recreational fishing would be localized, long term, and minor to moderate.

Motorcycle and ATV/UTV Use

Motorcycle and ATV/UTV drivers and riders could potentially encounter access delays and safety-related issues as well as temporary decreases in trail access as a result of construction, operations, and increased mine and vehicular traffic. While a public access road will be open and maintained within the Operations Area Boundary, trails leading to the Stibnite Mining District Interpretive Site would be closed to the public. Impacts are anticipated to be minor, long-term, and localized. Impacts to Special Use Permit ATV/UTV events are described below under Recreation Special Use Permits and in the corresponding sub-section in **Section 4.19.2.3** for the Johnson Creek Route Alternative.

Mountain Biking

Use of the Johnson Creek Route during construction could result in temporary impacts to bicyclists that use these roads, due to potential delays, increased traffic, and safety-related issues from mine-related traffic. Impacts to biking utilizing the Johnson Creek Route are expected to be minor, temporary, and localized while the Burntlog Route is being constructed. In addition, there could be potential access delays to areas utilized by the mountain biking community from construction and mine traffic, which would be minor, short term to long term, and localized.

Recreational River Users

The SGP would not have any direct impacts on recreational river use. Under the SGP operations and closure, water quality of surface flow departing from the Operations Area Boundary would be the same or better than existing baseline conditions; therefore, there would not be impacts to the quality of downstream waterways (**Section 4.9**) and the use by recreational river users. There would be no change in potential human health impacts from dermal contact or ingestion of river water downstream. There could be indirect short-term impacts to the recreational setting (i.e., visual changes and noise), most of which would be short-term during construction of the Burntlog Route while mine traffic is utilizing Warm Lake and Johnson Creek roads. These impacts are anticipated to be minor, short term, and localized.

Horseback Riding

There could be potential access delays to areas utilized by the horseback riding community from construction and mine traffic, which would result in minor, short-term to long term, and localized impacts.

Hiking

There could be potential access delays to trails and trailheads utilized by hikers from construction and mine traffic, which would result in minor, short-term to long-term, and localized. In addition, approximately 13,441 acres of NFS lands and approximately 780 acres of private patented lands within the Operations Area Boundary would remain inaccessible to hikers during operations. Construction of the Burntlog Route may provide additional backcountry hiking access into new areas and an additional road to established trails and trailheads, resulting in minor, long term, and localized impacts.

Winter Use

There would be potential access delays to backcountry skier access points, such as Landmark, due to construction and mine traffic that could affect recreation sites/areas along the surrounding roads such as Warm Lake Road and Johnson Creek Road, as well as sites and areas accessed from these roadways. Ski access from Big Creek Summit has been growing in recent years due to the increasing popularity of skiing in the area. The increase in truck traffic could impact skier safety, some of which includes skiers and OSV riders walking on the road to the summit parking lot. These potential moderate, short-term, and localized impacts to backcountry skier access would last seasonally until the Burntlog Route is constructed. Impacts to OSV recreation are discussed above in Recreation Opportunities, Facilities, Access, and Use for winter use.

Recreation Special Use Permits

Construction and Operations

There are several current recreation-related special use permits in the analysis area (fully described in Appendix A of the Recreation Specialist Report [Forest Service 2022m]). Recreation-related special use permits within the PNF include Big Creek Lodge, Elk Springs Outfitters, Flying Resort Ranches, Idaho Wilderness Company, and Yellowpine Escapades ATV/UTV event. In the BNF, recreation-related special use permits include Juniper Mountain Outfitters, North Shore Lodge, Warm Lake Lodge and Resort, Warm Lake Camp, Youth with a Mission (YWAM), and recreation residences. Impacts to each recreation

special use permit area are summarized below and described in greater detail in the Recreation Specialist Report (Forest Service 2022m).

There are no 2021 MMP components that would directly impact the Big Creek Lodge during construction; however, some components may affect recreation opportunities, access, and experiences in areas south of the lodge in the analysis area. Impacts to lodge customers would depend on their recreation location away from the lodge but are anticipated to be minor to moderate, short term, and localized.

Construction and operation of the new transmission line to the Operations Area Boundary, road improvements along the Burntlog Route, closure of Stibnite and Thunder Mountain roads through the Operations Area Boundary, communication facilities, and Operations Area Boundary facilities would temporarily affect the ability of Elk Springs Outfitters to access approximately half of their operating area, provide IOGLB licensed activities, and may degrade recreation experiences for customers participating in guided activities near construction of these components due to construction and mine operations noise and activity, construction and mine traffic, new motorized use, and reduction of acreage for available recreation. The portion of the Elk Springs Outfitters operating area north and west of Yellow Pine would be accessible, and free of the 2021 MMP construction activities; therefore, permitted use may be displaced to this area, as well as recreational use from the analysis area. Impacts from construction are anticipated to be minor, temporary to short term, and localized. Beneficial impacts during SGP operations to Elk Springs Outfitters may include increased cellular coverage in their operating area resulting in customer safety improvements. Impacts from operations are anticipated to be minor, long term, and localized.

There are no 2021 MMP components that would impact the Flying Resort Ranches operating area during construction or operations; there are no planned activities in or adjacent to their route through the FCRNRW to Big Creek.

Construction of road improvements along the Burntlog Route, closure of Stibnite and Thunder Mountain roads, and Operations Area Boundary facilities would affect the ability of the Idaho Wilderness Company to access approximately 25 percent of the southern portion of their operating area, provide IOGLB licensed activities, and may degrade recreation experiences for customers participating in guided activities near construction of these components due to construction and operations noise and activity, mine traffic, and reduction of acreage available for recreation. The portion of the Idaho Wilderness Company operating area in the FCRNRW northeast of the SGP would be available for any displaced permitted use; however, access to this portion of the operating area may need to be relocated to be out of Big Creek, rather than Thunder Mountain Road, due to the closures and improvements on this road. Impacts from construction are anticipated to be minor, short-term, and localized. 2021 MMP components that would affect the Idaho Wilderness Company during operations would be the same as those under construction, with the addition of operation of the communications facilities. Beneficial impacts to the Idaho Wilderness Company may include increased cellular coverage in their operations area and resulting customer safety improvements. Impacts from operations are anticipated to be minor, long term, and localized.

Construction and operation of all the 2021 MMP components would affect the Juniper Mountain Outfitters operating area either directly or indirectly, specifically the ability to access approximately 50

percent of their operating area, provide IOGLB licensed activities, and may degrade recreation experiences for customers participating in guided activities near construction of the 2021 MMP components due to construction and mine operations noise, traffic, new motorized use, and reduction of acreage available for recreation. The portion of the Juniper Mountain Outfitters operating area north and south of Warm Lake surrounding the SFSR would be accessible and free of the 2021 MMP construction and facilities operations activities; therefore, permitted use may be displaced to this area, as well as other recreational use from the analysis area. Impacts from construction are anticipated to be moderate, temporary to short-term, and localized. Impacts from operations are anticipated to be minor, long term, and localized.

Construction of transmission line upgrades and summer use of Warm Lake Road would affect traffic, noise, and vehicular access for the North Shore and Warm Lake Lodges, Warm Lake Camp, YWAM, and Warm Lake recreation residence tract and thus could adversely affect the recreation experience for some recreationists as well as the recreation setting due to an increase in traffic and traffic noise. It is not anticipated that transmission line upgrade activities, including work at the Warm Lake substation, would be visible or audible from the lodges or camps or from the Warm Lake recreation residence tract as this area is over 0.5 mile away from the transmission line and substation with intervening vegetation. Impacts from the transmission line upgrades would be minor, temporary, and localized. There would be no winter access changes on Warm Lake Road in the area near the lodges, Warm Lake Camp, or Warm Lake recreation residence tract, and there is no winter use of the YWAM facility and thus changes to winter use and maintenance/plowing of Warm Lake Road west of the facility would not result in winter impacts. There are no 2021 MMP component that would impact the lodges, camps, and Warm Lake recreation residence tract during operations; therefore, no impacts are anticipated from operations activities.

The Cabin Creek OSV route, which would be located near the Paradise Valley recreation residence tract, may result in more winter motorized use north of the lodges, camps, and Warm Lake recreation residence tract. Construction and operation of the transmission line upgrades, summer use of Warm Lake Road, and development and use of the Cabin Creek Road OSV route around the Paradise Valley recreation residence tract would affect traffic, noise, and vehicular access and thus could adversely affect the recreation experience for some recreationists as well as the recreation setting. The upgraded transmission line may be visible from the Paradise Valley recreation residence tract, but there would be some intervening vegetation present. Impacts are anticipated to be minor, temporary to short term, and localized. The new 10.4-mile groomed OSV route along Cabin Creek Road may lead to dispersed winter recreational use along this new route and would be the only available easterly OSV route to Landmark; therefore, there may be more traffic, noise, and recreation use within the area around the Paradise Valley recreation residence tract in the winter, potentially resulting in a change to a more developed recreation setting at the residence tract in the winter. Impacts are anticipated to be minor, long-term, and localized. The parking area for the new Cabin Creek OSV route would be located west of the Paradise Valley recreation residence tract near SFSR Road and would not affect the recreation residence tract.

There are no activities planned that would use SFSR Road; however, additional visitors could be present along this roadway due to displacement of recreational use from the analysis area. Impacts are anticipated to be negligible, long term, and localized.

Closure and Reclamation

There are no 2021 MMP components that would directly impact the Big Creek Lodge during or after closure and reclamation; however, 2021 MMP components may affect recreation opportunities, access, and experiences in areas south of the lodge in the analysis area. Impacts to lodge customers would depend on their recreation location away from the lodge.

2021 MMP components that would affect the Elk Springs Outfitters operating area during closure and reclamation would be similar to those described for construction and operations. The loss of cellular coverage on portions of the analysis area may impact customer safety in the Operations Area Boundary but would aid in returning primitive recreation experiences to the FCRNRW areas in the Elk Springs Outfitters operating area. Providing public access through the Operations Area Boundary after closure and reclamation would restore the ability for Elk Springs Outfitters to reach portions of their operating area without a detour. Displacement of permitted use may continue past reclamation due to permanent changes in the recreation setting within the Operations Area Boundary and potential changes to wildlife present in the area, as some species sensitive to human presence may not return to the area for years after the mine is closed, resulting in a minor, permanent, and localized impact.

The 2021 MMP components that would affect the Idaho Wilderness Company operating area during closure and reclamation would be similar to those described for construction and operations. The loss of cellular coverage on portions of the analysis area may impact customer safety in the SGP but would aid in returning primitive recreation experiences to the FCRNRW areas in the Idaho Wilderness Company operating area. Providing public access through the SGP after closure and reclamation would restore the ability for the Idaho Wilderness Company to reach portions of their operating area without a detour. Displacement of permitted use may continue past reclamation due to permanent changes in the recreation setting within the Operations Area Boundary and potential changes to wildlife present in the area, as some species sensitive to human presence may not return to the area for years after the mine is closed, which would result in a minor, permanent, and localized impact.

Closure and reclamation of all 2021 MMP components would affect the Juniper Mountain Outfitters operating area either directly or indirectly due to recreation displacement from other areas. The ability of Juniper Mountain Outfitters to access their operating area, provide IOGLB licensed activities, and the quality of recreation experiences for customers participating in guided activities near these components may be impacted during closure and reclamation due to noise and reclamation activity. Displacement of permitted use may continue past reclamation due to the changes in the recreation setting in the Operations Area Boundary, and potential changes to wildlife present in the area, as some species sensitive to human presence may not return to the area for years after the mine is closed, which would result in a negligible, permanent, and localized impact.

There are no 2021 MMP components that would impact the North Shore or Warm Lake Lodges, Warm Lake Camp, YWAM, or Warm Lake recreation residence tract during closure and reclamation; therefore, no impacts are anticipated.

Winter use of the Cabin Creek Road OSV route during closure and reclamation would continue to impact the Paradise Valley recreation residence tract as described for construction and operations.

4.19.2.3 Johnson Creek Route Alternative

The Johnson Creek Route Alternative is similar to the 2021 MMP, with the main differences that affect recreation consisting of use of the Johnson Creek Route for access to the mine for all phases (no construction or use of the Burntlog Route); a change in the location of the Landmark Maintenance Facility; and use of helicopters for construction and maintenance of cell towers and repeater sites in IRAs managed for backcountry/restoration. These changes would result in different impacts than the 2021 MMP, particularly the use of the Johnson Creek Route.

Recreation Opportunities, Facilities, Access, and Use

Construction and Operations

Impacts of the Johnson Creek Route Alternative during construction and operations would be the same as those described under the 2021 MMP, except for those described below. The Burntlog Route and Burntlog Maintenance Facility would not be constructed under the Johnson Creek Route Alternative; therefore, there would be no construction impacts related to those facilities.

Year-Round

Use of Johnson Creek and Stibnite roads as the route to the Operations Area Boundary during construction, operations, and reclamation and closure would result in impacts to the recreation setting of the existing recreation sites/areas along these roads due to increased noise, traffic, and safety-related issues from mine-related traffic (Forest Service 2022d, 2022k), leading to a change in recreation experiences for some visitors. Traffic on Johnson Creek and Stibnite roads would substantially increase (almost two times the current traffic conditions, respectively), thereby increasing the noise and activity near campgrounds and trailheads adjacent to these roads. Impacts are anticipated to be moderate, short-term, and localized.

Recreation facilities affected by the increase in traffic and traffic noise would include Burntlog and Quartz Creek Trailheads; Buck Mountain, Trout Creek, Ice Hole, Golden Gate, and Yellow Pine Campgrounds; Twin Bridges dispersed camping area; and Johnson Creek Cabin. The recreation setting of these facilities would be altered to a more developed setting due to an increase in the sights and sounds of humans, which would displace recreationists to avoid noise associated with activities and traffic along Johnson Creek and Stibnite roads, particularly recreationists participating in non-motorized activities. Motorized users who use Johnson Creek and Stibnite roads for recreation also may be displaced due to the increased traffic along the roadways. Wildlife-related recreation opportunities also would decrease along these roadways due to wildlife displacement from traffic and noise. This impact is anticipated to be minor, short term, and localized.

During construction, there would be periodic temporary road closures on Johnson Creek Road that would result in reduced access to recreation sites/areas, reduced recreation opportunities, reduced use due to a lack of access, and impacts to recreation experiences due to visitor expectations regarding site/area availability. Impacts from road closures would affect recreation sites/areas along Johnson Creek Road, as well as sites, trails, and areas accessed from this main route. Impacts would persist throughout construction and are anticipated to be moderate, short term, and localized. There also would be daily

closure of Stibnite Road for most of the middle of the day during mine construction that would result in reduced access to recreation sites/areas off Stibnite Road and Thunder Mountain Road, reduced recreation opportunities and use due to temporary reductions in access, and impacts to recreation experiences due to delays in reaching destinations. Impacts from road closures would affect recreation sites/areas along Stibnite Road, as well as sites, trails, and areas accessed from this main route, particularly sites off Thunder Mountain Road. Depending on where the closure started on Stibnite Road, access to the Big Creek area north of the mine also may be affected. Impacts would persist throughout the mine construction period and are anticipated to be moderate, short term, and localized.

Although Stibnite Road would be open for public access as part of the Johnson Creek Route, the Stibnite Mining District Interpretive Site would not be available for public use, because it would be within the Operations Area Boundary where no public use would be allowed. This impact is anticipated to be moderate, long term, and localized.

The Yellow Pine Escapades are Special Use Permit ATV and UTV events that frequently use Johnson Creek and Stibnite roads in addition to varying Forest Service trails based on the event type. The Yellow Pine Escapades are hosted by the Yellow Pine Community Hall Committee as fundraising events for the community hall maintenance (Yellow Pine Escapades 2022) and may include stops at interpretive sites for educational purposes. Increased traffic on Johnson Creek and Stibnite roads, decreased trail access due to road closures, and the closure of the Stibnite Mining District Interpretive Site are anticipated to have a moderate, long-term, and localized impact on these recreational events.

Impacts during construction and operations would be the same as under the 2021 MMP because Johnson Creek and Stibnite roads would continue to be used as the main access roads into the Operations Area Boundary and would require periodic road maintenance activities. AADT for these roads would be lower during operations than described under construction, but within 15 vehicles, thus resulting in similar impacts described under construction; however, impacts due to temporary closure of Johnson Creek and Stibnite Roads would not occur during operations. Fish adjacent to the Johnson Creek Route may be affected by increased sediment and could be affected if a spill were to occur. While there may be injury or mortality to individual fish, population-level effects are not expected (**Section 4.12**). There may be decreased fishing success immediately along the Johnson Creek Road, but there would continue to be opportunities for fishing within the creeks in the adjacent areas. Operational impacts from the Johnson Creek Route to fishing recreation would be minor, long term, and localized.

Winter

Impacts during construction and operations from the plowing of Johnson Creek Road would be similar to those described for construction under the 2021 MMP; however, the groomed OSV route along the western side of Johnson Creek Road would run from Trout Creek campground to Landmark (approximately 8 miles) under the Johnson Creek Route Alternative, allowing continued use of the Ditch Creek Road groomed OSV route. The new groomed OSV route along Johnson Creek Road would remain through operations and closure/reclamation under the Johnson Creek Route Alternative as the Johnson Creek Route would be used throughout the life of the SGP. Therefore, impacts from the plowing of Johnson Creek Road under the Johnson Creek Route Alternative are anticipated to be minor, long term, and localized.

Public Access

Road closure impacts on the Johnson Creek route would be the same as those described under the 2021 MMP, except impacts to recreation access, use, and opportunities along Thunder Mountain Road would begin during construction and continue until the public access road through the Operations Area Boundary was complete and open to public use to provide access to the Thunder Mountain area. Construction under the Johnson Creek Route Alternative is expected to take 2 years longer than the 2021 MMP.

The impacts to public access through the Operations Area Boundary would be the same as under the 2021 MMP. The public access road would provide access to recreation sites/areas via Thunder Mountain Road; therefore, the access road would allow continuous access to the Thunder Mountain Road sites/areas. However, as described under the 2021 MMP, there would be temporary closures of this route during some mining activities that would result in minor, short term, and localized impacts to recreation.

Landmark Maintenance Facility

The Landmark Maintenance Facility would be located approximately 0.1 mile south of Landmark and the historic cabins located there. Access to the maintenance facility would be off Warm Lake Road. There would be no delays or additional traffic along Warm Lake Road in this area since the Burntlog Route would not be constructed, but rather from all construction-related traffic using Warm Lake Road to Johnson Creek Road. It is assumed that construction equipment would travel east on Warm Lake Road; therefore, delays would likely affect access to Horn Creek Road, Rec Spur 579U2, 450 South, and Burnt Log Road, which are east of the maintenance facility site. This impact is anticipated to be moderate, short term, and localized.

Noise associated with construction activities could reduce opportunities for noise-sensitive recreation activities at and around the maintenance facility location (up to 1.1 miles away) (AECOM 2019c), including wildlife-related recreation activities, because wildlife may be displaced. Construction activities would not affect use of the historic cabins; however, construction noise at the site may affect the recreation setting of the cabins, because it may be audible from the cabin sites. Some recreationists may choose to visit other areas or sites to avoid delays or noise from construction activities. Any reduction in recreation opportunities, displacement of dispersed recreational use, or changes in access would be temporary until maintenance facility construction was completed. These impacts would be minor, short term, and localized.

Development of the Landmark Maintenance Facility would reduce recreation opportunities due to physical removal of acreage for the facility (3.5 acres). Traffic due to maintenance activities and vehicles would not be expected to result in frequent traffic delays on Warm Lake Road but may result in occasional delays due to road plowing, grading, repairs, etc., and would occur as operational impacts because the facility site would be accessed via the Johnson Creek Route. Traffic and other operational noise from the maintenance facility would generally not be audible from the facility; however, road maintenance activities would result in noise levels above background ambient noise levels of 40 dBA for up to 0.8 to 1 mile from the road (AECOM 2019c). This would likely reduce opportunities for some recreational activities in this area, particularly wildlife-related recreation activities, because wildlife may be displaced from the general maintenance facility area. Operation activity noise from the maintenance

facility would not be heard at the historic cabins at Landmark, although the large buildings and solar panels at the facility may be visible from the historic cabins and from nearby roads. The maintenance facility would increase man-made development in the Landmark area, including nighttime lighting, resulting in a moderate, long-term visual contrast. Such changes may affect the recreation setting of the general Landmark area, including the historic cabins and roads in the area, by decreasing the feeling of remoteness and thus affect the recreation experience for visitors to Landmark. Impacts would generally be limited to the area within visual and audible distance of the maintenance facility, and are anticipated to be minor, long term, and localized.

Communications Facilities

Construction of repeater sites and the cell tower in areas outside of IRAs would result in the same impacts as those described under the 2021 MMP. Constructing repeater sites in an IRA managed for backcountry/restoration, noise, and disruption from the use of helicopters for construction may temporarily affect the recreation setting for users within visual and audible distance of the helicopters. Impacts would be localized to the repeater sites in IRAs. Changes in the recreation setting around these repeater sites could lead to a temporary displacement of dispersed recreational use, particularly related to non-motorized activities, wilderness activities, and wildlife-related recreation activities (due to wildlife displacement), which currently typically occur in a quieter, non-motorized setting in these areas compared to existing conditions. Additionally, use of helicopters would eliminate the impacts of new access roads to the repeater sites (e.g., changes in the recreation setting along access route that could lead to displacement of dispersed recreational use, particularly related to non-motorized activities, and wildlife-related recreation activities) as described under the 2021 MMP. The impacts under this alternative are anticipated to be minor, temporary, and localized.

Impacts from operation of the cell tower and repeater sites not in IRAs would be the same as those described under the 2021 MMP.

Noise and disruption from the use of helicopters for maintenance of repeater sites in an IRA managed for backcountry/restoration may temporarily affect the recreation setting for users within visual and audible distance of the helicopters. Impacts are anticipated to be minor, temporary during operations and when maintenance activities are conducted, and localized to the repeater sites in IRAs managed for backcountry/restoration.

New cellular coverage in the analysis area would increase visitor safety on NFS lands; however, additional cellular coverage would detract from primitive recreation experiences. Impacts would begin once the cell tower was constructed and would conclude with decommissioning of the site. This impact is anticipated to be beneficial until decommissioning when it would return to baseline conditions.

Transmission Line and Associated Facilities

Impacts from transmission line upgrades and the new segment would be the same as described under the 2021 MMP.

Closure and Reclamation

Recreation impacts of the Johnson Creek Route Alternative during closure and reclamation would be the same as those described under the 2021 MMP, except for those additionally described below. The Burntlog Route and the Burntlog Maintenance Facility would not be constructed under the Johnson Creek Route Alternative; therefore, there would be no closure/reclamation impacts related to these facilities.

Johnson Creek Route

Year-Round

Impacts described under operations for the Johnson Creek Route also would occur during closure/reclamation, because Johnson Creek and Stibnite roads would continue to be used as the main access roads into the mine during closure and reclamation. Impacts due to temporary closure of Johnson Creek and Stibnite roads would not occur during closure/reclamation. Impacts to recreation from use of the road through the Operations Area Boundary following closure/reclamation are anticipated to be minor, long term, and localized.

Winter

Impacts described under operations for the Johnson Creek Route also would occur during closure/reclamation, because Johnson Creek Road would continue to be plowed during closure and reclamation. Following closure/reclamation, Johnson Creek Road would no longer be plowed; therefore, impacts are anticipated to be minor, long term, and localized.

Public Access After Reclamation

Under the Johnson Creek Route Alternative, public access through the Operations Area Boundary after closure/reclamation would be on a reopened Stibnite Road, which would include a permanent road through the backfilled Yellow Pine pit, the same as described under the 2021 MMP; however, under this alternative, Stibnite Road) would not be returned to its pre-mining width, and the nine-foot-high retaining walls and various culverts would remain after mine closure and reclamation. After closure and reclamation, traffic on Stibnite Road would be greatly reduced, which would benefit recreation experiences for visitors to the areas/sites east of the Operations Area Boundary off Thunder Mountain Road and encourage the return of recreational use at these sites/areas that was displaced during mine operations due to increased road traffic and road closures. Retaining the increased width of the road would continue to allow a wider range of vehicles to use this road, potentially increasing access. The alterations to the road, including the large retaining walls, would continue to affect the recreation setting, similar to impacts described under the 2021 MMP. Impacts to recreation access, experiences, and use from public access through the Operations Area Boundary would continue beyond closure/reclamation and are anticipated to be minor, permanent, and localized.

Landmark Maintenance Facility

Impacts from closure and reclamation of the Landmark Maintenance Facility would be similar to those described under the 2021 MMP, but in a different location. Impacts would be minor, temporary, and localized to the area surrounding the maintenance facility and the roads/trails accessed from the Warm Lake Road.

Communications Facilities

Impacts from closure and reclamation of the cell tower and repeater sites not in an IRA would be the same as those described under the 2021 MMP.

Noise and disruption from the use of helicopters for closure and reclamation of repeater sites in an IRA managed for backcountry/restoration may temporarily affect the recreation setting for users within visual and audible distance of the helicopters. Changes in the recreation setting around these repeater and cell tower sites could lead to displacement of dispersed recreational use, particularly related to non-motorized activities, wilderness activities, and wildlife-related recreation activities (due to wildlife displacement), which currently typically occur in a quieter, non-motorized setting in these areas. Impacts would be negligible, temporary and would conclude once the sites were closed and reclaimed and localized to the repeater sites in IRAs.

The loss of cellular coverage on portions of the analysis area may impact visitor safety in the area of analysis. The loss of cellular coverage would aid in returning to the previous baseline primitive recreation experiences to the FCRNRW areas adjacent to the Operations Area Boundary.

Transmission Line and Associated Facilities

Impacts during decommissioning of the transmission line, transmission line road, and road/trail improvements would be the same as those described for the 2021 MMP.

Designated ROS Classes and Physical Setting

Impacts of the Johnson Creek Route Alternative on designated ROS classes and estimated ROS physical settings would be the same as those described under the 2021 MMP, except for those summarized below. The Burntlog Route and the Burntlog Maintenance Facility would not be constructed under the Johnson Creek Route Alternative; therefore, there would be no impacts related to inconsistency with the existing ROS designation or the estimated ROS physical setting for these facilities. Impacts from public access through the SGP would be the same as those described for the 2021 MMP. Graphical representations of the estimated ROS physical settings as well as the acreages of disturbance to estimated ROS physical settings under the Johnson Creek Route Alternative are provided in the Recreation Specialist Report (Forest Service 2022m).

Johnson Creek Route

Summer

The areas surrounding roads that would be used as part of the Johnson Creek Route are currently designated as Roaded Natural; therefore, increased traffic on these roads as part of construction would not result in inconsistencies with the existing ROS designation surrounding the roads and no impacts are anticipated. Impacts would be the same as those described under the 2021 MMP for summer estimated ROS physical settings (Roaded Natural and Rural). Impacts would be similar to those described under the 2021 MMP for winter estimated ROS physical settings; however, plowing of Johnson Creek Road would occur through closure/reclamation and would alter the existing estimated winter ROS physical setting of the area around this road to Rural. Impacts to the estimated ROS physical setting are anticipated to be minor, long-term through closure and reclamation, and localized.

Winter

Johnson Creek Road from Wapiti Meadow Ranch to Landmark would be plowed and, and as currently occurs, Stibnite Road from Yellow Pine to the Operations Area Boundary would be plowed. Plowing of Johnson Creek Road and Stibnite Road would occur through closure/reclamation. Therefore, plowing 21 miles of Johnson Creek Road and 10.8 miles of Stibnite Road would not be consistent with the existing winter ROS designation classes for the area surrounding these roads, and would be more consistent with a designation of Roaded Natural. This impact is anticipated to be minor, long term, and localized.

Closure of Stibnite and Thunder Mountain Roads Through the SGP

Impacts would be the same as those described under the 2021 MMP. Closure of these roads would not result in inconsistencies with the existing ROS designation class of the area surrounding either road; therefore, no impacts are anticipated.

Landmark Maintenance Facility

The Landmark Maintenance Facility would be in an area with a current ROS designation and estimated ROS physical setting as Roaded Natural, which can have limited modifications that are visually subordinate to viewers. Therefore, the maintenance facility in this area would not result in inconsistencies with the existing ROS designation class or the estimated ROS physical setting. No impacts are anticipated.

Recreation Use and Users

The potential impact to recreation uses and users would be the same as described for the 2021 MMP, with some exceptions as described below.

Hunting

There could be potential access delays to areas utilized by the hunting community which would be focused on the Johnson Creek Route during construction of the upgraded roads and mine traffic throughout operations, closure, and reclamation, which would be minor, short term to long term, and localized. There would be no impacts in the Burntlog Route area as these roadways would not be utilized.

Fishing

Potential impacts to fish would be the same as the 2021 MMP but the duration of potential impacts along Johnson Creek and the East Fork SFSR would continue through closure and reclamation.

Motorcycle and ATV/UTV Use

Use of the Johnson Creek Route during construction, operations, and closure and reclamation could impact motorcyclists and ATV/UTV drivers and riders by creating potential delays, additional traffic, and safety-related issues from mine traffic. Users may experience decreased trail access due to road closures, resulting in minor to moderate, long term, and localized impacts.

Mountain Biking

Use of the Johnson Creek Route during construction, operations, and closure and reclamation could result in impacts to bicyclists that use these roads, due to potential delays, traffic, and safety-related issues from mine-related traffic. Users may experience decreased trail access due to road closures resulting in minor, long term, and localized impacts.

Recreational River Users

There could be indirect long-term impacts to setting (i.e., visual changes and noise) for the duration of operations, closure, and reclamation from mine traffic utilizing Warm Lake and Johnson Creek roads, which are anticipated to be minor, long term, and localized.

Horseback Riding

There could be potential access delays to areas utilized by the horseback riding community from construction and mine traffic in areas along the Johnson Creek Route, resulting in minor, short-term to long term, and localized impacts.

Hiking

The potential access delays to trails and trailheads utilized by hikers along the Johnson Creek Route would continue through operations, closure, and reclamation, resulting in minor, long-term, and localized impacts.

Winter Use

There would be potential access delays to backcountry skier access points, such as Landmark, due to construction and mine traffic that could affect recreation sites/areas along Warm Lake and Johnson Creek roads, as well as sites and areas accessed from these roadways. These potential impacts would be long-term to backcountry skier access be seasonal but last through operations, closure, and reclamation. Impacts to OSV recreation would be the same as discussed for construction and operations.

Recreation Special Use Permits

Construction and Operations

Impacts from construction and operations of the Johnson Creek Route Alternative on the recreation-related special use permits currently approved in the analysis area would be similar to those described under the 2021 MMP. There also would be no impacts to the Elk Springs Outfitters, Idaho Wilderness Company, and Juniper Mountain Outfitters from the Burntlog Route.

Closure and Reclamation

Impacts from closure and reclamation under the Johnson Creek Road Alternative on the recreation-related special use permits currently approved in the analysis area would be similar to those described under the 2021 MMP, except the Elk Springs Outfitters, Idaho Wilderness Company, and Juniper Mountain Outfitters would be impacted from reclamation activities along the Johnson Creek Route instead of the Burntlog Route.

4.19.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis.

4.19.4 Irreversible and Irretrievable Commitments of Public Resources

4.19.4.1 No Action Alternative

Under the No Action Alternative, no action would be undertaken. Consequently, no change would occur in the status of recreation resources in the analysis area.

4.19.4.2 Action Alternatives

The action alternatives would affect recreation access in the analysis area from construction through closure and reclamation. This change in access would be an irretrievable commitment of the recreation resource because existing access to Stibnite Road and Thunder Mountain Road sites/areas would be re-established, either through the Operations Area Boundary or on a portion of the Burntlog Route through the Operations Area Boundary, and winter OSV access would be re-established after reclamation. The only recreation facility that would be closed until Operations Area Boundary access was reclaimed would be the Stibnite Mining District Interpretive Site, which would represent an irretrievable commitment of this resource.

An irretrievable commitment of resources also would occur from the removal of Operations Area Boundary facility areas from recreational use during construction through closure and reclamation. The creation of motorized access to areas with no existing motorized access under the 2021 MMP would be an irretrievable commitment of resources due to displacement of non-motorized recreation opportunities in these areas. Both irretrievable commitments also would affect the ability of recreation-related special use permittees to provide IOGLB licensed activities, and/or may change recreation experiences for customers.

Changes to the recreation setting during construction, operation, and closure and reclamation, and the resulting potential displacement of recreational use to other locations, would be an irretrievable commitment of resources, particularly for FCRNRW areas where the recreation setting was affected. Changes to the recreation setting at the Operations Area Boundary and Burntlog Route, transmission line upgrade areas, and new transmission line ROW to the Operations Area Boundary under the 2021 MMP would be an irreversible commitment because the transmission line ROW would be a modification to the recreation setting of many areas and existing recreation facilities, and the Operations Area Boundary and Burntlog Route would be large reclaimed areas that would take a long period of time to fully revegetate to the point where the sights and sounds of humans would return to existing levels (if ever). Therefore, the recreation setting of these areas would experience long-term and potentially irreversible alterations. Wildlife displaced from the affected habitat may relocate throughout the region, changing the availability of game for hunters and predators. The change could increase or decrease hunting success, but any reduction in game availability would represent an irretrievable loss of opportunity. Although wildlife species are expected to return following reclamation, some species sensitive to human presence may not return to the area for years after the mine is closed. If wildlife does not re-populate affected areas, there

would be an irreversible commitment of resources in affected areas due to a reduction in wildlife-related recreation opportunities. Long-term impacts to the recreation setting and wildlife populations may affect the ability of recreation-related special use permittees to provide IOGLB-licensed activities and would affect the recreation experiences of customers.

4.19.5 Short-term Uses versus Long-term Productivity

4.19.5.1 No Action Alternative

Under the No Action Alternative, no action would be undertaken. Consequently, there would be no short-term use that would affect recreation resources, and no effect on long-term productivity.

4.19.5.2 Action Alternatives

Both action alternatives would result in short-term use of the Operations Area Boundary and construction of roads; however, the Operations Area Boundary and new roads would be closed and reclaimed at mine closure, except for the soil nail walls. Short-term use of the Operations Area Boundary and other facility locations on NFS lands would reduce acreage available for non-motorized recreation, and would result in displacement of recreational use, modified recreation access, motorized access to areas not currently accessible by motorized vehicles under the 2021 MMP, and changes in recreation opportunities in several management areas. All these short-term impacts to recreation would affect the ability of recreation-related special use permittees to access their operating areas; provide IOGLB-licensed activities; and would affect the recreation experiences of customers.

Because areas would be open for recreation once reclamation was completed, there would not be impacts to long-term use of the Operations Area Boundary, access roads, and other facility locations for recreation after mine closure, although there would be long-term impacts to the recreation setting and recreation experiences. The exception would be the post-closure water treatment plant operations and new transmission line to the Operations Area Boundary under both action alternatives, which potentially would not be reclaimed for an extended period of time and therefore would result in a long-term use of this area. Although wildlife species are expected to return following reclamation, some species sensitive to human presence may not return to the area for years after the mine is closed. If wildlife does not re-populate the area, there may be long-term impacts to recreation due to a reduction in wildlife-related recreation opportunities.

Because the Johnson Creek Route Alternative would have less new access road development, this alternative would have fewer long-term impacts to the recreation setting and recreation experiences; and less potential for a reduction in wildlife-related opportunities. Long-term impacts to the recreation setting and wildlife populations may affect the ability of recreation-related special use permittees to provide IOGLB-licensed activities and would affect the long-term recreation productivity.

4.20 Scenic Resources

4.20.1 Impact Definitions and Effects Analysis Indicators and Methodology

The analysis of effects to scenic resources includes one issue and the following indicators:

Issue: Construction and operation of SGP infrastructure may impact scenic integrity and quality and may result in change of the Forest Plan(s) VQOs.

Indicators:

- Visual contrast.
- SGP component visibility.

Scenic resources were analyzed using GIS spatial analyses, scientific literature reviews, visual simulations, and information and analysis documented in reports prepared for the SGP.

Visual contrast and daytime/nighttime SGP visibility are the primary indicators used to evaluate potential impacts to scenic resources that could result from construction, operation, and closure and reclamation of the SGP, including:

- Change in landscape character and scenic quality of the analysis area.
- Change in distance zone.
- Change in nighttime lighting.
- Context of impacts, including that directed by forest plan standards and guidelines.
- Change in scenic integrity.

Visual Contrast Assessment. Visual contrast is defined as the degree of visual change that occurs in the characteristic landscape due to the introduction of SGP-related alterations. The assessment for visual contrast was performed by comparing visual elements (form, line, color, and texture) of the existing landscape with the alterations associated with the implementation of the proposed SGP. The visual contrast assessment informs change in landscape character and scenic quality.

Viewshed Analysis. A viewshed analysis was completed using a GIS tool to identify locations where SGP components can theoretically be seen and areas where components would be obstructed by topography (**Figure 3.20-1**). The resulting viewshed represents the geographic area where one or more SGP components would theoretically be seen; however, it does not represent any measure of detectability of the components, nor does it account for vegetation that could screen SGP components from view. Actual visibility of SGP components also would be informed by viewer characteristics, described below.

Viewer Characteristics and Position. Viewer characteristics and position can affect the perception of visual contrast and a viewer's ability to discern objects in the landscape (BLM 2013). Viewer characteristics pertain generally to one's visual acuity, engagement in the visual landscape, and viewer motion (moving or stationary). Viewer position includes consideration of viewer geometry and distance. Viewer geometry refers to the relative elevation of the viewing location as compared to landscape being viewed. A viewer's elevation to components of the SGP could range from superior, where the viewer is looking down at SGP component(s); to level views and inferior views, where the viewer is looking up. Distance affects the perception of visual contrast because elements of form, line, color, and texture appear less detailed, as distance from a viewpoint increases. Distance zones were established to reflect visibility thresholds.

Key Observation Points. KOPs were established at locations representing sensitive-use areas, such as travel routes, waterbodies, recreation areas (developed and dispersed), and residences. Data sources used to identify KOPs included viewshed analysis results, existing land use plans, recreation data, aerial photography, and Forest Plan VQO data. These data were reviewed in conjunction with the alternatives to represent a comprehensive evaluation of the varied SGP components and their potential impacts to sensitive viewer locations in the analysis area, by alternative. Based on collected data sources, 17 viewpoints were identified (**Figure 3.20-1**).

Visualizations. Simulations (i.e., visualizations) were developed to characterize the anticipated level of visual change for the SGP. Simulations portray images of existing and proposed visual change to aid in visualizing the potential SGP effects for areas of high viewer sensitivity or concern. To generate the simulations, photographs were taken using a digital camera mounted on a tripod with a fixed 50-millimeter (equivalent) lens. At each KOP location, overlapping photographs were taken to allow for electronic conversion to a panoramic image representing the full human field of view. GPS equipment was used to record the date, time, and location of each photographic series. Simulations were created using a scaled computer-generated model of proposed facilities that was developed in Autodesk Civil 3D. GIS information from ESRI ArcMap software was imported into the 3D model. The model was then imported into Autodesk 3ds Max software where color and texture were added to resemble planned materials. The 3D model, the camera, and the lighting information was used to render a two-dimensional image of the proposed facility representing the view from the KOP for which simulations were developed. Simulations are used to evaluate the accuracy of predicted visual effects and are included in Appendix A of the SGP Scenic Resources Specialist Report (Forest Service 2022n).

VQO Classification Conformance. The results of the impact analysis were used to help determine SGP conformance with relevant VQO classifications for each action alternative. As described in the Scenic Resources Specialist Report (Forest Service 2022n), VQOs establish minimum acceptable thresholds for landscape alterations from an otherwise natural-appearing forest landscape. The threshold of effects is exceeded when alterations do not meet the visual intensity and dominance criteria of the VQO.

The impacts definitions for intensity, duration, and context (Forest Service 2012c) are provided in **Table 4.1-1.**

4.20.2 Direct and Indirect Effects

Additional details on the direct and indirect effects to scenic resources can be found in the SGP Scenic Resources Specialist Report (Forest Service 2022n).

4.20.2.1 No Action Alternative

Under the No Action Alternative, the mining and associated activities for the SGP would not be implemented, and no development of the SGP or supporting facilities would occur or be introduced. The existing environment as described in **Section 3.14** would remain as it currently exists. Existing disturbances associated with legacy mining activities at the SGP would still be visible to sensitive use areas, but there would be no changes to the PNF and BNF characteristic landscape. Reclamation activities would not be performed and permanent changes to the landscape in the area of the legacy mine activities would dominate the landscape. However, reclamation associated with authorized exploration under the

Meadow Creek Exploration Project would be conducted (Forest Service 2015c). Existing VQO classifications would remain the same under this alternative; therefore, there would be no direct or indirect effects to scenic resources as a result of the No Action Alternative. The existing disturbances associated with legacy mining activities do not meet the Partial Retention VQO and would continue under the No Action Alternative.

4.20.2.2 2021 MMP

Elements of the 2021 MMP may be inconsistent with current VQOs as designated by the PNF and BNF. More specific detail on acreages associated with these potential inconsistencies are provided in Appendix B of the Scenic Resources Specialist Report (Forest Service 2022n).

Operations Area Boundary

Based on the viewshed analysis, the proposed facilities in the Operations Area Boundary could be visible from two KOPs, where a detailed analysis was performed: KOP 1 and KOP 4. Although the viewshed analysis indicates the SGP also may be visible from KOP 2, a more in-depth review of site-specific photos indicate views of the SGP would be obstructed by intervening topography (Appendix C of the SGP Scenic Resources Specialist Report [Forest Service 2022n]).

Effects to the Characteristic Landscape

Throughout construction of facilities and early mining, excavating pits and reprocessing the historical tailings would expose lighter-colored rock and some unweathered rock that would introduce strong visual contrast with existing rock, soils, and vegetation. Landform modifications associated with initial development during pre-production would result in a low level of visual contrast to the existing landscape, primarily due to legacy mining disturbance and scale of construction activities during this timeframe. New disturbances in the footprint of existing modifications would introduce similar form, line, color, and textures.

As mining moves into undisturbed areas, slope cuts and terraces associated with the open pits would remove vegetation, expose unweathered lighter-colored rock, and create unnatural horizontal lines in the landscape. At night, lighting from the mine facilities, including the communications tower to the east of the SGP, the pits, haul trucks, and traffic on access routes would change the character of the night sky by increasing sky glow or light pollution. Long-term visual contrast would be associated with the expansion of mining activities to full build-out and continued nighttime lighting. However, these impacts would be reduced by implementing lighting design features, including directing lights downward, and shielding where appropriate. Overall, long-term visual contrast introduced to the characteristic landscape would be moderate and localized, primarily due to the expansion of mining activities and introduction of nighttime lighting.

Major landscape alterations under the 2021 MMP would expand on the existing mining landscape modifications through the operation of the Yellow Pine pit, West End pit, Hangar Flats pit, the TSF, and the TSF Buttress. Modifications that currently exist due to legacy mining activity include the introduction of monolithic landforms of an industrial scale that exhibit bold form, strong lines, contrasting color, and vegetation patterns and textures that do not blend into the natural landscape. The 2021 MMP would introduce additional modifications to the landscape similar to those present, which would further reduce

the scenic integrity of the area by introducing additional strong visual contrast and discordant elements. Other 2021 MMP support facilities, including ore-processing, lime-processing, storage areas, worker housing facility, and other administrative offices, also would modify the characteristic setting, but at a smaller scale.

Additionally, air quality modeling predicts visual impacts from the potential emissions plume. Actual visibility would depend on meteorological conditions. Visibility and associated impacts would lessen the greater the distance from the Operations Area Boundary and visual contrast would appear strongest during times of low sun angle. **Section 4.3** and the SGP Air Quality Specialist Report provide additional information regarding the emissions plume (Forest Service 2022a).

The TSF Buttress would be located in a steep valley between mountain ridges. The material would be placed on an active working base and expanded upward as the facilities are built out. As a result of storing development rock in a valley surrounded by mountainous terrain, this would appear as wider valley basins, with terracing or sloping evident at the valley edges. As landform modifications proceed for all three open pits, the TSF, and the TSF Buttress, the visual contrast would be strong, and result in a high level of change to the existing characteristic landscape.

The 2021 MMP would be within areas managed as a VQO of Retention or Partial Retention (**Figure 3.20-2**). Where visible from viewing platforms, the 2021 MMP would not meet either of these VQOs as the components would introduce form, line, color, and texture found infrequently or not at all in the characteristic landscape, and to a degree that would dominate the characteristic landscape. These effects could be visible from the Stibnite Road (CR 50-412) and the Meadow Creek Lookout viewing platforms. Overall, the disturbances associated with the 2021 MMP would introduce strong contrast as a whole; visual impacts of the SGP during construction and operations would be long term, moderate to major, and localized.

After closure and reclamation, permanent visual contrast associated with structures (i.e., buildings, communication facilities, transmission line) would be minimal, because mine support facilities would be dismantled, removed from the site, and the landform would be regraded, and reclaimed with native vegetation. Closure of the 2021 MMP facilities also would eliminate the primary source of nighttime lighting. Once reclamation is completed and mine-related vehicle travel to the Operations Area Boundary has ceased, nighttime lighting would be similar to existing conditions. At closure, major landform modifications at the 2021 MMP, including the Yellow Pine pit backfill, the TSF, TSF Buttress, the Hangar Flat pit backfill, and haul roads, would be contoured and graded to blend into the surrounding topography and terrain. Strong visual contrast would be permanent for a portion of the pits where lighter-colored exposed rock and horizontal benches would remain in unnatural, geometric landforms. These lighter-colored landforms would contrast sharply with adjacent scenery that has been unmodified. The geometric form of the horizontal benches above the backfilled portions of the Yellow Pine and West End pits would still appear unnatural in this setting. The TSF and TSF Buttress would have rounded crests and variably shaped angles to more closely resemble natural landforms, which would help to reduce visual contrast. As mature vegetation establishes on reclaimed TSF and TSF Buttress landforms over time, visual contrast associated with lighter-colored soils would diminish for a large portion of these disturbed areas. Although reclamation and revegetation efforts may reduce color contrast over time, the TSF would

require a substantial buttress to ensure long-term stability, which would introduce strong geometric lines and unnatural form into the landscape permanently.

The reconfiguration of the East Fork SFSR through the reclaimed 2021 MMP would introduce curvilinear (i.e., winding) and more natural-appearing forms to the landscape; however, the modified landforms associated with the 2021 MMP would dominate the setting. The reconfiguration of the East Fork SFSR over time would soften the sharp contrasts in that area as vegetation matures. The Hangar Flats pit would be completely backfilled, resulting in a line and form that would blend with the surrounding natural topography. With successful revegetation of the backfill, it would have a more uniform color with the surrounding undisturbed landscape, with varied colors and textures. The Yellow Pine pit would be backfilled to accommodate reconfiguration of the East Fork SFSR. The West End pit would not be backfilled and would have a pit lake that would introduce dark tones and reflectiveness from the water. Stibnite Road (CR 50-412) would not be reclaimed and a new connector to Thunder Mountain Road (FR 50375) would be constructed over the backfilled Yellow Pine pit. The level of visual contrast associated with the road would be low, similar to existing conditions; and would not contribute substantially to permanent effects. Meandering stream channels would be designed across the TSF and TSF Buttress. Reclamation and revegetation of SGP features would contribute collectively to reduce permanent visual contrast to the characteristic landscape. Permanent visual impacts would be moderate and localized.

Effects by Key Observation Point

KOP 1: Meadow Creek Lookout

A portion of the SGP would be visible from this viewpoint in the middle-ground distance zone, approximately 2.5 miles to the northeast. Short-term impacts visible from KOP 1 would be similar (moderate, localized) to those described above and would be seen from a superior vantage point. Visual impacts from construction would alter the experience for individuals at the lookout by transforming it to a more industrial setting.

Under the 2021 MMP, during operational conditions, the tailings would appear as large, flat, smooth, and uniform at the bottom of the valley, which would result in strong visual contrast against the sloping, uneven texture of the surrounding mountains and valley. The flat top and monolithic form of the TSF would introduce strong contrast against the more complex, rough, rugged surrounding topography. Complete backfill of the Hangar Flats pit would restore a more uniform line with topography. However, until successful revegetation, it would appear as a lighter color than the surrounding undisturbed landscape. From this viewpoint, the TSF full build-out would consume most of the Meadow Creek valley, creating a wider basin between the mountain ranges, which is not typical for this landscape. The TSF would appear to be an artificially smooth, regular, and continuous form, contributing to a strong level of long-term visual contrast. Intervening terrain would obstruct views of the Yellow Pine pit and West End pit. Only the TSF, TSF Buttress, and the recently backfilled Hangar Flats pit would be visually dominant in the middle-ground distance zone. Due to their distance, mine support facilities may be visible but individual components would not be perceptible from KOP 1. The emissions plume would be visible from KOP 1.

Nighttime lighting would be perceptible during construction and operation, although implementation of Forest Service mitigation measures specific to lighting would reduce the magnitude of impacts from sky

glow. Permanent contrast would be slightly reduced over time because color contrasts of the TSF and the backfilled Hangar Flats pit would gradually diminish through reclamation and revegetation. For areas where revegetation is not possible, in geologic time (i.e., millions of years), weathering would reduce the contrast but, in any human-type context, the change would be permanent because of the coloration and angular nature of the granitic rock against more surficial sedimentary type rocks. Visual impacts from mine operation would alter the experience for individuals at the KOP by transforming it to a more industrial setting. Impacts at KOP 1 would be moderate to major, localized, and long term.

At closure and reclamation, the strong visual contrast created by lines and colors of the SGP would be softened slightly over time as vegetation establishes and becomes more diverse. Overall, with the implementation of reclamation, the permanent level of visual contrast would be reduced to moderate-strong for viewers at this KOP indefinitely. Nighttime lighting would return to existing conditions.

KOP 4: Stibnite Road (CR 50-412)

A portion of the SGP would be visible from this viewpoint in the middleground distance zone. Short-term impacts visible from KOP 4 would be similar to those described above and would be seen from a superior vantage point. Visual impacts from construction would alter the experience for individuals at the KOP by transforming the area to a more industrial setting.

During operations, the 2021 MMP is completely obstructed by topography for most of the travel route between the village of Yellow Pine and the Operations Area Boundary, and views of the mine infrastructure in the Operations Area Boundary would be limited to a small portion of the road in the immediate vicinity of KOP 4.

During operations under the 2021 MMP, the Stibnite Road (CR 50-412) would no longer serve as the primary access road for the mine. Traffic past the North Gate would be limited to administrative access as needed. Near the North Gate, the 2021 MMP would be visually dominant to receptors due to the scale of landform modifications visible in the foreground. A portion of the Yellow Pine pit would be visible once it is fully built out, but adjacent terrain and vegetation would screen most of the associated disturbances. Where visible, the geometric formation and sharp color contrasts as a result of the Yellow Pine pit would strongly contrast with surrounding natural topography; however, during and after operations, the pit would be filled with development rock, and reclaimed. Color contrast associated with untreated development rock is anticipated to be strong, and would appear light tan in color, which is more uniform in appearance than the surrounding undisturbed landscape, which is primarily dark green.

Because the Operations Area Boundary would not be visible along most of the Stibnite Road (CR 50-412), overall long-term visual contrast associated with road improvements would be low to moderate and remain subordinate to viewers along this travel route. Although minimized through design features, nighttime lighting would be perceptible to travelers from both the 2021 MMP and mine-related traffic on the road. The impacts visible from KOP 4 would alter the experience of individuals traveling on the road by transforming the surrounding setting to a more industrial-like landscape. The emissions plume would be visible from KOP 4.

The limestone crushing plant could be visible from KOP 4 in the middleground once vegetation present in the foreground is cleared. Mine activity associated with the Yellow Pine pit would be present in the foreground between KOP 4 and the limestone crushing plant; therefore, activities associated with the Yellow Pine pit would dominate the views from KOP 4 so that activity and long-term effects associated with the limestone crushing plant would be subordinate. Impacts at KOP 4 during construction and operations would be long term, moderate, and localized.

At closure, Stibnite Road (CR 50-412) would be fully re-opened to the public and reclaimed close to existing conditions except for the new segment through the reclaimed Yellow Pine pit and SGP. Permanent contrast would be reduced to moderate-strong over time, as color contrasts of the backfilled Yellow Pine pit would gradually diminish through reclamation and revegetation. For areas where revegetation is not possible, in geologic time (i.e., millions of years), weathering would reduce the contrast but, in any human-type context, the change would be permanent because of the coloration and angular nature of the granitic rock against more surficial sedimentary type rocks. Night skies would appear as they did prior to the implementation of the 2021 MMP.

Access Roads

The primary features relevant to scenic resources for access road infrastructure related to the 2021 MMP include the Burntlog Route, Riordan Creek Segment (approximately 5.3-mile segment); Public Access via Stibnite Road to Thunder Mountain Road Link (12-foot-wide gravel road to connect Stibnite Road (CR 50-412) to Thunder Mountain Road [FR 50375]); and Soil Nail Walls (approximately 1.5 miles of soil nail walls constructed).

The viewshed analysis (Appendix C of the SGP Scenic Resources Specialist Report [Forest Service 2022n]) indicates that the Burntlog Route would be visible from seven KOPs: KOP 1, 2, 4, 9, 10, 12, and 13. The 2021 MMP components described in the list above would result in very similar visual changes to the characteristic landscape as viewed from KOP 4. These components would not be visible from KOPs 1, 2, 9, 10, 12, and 13; and effects would appear as described below. Visibility would generally extend up to 2 to 3 miles to the east of the Burntlog Route and less than 1 mile to the west. The route also could be visible from a ridgeline about 5 to 7 miles west, although due to distance, visual contrast would be weak. Upon further detailed review, the Burntlog Route would not be visible from KOP 2 because of topographic and vegetation screening; therefore, KOP 2 is not discussed further in this section.

Effects to the Characteristic Landscape

Construction activity associated with the Burntlog Route would introduce short term visual contrast. Mine traffic would use existing roads (Warm Lake Road [CR 10-579], Johnson Creek Road [CR 10-413], and Stibnite Road [CR 50-412]) to access the mine year-round until construction of the Burntlog Route and the linkage between Stibnite Road (FR 50412) and Thunder Mountain Road (FR 50375) are complete. Warm Lake Road (CR 10-579) does not require improvements to accommodate mine traffic during construction and would continue to be used throughout operations; therefore, short-term visual impacts associated with those roads would be limited to increased construction traffic and associated dust. It would be plowed year-round rather than seasonally groomed for snow machines.

Johnson Creek Road (CR 10-413) and Stibnite Road (CR 50-412) would require improvements, including ditching, culvert repair, graveling, and winter snow removal, to support the increased road use during construction. No widening or changes to the Johnson Creek Road alignment would occur under the 2021 MMP; although a groomed winter route would be added which would add movement to the winter landscape and additional winter viewer platform in this area. Additional tree clearing may be needed to support temporary winter maintenance activities along these roads until Burntlog Route is open to use. Construction activity on the Riordan Creek segment of the Burntlog Route and the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 502375) link would have the same type of impacts to the landscape. Increased construction traffic, dust, grading, ditching, and vegetation removal would occur. Short-term visual contrast associated with maintenance activities, vegetation removal, and winter plowing would be low because the level of visual change would be similar to existing conditions. Impacts would be short term, localized, and moderate.

During operations, long-term visual effects associated with improvements to Burnt Log Road (FR 447) would occur from Landmark to Trapper Flat, which would require grading and removal of vegetation to accommodate a travel width of 20 feet and total width of up to 26 feet (but less in some locations), including shoulders. Road modifications such as side-ditching, culverts, guardrails, and bridges may be upgraded and added to accommodate the expanded road width and stream crossing considerations. Grading improvements and vegetation removal would result in similar form, line, color, and texture of the existing road and disturbed areas associated with dispersed recreation activities. Similar to the existing portion of Burnt Log Road (FR 447), upgrades required along the portion of Thunder Mountain Road (FR 50375) between the worker housing facility and the mine entrance gate would require upgrades to existing access, including grading, vegetation removal, and upgrade of road structures.

During operation of the mine, the Burntlog Route would be routinely maintained, including grading (as needed), spot graveling, dust control, and snow removal in the winter. Mine operation would create traffic to the SGP from buses, vans, trucks, and personal vehicles throughout mine operations The presence of mine traffic on this route would introduce movement into the characteristic landscape, which for the new portion of the Burntlog Route is primarily roadless. In addition, the presence of vehicles on the road at night would introduce new lighting into the landscape.

The Riordan Creek segment of Burntlog Route and the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would result in changes to the characteristic landscape similar to the other upgraded section of Burnt Log Road, and appear as flat to sloping, smooth, light-brown linear forms through the landscape; and appear consistent with other existing roads in the area. The presence of vehicles on these routes would introduce movement to the landscape, and also provide access in an area with no current road access.

The Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would provide access to and through the SGP and provide a viewer platform from which the 2021 MMP can be viewed. Viewers traveling along the public access road through the SGP would experience close-up, transient, head-on, and peripheral views of large machinery, movement, exposed soil and rock, and other mine-related equipment and infrastructure that would appear as an industrial landscape within the greater forested setting of the PNF and BNF. Soil nail walls would result in strong visual contrast. A 140-foot-tall road cut

near the SGP would introduce a large, smooth light-colored surface above the road that would sharply contrast with the natural, variable lines and forms of the surrounding landscape.

New segments of the Burntlog Route would introduce approximately 15 miles of new road that would be a viewing platform for areas of the forest, providing views to portions of the forest that are not currently afforded any viewing opportunity by a road or trail. Approximately 2 miles of new road would be situated within the viewshed of the SGP in the middleground distance zone.

New construction associated with the Burntlog Route would cross areas managed as Retention, Partial Retention, and Modification VQOs (**Figure 3.20-2**). With the exception of the soil nail walls, access roads would generally conform to the Partial Retention and Modification VQO. Although new and upgraded portions of the access roads could introduce strong visual contrast in some areas, it typically would be limited to the immediate foreground as viewed from the road introducing the contrast and would appear subordinate from other viewing platforms. New access roads would not be consistent with the Retention VQO as they would introduce new lines, colors, and textures that would be evident. Impacts would be long term, localized, and moderate to major.

Upon closure and reclamation of the SGP, upgraded portions of Burnt Log Road (FR 447) would be reclaimed to existing conditions, and new portions of the Burntlog Route would be removed from use and reclaimed. Soil nail walls and the 140-foot-tall road cut near the SGP are proposed to remain in place after decommissioning and their appearance would continue to introduce strong visual contrast with the surrounding landscape as described above. Post-mine closure, traffic would likely return to a pre-mining level of use. Permanent visual contrast to the characteristic landscape generally would be minimal to moderate because the road would be returned to its previous width although the flatter grades and smoother curves would be retained. Changes to the landscape from removal of mature vegetation would remain evident for several years after reclamation activities. The remaining soil nail walls would be an exception; these areas would introduce strong visual contrast; however, the geographic extent of these changes would be localized. The Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would be reclaimed, and those areas would appear similar to the reclaimed areas of Burnt Log Road (FR 447). Impacts would be permanent, localized, and minor to moderate.

Effects by Key Observation Point

KOP 1: Meadow Creek Lookout

Short-term, construction-related impacts visible from KOP 1 would be associated with mine traffic construction activities along Burnt Log Road (FR 447), which would include increased movement from construction traffic and associated dust. These impacts would appear subordinate to viewers compared with the SGP.

Portions of Burntlog Route would be visible from KOP 1 when looking south. The light-tan color and straight horizontal line introduced by the new roadway portion of the Burntlog Route would introduce a visual contrast against the darker surrounding colors, undulating ridgelines, and variable textures of the vegetation covered terrain. Construction and operations impacts would be long term, localized, and negligible to minor.

After closure and reclamation, permanent visual contrast would be non-visible to weakly visible as viewed from KOP 1, because the portion of Burntlog Route visible from the KOP would be reclaimed to existing conditions.

KOP 4: Stibnite Road (CR 50-412)

Under the 2021 MMP, the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would begin at KOP 4. From KOP 4, construction activity associated with road construction would be visible in the foreground, including construction traffic, equipment, dust, and movement of equipment and construction workers.

From KOP 4, the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would travel north through the SGP and appear as a flat to sloping, smooth, light brown linear form traversing the landscape. Although the linear form and light color would contrast with the natural surroundings, it would appear consistent with other existing roads in the area that are visible from KOP 4. Impacts would be long term, localized, and minor.

KOP 9: Frank Church-River of No Return Wilderness

Visibility is primarily screened by existing vegetation and intervening topography. During construction activities, weak short-term visual contrast could be experienced from KOP 9. Construction equipment would be difficult to discern at this distance; however, dust and construction activities along the route may be visible. The impacts experienced from KOP 9 would have little to no impact on the overall user experience of the wilderness.

The increased width of the existing road would increase visual contrast, primarily associated with the expanded width of light-colored ground exposed as a result of the road widening. Visual contrast would appear weak from KOP 9 as the landscape already appears lighter in color than other surrounding areas due to the effects of past fires in the area. The improvements to Burnt Log Road (FR 447) would appear subordinate to the large-scale surrounding landscape that would absorb the visibility of these changes to the landscape. The new roadway would not be visible from KOP 9. Impacts would be long term, localized, and negligible.

After closure and reclamation, permanent visual contrast would be non-visible to weakly visible as viewed from KOP 9 because the portion of improved Burnt Log Road (FR 447) visible from the KOP would be reclaimed to existing conditions. Due to screening from vegetation and intervening topography and location within a previously burned area, changes to the landscape from removal of mature vegetation would likely not be evident.

KOP 10: Burnt Log Road (FR 447)

Burnt Log Road would be widened and graded to accommodate SGP traffic under the 2021 MMP. Short-term visual contrast from KOP 10 would result from construction activities associated with improvements along Burnt Log Road (FR 447). Construction traffic, equipment, and staff would be evident from this travel route during pre-production. The resulting level of short-term visual contrast would be moderate for receptors due to unobstructed views of construction activities in the foreground. The impacts visible from

KOP 10 would alter the experience of individuals traveling on the road by transforming the surrounding setting to a more industrial-like landscape.

Access road improvements along the existing portion of Burnt Log Road (FR 447) from Landmark to Trapper Flat would require grading and removal of vegetation to accommodate a total travel width of 20 feet and total width of up to 26 feet (but less in some locations), including shoulders. Removal of vegetation would result in moderate color and line contrasts at the road edges. These contrasts would be less strong for portions of Burnt Log Road (FR 447) that are affected by historical fires. Dead or felled trees would be removed, along with low-lying vegetation, resulting in a low to low-moderate level of visual contrast. Landform changes and color contrast associated with new disturbance, where widening or cut/fill is necessary, would contribute to a moderate level of visual change.

Visual impacts, although likely minor, would occur from the introduction of structural components such as culverts, guardrails, and bridges that may be upgraded or added to accommodate the expanded road width. Improved access would introduce a moderate level of visual change to existing form, line, and color; however, Burnt Log Road improvements would remain visually co-dominant to sensitive viewers on the road. During operation of the mine, Burntlog Route would be routinely maintained, including grading (as needed), spot graveling, dust control, and snow removal in the winter. Mine operations would generate traffic to the mine site from buses, vans, trucks, and personal vehicles throughout mine operations. When traveling on the road at night, these vehicles would introduce new lighting into the landscape. The impacts visible from KOP 10 would alter the experience of individuals traveling on the forest road by transforming the surrounding setting to a more industrial-like landscape. Construction and operations impacts at KOP 10 would be long term, localized, and moderate.

Upon closure and reclamation of the mine site, upgraded portions (except segments abandoned at the beginning of construction, which would have been currently reclaimed with construction activities) of Burnt Log Road (FR 447) would be reclaimed to existing conditions. At mine closure, traffic would likely return to a pre-mining level of use. Permanent visual contrast at KOP 10 would be minimal to low-moderate, because the road would be returned to existing conditions with an assumed low-traffic volume. Changes to the landscape from removal of mature vegetation would remain evident for several years after reclamation activities.

KOP 12: Mud Lake Dispersed Camping Area

Short-term visual contrast from this viewpoint would result from construction activities associated with improvements along Burnt Log Road (FR 447) within 100 feet of this site. Construction traffic, equipment, and staff would be evident from this area. The resulting level of short-term visual contrast would be moderate and localized for receptors due to views of construction activities in the foreground. The presence of heavy machinery and construction workers, and associated movement, would change the mostly natural setting viewed from KOP 12 to a more industrial-type setting, which would change the experience for viewers using the Mud Lake Dispersed Camping Area at KOP 12; campers would likely not use the site during construction due to visual and noise disruptions.

Access road improvements along Burnt Log Road (FR 447) near Mud Lake would require grading and removal of vegetation to accommodate a total road width of up to 26 feet, including shoulders. Grading

improvements and vegetation removal would result in similar form, line, color, and texture as the existing road. Landform changes and color contrast associated with new disturbance, where widening or cut/fill is necessary, would contribute to a minor to moderate level of visual change, because the site is relatively flat. Noticeable contrast would result from vegetation removal along the road. At this location, vegetation is densely wooded with thick understory vegetation. Removal would result in moderate color and line contrasts at the road edges.

Structural components such as culverts or guardrails may be upgraded or added to accommodate the expanded road width. Improved access would introduce a moderate level of visual contrast to existing form, line, and color; however, Burnt Log Road (FR 447) improvements would remain visually co-dominant to sensitive viewers at this dispersed camping area. During operation of the mine, Burntlog Route would be routinely maintained, including grading (as needed), spot graveling, dust control, and snow removal in the winter. Mine operation would create traffic to the mine site from buses, vans, trucks, and personal vehicles throughout mine operations. The presence of vehicles on this road at night would introduce new lighting into an area that has no permanent lighting sources. These impacts could result in some campers choosing to camp in other dispersed camping areas that have not been visually impacted, particularly night sky impacts.

Upon closure and reclamation of the mine site, upgraded portions of Burnt Log Road (FR 447) would be reclaimed to existing conditions (except segments abandoned at the beginning of construction, which would have been currently reclaimed with construction activities). At mine closure, traffic would likely return to a pre-mining level of use. Permanent visual contrast to the characteristic landscape would be minor to moderate because the road would be returned to existing conditions with an assumed low-traffic volume. Upon closure and reclamation of the mine site, upgraded portions of Burnt Log Road (FR 447) would eventually be reclaimed similar to existing conditions; although removal of mature vegetation would remain visually noticeable for many years after closure and reclamation activities are complete.

KOP 13: Warm Lake Road (CR 10-579)

Short-term visual contrast perceptible to travelers on Warm Lake Road (CR 10-579) would result from construction of the Burntlog Route. Construction traffic, equipment, and staff would be evident from this travel route during construction. The resulting level of short-term visual contrast would be moderate and localized for receptors due to views of construction activities in the foreground. The impacts visible from KOP 13 would alter the experience of individuals traveling on the road by transforming the surrounding setting to a more industrial-like landscape.

Access road maintenance and use along the existing Burnt Log Road (FR 447) near KOP 13 would be similar to those described above for KOP 12; therefore, visual impacts also would be similar. However, visual contrast introduced by improvements to Burnt Log Road (FR 447) would be weak as viewed from KOP 13 and associated visual changes would appear subordinate in the landscape. The impacts visible from KOP 13 would alter the experience of individuals traveling on the road by transforming the surrounding setting to a more industrial-like landscape.

After closure and reclamation, due to limited visibility of Burnt Log Road (FR 447) from Warm Lake Road (CR 10-579), visual changes from access road improvements would not be evident from KOP 13 after mine closure and reclamation.

Utilities

The viewshed analysis (Appendix C of the Scenic Resources Specialist Report [Forest Service 2022n]) indicates that utilities would be visible from 12 KOPs, where detailed analyses were performed: KOP 1, 2, 3, 5, 6, 7, 8, 9, 14, 15, 16, and 17 (**Figure 3.20-1**). Visibility is generally limited to a couple of miles on either side of the transmission line but does extend to some ridgelines 5 miles or more to the west. Potential visibility of the transmission line in the valley extends to about 5 miles on either side, although visual contrast would be weak due to distance and less vegetation removal required in these areas. Communications towers are not expected to be visible from the KOPs.

Effects to the Characteristic Landscape

Visual impacts associated with short-term activities include increased contrast during construction of the transmission line. Construction vehicles, equipment, and staff would be present along this corridor, which would be visible to viewers in the foreground. Short-term visual contrast during construction would be minor to moderate because these activities would occur intermittently along the ROW over a short duration of time. Construction-related changes to the landscape would not be visible from the Thunder Mountain Estates subdivision.

Upgrading the transmission line to a 138-kV facility would require widening the existing ROW from 70 feet to a total width of 100 feet. The new upgraded structures would be approximately 30 feet taller, with an estimated maximum height of 80 feet and spans ranging between approximately 300 to 600 feet, depending on the type of structure. Long-term visual contrast would primarily result from line and color where the expanded ROW would require additional vegetation removal. Visual changes associated with widening the ROW would reinforce the existing linear form of the ROW edge, resulting in a bolder, geometric, man-made element in this rugged natural landscape. Residents of the Thunder Mountain Estates subdivision would not have foreground views of the upgraded transmission line. The level of visual change would be moderate to high where tree clearing would occur in densely wooded areas with steep terrain due to grading or exposing lighter-colored rock. The taller replacement structures would result in minor to moderate structural contrast for the existing transmission line, and moderate when introducing new structures into an existing ROW. Access for construction and maintenance of the transmission line would occur in the existing ROW, including conductor-stringing vehicles, construction trucks, and equipment. Long-term visual contrast would range from minor to moderate when replacing existing structures in less steep terrain with minimal vegetation removal, to moderate to major where a new transmission line would be introduced in steep terrain with dense vegetation.

The new 8.5-mile-long 138-kV transmission line segment and associated 100-foot-wide ROW would introduce a light-colored line clear of vegetation across the landscape. This linear feature would contrast with the surrounding rugged landscape composed of irregular lines and vegetated, mounded, and triangular landforms carpeted with dark colored mature evergreens and lighter understory. The consistent form, line, and color of the ROW would introduce strong long-term contrast with the variable natural

surrounding landscape. Impacts associated with the new segment would be long term, localized, and moderate to major.

Substation facilities that would be upgraded or introduced into the characteristic landscape would result in long-term, localized visual contrast. For most substations, upgrades would require grading or improvement of land, and clearing vegetation. A new switching station in Cascade would be required on flat terrain occupied by low-lying vegetation, including grasses and shrubs. The level of visual change at this site would primarily be associated with the structural features of the facility, as well as a small area of grading and vegetation removal. Grading activities and vegetation removal would create minimal color and form contrasts with the existing landscape. The visual contrast introduced by the switching station would not be visible from the Thunder Mountain Estates subdivision. Long-term visual contrast to the characteristic landscape in Cascade would be localized and minor to moderate, primarily due to structural contrast.

A new substation, the Scott Valley substation, would be required to support the SGLF in Scott Valley, which is characterized by flat to slightly rolling terrain and low-lying vegetation. The Warm Lake substation would require an upgrade of switchgear facilities, but no additional ground disturbance or vegetation clearing would occur at this site. The existing location has already been modified by local access roads, vegetation clearing, or thinning near the facility; therefore, long-term visual contrast would be negligible due to additional structural contrasts associated with the upgrade. A new Thunderbolt Drop along Cabin Creek Road (FR 447) also would be necessary and would be built under the transmission line and stay within the line ROW FR 447 currently serves as the access road for the existing transmission line corridor and has been modified by vegetation removal and grading at pole locations. Additional grading and vegetation clearing would likely occur, resulting in minor to moderate, localized, long term visual contrast where lighter colored rocks and soil may be exposed, and dense vegetation removed. A new substation (Johnson Creek) would be required along Johnson Creek Road (CR 10-413) near the new transmission line corridor that heads east to the SGP. Similar to FR 447, the terrain is rough, and occupied by dense vegetation. Grading and vegetation clearing would result in moderate visual contrast. The introduction of structures in this landscape setting would result in localized, moderate, and long-term visual contrast due to existing modifications associated with the transmission line corridor.

A new transmission line would cross areas managed as Retention and Partial Retention and upgraded transmission lines would cross areas managed as Preservation, Retention, and Partial Retention (**Figure 3.20-2**). Generally, new transmission lines would not meet the Preservation, Retention, or Partial Retention VQO but would meet the Modification VQO. The line, color, form, and texture of the ROW would visually dominate the landscape but would not be out of scale with the natural surroundings. These effects would be visible from the following viewer platforms in the foreground and middleground distance zones: Johnson Creek Road (CR 10-413), Burntlog Route (new segment), and the Meadow Creek Lookout.

The upgraded transmission line would remain in service after mine closure along with several of the new and/or upgraded substations. Therefore, long-term effects described above would remain until IPCo completely decommissions the line and associated substations. The new transmission line segment would eventually be decommissioned, removed, and the ROW reclaimed. However, it would take years for the ROW to revegetate with trees. Impacts would lessen over time and eventually become negligible.

Effects by Key Observation Point

KOP 1: Meadow Creek Lookout

The new transmission line would be built approximately 2 miles north of KOP 1. Short-term effects to the landscape associated with the new transmission line, such as vehicle movement and dust, would not be evident to viewers from KOP 1.

The cleared ROW for the new transmission line would appear as a light-colored, thin band following the ridgeline. The light-colored line would create a strong level of contrast against the rugged, vegetation-covered hillside. Although visually evident, it would appear subordinate to the TSF that would dominate the landscape in the valley floor. The proposed communication tower located at the mine site also would be visible from this location.

KOP 2: Frank Church-River of No Return Wilderness – Summit Trail (NFST 088)

The new transmission line would be built approximately 5 miles north of KOP 2. Visibility would be limited due to distance and intervening topography. Distinct shapes and features are difficult to distinguish at distances of 5 miles and the scale of the landscape also would absorb modifications introduced by the construction of the transmission line. Short-term effects to the landscape associated with the new transmission line, such as vehicle movement and dust, would not be evident to viewers from KOP 2.

Long-term visual effects from the linear, light-colored cleared ROW and transmission structures associated with the new transmission line would not be evident from KOP 2 and would not affect user experience of Summit Trail (NFST 088) in the FCRNRW. The viewshed indicates that the upgraded communication tower located at the mine site would be visible from this location; however, due to distance it would likely not be visually evident.

KOP 3: Frank Church-River of No Return Wilderness – Mule Hill Trail (NFST 219)

The new transmission line would be built approximately 5 miles northwest of KOP 3. Visibility would be limited due to distance and intervening topography. Distinct shapes and features would be difficult to distinguish at distances of 5 miles and the scale of the landscape also would absorb landscape modifications introduced by the construction and operation of the transmission line and associated ROW. Short-term effects to the landscape associated with the new transmission line, such as vehicle movement and dust, would not be evident to viewers from KOP 3.

Long-term visual effects from the linear, light-colored ROW and transmission towers associated with the new transmission line would not be evident from KOP 3 and would not affect user experience of Mule Hill Trail (NFST 219) in the FCRNRW. The viewshed indicates that the upgraded communication tower located at the mine site would be visible from this location; however, due to distance it would likely not be visually evident.

KOP 5: Hennessey Meadow Trailhead

A new transmission line corridor would parallel FR 416W (Horse Heaven Road) and NFST 233 to the SGP. Construction vehicles, equipment, and staff associated with construction of the new transmission line would be visible to trailhead viewers in the foreground. Short-term visual contrast during construction would be minor to moderate because these activities would occur intermittently along the ROW over a short duration. However, while they are occurring, these activities would disrupt the natural setting of the landscape, making it appear and feel more industrial due to construction equipment and activity in the foreground.

The results of the viewshed analysis show that due to surrounding terrain, visibility of the new transmission line route would be limited locally. The characteristic landscape is highly constrained by steep mountainous terrain that creates an enclosed setting in which long-term visual contrast would be visible. Long-term contrast would primarily result from line and color changes where expansion of the ROW required vegetation removal. Vegetation in the existing ROW would be removed, as well as additional vegetation as required would be cleared to a total width of 100 feet. Grading would be necessary at structure locations, as well as the ROW access road. Moderate to major structure contrast would result from strong vertical lines, dark brown colors, and smooth texture of new transmission line structures. New structural contrast, landform grading, and vegetation removal would result in moderate to major visual contrast due to steep terrain and dense vegetation. Visual changes associated with widening the ROW would reinforce the existing linear form of the ROW edge, resulting in a bolder, geometric, man-made element in this rugged natural landscape. Resulting localized, long-term visual contrast would be moderate to major, which would be minimally screened, and viewed in the immediate foreground. The transmission line and associated ROW would affect the naturalness of the landscape at the trailhead; however, because it would primarily only be visible locally at the trailhead, it is not expected to have a major effect to users' experience of the trail.

KOP 6: Twin Bridges Dispersed Camping Area

Short-term visual contrast from this viewpoint would result from construction activities for the transmission line upgrade. Construction traffic, equipment, and staff would be evident from this site during construction, resulting in short-term minor to moderate visual contrast due to unobstructed views of construction activities in the foreground as viewed from KOP 6. It is likely that construction activities would discourage use of the camping area at least in the short term.

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures. The results of the viewshed analysis show that due to surrounding terrain, visibility of the new transmission line route would be limited locally.

Expansion of the transmission line ROW at this location would be highly constrained due to the proximity of the dispersed camping area to Johnson Creek and Johnson Creek Road (CR 10-413). The widened ROW would appear co-dominant for viewers at this moderate-sensitivity dispersed camping area due to scale dominance. Similar form and line would be replicated along the existing transmission line corridor, resulting in a moderate level of visual change that would be evident to viewers in the foreground. Terrain in this area is relatively flat; therefore, landform changes associated with grading and

creating improved access at the campsite would result in a moderate, localized level of visual contrast. Visual contrast would primarily result from removal of tall vegetation; and for viewers at the camping area, may completely eliminate existing trees that partially screen the existing transmission line. Overall, the long-term level of visual change would be moderate as a result of the wider corridor and would affect user experience at the dispersed camping area.

KOP 7: Idaho Centennial Trail at Johnson Creek Road (CR 10-413) and Burntlog Creek Trail (NFST 075)

Visual contrast at KOP 7 associated with short-term activities includes construction of the transmission line. Construction vehicles, equipment, and staff would be present along this corridor, which would be visible to viewers in the foreground. Short-term visual contrast during construction would be minor to -moderate because these activities would occur intermittently over a short duration. The presence of heavy machinery and construction workers, and associated movement, would change the rural setting viewed from KOP 7 to a more industrial-type setting, which would change the experience for viewers using the ICT at KOP 7.

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures. Expansion of the transmission line ROW at this location would cross very steep terrain above Johnson Creek Road (CR 10-413) at the junction of NFST 075 (ICT). The widened ROW would appear co-dominant for viewers due to scale dominance. Similar form and line would be replicated along the existing transmission line corridor, resulting in a moderate level of visual change that would be evident to viewers in the foreground. Visual contrast would primarily result from landform grading at the structure pad sites, additional removal of tall vegetation, and introduction of larger structures. The widened corridor ROW would enhance the existing linear form of the ROW edge, resulting in a bolder, geometric, man-made element in this rugged natural landscape. Long-term contrast would be moderate for recreational users due to unobstructed inferior (viewed from below) views in the foreground. Despite these visual changes, user experience would be similar to existing conditions, because a transmission line is currently visible from KOP 7. A simulation from this KOP is provided in Appendix A of the Scenic Resources Specialist Report (Forest Service 2022n).

KOP 8: Trout Creek Campground

Short-term visual contrast from this viewpoint would result from construction activities for the transmission line upgrade. Construction traffic, equipment, and staff would be evident from this site, resulting in short-term minor to -moderate visual contrast due to unobstructed views of construction activities in the foreground, as viewed from KOP 8. While construction activities are occurring, they would disrupt the natural setting of the landscape at the campground, appearing industrial due to construction equipment and activity in the foreground. It is likely that construction activities would discourage use of the campground at least in the short term.

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures. The widened ROW would appear co-dominant for viewers at this high-sensitivity campground due to scale dominance. Similar form and line would be replicated along the existing transmission line corridor, resulting in a moderate, localized level of visual change that would be

evident to viewers in the foreground. Terrain in this area is moderate to steep, and upgrades along the ROW may include changes to landform due to grading and exposure of lighter-colored rock. The potential expansion of the ROW at this location could partially or completely eliminate existing trees that screen the current transmission line for sensitive viewers. The widened ROW would enhance the existing linear form of the ROW edge, resulting in a bolder, geometric, man-made element in this rugged natural landscape. Overall, the level of visual change would be moderate due to form and line created by the wider corridor. ROW clearing would remove vegetation screening, resulting in moderate long-term visual contrast to campground viewers in the immediate foreground. These long-term changes would affect user experience at the campground and may deter some recreationists from using it.

KOP 9: Frank Church-River of No Return Wilderness – Pistol Lake

Viewshed modeling indicates that short-term visual contrast from this viewpoint could result from construction activities for the transmission line upgrade. However, due to distance and intervening terrain, visual contrast would be weak to none. Existing vegetation also would limit visibility as long as it is present.

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures. The widened ROW and new transmission structures would appear subordinate in the background due to distance as well as partial screening from intervening topography and vegetation. User experience would be similar to existing conditions since visual change would be low. Impacts would be localized, long term, and negligible.

KOP 14: Cabin Creek Road (FR 467)

Short-term visual contrast from this viewpoint would result from construction activities for the transmission line upgrade. Construction traffic, equipment, and staff would be evident from this site during construction, resulting in short-term minor to moderate visual contrast due to unobstructed views of construction activities in the foreground, as viewed from KOP 14. Based on the results of the viewshed analysis, visibility of the transmission line corridor along FR 467 would be localized due to steep terrain. While construction activities are occurring, they would disrupt the natural setting of the landscape by adding movement, dust, and construction equipment to the views.

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures. The widened ROW would appear co-dominant for viewers along this travel route due to scale dominance. Similar form and line would be replicated along the existing transmission line corridor, although color contrast may be more evident where rocky outcrops are disturbed, introducing lighter colors. Recreational users would have immediate foreground views of the upgraded transmission line with minimal screening. Removal of existing vegetation and additional clearing along the ROW edge would introduce a moderate level of contrast with existing vegetation. In addition, grading would be necessary at new structure locations and where access improvements are needed for construction and operation equipment. The widened ROW would enhance the existing linear form of the ROW edge, resulting in a bolder, geometric, man-made element in this rugged natural landscape. Structural contrast would be reduced by adjacent terrain, which would backdrop the structures for viewers traveling along this road while parallel to the transmission line. These conditions would result in an

overall long-term moderate level of visual contrast that would be visible to travel route viewers in the foreground. Despite these visual changes, user experience would be similar to existing conditions, because transmission lines already exist and are visible from KOP 14.

KOP 15: South Fork Salmon River Road (FR 474) and Warm Lake Road (CR 10-579)

Short-term visual contrast would include construction activities at the Warm Lake substation and upgrades to the transmission line, including construction vehicles, equipment, and staff. These activities would result in short-term, localized, minor to moderate visual contrast due to unobstructed views of construction activities in the foreground, as viewed from KOP 15. While construction activities are occurring, they would add movement, dust, and additional equipment to the views from SFSR Road (FR 474), which would make the setting appear more industrial compared to the existing rural setting.

Long-term visual contrast would result from landform modifications such as grading and vegetation clearing. The substation upgrade at this site would require no landform modifications or vegetation removal to accommodate additional equipment. Views of the substation would be unobstructed in the foreground. The substation would introduce new structures similar in form, line, and color to the existing transmission line and switchgear but would be larger in size. Facilities would be primarily geometric in form and complex and introduce colors that are more industrial in appearance. These facilities would contrast with the surrounding landscape, which is primarily rural; however, industrial modifications are evident, resulting in a minor to moderate level of structural contrast. Contrast would be minimized by implementing design features that mimic characteristics of the existing landscape, such as the color palette. The site would be large enough to accommodate maintenance vehicles, and these may be visible to sensitive viewers during operation. The perimeter of the substation would be fenced, and nighttime lighting would be required for maintenance activities, introducing sky glow that would impact the integrity of the night sky. Impacts to night sky would be reduced by implementation of design features such as using minimal lighting, directing lights downward, and shielding lights where appropriate.

KOP 16: Stibnite Gold Logistics Facility

Short-term visual contrast would include construction of the transmission line upgrade (and logistics facility described below), including construction vehicles, equipment, and staff. These activities would result in short-term, localized, minor to moderate visual contrast due to unobstructed views of construction activities in the foreground, as viewed from KOP 16.

Long-term visual contrast would result from ROW grading, vegetation removal, and introduction of new transmission line structures and a substation. The widened ROW would appear co-dominant for viewers along Warm Lake Road due to scale dominance. Removal of existing vegetation and additional clearing along the transmission line ROW edge would introduce a moderate level of contrast with existing vegetation. Visual contrast from the building would be minimized by implementing mitigation measures requiring design features that mimic characteristics of the existing landscape, as the color palette. The new SGLF would result in greater changes to the characteristic landscape; therefore, the changes introduced by the upgraded transmission line and new substation would appear less noticeable to viewers.

KOP 17: Lake Cascade Residence

Short-term visual contrast from KOP 17 would result from construction activities for the transmission line upgrade. Construction traffic, equipment, and staff would be evident from this site, resulting in short-term, localized, minor to moderate visual contrast due to unobstructed views of construction activities in the foreground, as viewed from KOP 17. Residents would experience these changes to the landscape as they come and go from their homes.

Expansion of the transmission line ROW at this location would be highly constrained due to the proximity of the residences to the existing structures. Terrain in this area is very flat; therefore, landform changes associated with grading and creating improved access along the ROW would result in a low level of visual contrast. Visual contrast would result from removal of some vegetation; and for residential viewers, may completely eliminate existing trees that currently screen transmission line structures. Vegetation is less dense at the bottom of flat valleys, which is characteristic of the Cascade area. Vegetation clearing along the expanded ROW would not result in strong line or form contrasts, as seen in densely wooded areas. The introduction of taller structures would increase structural contrast; however, the footprint location may change to accommodate a wider span. Visibility of the facility to residences would depend on the locations of the new transmission line structures. However, residents would likely see the transmission line as they come and go from their homes. Based on the simulation from KOP 17, (Appendix A of the Scenic Resources Specialist Report [Forest Service 2022n]**)**, impacts would be long term, localized, and negligible to minor.

Off-Site Facilities

Under the 2021 MMP, off-site facilities would include the Burntlog Maintenance Facility and the SGLF. The maintenance facility would be located along Burnt Log Road (FR 447), 4.4 miles east of the junction of the Johnson Creek Road (CR 10-413) and Warm Lake Road (CR 10-579) along the proposed Burntlog Route. Although the viewshed indicates the proposed maintenance facility would be visible from KOP 12, a closer look at site photographs from KOP 12A indicates that existing vegetation would entirely screen the proposed Burntlog Maintenance Facility from view. Appendix C of the Scenic Resources Specialist Report (Forest Service 2022n) shows the viewshed of the off-site facilities under the 2021 MMP includes site specific photographs from KOP 12.

Effects to the Characteristic Landscape

Short-term visual contrast perceptible to travelers on Burnt Log Road (FR 447) would result from construction of the Burntlog Maintenance Facility, including grading, new buildings, and other facilities. Construction traffic, equipment, and staff would be evident from this travel route, resulting in localized, moderate, short-term visual contrast perceived by receptors due to views of construction activities associated with the maintenance facility.

The Burntlog Maintenance Facility would result in minor to moderate visual contrast where grading, vegetation removal, and construction of facilities would occur. Contrast would be minor to moderate, because the facility would be at a borrow source location, so disturbances from road construction would already be present. Grading and vegetation removal would be minimal (previous disturbance associated with existing borrow area), and consistent with the changes to the landscape that occurred as a result of

Burntlog Route construction. The night sky would be impacted by lighting associated with the maintenance facility, which would contribute to sky glow.

The Burntlog Maintenance Facility would be located in an area managed as Partial Retention (**Figure 3.20-2**). It would meet the Partial Retention VQO as buildings would be constructed using materials and colors that appear in the characteristic landscape. Additionally, due to surrounding vegetation, these facilities would typically not be visible past the foreground distance zone. The SGLF is not within the PNF or BNF, and, therefore, there is no VQO associated with the facility. After reclamation activities have concluded at the SGP, the maintenance facility would be decommissioned and reclaimed to existing conditions. Over time, color contrast would be reduced to a low level of visual contrast once native vegetation becomes established. Permanent visual contrast would be low, and nighttime lighting would return to existing conditions, resulting in negligible permanent visual contrast.

Effects by Key Observation Point

KOP 16: Stibnite Gold Logistics Facility

The SGLF in Scott Valley would be constructed on an area of private land that is primarily undisturbed in a landscape with minimal structures. The 25-acre site footprint would extend along Warm Lake Road (CR 10-579) in flat to slightly rolling terrain with low-lying vegetation. Short-term visual contrast perceptible to travelers on Warm Lake Road (CR 10-579) would result from construction of the facility, including grading and introduction of buildings and other facilities. Construction traffic, equipment, and staff would be evident from this travel route. The resulting level of short-term, localized visual contrast would be moderate for receptors due to views of construction activities in the foreground.

Long-term visual contrast would primarily result from size and scale of the structural facilities at this site. Slight modifications to landform may be evident, and vegetation would be cleared in the majority of the site footprint. A 199-foot communications tower would be constructed at or near the facility to provide telephone, internet, and radio communications. It would introduce strong visual contrast due to its tall, vertical, linear form and smooth texture. However, impacts would be limited to within approximately 1 mile as surrounding topography would block it from view any distance farther than 1 mile.

These structural contrasts would introduce a localized, long-term, moderate to major level of visual change that would appear dominant to viewers on Warm Lake Road. Trucks, buses, and cars related to operations at this facility also would be evident to Warm Lake Road viewers, which would contribute to the dominance of this facility. Views of the facility would be viewed in the immediate foreground for high-sensitivity travel route viewers on Warm Lake Road. Additional nighttime lighting would be introduced at this facility, which would contribute to sky glow in an area where existing nighttime lighting is minimal; limited to the few residences in Scott Valley.

After closure of the mine, the SGLF would not be reclaimed and it would be made available for other light industrial uses. Permanent visual contrast would be high, and nighttime lighting would likely remain, resulting in permanent visual impacts.

4.20.2.3 Johnson Creek Route Alternative

Only impacts that differ from the 2021 MMP are discussed below. The viewshed and simulations of the Johnson Creek Route Alternative are provided in Appendix A of the SGP Scenic Resources Specialist Report (Forest Service 2022n).

Operations Area Boundary

Effects to the Characteristic Landscape and KOPs would be the same as those described under the 2021 MMP.

Access Roads

Under the Johnson Creek Route Alternative, the Burntlog Route would not be used for mine access; therefore, no road upgrades or new road segments would be constructed for that route. Therefore, the visual impacts associated with Burntlog Route would not occur under the Johnson Creek Route Alternative. However, visual impacts would occur as a result of the upgrades to, and year-round mine use of, the Johnson Creek Route.

A new road linking Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375), providing public access through the SGP, would occur under the Johnson Creek Route Alternative. The visual impacts would be the same as those described for the 2021 MMP (**Section 4.20.2.2**).

Effects to the Characteristic Landscape

Short-term visual effects associated with construction activities under the Johnson Creek Route Alternative would occur as a result of upgrades to the Johnson Creek Route. Major road widening and/or straightening of curves, with associated cut and fill, would be required for the Johnson Creek Road (CR 10-413) portion of the Johnson Creek Route. Construction of retaining walls and culverts would require vegetation removal and would expose large areas of native soil and rock that would visually contrast with surrounding vegetation and the rugged, varied topography. Further, traffic along the road from construction vehicles and equipment for widening the Stibnite Road portion of the route would introduce additional movement and dust from vehicle traffic along Johnson Creek Road compared to existing conditions. Because reconstruction of both roads would need to be completed prior to facilities construction at the SGP, construction activities and related traffic would extend to 5 years. Visual impacts from construction activities and related traffic would be long term, localized, and moderate to major.

Short-term impacts associated with the road linking Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) would be similar to those described for the 2021 MMP (**Section 4.20.2.2**). The Stibnite Road portion of the route would be improved by widening curves to accommodate 55-foot semi-truck trailers. Construction of retaining walls and culverts would require vegetation removal and would expose large areas of native soil and rock that would contrast with surrounding vegetation and rugged, varied topography. During road construction and improvement activities, there would be an increase in construction traffic, equipment, and associated movement, and generation of dust.

During operations, there would be minor to moderate long-term visual impacts to the characteristic landscape associated with the Johnson Creek Route Alternative, because the widened and straightened

roads would visually contrast with the topography. Modifications to landform would be evident, and vegetation would be cleared along the roadway. New access road construction through the SGP would appear as flat to sloping, smooth, light-brown linear forms through the landscape, and appear consistent with other existing roads in the area and would be visible from KOP 4. The presence of vehicles on these routes would introduce movement to the landscape, and also provide access in a previously primarily roadless area.

The Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would provide a new viewer platform from which the SGP can be viewed. The Johnson Creek Route would consist of all existing roads; therefore, the level of visual change introduced to the landscape would be lower than that experienced as a result of the Burntlog Route under the 2021 MMP. Upgrades to both Johnson Creek and Stibnite roads would increase the level of visual contrast from the road due to road widening and straightening, as well as retaining walls that would transform the existing line and form along the road from a natural, vegetated slope to smooth, lighter-colored man-made walls.

The new road would cross an area managed as Partial Retention and road upgrades would cross areas managed as Retention and Partial Retention (**Figure 3.20-2**). With the exception of the retaining walls, access roads would generally conform to the Partial Retention VQO. Although new and upgraded portions of the access roads could introduce strong visual contrast in some areas, it typically would be limited to the immediate foreground as viewed from the road and would appear subordinate from other viewing platforms.

The types of permanent visual effects associated with the Johnson Creek Route Alternative would appear similar to those described under the 2021 MMP, although these effects would be in different locations. However, the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would not be reclaimed, and those areas would have permanent increased visual contrast on the landscape due to the presence of the new road segment. This also would provide a permanent viewing platform along the route.

Johnson Creek and Stibnite roads would not be returned to the pre-mine width, and the retaining walls, and culverts would remain after mine closure and reclamation activities have ceased. Therefore, the visual impacts associated with the Johnson Creek Route would remain as permanent impacts.

Effects by Key Observation Point

KOP 1: Meadow Creek Lookout

Construction and operations activity and traffic associated with the Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) link would be visible from KOP 1 but would largely be absorbed by the larger, more visually evident activity associated with the SGP that would appear dominant.

KOP 4: Stibnite Road (CR 50-412)

Under the Johnson Creek Route Alternative, visual impacts at KOP 4 would be the same as described under the 2021 MMP.

KOP 6: Twin Bridges Dispersed Camping Area

Short-term visual contrast from this viewpoint would result from road construction activities. Construction traffic, equipment, and staff would be evident from this viewpoint during construction, resulting in short-term minor to moderate visual contrast due to unobstructed views of construction activities in the foreground as viewed from KOP 6. It is likely that construction activities would preclude use at times and discourage use of the camping area at least in the short term.

Expansion of the roadway at this location would be highly constrained due to the proximity of the dispersed camping area to Johnson Creek. The widened roadway would appear co-dominant for viewers at this moderate-sensitivity dispersed camping area due to scale dominance. Similar form and line would be replicated along the roadway, resulting in a moderate level of visual change that would be evident to viewers in the foreground. Terrain in this area is relatively flat; therefore, landform changes associated road upgrades would result in a moderate, localized level of visual contrast. Overall, the long-term level of visual change would be moderate as a result of the wider road and would affect user experience at the dispersed camping area. Long-term, localized, moderate visual contrast would result from landscape modifications due to widening and straightening of the road.

KOP 7: Idaho Centennial Trail at Johnson Creek Road (CR 10-413) and NFST 075

KOP 7 represents views from the ICT directed west. This trail is identified as a sensitive level 1 use area and is associated with high visual sensitivity. Short term construction activity would include road grading and vegetation clearing on Johnson Creek Route near the trailhead to accommodate heavy vehicle mine traffic. Grading and construction equipment used for these activities would generate dust during dry weather that would be visible during the daytime. Impacts during construction would be similar to those described under KOP 6.

Johnson Creek Road (CR 10-413) would be plowed for year-round use under the Johnson Creek Route Alternative, and vegetation clearance along the road would increase in order to accommodate heavy vehicle mine traffic. These activities would increase the visual contrast of the road compared to existing conditions. Increased road use would generate dust during dry weather that would be visible during the daytime and headlights from mine traffic would be visible at night. Plowing the road during the winter would introduce a smooth, linear feature to the winter landscape that, under existing winter conditions appears similar to the surrounding natural, winter forest landscape. Additionally, large vehicles traveling the road during winter months would introduce movement and audible disruptions to the winter forest environment.

KOP 8: Trout Creek Campground

Construction activity associated with road improvements for the Johnson Creek Route would be visible, particularly when entering and exiting the campground. Construction traffic, equipment, dust, and movement of equipment and construction workers would contrast against the natural, and rustic environment of the campground. Impacts during construction would be similar to those described under KOP 6.

Due to road widening and frequent maintenance, the road would introduce a higher level of visual contrast to its surroundings due to its wider, smoother, and straighter appearance. Mine operation would create traffic to the SGP from buses, vans, trucks, and personal vehicles throughout mine operations. Nighttime traffic on this road would introduce new lighting into an area that has no permanent lighting sources. These long-term, localized, moderate impacts would primarily be experienced as individuals enter and exit the campground, although nighttime lighting could be visible from inside the interior of the campground.

Utilities

Effects to the Characteristic Landscape

However, helicopters would be used during construction of communication repeater sites and would periodically enter into view from the majority of the KOPs during construction and maintenance activities. Because the activity would be periodic and only for a short duration, visual changes would be negligible to minor during construction, operations, and closure and reclamation.

Effects by Key Observation Point

Effects by KOP would be the same as those described under the 2021 MMP.

Off-Site Facilities

Effects to the Characteristic Landscape

Under the Johnson Creek Route Alternative, proposed off-site facilities would be similar to those described for the 2021 MMP, except the maintenance facility would be located on the southern side of Warm Lake Road (CR 10-579) at Landmark. Appendix D of the Scenic Resources Specialist Report (Forest Service 2022n) shows the viewshed of the off-site facilities under the Johnson Creek Route Alternative.

Effects by Key Observation Point

KOP 13: Landmark Maintenance Facility

Short-term visual contrast perceptible to travelers on Warm Lake Road (CR 10-579) would result from construction of the maintenance facility, including grading, new buildings, and other facilities. Construction traffic, equipment, and staff would be evident from this travel route during pre-production, resulting in localized, moderate, short-term visual contrast perceived by receptors due to views of construction activities in the foreground.

The Landmark maintenance facility would result in moderate visual contrast where grading, vegetation removal, and construction of facilities would occur. The site is immediately adjacent to the historic Landmark Ranger Station, where there are existing cabins, picnic areas, and other structures currently managed by the PNF. Terrain at Landmark is primarily flat, with patchy clusters of trees and other low-lying vegetation. Existing disturbances are evident in the proposed maintenance facility footprint, and storage facilities would be co-located in these areas, which would help minimize visual contrast. Vegetation removal and some grading would be necessary to accommodate parking, outdoor storage

areas, and covered structures for storage. The maintenance facility would be visually co-dominant to receptors when viewed in the context of adjacent facilities at Landmark. The proposed layout of the maintenance facility would preserve existing tall vegetation along Warm Lake Road (CR 10-579), which would help screen the maintenance facility from sensitive viewers. Long-term visual contrast is anticipated to be moderate, and the facility would be viewed in the foreground with vegetation partially screening the site. Additional nighttime lighting would be introduced at this facility, which would contribute to sky glow in an area where existing night lighting is minimal.

The Landmark Maintenance Facility would be located in an area managed as Partial Retention (**Figure 3.20-2**). It would meet the Partial Retention VQO as buildings would be constructed using materials and colors that appear in the characteristic landscape. Additionally, due to surrounding vegetation, these facilities would typically not be visible past the foreground distance zone.

After reclamation activities have concluded at the mine site, the maintenance facility would be decommissioned and reclaimed to existing conditions. Buildings would be removed, and parking areas would be ripped, recontoured, and reclaimed. Over time, color contrast would be reduced to a low level of visual contrast once native vegetation becomes established. Permanent visual contrast would be low, and nighttime lighting would return to existing conditions, resulting in minimal permanent visual contrast.

KOP 16: Stibnite Gold Logistics Facility

Impacts at KOP 16 would be the same as described under the 2021 MMP.

4.20.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Scenic Resources.

4.20.4 Irreversible and Irretrievable Commitments of Public Resources

4.20.4.1 No Action Alternative

Under the No Action Alternative, the proposed mine activities and construction and operation of associated infrastructure would not occur. Consequently, there would be no irretrievable and irreversible commitment of scenic resources.

4.20.4.2 Action Alternatives

Both the 2021 MMP and the Johnson Creek Route Alternative would result in an irreversible loss of the characteristic landscape caused by the high walls of the open pits, where cut-slope color contrasts would persist permanently. Due to the size and extent of the TSF and TSF Buttress, an irreversible loss of the characteristic landscape would persist for a long period of time, until rock weathering and slope revegetation, if applicable, reduce visual contrast for color, form, line, and texture. Viewsheds for sensitive use areas near the SGP would be irretrievably changed due to the scale of topographic changes

associated with the pits, TSF, and TSF Buttress. Even with reclamation and revegetation, the viewshed would be dominated by these unnatural landforms and those color contrasts that persist.

4.20.5 Short-term Uses versus Long-term Productivity

4.20.5.1 No Action Alternative

Under the No Action Alternative, the proposed mine activities and construction and operation of associated infrastructure would not occur, and there would be no additional short-term uses of the SGP area.

4.20.5.2 Action Alternatives

Short-term refers to uses with a duration of a few years or less. There would be no short-term uses that would affect long-term productivity of scenic resources.

4.21 Social and Economic Conditions

4.21.1 Impact Definitions and Effects Analysis Indicators and Methodology

The analysis of effects to social and economic conditions includes the following issue and indicators:

Issue: The SGP may impact the socioeconomics of Valley and Adams counties and the State of Idaho.

Indicators:

- Contributions to employment levels (total, State of Idaho, and Valley and Adams counties).
- Estimated value of projected mineral extraction.
- Estimated value of local income contributions.
- Estimated value of goods and services procured in Valley and Adams counties.
- Change in populations of Valley and Adams counties.
- Impacts to housing demand and affordability in Valley and Adams counties.
- Estimated tax revenue contributions.
- Changes in tourism and recreational based businesses.
- Changes in transportation, public services, and infrastructure.
- Effects on fisheries restoration programs

Other effects on tribes are described in the SGP Tribal Rights & Interests Specialist Report (Forest Service 2022q).

The Census' 2014-2018 American Community Survey was used to identify the population and housing characteristics of all the communities within the analysis area. Five-year estimates were used to evaluate the analysis area's communities because one-year estimates are only available for geographies with more than 65,000 people (Census 2018). American Community Survey data also was used to evaluate the three tribal communities located outside the analysis area with strong cultural associations and traditional use of the analysis area and surroundings.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1**.

Social and economic conditions were analyzed using the Economic Impact Analysis of the SGP (Highland Economics 2018), Populations at Risk profiles (Headwaters Economics 2019a,b,c), Socioeconomics Baseline Study (Midas Gold 2017h), state and local tax and revenue data, Census data, GIS spatial analyses, scientific literature reviews, and other information and analysis documented in reports prepared for the SGP. Additional analysis also was performed when necessary to assess the validity of the data and analyses provided by Perpetua to confirm their findings. A complete discussion of the assumptions used in this analysis as well as the analysis limitations is provided in the SGP Social and Economic Conditions Specialist Report (Forest Service 2022o).

The SGP would result in direct and indirect socioeconomic effects on residents, workers, and communities within the local analysis area (i.e., Valley and Adams counties and associated communities of Cascade, Council, Donnelly, McCall, New Meadows and Yellow Pine). For the purposes of the socioeconomic analysis, the indirect impacts also include induced socioeconomic effects that are attributable to the SGP activities.

Direct impacts are defined as those that would occur directly from the SGP activities at the same time and place. For example, direct employment includes not only Perpetua employees but also other on-site construction workers that are employees of contractors hired for on-site construction or operational tasks. Indirect and induced impacts are defined as those that would be caused by an action but would occur later in time or would be farther removed in distance from the SGP activities Induced effects are items that result from the direct and indirect effects. Given the remote locations of the SGP area and rural surrounding environment, most of the direct socioeconomics impacts are likely to occur within Valley County and the New Meadows area in Adams County. Analysis of statewide socioeconomic impacts from the SGP also are provided when appropriate.

4.21.2 Direct and Indirect Effects

4.21.2.1 No Action Alternative

Under the No Action Alternative, there would be no large-scale mine operations. As a result, no new mine site and off-site facilities, access roads, or utility infrastructure changes would occur.

Current uses by other users on patented mine/mill site claims and on the PNF and BNF would continue in compliance with all existing applicable codes and regulations. These uses of NFS lands include mineral exploration, dispersed and developed recreation, such as pleasure driving, hunting, off-highway-vehicle use, camping, hiking, snowmobiling, bird watching, target shooting, firewood cutting, and other forms of recreation. Private businesses, such as outfitter and guide services, also operate on NFS lands through special use permits. Traditional cultural uses of the area would continue, including the collection of plants, hunting, and fishing. Access to public land in the area would continue as governed by law, regulation, policy, and existing and future land ownership constraints.

Perpetua would continue to implement surface exploration and associated activities that have been previously approved on NFS lands as part of the Golden Meadows Exploration Project (Forest Service

2015c). These approved activities include construction of several temporary roads to access drill sites, drill pad construction, and drilling on both NFS and private lands at and in the vicinity of the mine site. The continuation of approved exploration activities at the mine site would result in the continued use of the existing man camp, office trailers, truck maintenance shop area, potable water supply system, wastewater treatment facility, helipad and hangar, and airstrip.

Any impacts on recreation, infrastructure development, revenues, population, housing, and transportation impacts would be temporary and short term and no long-term changes to socioeconomic resources would occur (Forest Service 2015c).

4.21.2.2 2021 MMP

In response to concerns from the public over socioeconomic impacts, Perpetua has engaged with local communities and governments in a variety of ways including engagement meetings and agreements, and community outreach activities, a complete list of which are provided in the SGP Social and Economic Concerns Specialist Report (Forest Service 2022o).

In general, details of committed actions and potential future actions remain in development. While they are briefly mentioned here for context, actions are not considered in the development of impact conclusions in the analysis below until they are finalized.

Employment

Direct Employment

An important factor in determining the economic benefits to the local and state economy under the 2021 MMP would be the home residency of the workforce. The proportion of SGP jobs filled by local workers would determine the level of SGP wages that would benefit local residents and the amount of new income that would be re-spent in the local economy benefitting other local businesses (induced impacts). Highland Economics (2018) projected low, mid, and high values of local employee residency for each SGP phase; the range of low to high values during each phase of the Project is provided in **Table 4.21-1**. The mid-value employment projection is utilized for the impact analysis to represent the expected future economic impacts as it is representative of the anticipated workforce requirements for the 2021 MMP (M3 2021).

Table 4.21-1 Projected Direct Annual Employment by Worker Residency and SGP Phase

	Total	Local Residents (Valley/Adams)	Other Idaho Residents	Out of State Residents
Construction (3 Years)				
Value Range (Low to High)	-	20% to 40%	30% to 45%	50% to 15%
Employment (Mid-Value)	640	190	230	220
Operations (15 Years)				
Value Range (Low to High)	-	20% to 50%	50% to 40%	30% to 10%
Employment (Mid-Value)	583	200	270	113

	Total	Local Residents (Valley/Adams)	Other Idaho Residents	Out of State Residents
Closure and Reclamation (5 Years)				
Value Range (Low to High)	-	40% to 70%	30% to 20%	30% to 10%
Employment (Mid-Value)	160	90	40 / 20	30
Post-Closure (15 Years)				
Value Range (Low to High)	-	40% to 70%	30% to 20%	30% to 10%
Employment (Mid-Value)	40	20	20	0

Source: Highland Economics 2018

The local jobs (Valley and Adams Counties) would contribute to the local economy and could improve the standard of living for the employees and their families if wage rates are raised relative to their current jobs.

It is expected that most of the local construction workers would be adequately qualified and/or trainable for mine operations work and that many construction workers living locally or elsewhere within Idaho would likely accept mine operations jobs. These, and other local residents, would be adequately qualified for the general, administrative, and maintenance positions. These job categories account for approximately one-half of the SGP's operations phase workforce needs (Highland Economics 2018). SGP employment under the post-operations phases would decline sharply from construction and operations phase levels. Perpetua has indicated that they could ramp up and ramp down employment in a measured way to result in a more gradual transition for local area residents and the economy (AECOM 2018).

The estimated number of SGP construction jobs for local residents are equivalent to 3.3 percent of the 2019 total employment for the local area of 5,777 (Idaho Department of Labor 2019). Operational, closure and reclamation, and post-closure employment represents 3.5 percent, 1.6 percent, and 0.3 percent, respectively of the local area's total employment. The 2019 local unemployment rates (4.2 percent) and unemployed individuals in the labor force in Valley and Adams counties indicate while some of these positions could be filled by currently unemployed or under-employed local residents, it also is expected that many of the SGP construction jobs may be filled by non-local area residents that would choose to relocate to Valley or Adams County.

This local area employment increase would be expected to last for the duration of the mine operations phase; however, the post-closure decrease in employment and other related economic activity could result in adverse economic impacts on the local area's economy from the "bust" following the prior "boom" from the SGP's construction and operations employment and spending. When mine operations cease, local communities and economies may experience a contraction in demand for private and public goods and services and a corresponding reduction in demand for labor. Investment and capacity expansion that occurred during mine operations may become under-utilized unless new economic productivity and business opportunities develop in the region. Post-closure economic expansion and investment may happen if tax revenue or fees from mining can be effectively re-invested in community services and infrastructure, creating an environment conducive for long-term economic growth.

Indirect and Induced Employment

The SGP would result in indirect and induced economic effects on the local analysis area's economy Increased sales for local suppliers providing construction materials and equipment represent an indirect effect of SGP activity and spending. Induced effects represent increased economic activity from household spending of labor income by both the SGP and supporting businesses' workers.

The indirect and induced job projections for the SGP are based on national data on the relationship between employment and output for each affected economic sector. Depending on the specific state and local economic conditions, businesses operating at or under capacity, or facing limited increased demand, may increase their utilization of their existing employees rather than hire new workers. Highland Economics (2018) estimated the indirect and induced economic impacts from the SGP for both the State of Idaho and Valley and Adams counties combined local economy using an input-output economic model (IMPLAN). IMPLAN was used to estimate regional or local economic impacts and the data used are compliant with the Data Quality Act (Section 515 of Public Law 106-554).

Under the SGP mid-value scenario, the IMPLAN analysis estimated that up to 830 full and part-time indirect jobs would be supported within Idaho's economy during the three-year construction period. Up to 570 full and part-time induced jobs also would be supported within the Idaho economy over the same period. As a result, it is projected that a total of 1,400 indirect and induced jobs would be supported annually in Idaho by the SGP during construction. Most of this employment would occur outside the local economy, as a total of 300 Valley and Adams counties jobs (180 indirect and 120 induced) of the 1,400 total are projected to be supported during construction (Highland Economics 2018).

Under the SGP mid-value scenario, IMPLAN analysis estimates that up to 310 full- and part-time indirect jobs within the State of Idaho would be supported during the 12- to 15-year period of operations. Over the same period, up to 370 full- and part-time induced jobs within Idaho also would be supported. As a result, it is projected that a total of 680 indirect and induced jobs would be supported annually by the SGP during operations. Most of this employment would occur outside the local economy, as a total of 270 Valley and Adams County jobs (150 indirect and 120 induced) out of the 680 total are projected to be supported by the SGP operations (Highland Economics 2018). Outside of Idaho, the total indirect and induced full and part-time jobs supported by the SGP would be approximately 1,430 (Highland Economics 2018).

The total local, state, and national indirect and induced full- and part-time jobs supported by the SGP would be approximately 4,050 (Highland Economics 2018). It is important to note that these are jobs and income supported by the SGP, but at the national level, these are not necessarily additional jobs and income in the U.S. compared to the No Action Alternative. If the capital and labor resources used for SGP's development were instead invested in mining or other economic activities elsewhere within the U.S., there would be employment and income benefits generated from these alternative activities (Highland Economics 2018).

The indirect and induced job projections are based on national data on the relationship between employment and output for each affected economic sector. Depending on the specific state and local economic conditions, businesses operating at under capacity or facing limited increased demand may increase their utilization of their existing employees rather than hire new workers.

For closure and reclamation spending and employment under the SGP mid-value scenario, IMPLAN analysis estimated that, on average, approximately 20 full- and part-time indirect jobs within Idaho would be supported annually during this five-year phase. Approximately 40 full- and part-time induced jobs within Idaho also would be supported over the same period. Most of these jobs would occur within the local economy. A total of 10 indirect and 30 induced local jobs are projected to be supported within the Valley and Adams counties' economy during closure and reclamation (Highland Economics 2018).

In addition, closure and reclamation activities after the first 5 years are expected to support approximately 20 full- and part-time indirect and induced jobs for Idaho residents per year during the 15-year duration, 10 of which are projected to be filled by local residents (Highland Economics 2018). The total local, state, and national indirect and induced full and part-time jobs supported by the SGP would be approximately 170 (Highland Economics 2018).

Employment Summary

Based on the direct, indirect, and induced employment impacts analyzed above, under the mid-value scenario, the overall statewide employment impact for the SGP is estimated to support 1,820 full and part-time jobs for Idaho residents annually during the 3-year construction period. The overall local employment impact during the 3-year construction phase is expected to provide 490 full and part-time jobs for the residents of Valley and Adams counties (i.e., 190 direct and 310 indirect/induced jobs). This local job impact would correspond to 8.7 percent of the local area 2019 total employment of 5,777 (Idaho Department of Labor 2020a, 2020b).

For the operating phase, overall statewide employment impact is estimated to support a total of 1,150 full- and part-time jobs for Idaho residents annually during the 12- to 15-year period of operations. The overall local employment impact of the SGP during operations is expected to total 470 full- and part-time jobs. This local job impact would correspond to 8.1 percent of the local area's 2019 total employment of 5,777 (Idaho Department of Labor 2020a, 2020b).

For the closure and reclamation phase, overall statewide employment impact is estimated to total 190 full and part-time jobs during the first 5 years. The overall local employment impact during this period is expected to total 130 full- and part-time jobs, resulting in a corresponding decrease in total employment of 340 full- and part-time jobs from prior employment levels during operations. This local employment corresponds to 2.2 percent of the local area's 2019 total employment of 5,777 (Idaho Department of Labor 2020a, 2020b).

For the post-closure phase of SGP, overall statewide employment impact is estimated to total 40 full- and part-time jobs during the additional 15-year period. The overall local employment impact of the SGP during this phase is expected to total 30 full- and part-time jobs. This local employment corresponds to 0.5 percent of the local area's 2019 total employment of 5,777 (Idaho Department of Labor 2020a, 2020b).

The number of unemployed residents in the labor force in 2019 in Valley and Adams counties was approximately 349 (Idaho Department of Labor 2021). Therefore, the SGP could provide jobs to unemployed or under-employed residents in the labor force in those counties. The SGP also is expected to attract worker in-migration to the local area.

Such potential "boom and bust" effects from a mine's closure are commonly recognized as potential source of adverse socioeconomic impacts on the local area economy. The impacts on the local area's economy depend on employees' responses after their mine employment ends, as well as their other employment opportunities. If the local area's economy is strong and there are sufficient job opportunities with adequate earning potential for the unemployed mine workers, then the adverse economic impacts on the local economy could be limited if the unemployed mine operations workers are re-employed locally. While it may be difficult for the displaced mine workers to find equally high-paying replacement jobs, some individuals may be willing to accept less wages for job positions. As discussed in the Scoping and Issues Summary Report, Perpetua also has indicated that they could ramp up and ramp down employment in a measured way to reduce the "bust" effects on the local area residents and economy (AECOM 2018).

In addition, economic development planning, job-retraining, and other mechanisms can be used to facilitate the transition after the mine's closure. However, in the absence of established funding and implementation commitments (either by Perpetua or state/local public agencies), potential adverse "boom and bust" impacts could occur.

When mine operations cease, local communities and economies may experience a contraction in demand for private and public goods and services and a corresponding reduction in demand for labor. Investment and capacity expansion that occurred during mine operations may become under-utilized unless new economic productivity and business opportunities develop in the region. Given the local analysis area's largely rural and small economy, in the absence of adequate economic transition mitigation, the mine-closure related decrease in local employment and income could have an adverse impact on the local area's residents, businesses, and overall economy.

Overall, the SGP is estimated to support 4,690 direct, indirect, and induced jobs for residents nationwide during the construction period, 2,690 jobs nationwide during the operations period, and 330 jobs nationwide during the closure and reclamation period (Highland Economics 2018). Employment impacts from the SGP would be beneficial, local and regional, moderate to major, and long term.

Income

Direct Income

Construction

Table 4.21-2 shows the average annual construction spending on labor, materials, equipment, and services. Anticipated expenditures for the SGP also are broken out by their sourcing location.

Based on the projected total annual direct labor cost of $66.7 million, the average, fully-burdened compensation in 2017 dollars of all SGP employees (i.e., including management staff) is calculated to be $108,000 (Highland Economics 2018). This fully-burdened compensation accounts for overtime, as well as employee health and other benefits. The average wage for local residents is projected to be approximately $96,600 per year (in 2017 dollars) and is fully burdened to account for employee health and other benefits. The corresponding unburdened salary is estimated to be $67,700, which is comparable to the area's prevailing Davis-Bacon rates of $20 to $30 per hour depending on the position (Highland Economics 2018).

Table 4.21-2 Projected Direct Construction Spending Per Year (in millions) (2017 Dollars)

Direct Spending	Total	Local	State Non-Local	State - Total	Out of State
Salaries & Wages [1]	$66.7	$17.4	$25.0	$42.4	$24.3
Vendor On-Site Operations	$17.7	$17.7	$0	$17.7	$0
Material, Equipment & Services	$260.1	$27.2	$179.6	$206.8	$53.3
Total	$344.5	$62.3	$204.6	$266.9	$77.6

Source: Highland Economics 2018
[1]Does not include direct labor expenses/income for vendor on-site workers and business proprietors.

The projected construction worker salaries and wages are considerably higher than the prevailing wages in the local area and in the Boise area, which average approximately $18 per hour (unburdened) for the construction and extraction sector and $16 per hour across all occupations (Idaho Department of Labor 2020a, 2020b). The average covered wage (i.e., for non-self-employed workers) statewide within Idaho is $43,480, $35,948 within Valley County, and $37,465 within Adams County. This high compensation rate for construction workers would partly reflect the specific work conditions and labor skill needs. Nonetheless, employment opportunities with the SGP would represent well-paying and attractive job opportunities for both local and non-local residents, as the average unburdened wage for employees ($67,700) would be 55 and 53 percent and higher than the average 2018 wage in Adams County and Valley County, respectively.

SGP employees and contractors would be expected to spend almost all their earnings in their community of residence, given their bi-weekly shift schedules and employee housing at the Operations Area Boundary's remote location. As a result, the economic contributions to Valley and Adams counties' economies would be related to the income earned by construction workers that live within the local area. The contribution of relatively well-paying local area employment and labor income from the SGP would result in increased spending and increased economic activity within the local economy during construction.

Operations

The SGP would mine a total of approximately 400 (356) million tons of ore and development rock from the Yellow Pine, Hangar Flats, and West End pits and would recover approximately 4.2 million ounces of gold, approximately 1.7 million ounces of silver, and 115 million pounds of antimony (M3 2021). Based on the 2018 to 2021 average mineral prices for gold ($1,600 per ounce), silver ($20 per ounce), and antimony ($3.50 per pound), the total future value of mineral production (after refining) would be estimated to be approximately $7 billion. The annual value of extracted minerals would be between approximately $350 million and $950 million per year over Mine Years 1 through 12 during operations (M3 2021).

Table 4.21-3 shows the average annual spending on labor, materials, equipment, and services for SGP operations. Operations expenditures also are broken out by their sourcing location.

Based on the projected total annual direct labor cost of $53.4 million, the average fully-burdened compensation of all SGP employees (i.e., including management staff) during operations is calculated to be $90,600 (in 2017 dollars) (Highland Economics 2018). This fully burdened compensation accounts for overtime, as well as employee health and other benefits. The average salary and wage for local residents is projected to be approximately $92,500 per year (in 2017 dollars) and is fully burdened to account for employee health and other benefits. The corresponding unburdened salary and wage is estimated to be $64,800, which is comparable to the area's prevailing Davis-Bacon rates of $20 to $30 per hour depending on the position (Highland Economics 2018).

Table 4.21-3 Annual Operations Spending ($M/year, 2017 Dollars)

Direct Spending	Total	Local	State Non-Local	State - Total	Out of State
Salaries & Wages	$53.4	$18.7	$24.0	$42.7	$10.7
Vendor On-Site Labor	$2.3	$0.8	$0.8	$1.6	$0.7
Vendor On-Site Operations	$13.7	$13.7	$0.0	$13.7	$0.0
Material, Equipment & Services	$165.3	$26.8	$48.1	$74.9	$90.4
Total	$234.7	$60.0	$72.9	$132.9	$101.8

Source: Highland Economics 2018

As with the construction phase, SGP employees would be expected to spend their earnings in their community of residence, given their bi-weekly shift schedules and employee housing at the mine site's remote location. As a result, the direct economic impact to the Valley and Adams counties economies would be related to the income earned by the 200 operations staff that live within the local area.

Closure and Reclamation

Table 4.21-4 shows the average annual spending on labor, materials, equipment, and services during closure and reclamation and post-closure activities. Closure and reclamation and post-closure expenditures also are broken out by their sourcing location.

Table 4.21-4 Annual Closure and Reclamation Spending (2017 Dollars)

Direct Spending ($M/year)	Total	Local	State Non-Local	State - Total	Out of State
Closure and Reclamation					
Salaries & Wages	$6.6	$3.6	$1.7	$5.3	$1.3
Material, Equipment & Services	$11.9	$1.2	$6.4	$7.5	$4.4
Total - Reclamation	$18.6	$4.8	$8.1	$12.9	$5.7
Post-Closure					
Salaries & Wages	$1.6	$0.9	$0.4	$1.3	$0.3
Material, Equipment & Services	$4.3	$0.5	$1.6	$2.0	$2.2
Total - Closure	$5.9	$1.4	$2.0	$3.3	$2.6

Source: Highland Economics 2018

As with the construction and operations phases, SGP employees would be expected to spend their earnings within their community of residence, given their bi-weekly shift schedules and employee housing at the mine site's remote location. As a result, the economic benefits to the Valley and Adams counties economies would be related to the income earned by SGP operations staff that live within the local area.

Indirect and Induced Income

Construction

SGP-related impacts from construction activities would result in indirect and induced income contributions to the statewide and local analysis area's economies. Indirect income earnings would result from the increased sales and employment for the businesses that supply goods and services for construction. Induced income effects represent the local workers' earnings resulting from increased household spending by both construction and support businesses' workers.

Under the mid-value scenario, the IMPLAN analysis estimated that $44.3 million in indirect and $21.2 million (in 2017 dollars) in induced income, for a total of $65.5 million, would be supported within Idaho economy's during the 3-year construction phase. Most of this income would occur outside the local economy. Construction activities are projected to support a total of $7.4 million indirect and $3.3 million per year (in 2017 dollars) in induced income within Valley and Adams counties' economies during the 3-year construction period (Highland Economics 2018). Outside of Idaho, the SGP is projected to support a total of $191.8 million in indirect and induced income, resulting in a nationwide total of $257.3 million in indirect and induced income (Highland Economics 2018).

Based on an assumed full-time equivalent employment rate of 80 percent for projected indirect and induced full-time and part-time local jobs, the average salary for these workers (including benefits) is estimated to range from $34,400 (induced) to $51,400 (indirect) per year.

Operations

SGP operational spending and employment would result in indirect and induced income changes to the state and local analysis area's economy. Under the SGP mid-value scenario, IMPLAN analysis estimates SGP operations would result in $15.7 million in indirect and $13.7 million in induced income annually in Idaho. Most of this income would be earned outside the local economy, as operations are projected to result in $7.6 million in indirect and $3.3 million in induced income within the two-county economy (Highland Economics 2018). Based on an assumed full-time equivalent employment rate of 80 percent for projected indirect and induced full-time and part-time local jobs, the average salary for these workers (including benefits) is estimated to range from $33,700 (induced) to $63,300 (indirect) per year.

Closure and Reclamation

Under the SGP mid-value scenario, IMPLAN analysis estimated that closure and reclamation activities would support $4.5 million in indirect and $5.3 million in total induced income. The majority of this induced income would occur outside the Idaho economy, as closure and reclamation activities are projected to support $1.1 million in indirect and $1.6 million in induced income out of the $4.5 million

and $5.3 million totals. Of the statewide totals, Valley County and Adams Counties residents are projected to receive $400,000 in indirect and $1.1 million in induced income. Based on an assumed full-time equivalent employment rate of 80 percent for projected indirect and induced full-time and part-time local job increase, the average salary for these workers (including benefits) is estimated to range from $41,700 (induced) to $50,000 (indirect) per year.

During the subsequent post-closure phase, it is projected that approximately $3.0 million in salaries and wages for indirect and induced workers would be supported by the SGP's closure activities, of which approximately $500,000 would be expected to be received by Valley and Adams County residents (Highland Economics 2018).

Income Summary

Based on the direct, indirect, and induced income effects analyzed above, under the SGP mid-value scenario, the overall statewide income impact is estimated to contribute a total of $110.9 million per year during construction (in 2017 dollars). Of this total, the overall local income impact is projected to total $28.1 million per year for Valley and Adams County residents. Outside of Idaho, the SGP is projected to support a total of $215.5 million in direct, indirect, and induced income resulting in a nationwide total of $326.4 million in direct, indirect, and induced income (i.e., combined total of Idaho and elsewhere in the U.S.) (Highland Economics 2018).

Operations statewide total income impact during the 15-year period of operations is estimated to be $71.6 million per year. Of this statewide total, the overall local income impact is expected to total $29.3 million per year for Valley and Adams counties residents. Outside of Idaho, the SGP is projected to support a total of $114.8 million in direct, indirect, and induced income resulting in a nationwide total of $186.4 million in indirect and induced income (i.e., combined total of Idaho and elsewhere in the U.S.; Highland Economics 2018).

Closure and reclamation is estimated to support a total of $7.8 million in annual income statewide under the SGP mid-value scenario, with total local income expected to be $5.3 million. In total, the SGP is estimated to contribute $16.4 million direct, indirect, and induced income per year nationwide (i.e., $7.8 million in Idaho and $8.6 million elsewhere in the U.S.) (Highlands Economics 2018) during closure and reclamation.

As discussed under the employment impact analysis, adverse economic disruption and dislocation impacts could occur as result of the decrease in activity from the prior levels during the construction and operations phases given the local analysis area's largely rural and small economy. These potential "boom and bust" effects after mine operations cease could result from reduction in 110 local jobs and corresponding decrease in local residents' labor income by $14.9 million. In addition, the projected reduction in 230 indirect and induced local jobs could result in a corresponding decrease in local residents' labor income by $9.5 million from the prior levels during mine operations. There would be a total local labor income decrease of approximately $24 million from the prior operations phase. The duration of this impact would depend on the affected workers and local area economy's ability to adapt in response to the economic dislocation.

Income impacts would be beneficial, moderate to major, long-term, and local and regional.

Population and Housing

Project construction, operations, and closure and reclamation would affect the surrounding communities through local employment and income effects, which in turn would cause changes in population and housing needs of communities within the local analysis area. The peak effect would be realized during the construction period when predicted in-migration of approximately 450 workers would need housing. This effect would diminish following completion of the on-site worker housing facility and incorporation of portions of the in-migrating workforce into the local community. Any such population changes also would affect the level of community public services needed. The extent of induced population growth would be a primary factor determining potential economic and social impacts (e.g., increased housing and public services demand). As discussed above, it is projected that up to 500 total local jobs (i.e., direct and indirect/induced) would be supported by SGP construction activities (Highland Economics 2018).

If there are insufficient replacement job opportunities for the local residents no longer employed (directly or indirectly) following the "bust" impacts discussed above with cessation of the SGP operations, then the local area economy would experience increased unemployment and reduced economic activity. Depending on the severity and duration of the economic dislocation and recovery, many of the local residents formerly employed (direct or indirectly) by the SGP's mine operations may choose to relocate out of the local area to find employment. There could be some adverse housing supply impacts from worker out-migration in the form of increased home sales and decreased tenancy/demand for rental properties, which might reduce property values if there is not adequate demand for their vacated homes. Housing impacts would be beneficial, minor to moderate, long-term, and local and regional; however, if future housing demand and supply conditions change, it may be possible that there could be adverse housing impacts to the local economy if any vacated properties remain unoccupied for an extended period of time.

Commuter and In-Migration Rates

Construction workers would be transported to the Operations Area Boundary by bus/vanpool pickup sites in Cascade, McCall, and Donnelly for their bi-weekly shifts (Highland Economics 2018). Most of these commuting employees would likely come from communities outside the local analysis area. It was assumed that most workers would reside in the Boise metropolitan area (approximately 75 miles and a 1.5-hour drive south from Cascade) or communities along Idaho SH 55 and U.S. Route 95 travel corridors that connect easily to the bus/vanpool pickup sites.

It is difficult to predict the actual extent and location of SGP-related in-migration to the local area, especially due to the mine site's remote location and two-week shift staffing. The need or incentive for employee relocation to the local area is limited because most of workers would be housed on-site during their bi-weekly shifts. Idaho residents (particularly those living in rural areas) commute or travel long distances on a regular basis, as do many workers in the mining industry. In the absence of benefits inducing workers to live locally, SGP employees can choose from a wide variety of housing locations and base their housing decisions on factors including housing availability/affordability, local amenities, and social conditions, among others.

In-migration by SGP construction employees and contractors could be limited for several reasons. Existing local residents may be expected to fill a portion of the construction jobs, and, during their two-week work-shift, most employees would be housed on-site and, consequently, there would be no benefit from living within the local analysis area. Additionally, non-local communities closer to Boise would offer greater housing options, amenities, and public services options within a relatively close travel distance (i.e., less than two hours) from the proposed employee bus/van pool pick-up locations in Cascade, McCall, and Donnelly (Highland Economics 2018).

In-migration effects on indirect and induced employment can be expected to be weaker than direct employment effects. The wage rates for the indirect and induced jobs would be lower and more comparable to prevailing wage rates within the local area and elsewhere in the state. Generally, indirect and induced employment opportunities would be less specialized and less skilled. As a result, there would be a larger labor pool of potential employees for any new positions. Finally, given the relatively short-term nature (three years) of the new jobs from SGP construction activities, many businesses may meet increased business demands through more interim measures (e.g., overtime and increased facility/equipment utilization) rather than business expansion (e.g., new hires or facility expansion). Consequently, projected indirect and induced employment impacts may result in comparatively less attraction and incentives for in-migration to occur than that from the SGP's higher paid and more secure job opportunities; however, the local area's current relatively low unemployment rate increases the potential for future in-migration from indirect and induced job demand. Currently, there is only a limited labor pool of unemployed and under-employed local residents available to fill the projected new job positions.

As a result, this socioeconomic analysis identifies and evaluates the potential impacts assuming moderate in-migration rates under Highland Economics (2018) mid-value local worker residency scenario. **Table 4.21-5** shows the existing resident and new in-migrant worker populations expected under the mid-value local worker residency scenario for each of the phases of the SGP (construction, operations, and closure/reclamation). New in-migrants relocating to the local analysis area could account for up to half of projected local direct employment and a third of the projected indirect and induced local employment. Construction activities are projected to potentially result in total in-migration of approximately 198 workers, most of which are estimated to be sustained during operations (190 in-migrants).

Table 4.21-5 Projected Employment by Worker Residency and SGP Phase

	Total Local Employees	Existing Local Residents	In-Migrant
Construction Employment			
Direct	190	95 (50%)	95 (50%)
Indirect and Induced[1]	310	207 (66.7%)	103 (33.3%)
Total – Construction[2]	**500**	**302**	**198**
Operations Employment			
Direct	200	100 (50%)	100 (50%)
Indirect and Induced	270	180 (66.7%)	90 (33.3%)
Total – Operations	**470**	**280**	**190**

	Total Local Employees	Existing Local Residents	In-Migrant
Closure and Reclamation Employment			
Direct	90/20	90/20 (100%)	0
Indirect and Induced	40/10	40/10 (100%)	0
Total – Reclamation/Closure	**130/30**	**130/30 (100%)**	**0**
Total – Annual Average[3]	**52**	**52 (100%)**	**0**

Source: Highland Economics 2018
[1] Estimated increased employment includes both full and part-time positions.
[2] Totals may not sum exactly due to rounding.
[3] Based on five-year closure and reclamation phase and 15-year post-closure phase durations.

Factors affecting relocation include housing availability and schools, as well as other amenities such as parks, restaurants, and recreation. Relocation is a personal decision based on interest, commute preferences, family make-up, and background. As a result, it is inherently difficult to reliably predict the future geographic distribution of the expected population growth. Potential relocation factors are further discussed in the SGP Social and Economic Conditions Specialist Report (Forest Service 2022o).

Housing impacts may be adverse from the overall local area perspective, and concentrated new in-migrant population increases could result in greater impacts within specific communities – especially if those communities are not well equipped to absorb the new residents. For example, while McCall has 4,259 housing units, only 1,440 are occupied year-round by residents (Census 2018). If half of the projected new in-migrant workers selected McCall for their place of residence, that would represent an approximate three percent increase in the community's population (3,226 people), which would likely represent and could be perceived by current residents as a noticeable and possibly adverse population effect. The potential for affordable housing impacts would depend on the number of lower-paid, in-migrants relocating to the specific community, discussed further below. As a result, if there is an insufficient existing inventory of suitable housing within the affected communities, adverse affordable housing availability impacts could result during construction activities. A lesser number of employees might be expected to relocate to Council or New Meadows, while few, if any, new employees and their families would be expected to relocate to the small communities of Yellow Pine or Donnelly, or elsewhere within the unincorporated and more rural areas of the two counties.

In-migration impacts would be negligible to moderate, long-term, and local and regional.

Population Demographics

Based on Idaho statewide averages, it is expected that 57 percent of the in-migrating workers would be married with an average of 0.64 child per capita (Census 2018). As a result, the 198 workers projected to relocate to the local analysis area during construction would be expected to result in a total population increase of up to 438 new residents, which would consist of 240 dependents (113 spouses and 127 children).

This in-migration worker population could increase new local housing demand by up to approximately 200 dwellings. Although, the actual total housing demand would be less if relocating workers opt to share

housing (either with existing residents or other in-migrating workers) or if in-migrating spouses also work on the SGP.

The potential for any such new housing demand to have an adverse impact on the local area's affordable housing supply is a commonly held and understandable concern for many local residents (AECOM 2018). In addition, the local analysis area's past population growth and in-migration rates also likely contribute to concerns of SGP-related adverse impacts on local affordable housing availability.

Housing Availability and Affordability

Overall, there were a total 91 homes for rent, 138 homes for sale, and 92 "other vacant" home in Valley and Adams counties available for in-migrating workers in 2018 (**Section 3.21.4.2)**. The data suggests that most of the local housing has been sold to second home buyers, thereby increasing the number of occasional housing units and decreasing the availability of housing to local residents (Highland Economics 2018).

Most of the "occasional use" housing within Valley and Adams counties generally consists of more expensive second homes that may be unavailable or unsuitable for workers to rent or purchase, as these custom and/or newer homes are typically less affordable. Details on housing affordability are further discussed in the SGP Social and Economic Conditions Specialist Report (Forest Service 2022o).

An influx of new SGP employees and contractors into the local communities would increase local housing demand. In-migrating employees may live in dispersed areas of the two counties, limiting the effects on housing in any one location within the two-county area (Highland Economics 2018). Given their higher paying salaries, these in-migrating workers could rent or buy homes with values closer to the area's median and market values. Although the 2018 quantities of homes for sale or rent is limited (321 homes), this supply exceeds the projected 95 new SGP construction workers expected to in-migrate to the local area. Since 2018 data, housing throughout western U.S. states has been affected by pandemic-era migration away from population centers (Hjerpe et al. 2020). Vacancy rates in Adams and Valley Counties have decreased by approximately 25 percent from 2018 to 2019. If this in-migration trend continues post-pandemic, there would be a general lack of housing that would be further affected by the housing needs of SGP construction workers. As a result, potential adverse housing availability impacts would likely predominantly result from the approximately 103 workers that may migrate into the local area for the indirect and induced jobs supported by SGP's construction activities. Given the lower typical salaries for the indirect and induced jobs supported by construction activities, the workers in-migrating to the local area for these jobs could increase competition for lower-priced housing, which could in turn contribute to greater scarcity of affordable housing.

The number of currently available homes for sale or rent is limited (321 homes), and it is expected that the 90 to 95 projected new SGP operational and construction workers relocating to the analysis area should be able to afford to buy or rent these available homes. In which case, 226 unoccupied homes would be expected to remain available for the approximately 103 in-migrant non-SGP workers (i.e., indirect or induced workers) that are projected to relocate to Valley or Adams counties unless these homes are utilized by other housing demands. Adverse affordable housing availability impacts could result from construction and operating activities if there is an insufficient existing inventory of suitable housing within the affected communities, in which case, SGP construction activities could result in

adverse impacts to housing availability and affordability within the local area. In addition, this impact would be expected to occur primarily during the start of construction and/or operations phases and then subsequently stabilize in the absence of any further increase in local employment. Many factors affect the actual housing demand from in-migrating workers. These include the extent that SGP-related indirect and induced jobs might be filled by existing residents or SGP employee spouses, the extent that in-migrating workers would cohabitate, and where they would reside within local communities, which would in turn affect local housing demand and affordability for the local analysis area's existing residential population.

Public Services

As described earlier in this section, construction and operations activities could attract a projected 420 to 438 new residents (workers and families) that could relocate to the local analysis area. This population growth would result in increased public services demand and use. The type and extent of the public service increases would depend on the demographics of the new residents. For example, the number and age of children relocating with in-migrating workers would determine increased enrollment impacts on the local public school system.

The population growth also would result in increased sales tax revenue (state and in some cases local), utility payments, and possibly property tax revenues (if existing property values appreciate or home development expands; discussed below under Government Revenues). Potential adverse impacts to public services may occur if the new residents' service demands exceed the specific public service/program's capabilities.

The local analysis area's public water utilities and school systems have the most potential to be impacted by the expected population increases. The communities of McCall, Cascade, New Meadows, and Donnelly all provide water and sewer services for their residents, and addition of new permanent residents may, in some cases, increase stress on their systems. Community members have expressed concern about these impacts (AECOM 2018).

The public school system within the local area consists of several independent school districts located in McCall, Donnelly, Cascade, New Meadows, and Council. Under the mid-value worker residency scenario, it is projected that up to 121 children may relocate to the local analysis area during the project's operations phase. In which case, the potential increase in school enrollment demand would be approximately 80 students as some relocating children would be younger than school age or opt for alternative schooling (Census 2015; Highland Economics 2018). If these new students are evenly distributed across grades, then the average enrollment increase per grade would be approximately six additional students in each grade.

As discussed in **Section 3.21.4.6**, Cascade and New Meadows are both under enrolled, while McCall and Donnelly currently do not have capacity for additional students (Idaho Department of Education 2019). The SGP-related influx of new students would correspond to an approximately six percent increase in local enrollment. If the in-migrating student population consists of more similarly aged children, then the increase for their corresponding grades would be higher and more likely to be difficult for the local school systems to accommodate. If this occurs, the adverse impact on the public school system could be substantial if the current programs and facilities have insufficient capacity to absorb that additional student enrollment. The specific effects on the number of teachers and classrooms would depend on the

actual ages and enrollment locations for new students. In Valley County, there are currently 52 middle and high school classroom teaching full-time equivalent positions with an average student-teacher ratio of 15:1 and 40 elementary school positions with an average student teacher ratio of 17.5:1 (Idaho Gazetteer 2021). If in-migrating students concentrated in the area, up to six full-time equivalent teaching positions would be needed to maintain current student-teacher ratios.

The population increase attributable to the SGP would result in effects to local police and fire protection services. Currently, there is a patrol officer for approximately 850 residents of Valley County (Valley County Sherriff's Office 2021). There are nine Valley County fire departments that serve approximately 1,300 residents per department and six Adams County fire departments that serve approximately 730 residents per department. The specific effects of adding an estimated 438 residents on police and fire services would depend on the actual residential locations selected by in-migrating workers. If in-migrating workers concentrated closest to the mine area in Valley County, demands on police and fire services and equipment would increase up to 4 percent assuming the frequency of in-migrating worker service needs would be equivalent to the current population.

Adams and Valley counties' telecommunications and internet infrastructure operate at near capacity and, therefore, may have difficulty in maintaining service levels from increased service demand in some locations.

Public service impacts would depend on both the location of any SGP-related population growth and the specific circumstances of the affected public services. It is possible that adverse public service impacts could occur to the local analysis area's water and public school system, particularly if in-migrants are more highly concentrated in individual communities such as McCall. In which case, there could be localized, long-term, substantial adverse impacts to those public services; however, if the relatively limited projected population growth is not highly concentrated, then construction could have negligible to minor, long-term, and adverse impacts on most of the local area's public services.

Valley County's 2021 unemployment rate was relatively low (four percent). Adams County's unemployment rate was higher at six percent in 2021 (Idaho Department of Labor 2021). While vacancies in these sectors might be more readily filled by Adams County's unemployed or under-employed residents, it is likely that Valley County communities would provide a larger share of local employees and, therefore, receive greater benefit of higher wage jobs in construction and mining. Consequently, Valley County's public agencies and service sectors also would have greater potential of possible adverse impacts from wage-inflation and/or understaffing. These jobs are important for the functioning of the local economies. A lack of employees able to fill these positions could negatively affect the local government service sectors, assuming new workers do not move into the area and government agencies have limited flexibility to adjust wages and/or increase funding to pay contractors.

Labor cost increases could adversely affect the capacity for public agencies that rely on lower paid, skilled workers for their operations (i.e., school bus drivers, garbage haulers, etc.) to continue providing their services. In addition to increasing their operating costs, in more serious cases, the labor shortages could result in business contractions and reduced public services if their work positions remain unstaffed. Contraction also could occur for private businesses relying on lower-wage or competing wage workers; however, businesses may have greater flexibility to react to increases in disposable income, adjust their

wage rates, attract new workers, and benefit from the influx of higher wage jobs. It also is possible that any adverse wage-inflation or staffing impacts would result in relatively short-term effects as the affected public agencies, private businesses, and local economy adjust their operations to the changes in labor force availability. These adjustments may occur during the both the mine construction and operation phases.

In the absence of any population or housing demand growth impacts, no related adverse impacts from increased demand for public services would be expected. Out-migration following cessation of SGP operations may have the potential for adverse impacts to public services if it results in underuse and/or underfunding for any facility expansion that occurred to serve SGP-related population growth (e.g., development of new utility connections or school buildings); however, the potential type and extent for both operational and post-operational impacts to public services would be dependent on the location of any SGP-related population growth and the capabilities of the specific public systems serving the new residents.

Government Revenues

Valley and Adams counties residents and businesses pay federal and state income taxes, federal payroll taxes, corporate taxes, and their purchases are subject to state sales taxes. In addition, the buildings within the local area owned by individuals and businesses are subject to local and state property taxes. Projected annual tax revenues resulting from construction and operations activities are summarized here and are further detailed in the Social and Economic Conditions Specialist Report (Forest Service 2022o).

The total annual government tax revenue benefits from construction activities are estimated to be $70.8 million per year and $212.4 million over the 3-year construction period. Perpetua is projected to pay $12.0 million of these taxes annually or $36.0 million over the construction period. The other $58.8 million per year in total taxes would be obtained from businesses and employees supporting the SGP. Over the entire 3-year construction period, the total taxes paid by SGP support businesses and employees are projected to total $176.4 million. The federal government is expected to receive most of total tax revenues resulting from construction activities. The state and local tax revenues generated are projected to total $9.3 million per year, of which the majority would be a regional, short-term, minor tax revenue benefit received by the State of Idaho. No property taxes would be paid by Perpetua until after the Operations Area Boundary facilities are completed and the mine operations begin. As a result, construction activities would result in negligible, short-term tax revenue benefits for the local area's economy.

Annual government tax revenue benefits from SGP operations are estimated to total $61.7 million. Perpetua is projected to pay $29.4 million in taxes annually. The other $32.3 million would be paid by SGP support businesses and employees. The federal government is expected to receive most of the total tax revenues resulting from operations. Federal tax receipts during the SGP operations phase are projected to be $51.6 million annually and total $774 million over the entire operations period (based on a 15-year operations period). The state and local tax revenues generated are projected to be $10.1 million per year and total $151.5 million over the entire operations period. Most of these taxes would be received by the State of Idaho. Local tax revenues paid by Perpetua are projected to average $0.3 million per year and total $4.5 million over the entire assumed 15-year period of operations. In 2018, Valley County's property

tax totaled $7.5 million; therefore, the SGP's projected annual property tax would account for approximately 4 percent of Valley County's current total property tax. As a result, operations would result in a relatively limited tax revenue increase for the local area's economy with a negligible to minor, long-term, and localized impact.

Local property taxes may be used to fund local schools, local governments, local law enforcement, fire protection, local roads, and other public services. The extent that the SGP-related increase in local tax revenues would result in a net benefit to Valley County's public services would depend on the extent that they offset increases in costs to provide public services.

It is expected that SGP's reliance on public services would be limited, as it would generally self-administer on-site security and fire protection services. Perpetua would be responsible for roadway maintenance measures under a cooperative agreement with Forest Service and Valley County (**Section 4.16**). As such, there would be no increased cost to Valley County and its taxpayers as a result of any SGP-related roadway repair costs.

As discussed previously, public services demand impact would predominantly result from SGP-related local population increases (i.e., worker in-migration). In addition, operations could result in adverse impacts on government provision of services and staffing from wage inflation and local worker shortages for lower paying jobs within the local area, contingent on the ability of agencies and contractors to backfill staff losses over the longer period of operations, compared to the three-year construction phase (e.g., government agencies could lose personnel to SGP with uncertain capacity to backfill positions).

Estimated annual tax revenues resulting from closure and reclamation activities are summarized here and further detailed in the Social and Economic Conditions Specialist Report (Forest Service 2022o). The total annual government tax revenue benefits from closure and reclamation activities are estimated to be $1.5 million per year, of which the federal government is expected to receive the majority ($1.1 million per year). State and local taxes revenues generated are projected to total $0.4 million per year, of which the majority would be received by the State of Idaho. As a result, closure and reclamation operations would result in negligible, long-term, and localized tax revenue benefits.

Transportation and Infrastructure

<u>Transportation</u>

Changes in the local network of access roads and traffic use could potentially have socioeconomic impacts on the surrounding communities and their residents and businesses if it results in substantial changes in roadway use and/or user spending within those communities.

Construction, operations, and closure and reclamation phase impacts on the local analysis area's transportation system from both use and network changes are analyzed in detail in **Section 4.16**. The socioeconomic impact analysis evaluates the nature and extent of projected travel redistribution and changes in traffic conditions to assess if they would result in corresponding economic changes for local area residents, businesses, and the local area's economy.

During the three-year construction phase, no measurable socioeconomic effects on the local area economy are expected due to the affected roadway system's remote location, very low use levels, and the limited traffic growth from construction activities. Traffic and access road details are discussed in **Section 4.16**. These roadway system changes have the potential to divert some recreational travel and spending from the village of Yellow Pine to other locations with access to the PNF and BNF. Traffic data on the number of annual recreationists travelling through Yellow Pine via this route is limited but is approximately 29 vehicles per day. This traffic likely includes current SGP employees and contractors accessing the mine site area as part of ongoing exploration activities. As a result, there is the potential for reduced economic activity in Yellow Pine from May through November from the project's roadway system changes; however, it also may be expected that any of the spending from diverted recreationists would be spent locally elsewhere and recaptured by the local area economy.

While the roadway improvements may redirect some traffic within the local area, the improvements are not expected to induce significant new visitation. SGP changes to the local area's roadway system and use are not anticipated to result in any major new economic activity or economic development. Consequently, the transportation impacts would have negligible, short-term, and localized socioeconomic effects on the local analysis area's economy during construction.

The traffic increases during the 15-year operating period of the SGP are anticipated to be approximately the same as that projected during the construction phase. In addition, the roadway network would be generally the same under both the construction and operations phases, but the Burntlog Route would be the designated route for mine traffic and provide an additional route for public access to the SGP and the FCRNRW. Therefore, socioeconomic impacts from transportation during operations would be similar to those during the construction phase. As during construction, Perpetua would be responsible for roadway maintenance measures under a cooperative agreement with Forest Service and Valley County. As such, there would be no increased cost to Valley County and its taxpayers as a result of SGP-related roadway repair costs. Consequently, transportation impacts would have negligible, long-term, and localized socioeconomic effects on the local analysis area's economy during the operations phase.

During closure and reclamation, less traffic increases would occur than during construction and operations and would be distributed across several routes within the local roadway network. Project socioeconomic impacts from transportation during closure and reclamation would be similar in nature but lesser in magnitude as those during the operations phase. Consequently, transportation impacts would have negligible, long-term, and localized socioeconomic effects on the local analysis area's economy during the closure and reclamation phase.

Infrastructure

Other infrastructure changes, such as utility system upgrades, also could have socioeconomic impacts on surrounding communities depending on nature of the effects on local area residents and businesses.

All the transmission lines and electrical substations that would be upgraded or built as part of the SGP are located within remote and underdeveloped areas with no current operating businesses or other economic activities. Concerns have been noted that the service capacity increase from SGP upgrade to the local area utility infrastructure could attract and result in other new development within the local study area that would result in additional socioeconomic impacts; however, it is considered highly unlikely that any such

induced development would occur, because utility service capacity is not considered a primary limiting factor to current economic development within the vicinity of the upgraded or new utilities. Consequently, no utility service capacity related impacts would occur from SGP utility service changes.

Tourism

Recreation and tourism are important sectors of the local area economy, as discussed under **Section 3.19** and **3.21**. The analysis of tourism to the area includes visitors from outside the area as well as seasonal residents who utilize the area for recreation and thus, contribute to the tourism economy.

Impacts to recreation are discussed in detail in **Section 4.19**. This section evaluates the potential impacts on tourism-related businesses and the region's economy from expected changes to recreation due to construction activities. The specific effects of resource changes on recreational and tourism use would depend on how the changes influence visitor use decisions. Studies and economic models of correlated mining and tourism observe an interaction between the two industries with resulting positive and negative economic effects for tourism ranging from increased discretionary spending and travel accommodations to competition for labor and resources (Tourism Research Australia 2013).

SGP-related changes in recreation access or opportunities (i.e., recreation and wildlife conditions) could affect the local area's economy through visitor and seasonal resident spending changes at local tourism businesses. The nature and extent of the impacts to the local area's tourism economy would depend on the type and magnitude of SGP-related changes in local visitation and use. Non-local visitor and seasonal resident use changes would generally have greater potential to impact local tourism businesses due to their higher spending on goods and services than local residents.

SGP-related changes in recreation access (and consequently use) may result from both restrictions on the areas currently open to public use and/or changes in the local transportation system that affect users' ability or inclination to travel to the local area's recreational destinations.

SGP construction and operations would require imposition of the Operations Area Boundary. Public use would not be allowed within the 13,441 acres of public lands within the Operations Area Boundary. Existing dispersed recreational use and opportunities that occur in this area would be displaced to other locations in or adjacent to the analysis area. Once the Burntlog Route is constructed, access to recreation areas beyond the Operations Area Boundary, such as Monumental Summit and Thunder Mountain, would be available in addition to the route through the mine site which would provide public access with safety controls to preclude public interaction with mine equipment and blasting operations. As a result, there would be a short-term decrease in recreational use and tourism-related business revenues during the three-year construction phase to these areas resulting in a moderate, short-term, and localized impact.

Impacts on recreation opportunities at and around the mine site would begin during construction and continue until the mine was closed, the site reclaimed, and the area reopened for dispersed recreation use. Some displaced visitors may choose to continue recreating at their current locations in other National Forest areas, such as the South Fork area, rather than return to the mine site area due to permanent changes in the recreation setting within the Operations Area Boundary. Nonetheless, there would be no net loss in recreation opportunity for the local analysis area, and the socioeconomic impacts to the local analysis area's tourism sector and overall economy based on recreational opportunity would be negligible,

long-term, and localized. It also is possible that SGP-related displacement of some specific recreational use and visitation from areas near local communities, such as Yellow Pine or Warm Lake (e.g., re-routing of groomed OSV trails), could reduce tourism spending at their businesses. Depending on the type and magnitude of any such lost spending, it is possible that adverse economic impacts on individual businesses and community economies could occur. These impacts could be negligible to moderate, long-term, and localized.

More specifically, SGP construction would affect access to the operating areas of three outfitters and guides as a result of the development of Burntlog Route and the OHV Trail, as well as the closure of Stibnite Road and the Operations Area Boundary, discussed further in **Section 4.19**.

The Operations Area Boundary established during construction would remain in place during operations. Public access through the Operations Area Boundary would be re-established during operations with safety controls to prevent public interaction with mine mobile equipment and blasting activities. Through access for the three outfitters impacted during the construction period would be restored. These SGP-related changes could result in increased or decreased recreation visitation (either in numbers of visitors and/or their recreation use). Use of the Burntlog Route and the Burntlog Maintenance Facility could impact two and one outfitters respectively, due to their locations within their operating areas. Operations impacts to the impacted outfitters are described further in **Section 4.19**.

Generally, it is expected that any impacted or displaced recreation would likely relocate to other National Forest areas within the local analysis area. This outcome may be expected due to both the limited recreation use levels of the affected areas where legacy mining disturbance dominates the existing condition and the existing availability of alternate and comparable recreational areas and resources. As a result, the corresponding change in recreation use under operations would have negligible, long-term, and localized socioeconomic impacts to the local area's tourism sector and overall economy.

During closure and reclamation, both the Operations Area Boundary and the Burntlog Route would be reclaimed, and other Operations Area Boundary facilities also would be similarly decommissioned. However, it would take years (20 or more) for major revegetation to occur and major physical features of the operations would remain (TSF, buttress, and pit walls). As a result, some of the Operations Area Boundary former facility sites would continue to appear disturbed. Consequently, the recreational setting for these locations would likely be permanently altered and some recreational use may remain permanently displaced to other more natural locations within the local area. Closure and reclamation noise would attenuate to background levels within 0.5 mile, nevertheless reducing recreation opportunities in these areas for activities that depend on a quiet, natural environment.

Until their completion, the impacts from closure and reclamation on recreation and tourism would likely be unchanged from the operations; however, following completion of closure activities, restrictions on visitation would no longer be in effect. Accordingly, the recreation use changes from reclamation would have negligible, long-term, and localized socioeconomic impacts to the local area's tourism sector and overall economy.

Fisheries Restoration Program

The Nez Perce Tribe's Department of Fisheries Resources Management (DRFM) operates Fisheries Restoration Programs in the vicinity of the proposed Operations Area Boundary such as the Johnson Creek Artificial Propagation Enhancement Project and its associated research program. Annual funding for the project and research is approximately $1.5 million from a total annual operating budget of $22 million and utilizes DRFM's staff labor from the total group of 200 employees (Nez Perce Tribe 2019). The project produces up to 110,000 Chinook salmon smolts annually for direct release into Johnson Creek while the research program examines smolt-to-adult return rates and the utilization of hatchery rearing of wild fish to supplement fish populations.

Construction period usage of the Johnson Creek Road would increase traffic and activity on an existing roadway along portions of Johnson Creek where the fisheries restoration program is active. Project impacts regarding water quality and the transport of hazardous materials have the potential to affect the restoration efforts (Forest Service 2022f). However, the socioeconomic components for the restoration program (e.g., road access, employment) would observe negligible and short-term effects from the increased use of an existing roadway. Implications for tribal treaty rights and interests are described in the SGP Tribal Rights and Interests Specialist Report (Forest Service 2022q).

Other Costs and Benefits

The SGP includes design and operational features intended to reduce impacts on water resources (streamflow, water temperature, and water quality) and aquatic habitat. These potential resource impacts are determined not to have quantifiable and/or monetizable impacts that can be incorporated as socioeconomic impacts. This is generally due to lack of discernable direct changes in human use that can be attributed to the resource changes in an area dominated by legacy mining impacts and disturbance as the existing condition.

The design and operations modifications would result in both incremental costs to the owner/operator (e.g., water treatment facility capital and operations and management costs) and benefits (e.g., improved water quality or probability of meeting water quality standards) due to their intrinsic, non-market value. More specifically, the expected water resource benefits are evaluated in the SGP Surface Water and Groundwater Quality Specialist Report (Forest Service 2022f) and the SGP Fish Resources and Fish Habitat Specialist Report (Forest Service 2022i).

While changes in these resources may have non-monetary value, these resource improvements are not expected to result in any human use changes (e.g., by recreational or by tribal member users) that can be quantified. Consequently, for the purposes of this socioeconomic impact analysis, the non-monetary benefits of such improved water quality and wildlife habitat would not have any socioeconomic effects. Similarly, the related fisheries and ecological/resiliency also are not recognized to have any socioeconomic effects for the purposes of this socioeconomic impact analysis.

In addition to the incremental non-monetary resource benefits discussed above, the owner/operator would incur some incremental capital and future operations and maintenance costs. Costs associated with the SGP would be primarily associated with the partial re-routing of Burntlog Route, construction and operation of the lime kiln on-site, and the addition of the road improvements for public access through the

Operations Area Boundary. Overall, the capital costs for the design and operations modifications would be a relatively limited additional incremental cost to the estimated $1.1 billion initial construction cost and the approximately $270 million annual operating cost, especially given the expected total future mineral production value over the SGP operating life.

4.21.2.3 Johnson Creek Route Alternative

Under this alternative, the access route to the mine for all phases of the SGP would be via the Johnson Creek Route. The Johnson Creek Route starts at the intersection of Warm Lake Road and Johnson Creek Road and includes the Johnson Creek Road and the Stibnite Road section of the McCall-Stibnite Road. Under this action alternative the Johnson Creek Route would be used as the primary route to the mine site during construction, operations, and reclamation/closure which would result in increased traffic on Johnson Creek and Stibnite roads. During the construction phase, AADT on Johnson Creek Road would increase from 57 to 122 and from 39 to 104 on Stibnite Road. This traffic growth would increase the noise and activity near campgrounds, dispersed camping areas, trailheads, and recreational residences adjacent to these roads which could change their recreation setting and reduce visitor recreation experiences. The village of Yellow Pine would experience an increase in truck traffic from SGP vehicle use of the Johnson Creek Route to the Operations Area Boundary throughout all phases instead of only the construction phase as under the 2021 MMP. Truck traffic increases along the Johnson Creek Route also could have some effects on other roadway users travelling along the roadway to and from Yellow Pine.

Temporary road closures on Stibnite Road would occur on a daily basis for 5 years during construction and periodically on the Johnson Creek Road as the road is improved to accommodate operations vehicles. These road closures would result in reduced access to recreation sites/areas, decreases in recreational opportunities/settings, decreases in tourism, and decreased recreation experiences. As a result of these impacts, visitors may be displaced from these areas during this alternative's construction phase, resulting in negligible to major, long-term, and localized impacts.

Aside from access road construction and use differences, actions under the Johnson Creek Route Alternative are similar to those under 2021 MMP and, therefore, would impact most local area residents, businesses, and economy in predominantly the same way. Construction under the Johnson Creek Route Alternative would be 5 years, 4 years to upgrade and reconstruct Johnson Creek and Stibnite roads and 1 year to construct facilities at the Operations Area Boundary once heavy equipment access is available, and consequently would be 2 years longer than the 2021 MMP. The overall schedule of mining post-construction phases and activities under the Johnson Creek Route Alternative would be the same as the 2021 MMP. Similarly, the quantities of ore extraction and mineral recovery would be the same while future construction and operating expenditures under the Johnson Creek Route Alternative would be higher. The net additional construction cost of the Johnson Creek Route is estimated to total $62.5 million. Perpetua estimates that the overall net cost effect could reduce the SGP's value by up to $174 million due to the combined capital, operating (i.e., longer haul routes and increased roadway O&M), and financial costs (i.e., resulting from the extended construction period and delayed operations) (Midas Gold 2019d); however, the related employment, income, population, housing, public services, and government revenue impacts (which would be predominately related to the increased construction and operations spending) would be marginally higher than those identified under the 2021 MMP.

Under the Johnson Creek Route Alternative, public road access through the mine during operations would be permitted and be similar to the 2021 MMP. As a result, the impacts during operations would be expected to be the same.

The minor relocation of Burntlog Maintenance Facility to Landmark would be expected to solely result in increased noise and visual impacts to the historic Landmark cabins.

The potential changes in socioeconomic impacts under the Johnson Creek Route Alternative analyzed for the socioeconomic analysis would be limited to those physical changes that could ultimately result in net changes in future visitor use and spending to the local area's tourism sector, fish restoration projects, and overall economy (e.g., changes in roadway access). Upgrade and use of the Johnson Creek Route for the SGP's future operations would reduce roadway-related surface disturbance, stream diversions, and wetland impacts compared to the 2021 MMP; however, the Johnson Creek Route's greater proximity to Johnson Creek and the East Fork SFSR would increase the roadway disturbance and use within both avalanche-prone areas and RCAs and thereby could result in increased public safety and environmental risks and impacts associated with transportation-related incidents and spills. The combined and overall magnitude of these impacts is not expected to result in any human use changes (e.g., by recreational or by tribal member users). Consequently, for the purposes of this socioeconomic impact analysis, the non-monetary benefits of these design changes are not recognized to have any socioeconomic effects.

The village of Yellow Pine would experience an increase in future truck traffic from SGP vehicle use of the Johnson Creek Route to the Operations Area Boundary during operations. Truck traffic increases along the Johnson Creek Route (estimated to average 60 vehicles daily) also could have some effects on other roadway users travelling along the roadway to and from Yellow Pine. Roadway changes under the Johnson Creek Route Alternative might also result in redistribution of recreational and other traffic to other roads. Given the low use levels of these other roadways, the increase in traffic to local recreation locations would be limited. The additional SGP-related traffic along the Johnson Creek Route may displace some recreation use to other less noisy locations. Under this alternative, outfitters would not experience the adverse changes in their ability to access their operating areas.

The magnitude of the recreation use changes from these components of the Johnson Creek Route Alternative would be marginal and localized. As a result, overall recreational impact is anticipated to be minimal and, therefore, no net change in local area's overall visitation and visitor spending would be expected. As a result, the tourism impact findings during the Johnson Creek Route Alternative construction and operations phases would be expected to be the same as those determined for the Burntlog Route construction phase. Overall, the Johnson Creek Route Alternative's construction activities would have a negligible, long-term, and localized impact on the local area's tourism sector and local economy.

With regard to other, non-monetary benefits, the use of the Johnson Creek Route would not incur any impacts to roadless area characteristics in the Black Lake, Burnt Log, and Meadow Creek IRAs that would be associated with the construction of the Burntlog Route.

Upon closure and reclamation activities, roadway improvements along the Johnson Creek Route would remain under this alternative. Traffic volumes and road closures would be reduced from construction and

operational phases. In addition, because the Burntlog Route would not be constructed under the Johnson Creek Route Alternative, the reclamation activity and long-term recreational resource impacts for that would be avoided.

4.21.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Social and Economic Conditions.

4.21.4 Irreversible and Irretrievable Commitments of Public Resources

4.21.4.1 No Action Alternative

No irretrievable or irreversible commitments of public resources are anticipated under the No Action Alternative.

4.21.4.2 Action Alternatives

Implementation of the action alternatives would result in the commitment of natural and human-made resources for new infrastructure, mine operations, closure and reclamation, and other post-mining activities. The predominant commitment of resources would result from the mining, which would deplete the valuable mineral assets in the targeted ore bodies. Extraction and use of the non-renewable mineral resources would constitute an irreversible commitment; however, the SGP is proposed in a legacy mining area, where substantial habitat reclamation is needed. The SGP may mitigate some existing environmental impacts, which would improve their resource conditions.

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

Implementation of the SGP would remove the land from other uses while it is in operation, but the use would eventually be reversed through reclamation. The temporary loss of the land's availability for other uses during that period would be irretrievable.

4.21.5 Short-term Uses versus Long-term Productivity

4.21.5.1 No Action Alternative

Under the No Action Alternative, no activity associated with the SGP as proposed would be undertaken. Consequently, there would be no short-term use that would affect social and economic conditions, and no effect on long-term productivity.

4.21.5.2 Action Alternatives

The action alternatives would result in short-term use of the SGP area, and construction of new roadways in the SGP area. After closure, the Operations Area Boundary and new roads would be reclaimed/decommissioned.

Short-term uses of both the mineral resources and other natural and human-made resources (i.e., for construction, operations, and closure/reclamation) would represent a lucrative use of these resources. The socioeconomic value of the short-term use of the resources is represented by both the extracted minerals market value and the monetary cost of the resources used to mine them.

As a non-renewable resource, the mineral extraction activities would permanently reduce the site's future productivity for mineral production and economic development potential; however, the activities would result in reclamation and environmental improvements of existing disturbances that would be expected to enhance other future use potential of the site in the long term.

Use of the Operations Area Boundary and other facility locations on NFS lands would also result in a short-term decrease in the acreage available for recreation. The mining activities and public exclusion from the Operations Area Boundary would result in short-term displacement of recreational use as well as changes in recreation opportunities and setting within portions of the local area. These changes to local outfitter businesses and their customers' and other visitors' recreation experiences changes would have the potential to result in short-term socioeconomic impacts on the local area's tourism sector and economy.

After reclamation is completed, the Operations Area Boundary would be re-opened to public access and recreation. As a result, there would not be recreation access impacts to long-term use of the Operations Area Boundary, access roads, and other facility locations for recreation after mine closure; however, it is possible that long-term impacts to the recreation setting and recreation experiences (e.g., reduced wildlife populations) that could adversely affect local outfitter businesses and their customers' and other visitors' recreation experiences. If these changes result in adverse socioeconomic impacts on the local area's tourism sector and economy, there could be a long-term reduction in the area's economic productivity for future tourism use.

4.22 Environmental Justice

4.22.1 Impacts Definitions and Effects Analysis Indicators and Methodology

The analysis of effects to environmental justice populations includes one issue and the following indicators:

Issue: The SGP may disproportionately impact minority or low-income populations.

Indicators:

- Number and size of minority populations affected.
- Number and size of low-income populations affected.

- Location of SGP facilities, including roads and transmission lines in relation to minority or low-income residents.
- Differences in access to public lands.
- Change in traditional Tribal practices and/or access to Tribal resources.

Impacts to environmental justice populations were analyzed using information from the Census 2013-2017 American Community Survey demographic data (the most recent complete data year available for this EIS) (Census 2017), Tribally sponsored research on Native American fish consumption (EPA 2016b), and information and analysis documented in the SGP specialist reports regarding Heritage Resources, Fish & Aquatic Resources, Social and Economic Conditions, Tribal Rights and Interests, Vegetation, and Wildlife (Forest Service 2022l, 2022i, 2022o, 2022q, 2022g, and 2022j, respectively).

For each identified environmental justice community, the analysis assesses if any SGP-related impacts would result in disproportionately high and adverse effects on minority populations and/or low-income populations.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1**.

4.22.2 Direct and Indirect Effects

The following analysis of effects associated with environmental justice is considered in the overall context of communities and populations that might potentially be disproportionately adversely affected by the SGP. As discussed in **Section 3.22**, the following environmental justice communities were identified:

- Nez Perce CCD Subdivision;
- Fort Hall Reservation (reservation of the Shoshone-Bannock Tribes); and
- Duck Valley Indian Reservation (reservation of the Shoshone-Paiute Tribes).

Tribal access and uses of the region (including hunting, fishing, ceremonial and spiritual, medicinal, and intrinsic values) have long-standing and on-going subsistence and cultural importance for Tribal members.

4.22.2.1 No Action Alternative

Under the No Action Alternative, no action would be implemented, and there would be no mine operations associated with the SGP. The No Action Alternative would not result in adverse impacts to environmental justice communities or Tribal members.

The exploration activities authorized under the Midas Gold Golden Meadows Exploration Project would continue in and near the vicinity of the SGP area. Areas affected by the Golden Meadows Exploration Project, future access to subsistence resources and uses would remain unchanged. As a result, no adverse and disproportionate impacts to minority or low-income populations are expected to occur under the No Action Alternative.

4.22.2.2 2021 MMP

None of the Operations Area Boundary, access roads, utilities, or off-site facilities are on reservation lands, and no significant adverse biological impacts (e.g., wildlife and vegetation resources), public health impacts (e.g., contamination of fish in local streams), or other physical impacts (e.g., air quality and noise) would directly impact reservation lands and their Tribal environmental justice communities that are located outside of the 2021 MMP area. However, the 2021 MMP could affect Tribal members' access to subsistence or traditional use of the lands within the SGP area. Currently, there is no restricted access on NFS lands in the SGP area. Some restrictions are in place on private lands. As a result, the potential for any adverse and disproportionate 2021 MMP-related impacts to the Tribal environmental justice communities would be limited to changes in access for Tribal members, and subsistence or traditional use of the lands during the project life.

Information received from the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes' ethnographies indicate that areas, resources, and off-reservation rights of concern and importance include disruption of traditional practices, tribal world view, fishing rights in the SFSR watershed, including the East Fork SFSR, Meadow Creek, Fiddle Creek, West End Creek, and Sugar Creek. Tribally significant travel corridors and waterways are known: Old Thunder Mountain Road (FR 440); the East Fork SFSR system, which includes several streams; and the Riordan Lake shore. Traditional plant gathering locations or collection areas within the analysis area also were cited as important to the Nez Perce Tribe, but exact locations of these collection areas have not been shared. Other landscape features of importance include Riordan Lake and high points in the landscape (e.g., mountain tops and ridgelines) that have religious significance, and traditional plant gathering locations or collection areas.

As discussed in **Section 4.12** and the Fishery & Aquatic Resources Specialist Report (Forest Service 2022i), entrainment by in-stream activities or manmade features, flow reductions, temperature changes, changes in habitat structure, water quality changes, and reduced access to suitable habitat may affect the distribution and relative abundance of fish populations in potentially affected streams. The potential for the 2021 MMP to cause changes in surface water quality from increased erosion and sedimentation, changes in temperature, and changes in general water chemistry (i.e., pH, temperature, major ions, TDS and dissolved metals, and organic carbon) are discussed in **Section 4.9** and the SGP Water Quality Specialist Report (Forest Service 2022f). Effects on public, including Tribal member, access to the Operations Area Boundary for recreational opportunities, including fishing are discussed in **Section 4.12** and the SGP Recreation Specialist Report (Forest Service 2022m).

Construction and operation of the 2021 MMP would impact access to traditional use areas and subsistence resources if they are located within the Operations Area Boundary. Public and Tribal member use would generally not be allowed in the mine site footprint, areas adjacent to the mine site (i.e., the Operations Area Boundary) (**Figure 2.4-2**). Approximately 14,221 acres of public lands within the Operations Area Boundary would become inaccessible to the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes once construction begins and would continue through closure and reclamation. SGP on-site and off-site facility construction and operation could also impact traditional use areas and subsistence resources through habitat loss; behavioral disturbance to wildlife from increased noise and human activity; concerns about contamination of resources; and avoidance by Tribal members of traditional use areas. Furthermore, safety considerations, equipment use, presence of workers,

construction-related traffic, and road closures may discourage and restrict use by Tribal members. However, construction of the Burntlog Route and the OSV groomed trails would facilitate access to other areas outside the Operations Area Boundary.

Previously accessible lands within the Operations Area Boundary would become inaccessible for a generation, thus potentially disrupt the transfer of place-based traditional knowledge from generation to generation. However, the Operations Area Boundary represents a small portion of the total area within the PNF and BNF (2.3 million and 2.6 million acres, respectively) available to the Tribes to conduct their traditional use and access subsistence resources. All other existing areas outside of the Operations Area Boundary would remain fully accessible for hunting, fishing, gathering, and other traditional land uses.

Public and Tribal access within the Operations Area Boundary would resume following closure of the site. However, reclamation could modify the fish, wildlife, and vegetation composition of the area compared to existing conditions. Therefore, traditional land uses could be altered by reclamation. Reclamation would also remove the new portions of the Burntlog Route and the OSV groomed trails along with any beneficial use of those routes for public and Tribal access to locations in proximity to the SGP or associated facilities.

In general, the 2021 MMP impacts to subsistence resource availability on Tribal communities with environmental justice concerns could potentially be adverse and would be moderate, long term to permanent, and localized.

The Tribes have multiple and inter-related interests and associations with the local area resources (e.g., religious, sacred site, traditional, and subsistence uses). Many of these interests also are inherently incompatible with any resource changes, including increased presence or alternate use of the local area by non-tribal individuals or entities. Unlike displaced recreational use, there are no substitute resources or replacement opportunities for location-specific Tribal interests and use of the local area. As a result, Tribal members are more likely to be impacted by local area resource changes than the general public. However, specific information from the Tribes regarding the exact nature, duration, and location of impacts on Tribal populations resulting from the excluded areas for the SGP and/or resource impacts is not available in the public domain. Based on the ethnographic information provided to the Forest Service by the Tribes, it is expected that the 2021 MMP-related impacts would be of a type and/or magnitude to represent an adverse environmental justice impact to the Tribal environmental justice communities. **Section 6.2.3**, Tribal Consultation and Government-to-Government Consultation, describes the efforts the Forest Service has made to involve local Tribal governments and to solicit their input regarding the 2021 MMP. Consultation is ongoing, and the Forest Service will continue to engage with the Nez Perce Tribe, Shoshone-Bannock Tribes, and Shoshone-Paiute Tribes to develop ways to avoid, minimize, and mitigate effects to tribal rights and resources that would be impacted by the 2021 MMP.

4.22.2.3 Johnson Creek Route Alternative

Under the Johnson Creek Route Alternative, the potential for any adverse and disproportionate impacts to the Tribal environmental justice communities are expected to be limited to changes in Tribal member access and subsistence or traditional use of the lands.

Under the Johnson Creek Route Alternative, the negative and positive effects of construction of new sections of the Burntlog Route on public and Tribal access would not occur. Long-term project use of the Johnson Creek Route would increase the duration and potential for direct and indirect effects on environmental resources in the vicinity of the Johnson Creek Road and Stibnite Road and their use by Tribal community members.

The impacts to subsistence resource availability on Tribal communities with environmental justice concerns could potentially be adverse and would be moderate, long term to permanent, and localized.

4.22.3 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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Environmental Justice resources.

4.22.4 Short-term Uses versus Long-term Productivity

4.22.4.1 No Action Alternative

The SGP would not be implemented under the No Action Alternative. Consequently, there would be no short-term use that would affect minority or low-income populations, and no effect on long-term productivity.

4.22.4.2 Action Alternatives

Use of the SGP and other facility locations in NFS lands would reduce Tribal member access to traditional use areas and subsistence resources; provide new and/or improved road access to the SGP area and vicinity; and facilitate increased public and Tribal member use of NFS lands, particularly for recreational users, as a result of the 2021 MMP and Johnson Creek Route Alternative road improvements.

As described in the companion Short-term Uses versus Long-term Productivity sections for the other resources analyzed, it is expected that the original land uses, including Tribal uses, would be reclaimed in the SGP areas where specific land uses for the action alternatives would be reclaimed (e.g., Burntlog Route, access roads, transmission line ROW). Therefore, long-term disproportionate effects on Tribal communities with environmental justice concerns would only be related to any differences in the reclaimed conditions of fish, wildlife, and vegetation resources in the area compared to existing conditions.

4.22.5 Irreversible and Irretrievable Commitments of Public Resources

4.22.5.1 No Action Alternative

The SGP would not be implemented under the No Action Alternative. Consequently, there would be no irreversible or irretrievable commitment of resources.

4.22.5.2 Action Alternatives

Based on the ethnographic information provided by the Tribes regarding traditional cultural properties, sacred sites, and traditional resource collection areas, it is expected that the action alternatives would cause irreversible impacts to those locations present within the disturbance footprint of the 2021 MMP and Johnson Creek Route Alternative (Battaglia 2018; Lahren 2020; Walker 2019).

Temporal loss of the area for hunting, fishing, gathering, and other traditional uses by Tribal members would be irretrievable. In addition, removing access to a culturally important area for approximately 20 years over the life of the 2021 MMP and Johnson Creek Route Alternative could result in the irretrievable and irreversible loss of cultural practices and identity to a generation of Tribal members.

4.23 Special Designations

4.23.1 Impact Definitions and Effects Analysis Indicators and Methodology

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 special designations. Although special designations 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 for Special Designations include the following issues and indicators:

Wilderness Issue: The SGP could change the quality of wilderness character in designated or recommended wilderness areas.

Wilderness Indicators:

- Distance of SGP facilities from designated or recommended wilderness.
- Distance of designated or recommended wilderness from sights and sounds of human activity.
- Change in opportunities for self-reliant recreation within designated or recommended wilderness.

WSR Issue: The SGP may affect WSRs.

WSR Indicators:

- Free-flowing conditions for eligible and suitable WSR segments;
- Water quality for eligible and suitable WSR segments;
- ORVs for which eligible and suitable WSR segments are designated or nominated;
- Potential changes to classification of eligible and suitable WSR segments as Wild, Scenic, or Recreational.

IRA Issue: The SGP may impact roadless character in IRAs and lands contiguous to unroaded areas.

IRA Indicators:

- Miles and acres of roads in IRAs or contiguous unroaded lands.

- Number and acres of SGP facilities in IRAs or contiguous unroaded lands.

RNA Issue: The SGP could impact research values or ecosystem conditions within RNAs.

RNA Indicator:

- Change in vegetation community composition and structure within an RNA.
- Change in number of vehicles using roads and human activity within or immediately adjacent to an RNA.
- Changes to water quality (chemistry, temperature) or quantity within an RNA.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.1-1.**

4.23.2 Direct and Indirect Effects

4.23.2.1 No Action Alternative

Wilderness

The use and character of the FCRNRW and recommended wilderness areas would continue as projected in the FCRNRW Plan and the Payette and Boise Forest Plans. Under the No Action Alternative, none of the approved exploration or planned ASAOC activities would be conducted within the FCRNRW boundary or recommended wilderness boundaries. There would be no measurable effects under the No Action Alternative on the five qualities of wilderness character in the FCRNRW or recommended wilderness areas.

Wild and Scenic Rivers

Planned ASAOC activities would still be implemented. Current uses by Perpetua on patented mine/millsite claims, and on the PNF and BNF would continue. Concurrent uses of NFS lands include mineral exploration, and dispersed and developed recreation, such as pleasure driving, hunting, OHV use, camping, hiking, snowmobiling, bird watching, target shooting, firewood cutting, and other forms of recreation. Traditional cultural uses of the SGP area would continue, including hunting, fishing, and the collection of plants for basket-making, food, and medicinal uses. Access to public land in the area would continue as governed by law, regulation, policy, and existing and future landownership constraints. Current access to the area, via Johnson Creek Road and Stibnite Road, would remain. Existing road access to Recreational river segments would not change, and existing effects to Wild segments would continue, including ongoing noise and sediment impacts from existing summer use. Traffic on Burntlog Road would remain largely recreational. No winter plowing of the road would occur, and snowmobiles would continue to use it.

Inventoried Roadless Areas

Approved mineral exploration adjacent to, but not within, Meadow Creek, Horse Heaven, and Sugar Mountain IRAs would continue. Planned and approved ASAOC activities would also still be conducted. As such, the roadless character within the 13 IRAs would be the same as existing conditions.

Research Natural Areas

The following analysis of effects associated with RNAs is considered within the overall context of vegetation and hydrologic conditions within the RNA analysis area. The purpose of the analysis is to disclose the potential effects on the research values, ecological site conditions, and processes in the two RNAs within the analysis area.

Perpetua would continue with exploration, monitoring, and reclamation commitments as described in the Golden Meadows Decision Memo and EA. Belvidere Creek, the RNA nearest to the SGP operations area, is approximately 6 miles north. Fugitive dust generated from vehicles and reclamation activities would attenuate within 300 feet of unpaved roads (Watson 2000). The distance of approximately 6 miles between the Belvidere Creek RNA and SGP reclamation and monitoring activities precludes the potential for fugitive dust and non-native invasive plant species establishment that could result in the loss of research values, ecological site conditions, and ecological processes within this RNA.

The spread of non-native invasive plant species varies based on each species characteristics. The distance from the mineral exploration and seeding of disturbed areas to any of the RNAs is more than 5 miles. The distance and the NFS and Valley County roads used for access reduce the potential for SGP activities to spread non-native invasive plant species into the RNAs. Therefore, there would be negligible direct or indirect effects on the hydrologic conditions, vegetation communities, or the research values within the RNAs from the No Action Alternative.

Warm Lake Road, Johnson Creek Road, and Stibnite Road would be used to access the SGP for exploration and monitoring activities in the summer. Motor vehicles and personnel using these roads or conducting maintenance activities could transport non-native invasive plant species seeds and propagules. Chilcoot Peak, the RNA nearest to Johnson Creek Road, is approximately 3 miles east of Johnson Creek Road, where aggregate and road maintenance activities would be conducted. The distance reduces the potential for fugitive dust and invasive plant species to spread within the Chilcoot Peak RNA from conducting road maintenance activities. Therefore, there would be negligible direct or indirect effects on research values or ecosystem conditions within the RNAs from the use of existing roads or their maintenance.

4.23.2.2 2021 MMP

Wilderness

The following activities could affect the wilderness character qualities of untrammeled, natural, undeveloped, and solitude or a primitive unconfined type of recreation: Mine site facilities; Access roads; and New transmission line. There is a measurable effect on designated wilderness and recommended wilderness areas at the following locations:

- Burntlog Route, Riordan Creek Segment – A 5.3-mile segment of the Burntlog Route would be routed high up in the Riordan Creek drainage, where it would cross Riordan Creek north of Black Lake.

- Public Access through the SGP – Public access through the SGP from Stibnite Road (CR 50-412) to Thunder Mountain Road (FR 50375) during mine operations would be provided by constructing a 12-foot-wide gravel road to connect Stibnite Road to Thunder Mountain Road. The route would be open to all vehicles year-round.

- Limestone Processing – Lime and crushed limestone would be produced on-site from mining a limestone formation in the West End pit.

Untrammeled

While no structures or facilities would be developed inside the FCRNRW, the untrammeled quality of wilderness character could be impacted by the SGP facilities and access roads. Construction, operation, and closure and reclamation could change soundscapes or natural dark sky conditions in the FCRNRW. The extent where the SGP facilities and access roads could change soundscapes or natural dark sky conditions is influenced by topography and weather.

Noise from SGP activities, an increase in human activity, or additional traffic on roads could change wildlife species natural distribution within the FCRNRW. The disturbance to wildlife species along or near the Johnson Creek Route would be short-term. Sound from mechanical equipment at the SGP and daily Burntlog Route maintenance could change natural wildlife species distribution in the Big Chief drainage within the FCRNRW. Constructing Burntlog Route close to the FCRNRW boundary (i.e., along Riordan Creek) could increase areas where noise and lights from vehicles could be audible and visible within the Big Chief Creek drainage. During the 3 years of construction and 15 years of operation, the natural distribution of wildlife species in the FCRNRW in habitats adjacent to the Johnson Creek Route (during construction) and Burntlog Route could change (IDFG 2019). Noise from blasting at the SGP would attenuate to the threshold of 55 dBA at 2.2 miles on distance alone but accounting for topography and atmospheric absorption, would attenuate to 55 dBA approximately 0.78 mile from the source (Forest Service 2022d). Blasting noise at the mine would be intermittent during the 15 years of mine operation. Noise from Burntlog Route summer maintenance would attenuate to the threshold of 55 dBA at approximately 0.42 miles based on distance alone and noise from Burntlog Route winter maintenance would attenuate to the threshold of 55 dBA approximately 0.54 mile from the source of activity. However, accounting for ground absorption and atmospheric absorption, noise from summer road maintenance would attenuate to 55 dBA approximately 0.22 mile away and noise from winter road maintenance would attenuate to 55 dBA approximately 0.27 mile from the source of activity. Burntlog Route maintenance and associated noise would be limited to between 7:00 a.m. and 10:00 p.m. Topography, and to a lesser extent vegetation, between the FCRNRW and blasting in the open pits and mine operation would reduce the distance noise from these activities are audible (Brüel and Kjaer 2000). The ridge between Burntlog Route cut and fill slopes and the FCRNRW boundary would influence noise intensity and block where headlights from vehicles on Burntlog Route could be visible within the FCRNRW.

Lights used during mine construction, operation, and closure could result in skyglow, changing natural dark sky conditions. There could be temporary impacts on night sky conditions from construction lights at the SGP and vehicle headlights. Lights from vehicles on Burntlog Route would be visible within the upper elevations of Big Chief Creek within the FCRNRW. Topography and vegetation could block or

filter lights, reducing the area where lights are visible (Larkin 1996). The extent of change to natural dark skies from lights during mine operation and vehicle headlights on Burntlog Route is unknown. EDFs (**Section 2.4.9**) to shield lights would reduce the area where mine operation lights change natural dark skies.

Human activity at the SGP would increase to accommodate the mine's year-round 24-hour a day operation schedule. Increasing human activity at the SGP and from the potential public use of Burntlog Route could alter wildlife species migration into habitats in the FCRNRW. The use of Burntlog Route could increase the number of people recreating and hunting in wildlife habitats adjacent to or in the FCRNRW. Increased human activity could change wildlife distribution. The extent wildlife distribution would change is influenced by the type of activity, vegetation, and species (Taylor and Knight 2003; Wisdom et al. 2018).

The untrammeled quality of wilderness character would be impacted when noise and lights change wildlife species distribution and behaviors. Noise from mine activities, vehicles on Burntlog Route, and changes to natural dark skies during construction, operation, and closure and reclamation activities could result in a long-term change in wildlife species natural distribution. The duration could be short-term as some individuals of wildlife populations become habituated to noise, lights, and human activity.

Noise from recontouring slopes during the decommissioning of the Burntlog Route and returning Meadow Creek Lookout Road (FR 51290) to the existing width could be audible within the Big Chief Creek drainage. Noise from recontouring slopes, removing buildings at the SGP, and Burntlog Route decommissioning would attenuate to the threshold of 55 dBA approximately 0.57 miles from the source of activity based on distance along. Accounting for topography and atmospheric absorption, noise would attenuate to 55 dBA approximately 0.28 mile from the activity (Forest Service 2022d). Noise from recontouring slopes or decommissioning Burntlog Route would be temporary. These activities would be completed within a few days or weeks in a specific area, and, as activities ended, wildlife species distribution could return to pre-disturbance conditions. The duration of changes to wildlife species distribution after closure and reclamation activities cease would depend on species sensitivity to disturbance.

Although no structures or facilities would be developed inside the FCRNRW or recommended wilderness areas, there would be minor to moderate and short to long-term impacts, depending on the location of the impacts, to the untrammeled quality of wilderness character as described above by associated noise and lights from the SGP.

Natural

Plants

During construction, the 65 mine-related vehicles per day using Johnson Creek Route could transport non-native plant species and could become established and spread into the FCRNRW. Removing vegetation and disturbance of soils during the construction of Burntlog Route could also spread non-native plant species (Forest Service 2019b). Constructing the Burntlog Route close to the FCRNRW boundary could increase the potential for non-native plants to become established within the FCRNRW. Within the headwaters of Riordan Creek, Burntlog Route cut and fill slopes would be approximately 100

feet from the FCRNRW boundary. This approximately 5.3-mile-long segment of Burntlog Route would be downslope of the FCRNRW boundary. This shorter distance between disturbed areas and the wilderness could increase the risk of non-native plant species spreading into the FCRNRW. The public access road through the SGP could indirectly increase recreation use in the FCRNRW. Vegetation established during the interim reclamation of disturbed areas could reduce opportunities for invasive species to establish (Foltz 2012; Gornish et al. 2016; Romme et al. 2003).

During the 15 years of mine operation, approximately 50 mine vehicles per day, on average, would use the Burntlog Route. This traffic and daily maintenance activities also could disperse non-native plant species or remove vegetation along the roadside. During the decommissioning of Burntlog Route, surface disturbance and removal of vegetation established during interim reclamation could provide opportunities for non-native plant species to become established and spread. In addition, equipment used during decommissioning could disperse non-native plant species. Reclamation could impact the "natural" quality of wilderness character if the non-native annual plant species included in the seed mix spread into the FCRNRW (Morris and Schupp 2009). Reclamation of disturbed areas, which involve revegetation on NFS lands, would be done according to Payette or Boise Forest Plan Standards and in coordination with a Forest botanist.

During Burntlog Route construction, operation, and closure and reclamation, dust and sediment could be deposited on vegetation within the FCRNRW. Dust and sediment deposition in areas of the FCRNRW adjacent to Burntlog Route could change vegetation community composition within the FCRNRW. Limiting mine traffic to a 25-mile per hour speed limit (**Section 2.4.9**), could reduce the amount of dust generated. The extent of dust and sediment deposition is unknown; however, the changes in vegetation would result in a long-term impact on the natural quality of wilderness character within the FCRNRW.

Burntlog Route would be open to public use during the 15 years of mine operation and 5 years of mine closure and reclamation (Rew et al. 2018). Recreation use could increase in areas of the FCRNRW accessed from trailheads along Burntlog Route. Due to mine construction and operation, recreation use could increase in recommended wilderness areas if forest visitors avoid areas of FCRNRW. Recreation equipment and vehicles could disperse non-native plant species seeds (Pickering et al. 2010; Taylor et al. 2012; Rew et al. 2018). Indirectly, the natural quality of wilderness character in the FCRNRW and recommended wilderness areas could be impacted if recreation use spreads non-native plant species.

The public access road through the SGP would be open to all vehicles year-round. Public use is expected to be seasonal because the destination areas for the public are generally inaccessible between December and May. Recreation equipment and vehicles could disperse non-native plant species. The potential increase in recreation use under the 2021 MMP either on Burntlog Route or the public access road is unknown. Where established, non-native plant species would have a long-term effect on vegetation communities within the FCRNRW. Applicable EDFs (**Section 2.4.9**) would be implemented to reduce the potential for non-native plant species to spread. The natural quality of wilderness character could decrease within the Big Chief Creek drainage.

In the long-term, the introduction of non-native plant species could change the composition of native plant communities. The potential for non-native plant species to spread depends on the specific characteristics and local site conditions (Zouhar 2003). The extent non-native plant species could spread

and the duration these species could persist in native plant communities is unknown. The natural quality of wilderness character would be impacted if non-native plant species became established within the FCRNRW or recommended wilderness areas.

Fish and Wildlife

During construction, operation, and closure and reclamation of the Burntlog Route, vegetation removal and excavation of soil and rock could increase sediment load into Big Chief Creek tributaries and affect fish and aquatic habitat. Erosion control measures, such as sediment fencing, ditch checks, and other measures, would reduce erosion from the road into the tributaries. There could be a long-term risk to fish and aquatic habitats from the accidental spill of material, such as fuel or mine processing chemicals, where Burntlog Route crosses a Big Chief drainage tributary. The extent of impacts to aquatic habitat would be from the site of the spill downstream to the point of dilution. The measures included in the SPCC Plan would reduce the potential for a spill to reach downstream waters.

In the short-term, the SGP would result in an estimated 104 AADT, from the 65 mine-related vehicles, on Johnson Creek Route during the first 2 years of construction. Based on the estimated traffic volumes and vehicle mix, and typical vehicle speeds of 25 mph, estimated average hourly noise levels from SGP-related traffic during the construction phase would be 48 dBA L_{EQ} at 50 feet from the roadway; this would be below the impact threshold level of 55 dBA. Noise from traffic on Johnson Creek Route could change wildlife migration in Tamarack Creek drainage during the first 2 years of SGP construction. Noise from an individual vehicle would be temporary; however, between 5:00 am and 7:00 pm, when most vehicles would use Johnson Creek Route, there would be approximately five mine-related vehicles per hour. Estimated average hourly noise levels from SGP-related traffic on the Burntlog Route during the operations phase would be 49 dBA L_{EQ}. This would be below the threshold of 55 dBA. Noise and the number of vehicles on Burntlog Route could change wildlife distribution in Big Chief drainage. Less mine-related traffic and the proximity of Burntlog Route to the FCRNRW could indirectly increase recreation use of the area. Constructing Burntlog Route close to the ridge on the FCRNRW boundary could increase dispersed recreation use, both in areas adjacent to the FCRNRW and within Big Chief Creek drainage within the FCRNRW. If recreation use in the FCRNRW increases, the duration, and extent where wildlife distribution changes, either from vehicles or increased human activity, could increase. The extent where big game and sensitive wildlife species habitats within the FCRNRW are avoided by wildlife could increase. Traffic and plowing on Stibnite Road from the village of Yellow Pine to the SGP, when audible, could change wildlife distribution in Tamarack Creek drainage. The natural quality of wilderness character could decrease within the Big Chief Creek drainage. Sound from mine traffic during the mine closure and reclamation also would be audible within the FCRNRW; however, with fewer mine vehicles using Burntlog Route, the daily duration of traffic sound could be less than during operation. Topography, weather, and natural sounds influence the distance noise can be heard.

Noise from the daily Burntlog Route maintenance could disturb wildlife and change their natural distribution. The extent of wildlife distribution changes is influenced by wildlife species sensitivity to noise, number of vehicles, and duration of human activity. Burntlog Route, which would be open to public use when other routes into the area are not available, could increase disturbance to wildlife species as the public could use the road at any time of day. Individuals in wildlife populations could become habituated to Burntlog Route noise and traffic during the 15 years of operation and 5 years of mine

closure and reclamation. In the long-term, vehicles on Burntlog Route would likely change the distribution of species in the FCRNRW.

During the 2 years of Burntlog Route decommissioning and reclamation after mine closure, noise and human activity could disturb big game and sensitive wildlife species within the FCRNRW. Untrammeled above, noise from these activities noise would attenuate to 55 dBA approximately 0.28 mile from the activity (Forest Service 2022d). Recontouring slopes, spreading growth media, and seeding areas would be conducted in May through November. Noise impacts from decommissioning Burntlog Route would last for a few weeks while decommissioning activities are conducted in a specific location. Once human activity and noise from decommissioning cease, habitat use in the FCRNRW by big game and disturbance-sensitive wildlife would return over time to natural distributions.

The extent within the FCRNRW where wildlife could be disturbed or areas where wildlife would avoid is unknown. Lights from mine operation and vehicle lights on Burntlog Route could be visible within the upper elevations of Big Chief Creek within the FCRNRW. Noise and lights could disturb sensitive wildlife species. However, over time, some individuals could become habituated to noise, lights, and human activity. The natural quality of wilderness character would be impacted where wildlife distribution changes within the FCRNRW.

A new transmission line would be constructed from the new Johnson Creek substation to the SGP. Raptors could use the new line structures as perches, which can expose them to electrocution risks (Eccleston and Harness 2018). Raptor species with home ranges that include portions of the FCRNRW, or recommended wilderness areas could perch and forage from transmission line structures. There could be raptor mortality from electrocution or collisions with transmission line structures, indirectly reducing the number of raptors in the FCRNRW or recommended wilderness areas. As part of the SGP, the transmission line structures would be designed and constructed to meet the APLIC recommended raptor-protection recommendations (**Section 2.4.9**) to reduce the potential for electrocution and to limit raptor perching. Power structures designed with APLIC recommended raptor-protection would reduce the risk of raptor mortality. The natural quality of wilderness character would be impacted if there was a decline in raptor populations from mortality caused by the transmission line, although this is not anticipated from the SGP.

Air and Water

The SGP would result in emissions that could affect air quality in the FCRNRW. The predicted emissions of pollutants from within the Operations Area Boundary into the FCRNRW, as discussed in **Section 4.3** and the SGP Air Quality Specialist Report (Forest Service 2022a), including ozone precursors (e.g., nitrogen oxides and volatile organic compounds) would be below the NAAQS thresholds. The potential deposition of nitrogen, mercury, and sulfur in the FCRNRW also were predicted to be below analysis thresholds outside the Operations Area Boundary.

The predicted regional haze from SGP operations to a distance outside the Operations Area Boundary of 31 miles, which includes portions of the FCRNRW, would be less than a 5 percent change in current conditions. Visibility of the landscape within the FCRNRW within 31 miles of the Operations Area Boundary would not be impaired.

Plumes from emissions sources during mine operation could be visible within the FCRNRW; however, when and where the plume is visible depends on topography, weather conditions, and time of day. The SGP emission sources would be in a valley, and the intervening topography would influence the plume's visibility within the FCRNRW. In the long-term, the natural quality of wilderness character within the FCRNRW would be impacted where and when plumes from emissions are visible likely to negligible to minor levels.

The mining and hauling of limestone and operation of the lime generation plant would increase air emissions in the analysis area. Emissions from the on-site generation of lime and the increased number of propane deliveries could increase sulfur dioxide emissions. However, emissions would be below NAAQS thresholds. SGP impacts to air quality, including haze and plumes, would be long-term and negligible to minor.

The potential exists for increased runoff, erosion, and sedimentation from vegetation removal and surface disturbance, which could result in increased sediment load in streams. SGP facilities would be constructed and operated in watersheds that do not contain tributaries that enter the FCRNRW. Widening approximately 1.3 miles of Meadow Creek Lookout Road (FR 51290) for construction of the Burntlog Route would remove vegetation and disturb soils within 170 300 feet from the FCRNRW boundary. Where vegetation would be removed, and surface disturbance is upgradient to the FCRNRW boundary, sediment could be deposited into headwater tributaries to Big Chief Creek. Sediment deposition in streams within 300 feet of Burntlog Route could increase relative to existing conditions (Watson 2000). Stormwater pollution protection measures and interim reclamation would reduce the potential for sediment deposition into Big Chief Creek tributaries within the FCRNRW. Interim reclamation would establish vegetation cover indirectly reducing erosion. In the short-term, the natural quality of wilderness character within the FCRNRW could be impacted if SGP activities along Burntlog Route resulted in increased sediment deposition in the headwater tributaries. The 5.3 miles of Burntlog Route in the Riordan Creek drainage would be located within 100 feet of the FCRNRW boundary. Although this road segment would be close to the wilderness boundary, a ridge separates it from streams in the FCRNRW. Surface water flow and sediment from this section of Burntlog Route would not deposit to headwater tributaries within the FCRNRW.

The reduction in mine traffic during operations on Burntlog Route to 50 vehicles per day on average could reduce the amount of dust generated; however, there could be an increase in vehicles from public recreation. Dust abatement mitigation measures on Burntlog Route would decrease the generation of fugitive dust from vehicles, although some dust deposition could occur on plants within the FCRNRW.

Ecological Processes

Widening approximately 21 miles of existing roads (Meadow Creek Lookout Road [FR 51290], Thunder Mountain Road (FR 50375), and Burnt Log Road [FR 447]) could indirectly increase recreation use within the FCRNRW as a result of improved access. The connection of Burntlog Route to Meadow Creek Lookout Road (FR 51290) could indirectly increase recreation use and duration of recreation activities within areas of the FCRNRW accessed from these roads. If recreation use increased, people and pack animals could compact soils, indirectly increasing erosion potential on portions of trails within the

FCRNRW. The intensity of the effect on ecological processes from increased recreation use within the FCRNRW is influenced by site conditions, vegetation, and the duration of use at a specific site.

The number and size of vehicles using Burntlog Route for mine operation and closure and reclamation could result in wilderness visitors avoiding areas of the FCRNRW and this avoidance could indirectly increase recreation use in recommended wilderness areas or other areas of the FCRNRW, such as Big Creek. The increase in recreation use could result in areas where human influence impedes the free play of natural forces or interferes with natural processes in localized areas of the FCRNRW and recommended wilderness areas. Depending upon the magnitude, there could be long-term local changes in ecological processes within the FCRNRW and recommended wilderness areas. The natural quality of wilderness character could be impacted where there are changes in ecological processes.

The public access road would be open to all vehicles year-round. Forest visitors would have motorized access to public lands beyond the SGP and adjacent to Monumental Summit from the village of Yellow Pine. Public access road use through the SGP is expected to be seasonal due to snow cover between December and May, or later in the year. During the 15 years of operation, mine-related traffic on the Burntlog Route would be 50 AADT. Recreation equipment and vehicles could disperse non-native plant species. The potential increase in recreation use under the 2021 MMP, either on Burntlog Route or the public access road through the SGP, is unknown. If recreation use in areas of the FCRNRW adjacent to the Burntlog Route increased, there could be a loss of natural ecological processes where non-native plant species become established, and wildlife is disturbed.

Undeveloped

No structures would be constructed, or SGP-related mechanical transport used, within the FCRNRW or recommended wilderness areas. Changes in Valley County road maintenance or groomed OSV routes would not include roads or routes within or adjacent to recommended wilderness areas. The construction, operation, and closure and reclamation of SGP facilities would not change existing infrastructure within the FCRNRW or recommended wilderness areas. The undeveloped quality of wilderness character would remain unchanged relative to existing conditions within the FCRNRW and the recommended wilderness areas.

Solitude, Remoteness, and Primitive Recreation Opportunities

The opportunities for solitude, remoteness, and primitive recreation within the FCRNRW and recommended wilderness areas could be indirectly affected by mining facilities and access roads outside of the FCRNRW and changes in wilderness visitation. Weather, topography, and vegetation influence the distance sounds would be audible and lights visible within the FCRNRW.

The public access road through the SGP and construction of the Burntlog Route could increase recreation use within the FCRNRW. During the 15 years of operation, the public access road usage is expected to be seasonal because the destination areas for the public are generally inaccessible between December and May due to snow cover, with some areas such as Monumental Summit not accessible until June or early July. Forest visitors would have motorized access to public lands beyond the SGP and adjacent to Monumental Summit from the village of Yellow Pine. The public access road could increase the number of wilderness visitors by providing another access route. Forest visitors seeking solitude in Monumental

Creek and Big Chief Creek may need to venture farther into the FCRNRW. The location of the Burntlog Route close to the FCRNRW boundary could indirectly increase recreation use. Because the distance between the Burntlog Route within the Riordan Creek drainage and the wilderness boundary would be minimal, there would be an increase in the areas where the sounds and lights would be audible or visible within the FCRNRW. Increases in recreation use and areas where noise and lights from human activity would be audible or visible would reduce the area with opportunities for solitude, remoteness, and primitive recreation. Traffic and plowing on Stibnite Road from the village of Yellow Pine to the SGP, when audible, would reduce opportunities for solitude in Tamarack Creek drainage. During construction, operations, and closure and reclamation there would be less area within the FCRNRW or recommended wilderness areas where solitude, remoteness, and primitive recreation opportunities quality of wilderness character would be available. These impacts would be long term, negligible to moderate, and localized.

Noise from mine related vehicles on the Johnson Creek Route during construction could decrease remoteness and increase the evidence of humans in Tamarack Creek drainage adjacent to the road. The Burntlog Route would decrease remoteness and increase the evidence of humans within Big Chief Creek drainage during construction, operation, and closure and reclamation. Burntlog Route cut and fill slopes, repeater site access roads, and mine operation lighting could be visible to wilderness visitors within Big Chief drainage, Summit trail, and at higher elevations within the FCRNRW. Sounds from the construction, operation, and daily maintenance of Burntlog Route also could be audible in these areas. As the visitor ventures farther into the FCRNRW, the effects on solitude, remoteness, and primitive recreation opportunities could lessen. Where visible, cut and fill slopes and changes in vegetation structure could detract from the wilderness visitors experience within close proximity to the FCRNRW boundary.

During decommissioning and reclamation of the Burntlog Route, the duration of sound from recontouring slopes and seeding areas would be temporary, as activities would be completed within a few days or weeks at any given location. While the cut and fill slopes would be seeded during reclamation, the change in vegetation structure could be visible from areas within the FCRNRW for decades. The duration would be greatest in areas where cut slopes remain after decommissioning Burntlog Route or where trees are removed during construction.

The Burntlog Route would change motorized access to several trailheads/trails leading into the FCRNRW. Indirectly, the Burntlog Route could increase the number of wilderness visitors and the duration of recreation in the FCRNRW. The potential for recreation use to increase is unknown; however, once constructed, the public could use Burntlog Route for approximately 20 years. Visitor encounters at trailheads/trails within the analysis area of the FCRNRW wilderness could increase due to the widening of Burnt Log Road (FR 447) and Meadow Creek Lookout Road (FR 51290) as part of the Burntlog Route.

The number and size of vehicles transporting supplies to the SGP on the Johnson Creek Road and the Burntlog Route could deter some visitors from the FCRNRW. The number of vehicles and delays due to construction and maintenance activities could indirectly increase recreation use in recommended wilderness areas or other areas of the FCRNRW. During construction, operations, and closure and reclamation, wilderness visitors would need to travel farther into the FCRNRW or recommended wilderness areas to attain solitude, remoteness, and primitive recreation opportunities.

Wild and Scenic Rivers

The following activities under the 2021 MMP have the potential to intersect with eligible or suitable WSRs, as discussed in the sections below.

During construction, operation, and closure and reclamation, mine-related traffic would access the SGP from SH 55, north of the town of Cascade, via Warm Lake Road (CR 10- 579). This route crosses the SFSR.

During construction, access to the SGP from Warm Lake Road would be via Johnson Creek Road (CR 10-413) to the village of Yellow Pine, and from Yellow Pine to the SGP via the Stibnite Road portion of McCall-Stibnite Road (CR 50-412) (i.e., the Johnson Creek Route) until the Burntlog Route is complete. The Johnson Creek Road has multiple crossings of Johnson Creek. During operations and closure/reclamation, mine-related traffic would use the Burntlog Route.

Burnt Log Road (FR 447) crosses the WSR-eligible Burntlog Creek and its tributaries. The road would change from a summer-only route with primarily recreational traffic to year-round use involving plowing, de-icing, and serving heavy industrial vehicles. During mine operations, these borrow (quarry) sites would be used to stockpile soil/cleared vegetation for use in eventual reclamation. Mine closure and reclamation traffic would continue to use the Burntlog Route during these activities, and the new road segments would be decommissioned at completion of closure and reclamation activities. Any additional access to the SGP post-closure would be via the Johnson Creek Road or other existing routes.

Construction activities at existing substations, the construction of new substations, the upgrading of an existing transmission line along the WSR-eligible segment of Johnson Creek, and the construction of a new transmission line between a new Johnson Creek substation and a SGP substation. The transmission line ROW would be widened to 100 feet from 70 feet, and vegetation would be cleared and maintained in this area as needed. The upgraded transmission line also would cross the eligible SFSR at Warm Lake Road.

The Burntlog Maintenance Facility would be located along Burnt Log. This location is near Peanut Creek in the Burntlog Creek watershed. The Burntlog Maintenance Facility would be located in part of a new borrow site that would be excavated for gravel for the Burntlog Route road improvements. Following excavation, the maintenance facility would serve as a base for equipment and materials stockpiles needed for winter plowing and sanding of the Burntlog Route.

Construction

Burntlog Creek

Free-flowing conditions of eligible, suitable, and designated WSRs

Construction activities would result in short-term, negligible, and localized impacts to the free-flowing condition as a result of culvert and bridge replacement on Burnt Log Road under the 2021 MMP. There would be no impact to the free-flowing characteristics of Burntlog Creek.

Water quality of eligible, suitable, and designated WSRs

The 2021 MMP includes widening and resurfacing Burnt Log Road through the Burntlog Creek watershed (approximately 13.75 miles of roadway). Widening would entail the excavation (or blasting) of uphill cut slopes and construction of downhill fill slopes. Three bridges would be replaced within the watershed, at Burntlog Creek, East Fork Burntlog Creek, and a tributary to East Fork Burntlog Creek. Remaining stream and drainage crossings would be via culverts. Because the roadway would be widened, existing culverts would be removed and replaced.

Up to three borrow sources in the Burntlog watershed have been identified, two for rock to be used during road construction, and one for sand to be used for road maintenance during operations. The Motorized Mixed-Use Analysis Report (DJ&A, PC 2017) anticipates an addition of 65 vehicles per day on the Burntlog Route during construction, with 69 percent of those anticipated to be heavy vehicles.

The addition of the Burntlog Maintenance Facility would likely have an incremental increased effect on stormwater runoff, potential leaks or spills of automotive fluids, and sedimentation of dust from on-site road sanding material storage and vehicle travel over gravel surfaces. However, the facility would change less than 0.1 percent of the watershed to industrial use from forestry use, so any effects on water quality, ORVs, or the Wild classification of Burntlog Creek are likely to be negligible.

During Burntlog Route construction, the potential also exists for increased runoff, erosion, and sedimentation as a result of localized vegetation removal and excavation of soil, rock, and sediment, which could result in increased sediment load in streams. Expected permit stipulations from the IDWR and IDEQ would require that: streambank vegetation be protected except where its removal is necessary; new cut or fill slopes not protected with some form of riprap be seeded and planted with native vegetation to prevent erosion; use of temporary erosion and sediment control BMPs associated with a SWPPP; and all construction activities be conducted per Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations.

ORVs for which eligible, suitable, and designated WSRs are recognized

During construction, replacement of culverts at stream crossings along the Burnt Log Road has the potential to temporarily impact fish passage, increase sedimentation, and alter primary productivity. Use of typical BMPs during installation of stream crossing structures, would minimize the potential for temporary effects to fish passage if used during periods of the year when passage is most critical (e.g., spawning periods for salmon and juvenile outmigration). With implementation of required BMPs, impacts would be temporary, negligible, and localized.

Preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs

Figure 4.23-1 shows the noise and visual impacts of the 2021 MMP along the Burntlog Route. Roadway widening would be generally consistent with the VQO of Preservation (Wild segment) and Partial Retention (Recreational segment).

These impacts are likely to be most pronounced during construction of the route. During widening of the road, noise levels would attenuate to the threshold of 55 dBA approximately 0.57 mile from the source of activity based on distance alone. Accounting for ground absorption and atmospheric absorption, noise from access road construction would attenuate to 55 dBA approximately 0.28 mile from the source of activity. Road construction and associated noise would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.) and roadway construction noise would dominate the noise environment within about 2,000 feet of the road. Downstream of the Burntlog Route, Burntlog Creek has a preliminary classification of Wild. Noise is expected to temporarily adversely affect approximately 880 acres of the WSR corridor, and visual impacts would be noticeable from approximately 600 acres of the corridor.

The segment upstream of Burntlog Route has a preliminary classification of Recreational. Noise impacts during construction would temporarily affect approximately 720 acres in this segment and visual impacts would affect approximately 1,140 acres. As one of the potential borrow areas is located adjacent to the road crossing of Burntlog Creek and partially within the WSR corridor, recreation access to this portion of the waterway could be adversely affected.

Due to increased ROW width, approximately 28.6 acres of additional utility ROW would be located within the Wild segment of the Burntlog Creek WSR corridor at its confluence with Johnson Creek. However, at this location the existing utility corridor and transmission line are not visible from Burntlog Creek itself (Forest Service 2013b) and changes to it would not affect the preliminary classification of Wild.

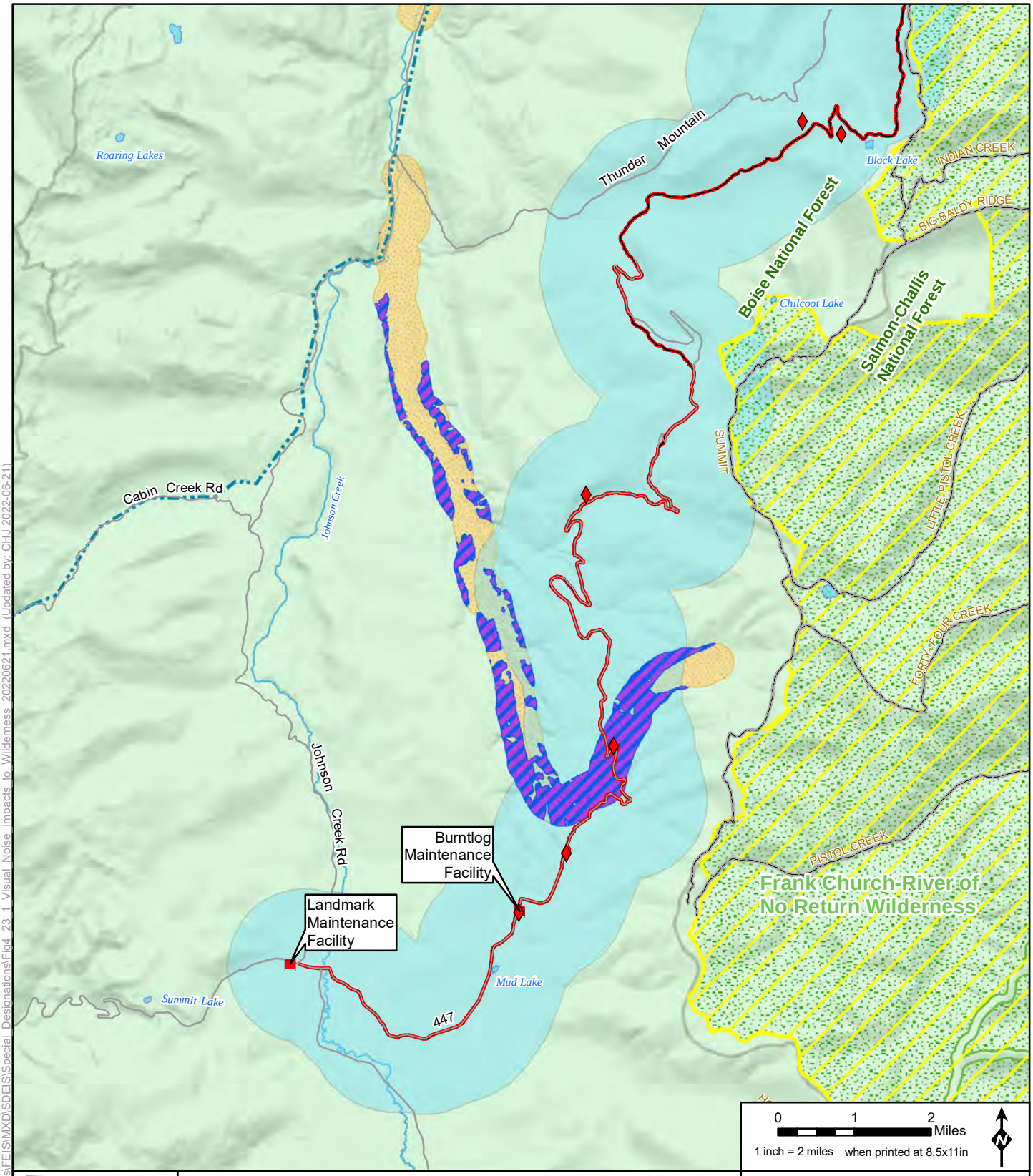
Johnson Creek

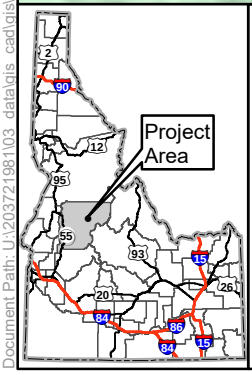
Free-flowing conditions of eligible, suitable, and designated WSRs

Construction activities would not impact the free-flowing condition of Johnson Creek, as there would be no impoundment, diversion, or other water resource projects within this waterbody as a result of the 2021 MMP. There would be no impact to the free-flowing characteristics of Johnson Creek.

Water quality of eligible, suitable, and designated WSRs

The transmission line corridor parallels the eligible Recreational segment of Johnson Creek. The existing ROW would increase from 70 to 100. If additional vegetation such as trees require clearing for construction or transmission line safety, this could result in an adverse impact to water quality from vegetation clearance. Decreased shade can increase water temperatures in the creek, and reduced vegetation cover can increase sedimentation rates. Upgrade of the transmission line would include new spur roads that also could increase sediment runoff. Vehicle use on spur roads or along the ROW corridor could result in potential impacts from oil or gas spills. During construction, sedimentation from construction sites could increase in the short term. Expected permit stipulations from IDWR and IDEQ would require the use of erosion and sediment control BMPs associated with a SWPPP (Forest Service 2022f and **Section 4.9)**. All activities would be conducted in accordance with Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations. ROW clearing would be for the purpose of maintaining low height vegetation during operations and would not entail clearing and grubbing to bare soil. Consequently, the vegetation root structure within soils would be retained, reducing erosion potential compared to bare soil. With implementation of required BMPs,





LEGEND

Project Components*

- Burntlog Route
- Burntlog Route Borrow Source

Utilities

- Upgraded Transmission Line

Offsite Facilities

- Perpetua Offsite Facilities
- Wilderness Analysis

Impacts to Wilderness

- Burntlog WSR Corridor Visual Impacts
- Burntlog WSR Corridor Noise Impacts
- Burntlog Creek WSR Corridors
- Burntlog Road New Construction/Operation/Reclamation Noise Impacts (1 Mile)

Other Features

- U.S. Forest Service
- Wilderness
- County
- City/Town
- Highway
- Road
- Stream/River
- Lake/Reservoir

*Project Components are associated with Burntlog Route

Note: The McCall – Stibnite Road (CR 50-412) onsists of Lick Creek Road, East Fork South Fork Salmon River Road (East Fork Road) and Stibnite Road.

Figure 4.23-1
Visual and Noise Impacts to Wilderness from Burntlog Road
Stibnite Gold Project
Stibnite, ID

Base Layer: USGS The National Map: 3D Elevation Program. USGS Earth Resources Observation & Science (EROS) Center: GMTED2010. Data refreshed January, 2020. Other Data Sources:Perpetua; State of Idaho Geospatial Gateway (INSIDE Idaho); Boise National Forest; Payette National Forest

Document Path: U:\2037\2198\03_data\gis_cad\gis\FEIS\MXD\SDEIS\Special_Designations\Fig4_23_1_Visual_Noise_Impacts_to_Wilderness_20220621.mxd (Updated by: CHJ 2022-06-21)

impacts to water quality would be short term, negligible to minor, and localized during construction and long term, negligible to minor and localized during operations and closure and reclamation.

ORVs for which eligible, suitable, and designated WSRs are recognized

The existing transmission line parallels Johnson Creek and its ROW overlaps with the creek and WSR study corridor. Accessing the existing transmission line for upgrades and maintenance would require truck traffic that could damage heritage resources along the transmission line upgrade route. However, avoidance of historic properties (i.e., National Register eligible heritage resources) would be implemented, or mitigation required prior to construction activities (Forest Service 2022l and **Section 4.17**). The transmission line itself is an eligible historic property and part of the heritage ORV of this segment of river, however, maintenance and upgrade of the transmission line are part of the nature of the infrastructure and therefore would not be considered an adverse effect to the historic property.

During construction, mine-related traffic would access the SGP using Johnson Creek Road (CR 10-413). Because no roadwork would occur outside of the existing ROW, no physical impacts to heritage resources (artifacts or sites) would occur. Increased mine traffic on Johnson Creek Road next to the eligible segment could have noise and visual impacts to the area, although this would not physically impact heritage resources. Impacts to heritage resources would be negligible to major (if a historic property cannot be avoided by construction), localized, and long-term (Forest Service 2022l and **Section 4.17**).

Short-term indirect effects to the recreation setting could result from increased traffic related to mine construction (approximately 65 AADT during construction). These impacts would be short term (approximately 3 years), as mine-related traffic under the 2021 MMP would be diverted to the Burntlog Route during operations and closure/reclamation.

Preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs

During construction, traffic noise levels along Johnson Creek would rise by 2 dBA day-night noise level (Forest Service 2022d). On average this increase is not detectable, and so would not likely adversely impact the Recreational designation of Johnson Creek. Recreation access would not be impacted under long-term operational conditions.

South Fork Salmon River

Free-flowing conditions of eligible, suitable, and designated WSRs

Construction activities would not impact the free-flowing condition of the SFSR as a result of the 2021 MMP. There would be no impact to the free-flowing characteristics of the SFSR.

Water quality of eligible, suitable, and designated WSRs

The transmission line corridor crosses the eligible SFSR at Warm Lake Road. Widening the ROW from 70 to 100 feet would increase the ROW by 17.4 acres within the SFSR WSR study corridor. Although some loss of shading or temporary sediment increases during vegetation clearance or line construction would occur, any effects to water quality would likely be too small to measure because of this waterway's large watershed and large flow volume. As discussed in the SGP Surface Water and Groundwater Quality Specialist Report and **Section 4.9** (Forest Service 2022f), expected permit stipulations from the IDWR

and IDEQ would ensure that streambank vegetation would be protected except where its removal is absolutely necessary; use of temporary erosion and sediment control BMPs associated with a SWPPP; and that all activities would be conducted in accordance with Idaho environmental anti-degradation policies, including IDEQ water quality regulations and applicable federal regulations. With implementation of required BMPs, impacts to water quality would be short term, negligible to minor, and localized during construction and long term, negligible to minor, and localized during operations and closure and reclamation.

ORVs for which eligible, suitable, and designated WSRs are recognized

During construction, temporary, negligible to minor, and localized impacts would occur to recreation ORVs for the SFSR through temporary impacts to recreational access by construction-related access restrictions; or access delay, noise, or visual impacts in the vicinity of the existing transmission line crossing.

Recreation access would be restored following transmission line construction, and, therefore, no long-term impacts to recreation ORVs are anticipated.

Construction activities related to vegetation clearing in the transmission line ROW and replacement of conductors and support structures would cause short-term, negligible to minor, and localized impacts to scenery ORVs (Forest Service 2022p). Long-term impacts to scenery ORVs at the crossing could result from vegetation clearing within the expanded ROW and the larger, taller utility poles. Direct impacts would be of limited geographic extent and associated with the existing disturbance of the crossing of Warm Lake Road over the SFSR. Therefore, long-term direct impacts to scenery ORVs would be minor. There would be no construction impacts to geological, cultural, botanical, and fisheries ORVs.

Impacts to the Wild, Scenic, or Recreational classification for eligible and suitable WSRs

Construction activities could briefly limit recreational access to the Recreational SFSR during widening of the transmission line ROW where it crosses the river at Warm Lake Road. Impacts would be temporary, negligible to minor, and localized and would not affect the Recreational classification.

Operations

As described below, activities at the SGP during the operations phase would not directly or indirectly affect eligible or suitable WSR segments on the SFSR, Burntlog Creek, or Johnson Creek. Under the 2021 MMP, the Burntlog Maintenance Facility would be located along Burnt Log Road (FR 447) approximately 4.4 miles east of the junction of Johnson Creek Road (CR 10-413) and Warm Lake Road (CR 10-579) and would house road maintenance and snow removal equipment.

Upon completion of the Burntlog Route, all mine-related operational traffic would use that route. The nexus of access roads to eligible and suitable WSR segments is all mine access routes cross the suitable segment of the SFSR on Warm Lake Road and Burnt Log Road crosses the eligible segment of Burntlog Creek and divides the upper Recreational portion from the lower Wild portion.

Burntlog Creek

Free-flowing conditions of eligible, suitable, and designated WSRs

Impacts to free-flowing conditions of Burntlog Creek would continue due to the presence of culverts and bridge crossings along the Burntlog Route. Stream crossings would be designed to minimize potential impacts on surface water hydrology, water quality, and fish passage. Perpetua would be required to comply with specific design requirements as part of the IDWR Stream Channel Alteration Permit. Permit-related design requirements, use of BMPs, and required maintenance activities would allow natural streamflow and minimize impacts to free-flowing condition. There would be no impact to free-flowing conditions of Burntlog Creek during operations.

Water quality of eligible, suitable, and designated WSRs

Burnt Log Road would be widened and mine-related traffic on it would increase. Approximately 70 acres of the Burntlog Creek watershed would be affected by road widening cut and fill activities. Approximately 10 of those acres would be within the eligible WSR corridor. The road would be plowed and sanded during winter months (currently it is not plowed or sanded). The road would be re-surfaced with sub-base material topped by gravel. The culvert at the Burntlog Creek crossing would be replaced. A borrow pit (gravel extraction) would be within the eligible WSR corridor, on the east side of the current road crossing of Burntlog Creek (**Figure 4.23-1**).

As described above under Construction, increased acreage of gravel roads and increased heavy vehicle traffic is associated with increases in sediment load delivery to streams (Reid and Dunne 1984). Forest roads can accelerate erosion and sediment delivery to streams and have been identified as the primary contributor of sediments to stream channels in managed watersheds (Trombulak and Frissell 2000). Roads are often chronic sources of sediment delivery from cut-slopes, ditch-lines, and running (i.e., driving) surfaces, and act as potential sites for accelerated mass movements (e.g., mud slides). Roads also intercept subsurface flows, concentrate flows in ditch lines and through culverts and bridges, and act as direct conduits for sediment delivery to stream channels (Beschta 1978).

For operation and use of the Burntlog Route, standard erosion control measures, such as silt fencing, ditch checks, and other measures, would be installed and maintained to minimize the potential for erosion and sedimentation. Numerous small (15- to 60-inch) drainage culverts would be installed along the Burntlog Route to reduce rutting and shunt water out of ditches and off the road prism. The road would be maintained as a hardened road surface with gravel surfacing to allow for all-weather use of the road. Impacts would be long term, minor, and localized.

ORVs for which eligible, suitable, and designated WSRs are recognized

Burntlog Creek has an ORV for fish. If year-round heavy vehicle use and winter plowing/sanding of the Burntlog Route during mine operations increases sedimentation rates to Burntlog Creek, this could adversely affect fish spawning habitat in the creek. The SGP may cause changes in fish habitat in the analysis area that may affect aquatic species, including federally listed fish species and aquatic habitat and Management Indicator Species downstream of the SGP area. The SGP may affect fish species by degrading water quality in waterways adjacent to access roads. Fish populations may be impacted through the establishment of fish access upstream of the Yellow Pine pit and fish health may be impacted if any

hazardous material spills occur at the SGP or along the access roads (Forest Service 2022i) and are not immediately contained.

Preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs

Noise levels during mine operations along the Burntlog Route from road maintenance and use would increase by about 10-12 dBA (at about 2,000 feet distance from the road) and would be particularly noticeable in winter due to plowing and winter traffic, which does not currently occur. Noise impacts could adversely impact the overall wild character of the eligible Wild segment of Burntlog Creek.

The 2021 MMP includes a borrow site that would be located partially within the Burntlog Creek WSR corridor, at the crossing of Burnt Log Road. Sand and gravel excavated from this burrow site and other quarries would be stockpiled at the borrow site for use during winter maintenance. This may inhibit recreational access to the Recreational portion of Burntlog Creek, as the location of the quarry and stockpile site would be located at the only road access point to the Recreational section of the creek.

Johnson Creek

Free-flowing conditions of eligible and suitable WSRs

No impacts to the free-flowing conditions of Johnson Creek are anticipated during operations as no impoundments or diversions are anticipated to occur.

Water quality of eligible, suitable, and designated WSRs

As discussed in the Access and Transportation Specialist Report, traffic during operations on the native-surfaced/gravel Johnson Creek Road would return to non-mine related traffic as mine traffic would shift to the Burntlog Route. The road would not be plowed for winter use once the Burntlog Route was complete. Impacts to water quality in Johnson Creek during operations would be long term and negligible (Forest Service 2022f).

ORVs for which eligible, suitable, and designated WSRs are recognized

There would be no effect to the Heritage ORV on the eligible segment of Johnson Creek from operations, as SGP operations traffic would use the Burntlog Route.

Preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs

Although traffic along Johnson Creek Road would potentially increase over current conditions during mine operations if vendors utilize that road rather than the Burntlog Route, this increase in traffic would not change access to the eligible corridor. Consequently, there would be no impact to the preliminary classification of Recreational for this segment of Johnson Creek.

South Fork Salmon River

Free-flowing conditions of eligible, suitable, and designated WSRs

No impacts to the free-flowing conditions of the SFSR are anticipated during operations as no impoundments or diversions would occur.

Water quality of eligible, suitable, and designated WSRs

No impacts to water quality in the suitable SFSR would occur from implementation of the 2021 MMP, as no SGP activities are likely to cause such impacts in this location.

ORVs for which eligible, suitable, and designated WSRs are recognized.

No access road upgrades are proposed for Warm Lake Road (where it crosses the SFSR); therefore, no impacts to ORVs for which the SFSR is recognized would result from this component of the 2021 MMP.

Preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs.

Recreational classification is compatible with roadway access to or along Recreational WSR waterways. The 2021 MMP would not alter access to the suitable segment of the SFSR, so there would be no impacts to its preliminary classification of Recreation.

Closure and Reclamation

Closure activities at the SGP would have the same effects to the SFSR, Johnson Creek, and Burntlog Creek as activities during operations therefore are not discussed further.

Inventoried Roadless Areas

Construction, operation, and closure and reclamation of the SGP could affect the wilderness attributes of naturalness; undeveloped character; outstanding opportunities for solitude and primitive types of recreation. A detailed evaluation of the impacts of SGP activities on roadless area characteristics by phase is included in the SGP Effects on Roadless Character (AECOM 2020j) report. Following is a summary of the analysis.

Table 4.23-1 identifies the direct impacts to IRAs that would occur under the 2021 MMP and **Figure 4.23-2** shows the location of the 2021 MMP components within the IRAs in the analysis area.

Table 4.23-1 Direct Effects to Inventoried Roadless Areas (Acres/Miles)

IRA Name/ (Total IRA Acreage)	SGP Component	2021 MMP Acres/(Miles)	Johnson Creek Route Alternative Acres/(Miles)
Bernard (20,891)	None	N/A	N/A
Black Lake (5,335)	Access roads	80.9 / (7.2)	0
Burnt Log (23,699)	Access roads	39.1 / (1.5)	0
Caton Lake (84,530)	Utilities	0.8 / (0)	0.8 / (0)
Horse Heaven (17,747)	Mine site (Acres only)	79.3	79.3
Horse Heaven (17,747)	Utilities	34.0 / (2.5)	34.0 / (2.5)
Meadow Creek (29,288)	Mine site (Acres only)	348.7	348.7
Meadow Creek (29,288)	Access Roads	86.1 / (5.0)	5.1
Meadow Creek (29,288)	Utilities	3.4 / (0.5)	3.4 / (0.5)
Needles (161,173)	None	N/A	N/A
Peace Rock (191,734)	None	N/A	N/A

IRA Name/ (Total IRA Acreage)	SGP Component	2021 MMP Acres/(Miles)	Johnson Creek Route Alternative Acres/(Miles)
Reeves Creek (10,542)	Utilities	1.2 / (0.1)	1.2 / (0.1)
Secesh (248,088)	None	N/A	N/A
Stony Meadows (13,551)	None	N/A	N/A
Sugar Mountain (10,340)	None	N/A	N/A
Whiskey (4,970)	None	N/A	N/A
Total		673.5 / (16.8)	472.5 / (3.1)

N/A = not applicable

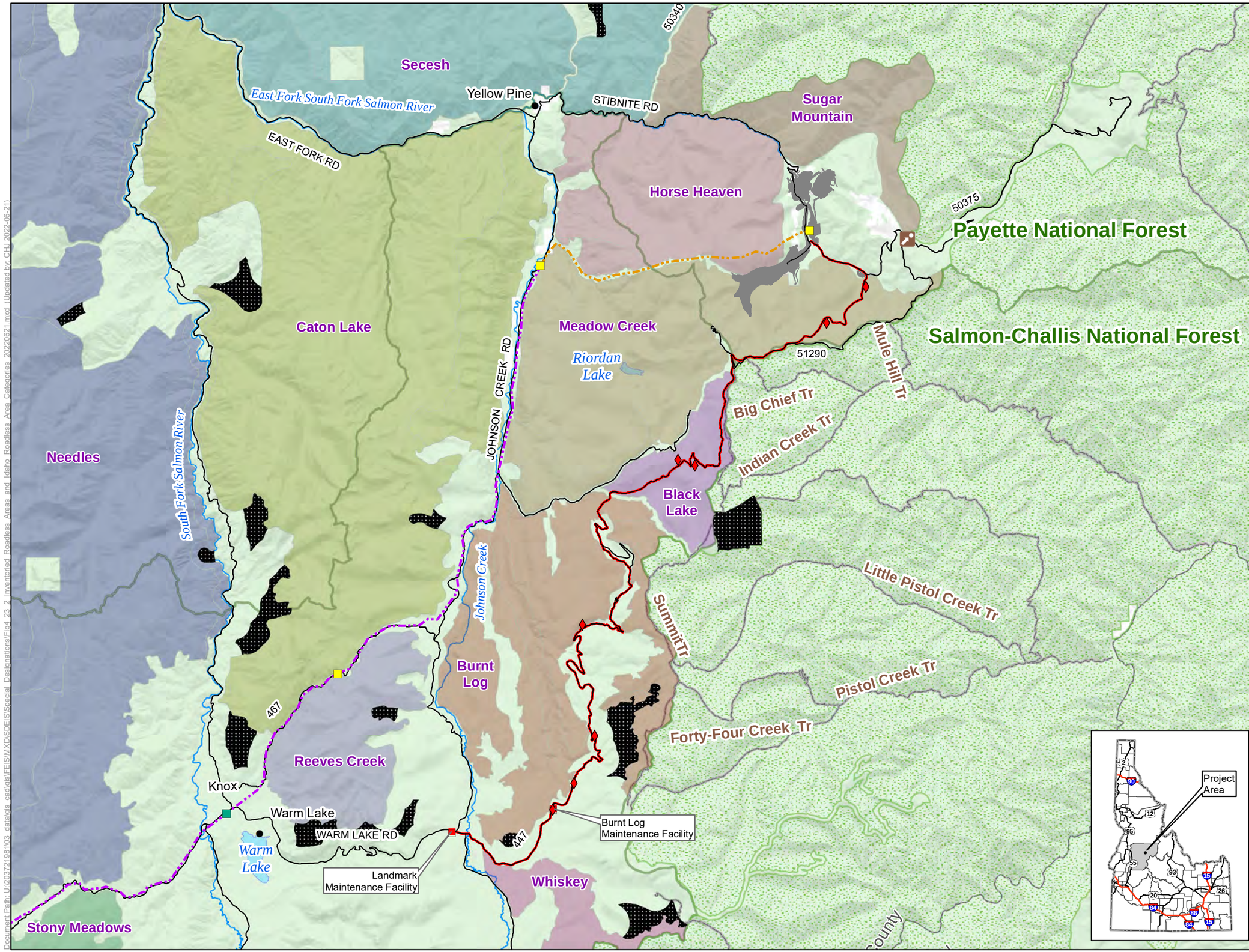
Naturalness

The 13 IRAs and lands contiguous to unroaded areas within the analysis area contain large areas of undisturbed habitat and support diverse plant communities. Air, water, and soil quality in the IRAs also are considered high quality. As shown in **Table 4.23-1**, construction and operation of the SGP under the 2021 MMP would directly impact Meadow Creek, Horse Heaven, Black Lake, Burnt Log, Caton Lake, and Reeves Creek IRAs. Construction and operation of mine facilities, the Burntlog Route, and the new segment of transmission line would remove vegetation, alter topography, and modify fish and wildlife habitat within IRAs. A segment of the Burntlog Route would be in the Riordan Creek drainage, where it would cross Riordan Creek north of Black Lake, where human activity and noise from construction could disturb wildlife species that use Black Lake and the associated riparian areas along Riordan Creek.

Plants

Approximately 740 acres of vegetation would be removed within six IRAs. Vegetation removal and construction traffic could spread non-native plant species within IRAs during the 3 years of construction. Maintaining the new transmission line, SGP facilities, and Burntlog Route during the 15 years of mine operation would increase the opportunities for non-native plant species distribution. Areas within IRAs where non-native plant species become established would alter vegetation composition and change the natural ecological processes. Perpetua would inspect vehicles at the SGLF prior to use and survey disturbed areas and treat invasive plant species for 3 years after a disturbed area is seeded or planted. These measures would decrease the potential for non-native plant spread. Surveys and implementing treatments described in the Integrated Weed Management program for the PNF and BNF would reduce the potential for non-native plant species to spread. During the 5 years of mine closure and reclamation, recontouring slopes and seeding disturbed areas would reclaim vegetation in the impacted IRAs; however, plant communities would be less diverse relative to existing conditions.

Construction of the Burntlog Route, repeater site access roads, and the new segment of transmission line would impact and result in the fill of wetlands in Burnt Log, Black Lake, Meadow Creek, and Horse Heaven IRAs. Construction of the TSF and TSF Buttress at the SGP would permanently affect slope and valley wetlands in the Meadow Creek drainage, including wetlands and riparian vegetation within the Meadow Creek IRA.



LEGEND

Project Components *
- SGP Features
- Burntlog Route
- Burntlog Route Borrow Source
- Perpetua Offsite Facilities

Utilities
- New Substation
- Existing Substation
- Upgraded Transmission Line
- New Transmission Line

RoadlessAreas
- Black Lake
- Burnt Log
- Caton Lake
- Horse Heaven
- Meadow Creek
- Needles
- Reeves Creek
- Secesh
- Stony Meadows
- Sugar Mountain
- Whiskey
- Contiguous Unroaded Lands

Other Features
- U.S. Forest Service
- Wilderness
- County
- City/Town
- Monumental Summit
- Road
- Trails
- Stream/River
- Lake/Reservoir

0 1.35 2.7 Miles

1 inch = 2.7 miles when printed at 11x17

Figure 4.23-2
Project Components and Inventoried Roadless Areas
Stibnite Gold Project
Stibnite, ID

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

During the 15 years of operation under the 2021 MMP, with the limestone processing at the SGP, the number of mine vehicles on Burntlog Route would be 50 AADT. Reducing the amount of mine related traffic could reduce the transport of non-native plant species within the Burnt Log, Black Lake, and the eastern part of Meadow Creek IRAs. Maintaining vegetation in the new transmission line segment and use of access roads would permanently change plant succession within the Horse Heaven and Meadow Creek IRAs. Vehicles used to maintain the transmission line could transport non-native plant species.

Fish and Wildlife

Diverting Meadow Creek into a channel and construction of a TSF embankment would reduce aquatic habitat complexity and aquatic habitat connectivity within Horse Heaven and Meadow Creek IRAs. A 5.3-mile segment of Burntlog Route would be near the ridge between the upper elevations of Riordan Creek and the FCRNRW. Human activity and noise during construction and operations could disturb wildlife species near Black Lake and the associated riparian areas along Riordan Creek. Maintaining vegetation in the new segment of transmission line and use of access roads would permanently change wildlife within small portions of the Horse Heaven and Meadow Creek IRAs.

The approximately 0.8-mile East Fork SFSR tunnel with fish passage could remove a barrier to fish passage and improve aquatic species habitat connectivity. Increases in fish habitat connectivity in the East Fork SFSR stream segments above Yellow Pine pit could improve fish species distribution in Sugar Creek drainage. The extent and intensity of the increase would vary depending on fish species and other water quality parameters. In the long-term, if aquatic habitat connectivity increased, the natural quality of roadless character could improve in the Sugar Mountain IRA.

During construction, operation, and closure and reclamation of access roads, vegetation removal and excavation of soil and rock could increase sediment load in sections of streams within Sugar Creek, Burnt Log, Black Lake, Meadow Creek, and Horse Heaven IRAs. Fish habitat connectivity would be temporarily disrupted during the installation or removal of culverts on access roads within these five IRAs. Erosion control measures, such as sediment fencing, ditch checks, and other measures, would reduce erosion from the road into streams.

Vegetation including habitat for Canada lynx and wolverine removed within the Meadow Creek, Horse Heaven, Black Lake, and Burnt Log IRAs would alter wildlife habitat by reducing cover and changing habitat quality. The lack of vegetation cover in addition to the newly constructed retaining walls for access roads could change wildlife movement and distribution (Montgomery et al. 2012). During mine operation, vegetation would continue to be removed as the TSF facility is expanded. A 6-foot-tall wildlife fence would surround the TSF. Creation of the TSF and TSF Buttress would remove wildlife habitat and could change wildlife species distribution in the Meadow Creek and Horse Heaven IRAs. The SGP Wildlife and Wildlife Habitat Specialist Report (Forest Service 2022j) provides additional information.

Construction and operations noise, lights, and human activity could displace wildlife species from habitat within IRAs and lands contiguous to unroaded areas during the 3 years of construction. Some wildlife species could temporarily avoid habitat if noise from construction activities is greater than ambient levels (Robinson et al. 2010; Trombulak and Frissell 2000). As described in the Noise Specialist Report, SGP-related noise levels are predicted from noise generated by major SGP-related noise sources. Estimated average hourly noise levels from SGP-related traffic on the Burntlog Route during the operations phase would be 49 dBA $L_{EQ,}$ below the threshold of 55 dBA (Forest Service 2022d and **Section 4.6**).

During mine closure and reclamation activities, approximately 5 years, the wildlife security fencing around the TSF and other areas would be removed. As vegetation becomes established, and human activity decreases, wildlife distribution for some species could return to existing conditions.

Soil, Water, and Air

Construction of SGP facilities would result in soil resource commitments and DD resources within IRAs. Interim reclamation and EDFs could reduce the potential loss of soil resources. Growth media from Burntlog Route construction would be stockpiled and stored in borrow source sites and in windrows at the top of fill slopes. Long-term storage of growth media also could reduce mycorrhizal activity and a loss of soil viability. During closure and reclamation, growth media would be spread and areas reseeded within the TSF and backfills in the Meadow Creek and Horse Heaven IRAs and along the Burntlog Route within the Meadow Creek, Burnt Log, and Black Lake IRAs. Areas with soil nail walls would be reclaimed to the foot of the wall; however, soil nail walls would remain.

During construction, approximately 2 miles of Meadow Creek would be diverted around the south side of the TSF and TSF Buttress. In the Meadow Creek and Horse Heaven IRAs, water temperature and chemistry in the 2-mile stream segment of Meadow Creek located in a channel could change and become less productive for fish and aquatic species. Changes to streamflow, groundwater-surface water interactions, and stream shading have the potential to affect stream temperatures (Forest Service 2022e and 2022i).

Fugitive dust sources during construction would include haul roads, access roads, dust from vehicle travel, and transferring material which would be deposited in adjacent areas. Dust from vehicles using unpaved roads could become airborne and there could be a temporary impact on air quality in adjacent areas of IRAs. During construction, the predicted particulate matter 2.5 microns or less and 10 microns or less emissions would be below NAAQS thresholds at the Operations Area Boundary. During operations, pollutants including ozone precursors (e.g., nitrogen oxides and volatile organic compounds) are predicted to be below NAAQS thresholds at Operations Area Boundary. The potential deposition of nitrogen, mercury, and sulfur also are predicted to be below analysis thresholds from the Operations Area Boundary outward. The lime kiln operation would increase emissions of sulfur dioxide but would remain below NAAQS thresholds (Forest Service 2022a and **Section 4.3**).

Natural Appearing Landscapes with High Scenic Quality

Construction of the TSF, TSF Buttress, access roads, and the new transmission line segment would result in new disturbance within six IRAs. During the 15 years of operation, the flatter valley basins, terraces, and slopes from the TSF and TSF Buttress would contrast with the surrounding unmodified landscapes

within Meadow Creek and Horse Heaven IRAs. During closure and reclamation, the TSF would be graded/recontoured to blend into the surrounding topography and terrain; however, it would still be apparent in the environment. The change in elevation, flatter valley basins, terraces, and sloped landforms would continue to show evidence of human modification to natural landscapes within Meadow Creek drainage after closure and reclamation.

Areas cleared of vegetation, rock cuts, retaining walls, and human activity would be visible in Burnt Log, Black Lake, and Meadow Creek IRAs during the construction and operation of Burntlog Route. Areas cleared of vegetation, exposed soil color, and changes in terrain during the construction and operation of Burntlog Route would modify the natural landscape and reduce scenic quality. Locating a segment of the Burntlog Route within the Riordan Creek drainage would be visible in the Black Lake and Meadow Creek IRAs, depending upon the height of cut slopes. Maintaining vegetation in the new transmission line ROW and use of access roads would change plant succession within portions of the Horse Heaven and Meadow Creek IRAs for the long term. The 100-foot-wide ROW would contrast with the adjacent undisturbed vegetation, reducing the quality of scenic resources.

After decommissioning, less than one mile of soil nail walls, some slopes, and rock cuts would remain. Soil nail walls and rock cuts would continue to be evidence of human alterations in localized areas.

Undeveloped Character

The wilderness attribute of undeveloped character informs impacts to the roadless area characteristics of *reference landscapes* and *natural appearing landscapes with high scenic quality*. The location of the Burntlog Route would result in new surface disturbance within the Burnt Log, Black Lake and Meadow Creek IRAs. After mine closure and reclamation, the TSF and TSF Buttress would be reclaimed; however, the TSF and backfill liners, and retaining walls would remain as structures within the Meadow Creek, Horse Heaven, Black Lake, and Burnt Log IRAs. There are NFS roads and trails that allow motorized use in the roadless expanse. The SGP would result in human development, including new structures within IRAs.

Structures

The TSF and TSF Buttress would be permanent structures within the Meadow Creek and Horse Heaven IRAs. During mine operation, tailings deposition would change the elevation of lower Meadow Creek drainage several hundred feet amsl.

New road segments, cut and fill slopes, and soil nail retaining walls would be present along the Burntlog Route that would be within the Burnt Log, Black Lake, and Meadow Creek IRAs during construction, operations, and closure and reclamation. Indirectly, improvements to Burnt Log Road (FR 447) and the newly constructed road could increase the number of user-created dispersed recreation sites in IRAs. The proliferation of dispersed recreation sites along Burntlog Route could decrease the undeveloped roadless characteristic IRAs.

Several miles of new transmission line would be present within the Meadow Creek and Horse Heaven IRAs. Existing transmission line structures would be replaced, and new access roads to transmission structures would be present within the Reeves Creek and Caton Lake IRAs.

As a result of facilities constructed within the IRAs, there would be a conversion of acres within IRAs managed for Backcountry Restoration meeting the semi-primitive non-motorized setting to the area meeting rural and semi-primitive motorized physical setting during both the summer and winter relative to existing conditions (AECOM 2020j).

During closure and reclamation, mining facilities on and off the SGP and associated utilities would be removed (e.g., transmission line from Johnson Creek substation to the SGP), and new mine access roads (i.e., portions of Burntlog Route) would be decommissioned and reclaimed. After mine closure, areas of mine related disturbance, access road retaining walls, geotextile fabric, and potentially foundations for the transmission poles, would remain within the Meadow Creek, Horse Heaven, Black Lake, and Burnt Log IRAs.

Natural Appearance

In the long term, the Burntlog Route, transmission line structures, access roads, and repeater sites within IRAs would reduce the undeveloped area and natural landscape in localized areas. Noise, lighting, and human activity from construction and operation of mining facilities and access road construction and maintenance would change the natural landscape within the Burnt Log, Black Lake, Meadow Creek, Horse Heaven, Secesh, and Sugar Mountain IRAs and would be evidence of modern human presence and modifications to the natural environment.

During closure and reclamation, the TSF and TSF Buttress within the Horse Heaven and Meadow Creek IRAs would be recontoured to blend with adjacent slopes. However, the elevation and change from a V-shaped valley topography to a level valley would remain noticeable and provide evidence of past human activity. The recontoured slopes, topography, and sparser vegetation would decrease the area within IRAs with a natural appearance. Recontouring slopes, reestablishing drainage, and seeding the constructed portion of the Burntlog Route within the Black Lake, Burnt Log, and Meadow Creek IRAs could help return these areas to a natural appearance over time.

Outstanding Opportunities for Solitude and Primitive Recreation

The 13 IRAs and lands contiguous to unroaded areas are large enough to provide outstanding opportunities for solitude and primitive recreation. Outstanding opportunities for solitude or primitive recreation vary throughout the roadless expanse depending on topography, vegetation, distance to roads and trails that allow motorized use, and other human structures. Forest visitors seeking outstanding opportunities for solitude could be displaced from IRAs and adjacent unroaded areas during construction, operation, and closure and reclamation of the SGP. The Operations Area Boundary encompasses approximately 15 percent of the total acres within the Sugar Mountain, Horse Heaven, and Meadow Creek IRAs combined and reduces the area available for outstanding opportunities for solitude or primitive recreation. The presence of workers, vehicles, and the sound of equipment would be high during the entire life of the SGP in adjacent areas. The presence of workers, vehicles, and the sound of equipment would decrease the areas within the Meadow Creek, Black Lake, Burnt Log, and Horse Heaven IRAs and adjacent unroaded areas with outstanding opportunities for solitude and primitive types of recreation.

There would be 135,827 acres within IRAs that would meet the semi-primitive non-motorized recreation setting during the summer. During the winter, there would be 104,717 acres meeting the semi-primitive motorized recreation setting. Increasing areas within the roadless expanse meeting the semi-primitive motorized physical recreation setting could reduce opportunities for solitude and primitive recreation. Maintaining the new transmission line and use of access roads would reduce the area within the Horse Heaven and Meadow Creek IRAs with outstanding opportunities for solitude. The construction and use of the public access road through the SGP could increase recreation use and motorized access in the Meadow Creek IRA (Forest Service 2022m).

During operation, noise from daily road use or maintenance and blasting at the SGP could continue to reduce areas within these IRAs with outstanding opportunities for solitude. The Burntlog Route could lead to increased motorized public use and, thereby, indirectly increase recreation use in the Meadow Creek, Horse Heaven, Black Lake, and Burnt Log IRAs. Due to increased traffic, forest visitors also may avoid IRAs nearer to the SGP, indirectly increasing recreation use in the adjacent IRAs. After mine closure, the currently existing Burnt Log Road (FR 447) would remain and could lead to increased recreation use and decreased opportunities for primitive recreation and solitude within IRAs.

Special Features and Values

Special features in the 13 IRAs include areas valued for their scientific qualities, scenic qualities, or other notable distinct features. Special features that could be affected by the SGP under the 2021 MMP include habitat for Canada lynx, wolverine, and anadromous fish species; elk security areas (winter range) and migration paths; and vegetation communities where whitebark pine could be present. Construction of SGP facilities, access roads, and utilities could result in a loss or fragmentation of Threatened and Endangered Species and Forest Service Sensitive species habitat within the Meadow Creek, Horse Heaven, Black Lake, Burnt Log, Caton Lake, and Reeves Creek IRAs. Elk use and migration within the elk security area of the Horse Heaven IRA could be disturbed by noise from mine-related traffic and human activity during all SGP phases. Fish habitat would be improved if sediment loads are reduced and fish passage improves in streams within the Meadow Creek, Caton Lake, and Horse Heaven IRAs. Portions of the Chilcoot Peak RNA and eligible WSR segments of Burntlog Creek and Johnson Creek located within IRAs also could be indirectly affected by activities under the 2021 MMP from invasive species and sediment loading changes creating changes to water quality. Roadless area characteristics that correspond with this wilderness attribute are *traditional cultural properties and sacred sites* and *other locally identified unique characteristics*. A detailed evaluation of the impacts of SGP activities on TCPs and sacred sites is included in the SGP Tribal Rights and Interests Specialist Report (Forest Service 2022q).

Manageability

Manageability of IRAs is the ability of the Forest Service to manage these areas to maintain roadless characteristics. The new mining facilities, access routes, and the transmission line would create substantially noticeable human development and structures within IRAs and would create isolated parcels that may be difficult to manage during construction and operation of the SGP. The new transmission line segment and access roads would create an isolated parcel within the Horse Heaven IRA for the long term. The Burntlog Route within the Black Lake, Burnt Log, and Meadow Creek IRAs would create isolated

parcels that would be difficult to manage to maintain roadless characteristics during mine construction and operation. The location of the Burntlog Route and the new transmission line segment in the Black Lake, Burnt Log, and Meadow Creek IRAs would create isolated parcels that would also be difficult to manage to maintain roadless characteristics.

Research Natural Areas

Table 4.23-2 describes the distance and direction of the nearest SGP component to each RNA.

Table 4.23-2 Research Natural Area Location and Distance to Nearest SGP Component

RNA	Location and Distance to SGP Component
Belvidere Creek	The entire Belvidere Creek RNA is within the FCRNRW and is located about 7 miles northeast of the village of Yellow Pine and approximately 6 miles north of the SGP Operations Area Boundary. Cut and fill areas associated with upgrades to the Johnson Creek Road are within 5 miles of this RNA. No impacts to this RNA from the SGP are anticipated.
Chilcoot Peak	Portions of the Chilcoot Peak RNA are within the FCRNRW and Burnt Log IRA and are located near FR 447 (Burnt Log Road) and the Burntlog Route.

Source: AECOM 2020a

Construction

As part of Burntlog Route, reconstruction of (i.e., widening, installing drainage features, etc.) approximately 3 miles of Burnt Log Road (FR 447) would remove vegetation and disturb soils located within 100 to 3,100 feet of the Chilcoot Peak RNA boundary. An approximately 2.4-mile section of Burnt Log Road that is currently within 700 to 800 feet of the Chilcoot Peak RNA boundary, would be reclaimed and decommissioned due to rerouting of the alignment. Removing existing vegetation and disturbing soils could disperse non-native invasive plant species that could become established within the Chilcoot Peak RNA (Forest Service 2019b; Jacobs et al. 2009). If the spread of plant species not currently present within the Chilcoot Peak RNA occurred, it would change research values, ecological site conditions, and ecological processes within the Chilcoot Peak RNA (Forest Service 1995). Impacts would be localized, negligible to moderate, and long term.

Once the Burntlog Route is complete, the AADT would increase from 27 to 65 vehicles, approximately 2.4 times the existing traffic volume. Increasing the number and size of vehicles using Burnt Log Road as part of Burntlog Route could increase the amount of dust deposited on adjacent vegetation. During the 2 years of the Burntlog Route construction, the effects on vegetation health from dust deposition within the RNA would likely be negligible (Squires 2016; Trombulak and Frissel 2000; Ulrichs et al. 2008).

During construction, widening Burnt Log Road would increase human activity in areas near the Chilcoot Peak RNA and could increase the potential for human-ignited fires. Fires occurring more frequently or during different seasons than lightning-ignited fires could change vegetation plant species succession and ecological processes within the Chilcoot Peak RNA. The presence of road construction crews in construction camps could have both positive and negative effects on fire conditions. Crews' observations could decrease the amount of time before a fire is detected; however, they could also increase the

probability of a human-caused fire. In addition, design features would also limit the potential for human-caused fires during construction.

Timber harvested at the SGP could be transported on Burntlog Route. Timber from the SGP could have conifer pathogens such as pathogenic bark beetle species (e.g., mountain pine beetle [*Dendroctonus ponderosae*]), and white pine blister rust, which is caused by the introduced pathogen *Cronartium ribicola* (Hinke et al. 2016; Keane et al. 2017) and these pathogens could be distributed during the transport of timber on the Burntlog Route. The potential for conifer pathogens to be introduced into the Chilcoot Peak RNA depends upon site conditions during the transport of timber and specific characteristics of a conifer pathogen. Whitebark pine/subalpine fir habitat type is one of the distinguishing features of the Chilcoot Peak RNA, and conifer pathogens could cause mortality of whitebark pine and other conifers. If this occurs, changes in the composition and structure of existing vegetation communities and ecological succession would result in a localized, minor to major, long-term loss of the Chilcoot Peak RNA research value and ecological condition.

The removal of vegetation, soil disturbance, and access road improvements from the upgrade to the existing Idaho Power Company [IPCo] transmission line could disperse non-native invasive plant species into adjacent RNAs. Vehicles and equipment could transport non-native plant species seeds that could become established and spread (Trombulak and Frissell 2000). This increase in vehicles, human activity, and the disturbance of vegetation and soils would be over 3 miles from the two RNAs. Constructing the upgraded transmission line would result in negligible direct or indirect effects on the research values, ecological site conditions, and ecological processes within the two RNAs.

The application of Forest Plan standards and implementing treatments consistent with the PNF Noxious Weed Program and Idaho's Noxious Weed Management and Control Program would reduce the potential for non-native plant species to become established within the two RNAs. Non-native invasive plant species could become established within the RNAs. This would result in a localized, negligible to minor, long-term loss of research values, ecological conditions, and ecological processes.

Operation

During the 15 years of operation, AADT along the Burnt Log Road and newly constructed Burntlog Route would increase from 27 to 50 vehicles, approximately 1.9 times the existing number of vehicles on Burnt Log Road. Forest visitors may choose to avoid Burntlog Route and the SGP due to the increased traffic, increased number of large vehicles, and potential delays during daily Burntlog Route maintenance activities. Recreation use could increase in other areas, such as the South Fork Salmon River and Big Creek drainages. During the summer, if recreation use on Warren-Profile Gap Road (FR 50340), Hamilton Bar (FR 50673), South Fork Road (FR 50674), and NFST 291 increases, the risk of non-native invasive plant species distribution and establishment would increase (Trombulak and Frissel 2000). Non-native plant species could become established within the Chilcoot Peak RNA, although due to the design features that would be implemented, the anticipated overall impacts are expected to be negligible to minor and long-term.

Traffic on Burntlog Route could continue to deposit dust on vegetation within portions of the Chilcoot Peak RNA. Dust abatement measures during operation would reduce the amount of fugitive dust generated and the amount of dust that could be deposited on vegetation within the Chilcoot Peak RNA

(Lewis et al. 2017; Ulrichs et al. 2008). Changes in vegetation community composition and structure would result in a loss of research values, ecological site conditions, and ecological processes in the Chilcoot Peak RNA.

Changes in vegetation community composition and structure within the RNAs would occur where non-native invasive plant species become established, soils are compacted, or trails widened, or there is a change in fire frequency. Changes to vegetation community composition and structure would result in the long-term loss of research values, ecological site conditions, and ecological processes within these this RNA.

The operation and maintenance of the upgraded transmission line could disperse non-native invasive plant species. Vehicles and equipment could transport non-native plant species seeds that could become established and spread (Trombulak and Frissell 2000). The increase in vehicles, human activity, and the vegetation management of the transmission line would be over 3 miles from any RNAs. At this distance, these activities would result in negligible direct or indirect effects on the research values, ecological site conditions, and ecological processes within the two RNAs.

Closure and Reclamation

During mine closure and reclamation, an estimated AADT of 57 vehicles, including 27 mine vehicles, would use the Burntlog Route an additional 5 to 7 years after the mine operation ceases. During mine closure, the AADT on Burntlog Route, including 27 mine vehicles, would increase from 27 to 57, approximately 1.9 times the existing traffic on Burnt Log Road. Vehicles and daily road maintenance activities could disperse non-native invasive plant species and continue to deposit dust on vegetation within portions of the Chilcoot Peak RNA. Dust abatement measures during closure and reclamation would reduce the amount of fugitive dust generated.

Any spread of native and non-native plant species into the Chilcoot Peak RNA would change vegetation community composition and structure (Forest Service 1995). Changes in vegetation community composition and structure would result in a loss of research values, ecological conditions, and ecological processes in the Chilcoot Peak RNA. Reclamation of disturbed areas, which involve revegetation on NFS lands, would be done according to Payette or Boise Forest Plan Standards and in coordination with a Forest Service botanist. After reclamation and closure, impacts from the spread of non-native invasive plant species or changes in vegetation composition and structure would be localized, negligible, and long term.

Implementing actions described in the SGP Reclamation Plan (Tetra Tech 2021a), South Fork Salmon River Subbasin Noxious and Invasive Weed Management Plan (Forest Service 2007b), Forest Standards, the Payette and Boise National Forest Noxious Weed and Poisonous Plant Control Programs, and Valley County noxious weed control programs would reduce the potential for non-native plant species to become established within the RNAs. Implementing design features, surveys, and treatments would not altogether remove the risk of non-native invasive plants or species that are not already present in existing habitat types from becoming established and spreading into the Chilcoot Peak RNA, but it would limit the potential for this risk. Where non-native plant species become established within an RNA, there would be a localized, negligible to minor, permanent loss of RNA values.

4.23.2.3 Johnson Creek Route Alternative

Under the Johnson Creek Route Alternative, the construction of mine facilities and the new transmission line would be the same as the 2021 MMP. The differences between the 2021 MMP and the Johnson Creek Route Alternative include:

- Johnson Creek Road – Under the Johnson Creek Route Alternative the SGP's construction phase would be 5 years, 2 years longer than the 2021 MMP. During the construction phase, the Stibnite Road section of McCall-Stibnite Road (CR 50-412) from the village of Yellow Pine to the SGP would require daily temporary road closures from 10:00 AM to 4:00 PM, and temporary closures of Johnson Creek Road during road maintenance activities also could be necessary during the 15 years of mine operation (Parametrix 2018b). The Johnson Creek Road (CR 10-413) also could be closed for 1 year during construction (Forest Service 2022k and **Section 4.16**).
- Radio repeater site construction – Radio repeater sites in IRAs would be constructed using helicopters.

Wilderness

Untrammeled

Under the Johnson Creek Route Alternative, mine operation, off-site facilities, and the new transmission line would have the same impact on the untrammeled quality of wilderness character as those described for the 2021 MMP and are not discussed further. The Burntlog Route would not be constructed; therefore, the effects from the Burntlog Route would not exist. Because the Burntlog Route would not be constructed, the maintenance facility would be located at Landmark nearer Johnson Creek Road. The potential changes to soundscapes, natural dark skies, and natural wildlife distribution within the FCRNRW from the Johnson Creek Route Alternative operation and closure and reclamation phases would be the same as those described under the 2021 MMP. Sky glow visible within the FCRNRW during operation would be the same as the 2021 MMP.

Using the Johnson Creek Route for mine access would require improvements to Johnson Creek Road and widening/reconstructing Stibnite Road from the village of Yellow Pine to the SGP. Under the Johnson Creek Route Alternative, the number of vehicles on Stibnite Road as part of the Johnson Creek Route would increase to 102 AADT during mine construction and 87 AADT during mine operation. Traffic volumes on Stibnite Road would be approximately 2.6 times the existing AADT of 39 vehicles. Construction and road maintenance on the Johnson Creek Route could reduce the number of forest and wilderness visitors in areas of the FCRNRW where access is from Stibnite Road or Thunder Mountain Road and increase recreation use in recommended wilderness areas near these roads. After mine closure, improvements to Stibnite Road could increase recreation use in Tamarack Creek drainage of the FCRNRW if road conditions influence wilderness visitors.

The disturbance of wildlife species from dispersing into or from habitats adjacent to Johnson Creek Route could be a long-term effect. The volume of traffic during mine construction and operation could change the natural distribution of wildlife within the Tamarack Creek drainage (IDFG 2019). The extent of effects on wildlife distribution would be less because the Burntlog Route would not be constructed or used. However, the intensity of the effect on wildlife distribution within Tamarack Creek could be greater

because there would be increased traffic for about 20 years during construction and operation. Under the Johnson Creek Route Alternative, the untrammeled quality of wilderness character could be impacted in the Tamarack Creek drainage of the FCRNRW. Impacts would be long-term, negligible to minor, and localized.

Natural

Plants

Using Johnson Creek Route as the mine access road could reduce motorized recreation use on Thunder Mountain Road and Meadow Creek Lookout Road. Delays on the public access road through the SGP and the increase in size and number of mine-related vehicles on Johnson Creek Route could decrease recreation use within the FCRNRW. Decreased recreation use could indirectly reduce the risk of non-native plant species becoming established within the FCRNRW. During mine closure and reclamation, surface disturbance from recontouring slopes, seeding and planting areas disturbed by mine facilities, and stream relocation would be 1 mile or more from the FCRNRW boundary. The distance between areas disturbed during recontouring and areas where the seed mix includes non-native annual plant species would decrease the potential for changes to vegetation communities within the FCRNRW. Reclamation of disturbed areas, which involve revegetation on NFS lands, would be done according to Payette or Boise Forest Plan Standards and in coordination with a Forest botanist. This could help retain the existing vegetation conditions within the FCRNRW. The natural quality of wilderness character within the FCRNRW could be the same as existing conditions.

However, if recreation use in recommended wilderness areas near the SFSR increases, the spread of non-native plant species also could increase. Mine related traffic on the Johnson Creek Route could result in forest visitors avoiding areas of the FCRNRW accessed from trailheads along Stibnite Road, such as Missouri Ridge. This could indirectly increase recreation use in recommended wilderness areas and other trails in the FCRNRW. Changes in recreation use could increase the potential for non-native plant species to spread into recommended wilderness areas or other areas of the FCRNRW. Surveys and implementing treatments, as described in the Integrated Weed Management program for the PNF and BNF, would reduce the potential for non-native plant species to spread. The natural quality of wilderness character within the recommended wilderness areas would be impacted if there was an increase in non-native plant species populations. Impacts would be long-term, negligible to minor, and localized.

Fish and Wildlife

Under the Johnson Creek Route Alternative, there could be a long-term risk to fish and aquatic habitats from the accidental spill of material, such as fuel or mine processing chemicals, where the Johnson Creek Route is adjacent to or crosses streams (e.g., Johnson Creek, East Fork SFSR). If a spill occurred and material entered a stream, there could be injury or mortality of fish and aquatic species, which could indirectly alter species distribution in portions of the FCRNRW Tamarack Creek drainage. The extent an accidental spill could affect aquatic species or fish habitat is unknown. The measures included in the SPCC Plan would reduce the extent of a spill in adjacent streams.

Using Johnson Creek Route as the mine access road could reduce motorized recreation use on Thunder Mountain Road (FR 50375) and Meadow Creek Lookout Road (FR 51290). Delays on the public access

road through the SGP and the increase in size and number of mine-related vehicles on Johnson Creek Route could decrease recreation use within the FCRNRW. Decreased recreation use could reduce the disturbance of big game and sensitive wildlife species within the Monumental Creek and Big Chief Creek drainages within the FCRNRW. During mine closure and reclamation, surface disturbance from recontouring slopes, seeding, and planting areas disturbed at the SGP would be 1 mile or more from the FCRNRW boundary. The distance from the noise generated during mine closure activities and the FCRNRW boundary would reduce disturbance to big game species and sensitive wildlife within the Big Chief Creek drainage.

The increased number of vehicles on Stibnite Road during mine construction and operation could change the natural distribution of wildlife within the Tamarack Creek drainage (IDFG 2019). The long-term effect on big game species could include reduced habitat quality and changes in the natural distribution of wildlife species within the Tamarack Creek drainage. The natural quality of wilderness character would be impacted in the areas where wildlife species change their migration patterns.

However, the volume of traffic and potential delays along Johnson Creek Route could result in forest visitors avoiding FCRNRW trailheads accessed from Stibnite Road. Indirectly, recreation use in recommended wilderness areas and other areas of the FCRNRW could increase. Changes in recreation use could increase disturbance of big game and sensitive wildlife species in recommended wilderness areas or other areas of the FCRNRW. The natural quality of wilderness character would be impacted in recommended wilderness areas where wildlife species change their migration patterns. Impacts would be long-term, negligible to minor, and localized.

Air and Water

The effects on air and water within the FCRNRW and recommended wilderness from mine construction and operation emissions would be the same as the 2021 MMP. Although the Burntlog Route would not be constructed, there would be similar construction emissions for the road improvements along the Johnson Creek Route. The rate of sediment deposition into streams within the FCRNRW and recommended wilderness areas would be the same as existing conditions. Streams crossed by the Johnson Creek Route do not flow into the FCRNRW or the recommended wilderness areas.

Ecological Processes

Using the Johnson Creek Route as the mine access road could reduce motorized recreation use on Thunder Mountain Road and Meadow Creek Lookout Road. Timing restrictions during the construction phase and road maintenance activities could deter wilderness visits to areas of the FCRNRW accessed from Monumental Creek. Decreased recreation use could reduce the potential for non-native plant species to be introduced from recreation equipment and vehicles (Rew et al. 2018). In the long-term, ecological processes within the FCRNRW would be the same as existing trends. The natural quality of wilderness character for ecological processes within the FCRNRW would be the same as existing conditions.

Indirectly, the volume and size of mine related traffic on Johnson Creek Route could indirectly increase recreation use in recommended wilderness areas. If recreation use in recommended wilderness areas increases due to forest visitors avoiding areas of the FCRNRW accessed from Johnson Creek Route, there could be an increase in the dispersal of non-native plant species. In the long-term, ecological processes

would change in areas where non-native plant species become established. The number of forest visitors who might avoid areas of the FCRNRW accessed from Johnson Creek Route is unknown. The natural quality of wilderness character would be impacted in recommended wilderness areas where non-native plant species become established.

Undeveloped

Under the Johnson Creek Route Alternative, no structures would be constructed, or SGP-related mechanical transport used within the FCRNRW or recommended wilderness areas. The undeveloped quality of wilderness character would remain unchanged relative to existing conditions within the FCRNRW and the recommended wilderness areas.

Solitude, Remoteness, and Primitive Recreation Opportunities

The 102 to 87 AADT and potential delays on Johnson Creek Route during the construction and operation phases could decrease recreation use in the FCRNRW. Public access would be allowed through the SGP under the Johnson Creek Route Alternative via a 12-foot gravel road that connects Stibnite Road to Thunder Mountain Road. During mine construction and operation, public access roads through the SGP would be temporarily closed during mining activities that are public safety hazards (e.g., high wall scaling, blasting). When the public access roads are closed due to mine operations, forest and wilderness visitors would not be able to use Thunder Mountain Road to drive to Monumental or Lookout Mountain trailheads. During mine construction, public access roads and indirectly Thunder Mountain Road could be closed for 2 to 3 months.

Helicopters used to construct and maintain cell towers or repeater sites located within IRAs could be audible in the FCRNRW. Helicopters would be used for a few hours during the day during construction and maintenance. Noise from helicopters could be audible in the Big Chief drainage and would temporarily reduce opportunities for solitude, sense of isolation, and remoteness from sights and sounds of human activities.

During the 15 years of mine operation, public access roads could be closed for periods of five days to one month. Indirectly, this could increase recreation use in other areas of the FCRNRW and recommended wilderness areas. If recreation use increases, wilderness visitors would need to travel farther into the FCRNRW or recommended wilderness areas to attain solitude, remoteness, and primitive recreation opportunities. The extent where roads adjacent to the FCRNRW boundary would be visible or audible would be the same as existing conditions. Impacts would be long-term, negligible to minor, and localized.

Wild and Scenic Rivers

Under the Johnson Creek Route Alternative, actions related to the SGP and the utility corridor would have the same effects as described under the 2021 MMP. Effects of access roads would differ for Johnson Creek, Burntlog Creek, and the Burntlog Maintenance Facility. Effects to the SFSR would be the same as described for the 2021 MMP.

Burntlog Creek

The Johnson Creek Route Alternative would have no direct impacts to the eligible Burntlog Creek WSR, as the access route to the mine would not utilize Burnt Log Road. No road widening, bridge and culvert replacement, slope excavation/blasting, or quarrying of sand and gravel would occur in the Burntlog Creek watershed. Under the Johnson Creek Route Alternative, the aforementioned Burntlog Maintenance Facility would be relocated and called the Landmark Maintenance Facility. The Landmark Maintenance Facility would be located where Warm Lake Road crosses Johnson Creek (upstream from the eligible Recreational segment) and would house road maintenance and snow removal equipment. The existing Burnt Log Road would not be plowed and sanded during winter and would not have dust suppressant applied during summer. Traffic on the road would remain primarily recreational and seasonal. The amount of traffic may increase over current conditions if recreationists seek alternate areas away from the SGP for their recreation activities but would likely be less than traffic projections associated with mining activity and would not include heavy industrial vehicles and equipment. The Johnson Creek Route Alternative would have no effects to water flow or quality, ORVs, or classification for Burntlog Creek.

Johnson Creek

Johnson Creek Road (CR 10-413) would be part of the mine access route under the Johnson Creek Route Alternative. Increased traffic would occur along this route, which parallels the eligible segment of Johnson Creek.

Free-flowing characteristics of eligible and suitable WSRs.

Construction activities could result in short-term impacts to the free-flowing condition of Johnson Creek as a result of culvert replacement on Johnson Creek Road. Operations-related impacts would be similar to current conditions, with free-flowing conditions modified by culverts. As described under 2021 MMP - Construction, permit-related design requirements, use of BMPs, and required maintenance activities would maintain natural streamflow and minimize impacts to free-flowing condition.

Water quality of eligible, suitable, and designated WSRs.

Heavy construction vehicles and equipment traffic would occur throughout construction, operation, and closure and reclamation phases. Increases in heavy vehicle traffic are associated with increases in sediment delivery load to streams (Reid and Dunne 1984). Sedimentation could adversely affect water quality and fish spawning habitat. In general, increases in sedimentation are expected from:

- Travel-generated dust and sedimentation due to the change in road use from seasonal, primarily recreational or 4x4 vehicle use, to year-round use by heavy equipment.
- Application of deicers or sand for traction during winter months.

ORVs for which eligible, suitable, and designated WSRs are recognized.

Johnson Creek has a Heritage ORV, primarily related to the area's history of mining. Construction activities on the Johnson Creek Route could directly disturb historic properties (i.e., heritage resources eligible for the National Register of Historic Places) along this segment. Further, increased mine traffic on Johnson Creek Road next to the eligible segment could have noise and visual impacts to the area,

although this would not physically impact heritage resources. Impacts to heritage resources would be negligible to major (if a historic property cannot be avoided by construction), localized, and long-term (Forest Service 2022l).

Preliminary Wild, Scenic, or Recreational classification for eligible and suitable WSRs.

Although traffic along Johnson Creek Road would increase over current conditions during mine operations, this increase in traffic would not change access to the eligible corridor. Consequently, there would be no impact to the preliminary classification of Recreational for this segment of Johnson Creek.

Inventoried Roadless Areas

The upgrade to the transmission line would have the same effects on the roadless expanse as the 2021 MMP. A summary of the impacts under the Johnson Creek Route Alternative that would result in changes to roadless characteristics are described in the following sections.

Naturalness

Construction and operation of the SGP under the Johnson Creek Route Alternative would directly impact the Meadow Creek, Horse Heaven, Caton Lake, and Reeves Creek IRAs. Impacts to these IRAs from mine facilities and utilities would be similar in nature to the 2021 MMP. Under the Johnson Creek Route Alternative, improvements and use of only the Johnson Creek Route for mine access would eliminate impacts within the Black Lake and Burnt Log IRAs and within portions of the Meadow Creek IRA associated with the Burntlog Route.

Plants

Similar impacts to vegetation as described under the 2021 MMP would occur, but less acres within IRAs would be impacted. Construction of the Johnson Creek Route along the boundary of the Meadow Creek, Horse Heaven, and Sugar Mountain IRAs could disperse non-native invasive plant species. Construction and operations traffic along Johnson Creek Route also would increase the spread of non-native plant species into these IRAs.

Using a helicopter to construct repeater sites located within IRAs would reduce the miles of temporary access roads needed and reduce the potential for non-native plant species to spread in the eastern part of the Meadow Creek IRA.

Fish and Wildlife

Fish and aquatic species habitat alterations at the SGP would be the same as those described under the 2021 MMP. The Burntlog Route would not be constructed; therefore, the impacts from that would not exist.

Using the Johnson Creek Route to access the SGP could disturb wildlife movement within the Caton Lake, Meadow Creek, Horse Heaven, and Sugar Mountain IRAs. Altering of wildlife habitat within IRAs described under the 2021 MMP would be the same under this alternative. Construction of the Johnson Creek Route along the boundary of the Caton Lake, Meadow Creek, Horse Heaven, and Sugar Mountain

IRAs would extend SGP construction to 5 years. The additional 2 years of construction and 15 years of mine operation would increase the duration when sensitive wildlife species could be displaced from habitats in IRAs adjacent to the Johnson Creek Route.

Soil, Water, and Air

Similar impacts to soils as described under the 2021 MMP would occur, but less acres within IRAs would be impacted. Sediment deposition during the construction of the Johnson Creek Route from replacing or clearing culverts would have a temporary impact on water quality. Construction to widen Johnson Creek Route would generate fugitive dust.

Natural Appearing Landscapes with High Scenic Quality

The effects on the natural appearing landscapes from constructing the TSF, TSF Buttress, and the new transmission line segment would be the same as the 2021 MMP. Widening Johnson Creek Route would change natural appearing landscapes in adjacent areas within the Secesh, Sugar Mountain, and Horse Heaven IRAs.

Undeveloped Character

Under the Johnson Creek Route Alternative, the TSF and TSF Buttress structures and mine closure would have same effect on IRAs as those described under the 2021 MMP.

Outstanding Opportunities for Solitude and Primitive Recreation

Using the Johnson Creek Route to access the SGP during construction, operation, and closure and reclamation, would decrease opportunities for solitude in adjacent areas of the Secesh, Sugar Mountain, Horse Heaven, and Meadow Creek IRAs. Under the Johnson Creek Route Alternative, areas that meet the semi-primitive non-motorized recreation setting would be 136,077 acres during the summer (AECOM 2020j) report. During the winter 154,240 acres would meet the semi-primitive non-motorized recreation setting.

Indirectly, the number and size of mine vehicles using Johnson Creek Route could change dispersed recreation use within the 13 IRAs. Some forest visitors may choose to avoid areas where SGP components would be constructed or where the Johnson Creek Route would be used for access. This could increase recreation use in other areas of the 13 IRAs and lands contiguous to unroaded areas.

Special Features and Values

The construction of the Johnson Creek Route would have no direct effect on the eligible Burntlog Creek WSR. The Johnson Creek Route Alternative would disturb less acres of special features and areas valued for their scientific qualities, scenic qualities, or other notable distinct features compared to the 2021 MMP as a result of the Burntlog Route not being constructed under this alternative.

Manageability

Under the Johnson Creek Route Alternative, the difficulty to manage the Black Lake and Burnt Log IRAs to maintain roadless characteristics would be the same as existing conditions. The components under the

2021 MMP in the Horse Heaven and Meadow Creek IRAs would have the same effect on the ability for the Forest Service to manage these areas to maintain roadless characteristics.

Research Natural Areas

Construction

Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed, and the 65 mine construction vehicles would use the Johnson Creek Route. During the 5 years of mine construction, the AADT would increase from 57 to 122 vehicles on Johnson Creek Road (CR 10-413), and from 39 to 104 on the Stibnite portion of the McCall-Stibnite Road (CR 50-412). These activities would disperse non-native invasive plant species (Forest Service 2019b; Jacobs et al. 2009). The increase in vehicles, human activity, and the disturbance of vegetation and soils would occur over 3 miles from the two RNAs. These activities would result in negligible direct or indirect effects on the research values, ecological site conditions, and ecological processes within the two RNAs.

Construction of mine access roads under the Johnson Creek Route Alternative would increase in vehicles and delays during the 5 years of construction could indirectly increase recreation use in other areas such as the SFSR. If recreation use on Phoebe Meadows trail (NFST 291) and SFSR East trail (NFST 076) increases, the risk of non-native invasive plant species distribution and establishment would increase (Trombulak and Frissel 2000). Vehicles, clothing, and recreation equipment could transport non- native plant and invasive plant species seeds (Ansong and Pickering 2016; Taylor et al. 2012; Trombulak and Frissel 2000). The potential for non-native plant species to spread into the RNAs depends upon environmental conditions (e.g., soils, climatic influences, vegetation, etc.) and the non-native plant species characteristics, as well as the level of increase in recreation use. Changes in vegetation community composition and structure within the RNAs would occur where non-native invasive plant species become established, soils are compacted, or trails widened, or there is a change in fire frequency. Changes to vegetation composition and structure would result in the long-term loss of research values, ecological site conditions, and ecological processes within the Belvidere Creek RNA.

The application of Forest Plan standards and implementing treatments consistent with the PNF Noxious Weed Program and Idaho's Noxious Weed Management and Control Program would reduce the potential for non-native plant species to become established within the Belvidere Creek RNA. Non-native invasive plant species could become established within the RNAs. This would result in a localized, negligible to minor, long-term loss of research values, ecological conditions, and ecological processes.

Operations

During the 15 years of the mine operation, traffic volumes on Johnson Creek Route would increase. The AADT on Johnson Creek Road would increase from 57 to 125 vehicles, and on Stibnite Road from 39 to 107 vehicles. Forest visitors may choose to avoid Johnson Creek Route due to the increased traffic, increased number of large vehicles, and potential delays during daily maintenance activities. Forest visitors could increase recreation use in the SFSR and Big Creek drainages. Widening Stibnite Road could increase recreation use in the Big Creek drainage. During the summer, if recreation use on Warren-Profile Gap Road (FR 50340), Hamilton Bar (FR 50673), South Fork Road (FR 50674), and Phoebe Meadows Trail (NFST 291) increases, the risk of non-native invasive plant species distribution and

establishment would increase (Trombulak and Frissel 2000). Vehicles and recreation equipment could disperse non-native invasive plant species (Forest Service 2013b, 2015c, 2019k; Jacobs et al. 2009). Non-native plant species could become established within the Belvidere Creek RNA. Changes in vegetation community composition and structure within the RNA would occur where non-native invasive plant species become established, soils are compacted, or trails widened, or there is a change in fire frequency. Changes to vegetation community composition and structure would result in the long-term loss of research values, ecological site conditions, and ecological processes within this RNA.

Closure and Reclamation

During the 5 years of mine closure and reclamation, the AADT on Johnson Creek Road increases from existing 57 to 84 vehicles, and on Stibnite Road from 39 to 66 vehicles. Human activity and the disturbance of vegetation and soils would be over 4 miles from any RNA. Belvidere Creek, the RNA nearest to the SGP, is approximately 6 miles north. These activities would result in negligible direct or indirect effects on the research values, ecological site conditions, and ecological processes within this RNA.

During the summer, if recreation use on Warren-Profile Gap Road increased, the risk of non-native invasive plant species distribution and establishment could increase (Trombulak and Frissel 2000). Vehicles and recreation equipment could disperse non-native invasive plant species (Forest Service 2013b, 2015c, 2019a; Jacobs et al. 2009). Non-native plant species could become established within the Belvidere Creek RNA. Changes in vegetation community composition and structure within Belvidere Creek RNA would occur where non-native invasive plant species become established, soils are compacted, or trails widened, or there is a change in fire frequency. Changes to vegetation community composition and structure would result in the long-term loss of research values, ecological site conditions, and ecological processes within the Belvidere Creek RNA, but for the reasons described above these changes are unlikely.

4.23.3 Mitigation Measures

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 would be in addition to the Forest Service requirements and EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Special Designations.

4.23.4 Irreversible and Irretrievable Commitments of Public Resources

4.23.4.1 No Action Alternative

No irreversible and irretrievable commitments of public resources relating to Wilderness, WSRs, IRAs, or RNAs would occur under the No Action Alternative.

4.23.4.2 Action Alternatives

Wilderness

The extent of and locations where non-native plant species could establish is unknown, but the most likely areas would be along ROWs and access roads. Irretrievable effects on the natural quality of wilderness character within the FCRNRW or recommended wilderness areas would occur where non-native plant species become established. The spread of non-native plant species would be an irretrievable effect on the natural quality of wilderness character.

Under the Johnson Creek Route Alternative, Stibnite Road from the village of Yellow Pine to the SGP would be plowed to support construction, operations, and reclamation and closure. Where and when audible, plowing Stibnite Road from Yellow Pine to the SGP would be an irreversible commitment of solitude.

The increase in human activity in the FCRNRW or recommended wilderness areas would decrease opportunities for solitude, remoteness, and primitive recreation under the action alternatives. The extent of the decrease in the solitude, remoteness, and primitive recreation opportunities quality of wilderness character is unknown; however, following mine closure, recreation use could return to pre-mining levels, and there would be no long-term irreversible commitment of resources.

WSR

If National Register-eligible heritage resources (i.e., historic properties) along Johnson Creek are impacted under the action alternatives, this would constitute an irreversible commitment of an eligible heritage resource, which would have an adverse effect on ORVs.

IRA

Under the 2021 MMP, soil nail walls would remain within the Burnt Log, Black Lake, and Meadow Creek IRAs after decommissioning the Burntlog Route and this would be considered an irreversible commitment of natural roadless character. Soil nail walls would not support vegetation communities or habitat for wildlife species that require large undisturbed areas. Soil nail walls would provide evidence of past human activity, resulting in an irreversible decrease in the undeveloped roadless character within the three IRAs.

Where clearing of the transmission line corridor and access roads remains, there would be an irretrievable commitment of natural roadless character. Where and when audible, plowing Stibnite Road from the village of Yellow Pine to the SGP would be an irretrievable commitment of solitude roadless character.

Under the action alternatives, non-native plant species could spread into the IRAs, and disturbance of wildlife would increase relative to existing conditions. Surveys conducted by Perpetua for 3 years after seeding or planting a disturbed area, and treatment of non-native plant species, could reduce the extent where non-native plant species become established. Where treatments of non-native plant species are successful, vegetation composition and structure could provide high-quality wildlife habitat over years or decades. The extent of where non-native plant species could establish is unknown but would most likely

be along ROWs and access roads. There could be an irretrievable loss of the natural quality of roadless character where non-native plant species become established.

The increase in human activity in the IRA and lands contiguous to unroaded areas would decrease outstanding opportunities for solitude and primitive types of recreation under the action alternatives. The extent of the decrease in associated roadless character is unknown; however, following mine closure, outstanding opportunities for solitude could return to pre-mining levels, and there would be no long-term irreversible commitment of roadless resources.

RNA

The establishment of non-native invasive plant species and human-ignited fire could indirectly change the composition and structure of vegetation communities, the ecological values, and the unique communities within the two RNAs. These potential changes would be an irretrievable loss of research values within an RNA and the Intermountain Region. The extent of non-native invasive species established or within the RNAs listed in **Table 4.23-2** or changes in fire frequency from human-ignited fires is unknown.

4.23.5 Short-term Uses versus Long-term Productivity

4.23.5.1 No Action Alternative

No short-term or long-term effects to Wilderness, WSR, IRAs, RNAs would occur under the No Action Alternative.

4.23.5.2 Action Alternatives

Wilderness

The untrammeled, natural, and solitude, remoteness, primitive recreation opportunities qualities of wilderness character would be impacted in both the short- and long-term under the action alternatives. The decrease in solitude where the duration is temporary would be considered a short-term impact. However, the establishment of non-native plant species within the FCRNRW or recommended wilderness would result in a long-term reduction in the natural quality of wilderness character.

WSR

Short-term indirect effects to the setting along WSR-eligible Johnson Creek could result from increased traffic related to mine construction on Johnson Creek Road (CR 10-413) (approximately 65 AADT during construction). These impacts would be temporary, as traffic would be diverted from Johnson Creek Road (CR 10-413) to the Burntlog Route during operations, reclamation, and closure. Construction traffic would not affect the Johnson Creek setting over the long term.

Under the Johnson Creek Route Alternative, Johnson Creek Road (CR 10-413) would be the main route to access the SGP over its entire construction, operation, and closure and reclamation timespan. The duration of effects described in the paragraph above would, therefore, be long-term.

IRA

Short-term uses of areas disturbed for the new transmission line segment and upgraded transmission line would have a long-term effect on solitude in the Horse Heaven, Meadow Creek, and Reeves Creek IRAs. The TSF, TSF Buttress, and retaining soil nail walls along the Burntlog Route would be a long-term loss of soil productivity within six IRAs. There would be evidence of disturbance from the Burntlog Route and the transmission line in the Horse Heaven and Meadow Creek IRAs that would remain long-term. In the long term, areas that were cleared of vegetation for SGP components would be visible from several key viewpoints, resulting in a long-term impact on visual quality within the IRA.

RNA

Under both action alternatives, the research values, ecological site conditions, and ecological processes within the RNAs could be impacted in both the short and long term, although these changes are only likely in the Chilcoot Peak RNA. The increase in risk for non-native invasive plant species to establish within the RNAs where the duration of the surface disturbance is temporary would be considered a short-term impact. However, the establishment of non-native invasive plant species would be a long-term reduction in research values, ecological site conditions, and ecological processes within any of the RNAs.

4.24 Tribal Rights and Interests

4.24.1 Impact Definitions and Effects Analysis Indicators and Methodology

Public and tribal access were identified as a significant issue during scoping for the SGP. Construction and operation of the mine and infrastructure may impact access to NFS lands, travel routes, and tribal rights to access, hunt, gather, pasture, and fish in the SGP area. Other issues related to tribal rights and interests were identified during the scoping process, consultation, and through professional research.

The analysis of effects to tribal rights and interests includes the following issue and indicators:

Issue: The SGP would affect tribal rights and interests through physical, audible, and visual disturbances to tribal resources, through restricting access of tribal members from usual and accustomed fishing places; hunting, pasturing and plant gathering areas; and through changes to the viability and availability of culturally significant fish, wildlife, and plant species.

Indicators:

- Presence of TCPs, CLs, sacred sites or places, usual and accustomed fishing places, and tribal resource gathering areas that may be physically impacted by ground disturbance.
- Presence of TCPs, CLs, sacred sites or places, and tribal resource collection areas that may be impacted by an increase in audible elements (noise and vibrations).
- Presence of TCPs, CLs, sacred sites or places, and tribal resource collection areas that may be impacted by an increase in visual intrusions caused by SGP components.
- Changes in access to TCPs, CLs, sacred sites or places, and tribal resource collection areas due to the restricted access within the Operations Area Boundary.

- Changes to water quality and quantity of both surface water and groundwater in relation to how that affects wildlife, fisheries, and vegetation, or other resources of tribal importance.
- Changes to species viability and/or availability for tribal harvest of culturally important fish, wildlife, and plants and/or their habitat.
- Acres of access and traditional use areas of tribal importance that would be unavailable for the duration of mining activities to exercise treaty rights.
- Known archaeological, cultural resource, and traditional use sites impacted by the Project and visibility of disturbances to these areas.
- Changes in air quality in relation to how that affects wildlife, fisheries, and vegetation, or visibility impacts from fugitive emissions to areas of tribal importance.

The impacts definitions for intensity, duration (FSH 1909.15, 152b), and context are provided in **Table 4.24-1.**

Table 4.24-1 Impact Definitions for Tribal Rights and Resources

Attribute	Term	Description
Intensity	Negligible	There would be no change to the current condition of areas of concern to Tribes as a result of construction, operation, or reclamation of the Proposed Action or Alternatives. There would be no effect to the existing access of specific areas. Archaeological or ethnohistoric cultural resources, areas of elevated spiritual concern, TCPs, or sacred sites would not be affected.
Intensity	Minor	There would be no discernable change to the current condition of areas of concern to Tribes as a result of construction, operation, or reclamation of the Proposed Action or Alternatives. While a change to the existing access of specific areas may occur, it would not affect that access. Archaeological or ethnohistoric cultural resources, areas of elevated spiritual concern, TCPs, or sacred sites would not be affected to a measurable degree.
Intensity	Moderate	An easily discernable change to the current condition of areas of concern to Tribes as a result of construction, operation, or reclamation of the Proposed Action or Alternatives would occur. Changes to existing access would occur. Archaeological or ethnohistoric cultural resources, areas of elevated spiritual importance, TCPs, or sacred sites would be affected to a measurable degree.
Intensity	Major	A large, easily discernable change in condition (e.g., physical, visible, or audible impacts; a change in integrity of the setting or condition of the resource) to areas of concern to Tribes would occur as a result of construction, operation, or reclamation of the Proposed Action or Alternatives. Changes to existing access would occur. Archaeological or ethnohistoric cultural resources, areas of elevated spiritual importance, TCPs, and/or sacred sites would be substantially altered.
Duration	Temporary	Impacts are anticipated to last no longer than 1 year.
Duration	Short-Term	Impacts would last up to 3 years.
Duration	Long-Term	Impacts would last longer than 3 years.
Duration	Permanent	Impacts would remain after reclamation.

Attribute	Term	Description
Context	Localized	Effects would be limited to archaeological sites or properties of tribal importance within the analysis area.
Context	Regional	Effects would occur to archaeological sites or properties of tribal importance outside of the analysis area.

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.

4.24.2 Direct and Indirect Effects

4.24.2.1 No Action Alternative

Under the No Action Alternative, the current ability of Tribes to access NFS lands in the analysis area and specifically the mine area would not change. Project related ground disturbance, visual and audible impacts, and impacts to culturally significant subsistence resources including fish, wildlife, and plant species would not occur. Legacy impacts from historic mining of the area would not be reclaimed other than those identified in the Administrative Settlement Agreement and Order on Consent (ASAOC, EPA and USFS 2021). Currently, there are ongoing releases of hazardous substances, pollutants, and contaminants to surface water and groundwater at the mine site including elevated concentrations of antimony, arsenic, copper, lead, mercury, and cyanide. Most notable are elevated concentrations of arsenic and antimony. Past mining activities have also caused alterations to stream configurations and habitat including the Yellow Pine pit lake, sediment and tailings deposits, development rock dumps, and channel diversions. Legacy mining effects would continue to alter the nature and potential use of the usual and accustomed fishing places and springs. Activities under the ASAOC would include construction of stream diversion ditches to avoid contact of water with sources of contamination and removal of development rock and tailings from Meadow Creek or the East Fork SFSR that are currently impacting water quality.

The No Action Alternative would not preclude Perpetua from submitting another plan of operations in the future. Perpetua would continue to implement surface exploration and associated activities that have been previously approved on the NFS lands as part of the Golden Meadows Exploration Project, per the Golden Meadows Exploration Project Plan of Operations and the Golden Meadows Exploration Project Environmental Assessment (Forest Service 2015).

4.24.2.2 2021 MMP

The 2021 MMP would result in adverse impacts to some of the natural resources that the Tribes may utilize in the exercising of their treaty rights. Long-term, minor impacts would be associated with the disturbance or displacement of plant and wildlife species that are used for traditional purposes and subsistence. However, it is understood that any loss of the ability to implement treaty rights would be a major impact to the Tribes. The following analysis describes the effects to tribal rights and interests.

Information received from the Tribes' ethnographies indicate that areas, resources, and off-reservation rights of concern and importance include disruption of traditional practices, tribal worldview, fishing rights in the SFSR watershed, including the East Fork SFSR, Meadow Creek, Fiddle Creek, West End

Creek, No Man's Creek, and Sugar Creek (Battaglia 2018; Lahren 2020; Walker 2019). Tribally significant travel corridors and waterways include portions of the historic Old Thunder Mountain Road (FR 440), portions of the historic Burnt Log Road, the East Fork SFSR watershed system which includes several tributaries, and the Riordan Lake shore. Traditional mineral and plant gathering locations or collection areas within the analysis area also were cited as important to the Nez Perce Tribe, but exact locations of these collection areas have not been shared. Other landscape features of importance include Riordan Lake and prominent points on the landscape (e.g., mountain tops and ridgelines) that have religious significance, and traditional plant gathering locations or collection areas.

Quantifications (context, duration, and intensity) are assigned to the impacts to resources such as wildlife or water quality; however, it is difficult to quantify or otherwise determine the impact of a temporary to long-term loss of a right. In consultations with the Tribes, they noted that any loss of treaty rights is significant to them and could potentially affect all tribal members.

Tribal Historical/Archaeological Sites

Effects to tribal historical and archaeological sites could occur during all phases of the SGP including construction, operations, exploration, and reclamation. However, it should be noted that effects to historic and archaeological resources during the reclamation phase would likely be avoided because impacts associated with historic properties in the reclaimed areas have already taken place or measures would be in place to avoid impacts to these known locations. There is one known pre-contact archaeological site identified as the Stibnite Lithics Site, within the Operations Area Boundary that would be avoided through protective measures (i.e., fencing); protective measures would also prevent inadvertent impacts resulting from SGP activities. No pre-contact archaeological sites are located within the physical APE for the Burntlog Route, however two historic tribal travel routes, including the Thunder Mountain Road, do intersect the Burntlog Route and could be affected. The Thunder Mountain Road and Burnt Log Road, prior to its use by settlers, included portions of well-traveled tribal routes. The current research indicates that there are five pre-contact archaeological sites located within the transmission line improvement areas; however, it is anticipated that these sites would be avoided through design alterations or protective measures. Further, consultation with the Tribes would be ongoing; therefore, if additional potential impacts are identified such as discoveries of cultural significant sites or resources during or post construction, formal government-to-government consultation would occur. The impact to tribal historical and archaeological sites would be localized, temporary to permanent, and negligible to minor.

Sacred Sites, Traditional Cultural Properties, and Cultural Landscapes

Impacts to non-archaeological tribal sites including sacred sites or places, TCPs, and CLs, could occur during all phases of the SGP including construction, operations, exploration, and reclamation. Currently, there are no known sacred sites within the Operations Area Boundary, however tribal consultation and the preparation of the confidential tribal ethnographies have identified a TCP District within the analysis area. Consultation regarding sacred sites, the identified TCP, and CLs is ongoing.

Restricted or altered access to the mine site area during construction and operation closures would affect tribal access to important sites, some that could be identified as TCPs and CLs. The Stibnite and Thunder Mountain roads through the SGP would be closed during the mine operations, potentially restricting access to important tribal resources and sites. In locations where viewshed and a sense of solitude is

important to the cultural significance, interruptions from noise, vibrations, and alterations in the landscape, could adversely affect a significant aspect of religious and sacred sites or places. Although impacts from construction noise would be temporary and intermittent, these intrusions may potentially disrupt tribal religious and cultural practices. Traditional cultural uses of the area, including tribal fishing, hunting, gathering, and spiritual practices would also be potentially affected by the construction, operation, and reclamation phases of the SGP.

The SGP would create permanent landscape alterations within the Operations Area Boundary, as well as the local landscape if visible outside the Operations Area Boundary. Changes to the landscape would have negligible to moderate impacts on sacred sites or places, TCPs, or CLs that may exist depending on whether they could be seen from those locations. The change in the visual landscape resulting from the introduction of new infrastructure may alter the landscape in such a way as to detract from the cultural significance. The impact to sacred sites or places, TCPs, or CLs would be localized, temporary to permanent, and negligible to major.

Traditional Use Sites

In addition to the permanent alterations of the SGP Operations Area, the 2021 MMP would cause changes to the local landscape that may include traditional use areas. Changes to the landscape would have localized, long term to permanent, negligible to major impacts on nearby ceremonial or traditional use sites that may exist, depending on whether the changes could be seen from those sites.

Construction and operation of the SGP would impact access to traditional use areas and subsistence resources. Public and tribal member use would generally not be allowed in the mine site footprint, areas adjacent to the mine site (i.e., the Operations Area Boundary), the upgraded transmission line ROW, and the new transmission line ROW from Johnson Creek Substation to the mine site. Approximately 13,441 acres of public lands within the Operations Area Boundary (14,221 acres) would become inaccessible to the Tribes once construction begins and would continue through closure and reclamation. SGP on-site and off-site facility construction and operation could also impact traditional use areas and subsistence resources through habitat loss; behavioral disturbance to wildlife from increased noise and human activity; concerns about contamination of resources; and avoidance by tribal members of traditional use areas.

The disruption of traditional practices, tribal worldview, viewshed characteristics and solitude, and fishing rights in the SFSR watershed, including the East Fork SFSR, Meadow Creek, Fiddle Creek, West End Creek, No Man’s Creek and Sugar Creek are of concern to the Tribes. Tribally significant travel corridors and waterways include portions of the Old Thunder Mountain Road (National Forest System Road 440), portions of the Burnt Log Road (National Forest System Road 414), the East Fork SFSR system, which includes several tributaries, and the Riordan Lake shore.

Land Status and Access

There would be no change in land ownership status. The federal portion of the affected land would remain under federal ownership. The use of lands for mining operations and associated facilities would be long-term; lands would be reclaimed and structures removed after mining was completed. Mining is governed

by the Locatable Minerals regulations at 36 CFR Part 228, Subpart A and the 1872 U.S. mining laws, as amended (30 U.S.C. 22 et seq.).

Construction and operation of the SGP would impact access to traditional use areas and subsistence resources if they are located within the Operations Area Boundary. Public and tribal member use would generally not be allowed in the mine site footprint and areas adjacent to the mine site (i.e., the Operations Area Boundary). There would be a long-term loss of access to land for exercising treaty rights, usual and accustomed fishing places, access to streams and fountains, and access to potential sacred sites or places, TCPs, CLs, and historic properties within the Operations Area Boundary while the lands are occupied for mining. Therefore, a mitigation measure for access impacts would be incorporated into any decision on the SGP.

The SGP mine area has been the object of mining and exploration since the 1930s with vehicle access associated with mine access roads (e.g., Stibnite Road, Thunder Mountain Road). As such, the area has been affected by historical mining that has altered the nature and potential use of usual and accustomed fishing locations and springs. Hence, there is no archeological, ethnographic, or historical evidence of recent or present use according to the affidavit (Greiser 1998), which is consistent with use of the area for mining. Site reclamation and restoration efforts included in the project following its operational period would result in similar or improved stream conditions and access for usual and accustomed fishing places in the Operations Area Boundary. However, until conclusion of reclamation and restoration efforts, mining effects would continue to alter the nature and potential use of the usual and accustomed fishing locations and springs.

However, lands within the Operations Area Boundary have been highly disturbed by past mining activities. The SGP would expand the mining disturbance and increase industrial development. The SGP mining area would disturb approximately 1,675 acres, which would be much less than one percent of the PNF; a negligible long-term impact. There are no known subsistence resources located exclusively within the Operations Area Boundary that are not available on the remaining portions of the PNF. However, access to potential scared sites or places, TCPs, CLs, and historic properties that may have specific significance at their location(s) within the Operations Area Boundary could be impacted in way that cannot be offset by access to other in-kind areas. There would be a long-term loss of approximately 13,441 acres of federal land associated with land occupancy within the Operations Area Boundary under the 2021 MMP, which represents less than 0.3 percent of the BNF and PNF (2.3 million and 2.6 million acres, respectively). After mine closure, hunting, fishing, and gathering areas would be restored through reclamation and revegetation of disturbed areas and wildlife would return. Tribal members would regain access to the federal lands. There are no known types of natural resources available for exercising treaty rights in the Operations Area Boundary that are not available on the surrounding NFS lands. The impact to federal land available for treaty rights access from the 2021 MMP would be localized, long term, and moderate. While offsite presence of tribal resources means the impact to overall access to a specific resource would be negligible to minor, this would still constitute a localized, long-term, and moderate to major impact to tribal treaty rights specific to those resources in their specific locations including those associated with potential historic properties, sacred sites or places, TCPs, and CLs.

The Burntlog Route would create additional access into a remote area. Although this could provide access to additional areas to exercise treaty rights, mine traffic as well as other public users that use this access would impact current solitude. The impact would be localized, long term, and minor to major.

The Operations Area Boundary (14,221 acres) represents less than one percent of the total area within the PNF and BNF (2.3 million and 2.6 million acres, respectively) available to the Tribes to conduct their traditional use of and access to subsistence resources. However, these previously accessible lands would become inaccessible for a generation, thus potentially disrupting the transfer of place-based traditional knowledge from generation to generation. In addition, closed access to potential specific religious or culturally significant sites may not be offset by access to other in-kind sites. All other existing areas outside of the Operations Area Boundary would remain fully accessible for hunting, fishing, gathering, and other traditional land uses. The overall impact to treaty rights access from the 2021 MMP would be localized, long term to permanent, and minor to major depending on the type of tribal use for the area.

Existing public access roads would remain open under the 2021 MMP. There would be a public access road route through the mine site during the SGP construction, operations, and closure and reclamation phases. Public (including tribal) motorized access to active mine areas, including haul/access roads, would be restricted during the life of the SGP. Non-motorized access (i.e., walking, hiking, horse) would be restricted in the Operations Area Boundary as well. The impact would be localized, long-term, and moderate.

Tribal access within the Operations Area Boundary would resume following closure of the SGP. However, reclamation could modify the fish, wildlife, and vegetation composition of the area compared to existing conditions. Therefore, traditional land uses could be altered by reclamation. The impact to Tribal access after reclamation would be localized, long term to permanent, and negligible to major.

Authorization of the SGP would require Forest Plan amendments. No standards and guidelines were identified that are strictly applicable to tribal resources; however, a number of standards and guidelines are related to resources considered important or sacred by Tribes, including wildlife, water resources, and scenic resources.

Water Resources

The 2021 MMP would have impacts to stream flow volumes, water chemistry and temperature, and fish occupancy, as described in the Water Quantity (**Section 4.8**), Water Quality (**Section 4.9**), and Fish Resources and Fish Habitat (**Section 4.12**) Section. Mitigation measures along with EDFs to address those impacts would be incorporated into any decision on the Project. Runoff associated with the SGP would be contained, which would minimize contribution of sediment to local streams. Water quality of surface flow departing from the Operations Area Boundary would be the same or better than baseline conditions (**Section 4.9**). Surface water available for tribal use in the area would not be impacted above human drinking water standards by the SGP. The potential for the SGP to cause changes in surface water quality from increased erosion and sedimentation, changes in temperature, and changes in general water chemistry (i.e., pH, temperature, major ions, total dissolved solids and dissolved metals, and organic carbon) are discussed in detail in the Water Quality Specialist Report (**Section 4.9**).

Active contact water collection and water treatment would be required for a period of time during the operations and post-closure period until geochemical stability of mined materials could be achieved. The water treatment would prevent mine-impacted waters with elevated analyte concentrations from contacting surface water in the environment. The effects of capture, treatment, and discharge of mine-impacted waters on surface water chemistry would be localized, long-term, and minor.

Surface waters also would be impacted by modification of temperature due to removal of shading vegetation, development of pit lakes, and modification of stream depth during construction, operations, or the post closure/reclamation period. Changes in stream water temperatures for the East Fork SFSR would be negligible to major, localized, and long term. Design features to reduce stream temperatures in the East Fork SFSR would take approximately 10 years to implement post-closure. Temperature changes in the restored Meadow Creek would be a localized, long-term, and major impact. Temperature changes in West End Creek would be permanently raised compared to existing conditions resulting in a localized, permanent, and major impacts.

Under the 2021 MMP, there would be 71 access road stream crossings with increased potential for sedimentation and risk of inadvertent spills. The effect to surface water quality as a result of sedimentation and erosion would be limited by applicable environmental protection measures and control techniques, by the limited duration of active surface disturbing activities, and by the adaptability of the receiving environment. The extent of sedimentation effects from erosion and fugitive dust would be concentrated at the SGP and along the Burntlog and Johnson Creek access routes; however, due to the nature of sediment transport by streams, the geographic extent of the impact could extend farther downstream in the East Fork SFSR. The effects of the SGP on sedimentation are expected to be localized, long term, and moderate.

Both surface water and groundwater quality could potentially be impacted by accidental spills and releases of fuels and hazardous chemicals used in mine construction or operations. Implementation of required standard design, permit stipulations, and regulatory requirements governing storage and handling of these materials would reduce the risk of spills and promote effective response should a spill occur, which would limit impacts to both surface water and ground water quality. Should accidental spills or releases of fuels and hazardous chemicals occur, the impact(s) would be localized, temporary, and minor to moderate.

For risks associated with the consumption of fish, the Idaho human health fish tissue criterion for methylmercury is 0.3 mg/kg. Under baseline site conditions, fish tissue concentrations have not exceeded that criterion (MWH Americas 2017). The current EPA water quality standard (12 ng/l) and a NMFS proposed standard (2 ng/l) for total mercury are based on human consumption of fish. Site baseline total mercury concentrations range between 2.4 and 5.7 ng/l and methylmercury concentrations are less than 0.1 ng/l. Water treatment would be required under any action alternative in order to not exceed baseline conditions. Proposed water treatment associated with the 2021 MMP would maintain methylmercury concentrations below 0.1 ng/l and, at that concentration, would not modify fish tissue concentrations compared to the baseline condition.

Overall effects of impacts to water resources on tribal treaty rights and resources, in particular fisheries, but also plant and wildlife populations, would be localized to regional, long term to permanent, and

major. Impacts to water resources also has the potential to impact the integrity of potential historic properties, sacred sites or places, TCPs, and CLs in the analysis area as these cultural properties relate to tribal treaty rights and resources.

Access to streams, springs, and fountains within the Operations Area Boundary would be restricted for the life of the SGP (approximately 20 years). This would constitute a localized, long-term, and moderate to major impact to tribal treaty rights specific to access to streams, springs, and fountains. Because access to the usual and accustomed fishing locations along streams and springs would be impacted by the project, a mitigation measure for access impacts would be incorporated into any decision on the project.

Wetlands

The 2021 MMP would result in a loss of wetlands and riparian areas. Because wetlands and riparian areas provide a broad range of ecological functions, the loss or alteration of wetland and riparian acreages would have indirect effects on other resources within each of the affected drainage basins. Potential indirect impacts would include reductions in water quality and water storage/recharge, as well as loss of habitat. Regarding habitat, numerous wetland-dependent species, including fish, amphibians, and birds would be displaced from the SGP into other areas that may or may not be available and may provide less suitable habitat. Within the Operations Area Boundary, approximately 28 percent of the existing wetlands within the contributing basin for the East Fork SFSR watershed above the Sugar Creek/East Fork SFSR confluence would be impacted, all of which are within the Headwaters of the East Fork SFSR, a place of known importance to the Tribes. These wetlands impacts would affect water quality, water storage/recharge, and therefore flow. Additional details are provided in **Section 4.11** Wetland and Riparian Resources. The impact to wetlands would be localized, temporary to permanent, and major which could result in localized, temporary to permanent, and major impacts to usual and accustomed fishing places along Sugar Creek and portions of the East Fork SFSR, as well as tribal treaty rights and resources including those associated with potential historic properties, sacred sites or places, TCPs, and CLs depending on the wetland and the type of tribal use.

As part of the Clean Water Act, Section 404 permit, a compensatory mitigation plan would be required to compensate for lost wetland areas and their associated functions. It would also address the temporal loss of aquatic functions and values. There would be a temporal loss of wetland functions in the Salmon River drainage for approximately 20 years (**Section 4.11**).

Fisheries

During construction and operations, fish bearing streams would be diverted into ditched channels and some new barriers would be created; however, enhancements would occur in some stream channels and existing barriers to natural fish movement would be removed. Entrainment by in-stream activities or human-made features, flow reductions, temperature changes, changes in habitat structure, water quality changes, and reduced access to suitable habitat may affect the distribution and relative abundance of fish populations in affected streams in the SGP area thereby affecting availability and harvestability by the Tribes. Additional impacts to specific fish (i.e., Chinook salmon, westslope cutthroat trout, steelhead trout, bull trout etc.) is detailed in **Section 4.12** Fisheries and Aquatic Resources. Impacts to fisheries would be a localized, long-term to permanent, major impact to tribal treaty rights and resources including those associated with potential historic properties, sacred sites or places, TCPs, and CLs.

Vegetation

Vegetation would be cleared in order to construct the mine facilities, access roads, and associated infrastructure. Clearing would likely include plants of traditional, cultural, and religious importance to the Tribes including whitebark pine, limber pine, lodgepole pine, sweetgrass, bitterroot, and subalpine fir trees. The 2021 MMP would impact approximately 259.5 acres of occupied whitebark pine habitat and would remove an estimated 1,235.8 individual trees, 23 of which would be mature, cone-bearing individuals. This would result primarily in localized, long-term to permanent, moderate impacts to whitebark pine populations.

The one known occurrence of sweetgrass, located along the Burntlog Route, would be indirectly impacted during proposed upgrades to the route if the alternative is selected. The impact would be localized, long term to permanent, and moderate to major.

The one known occurrence of bitterroot, located in the transmission line corridor, could also be indirectly impacted during construction of the transmission line upgrade. The impact would be localized, long term, and negligible to moderate.

Several subpopulations of a single occurrence of bent-flowered milkvetch, occur to the east of the SGP and there is one subpopulation in proximity to the West End Creek diversion. Further, modeled habitat for this species would be impacted. The impact would be localized, long term, and negligible.

There are no known plant-based subsistence resources located exclusively within the Operations Area Boundary that are not available on the remaining portions of the PNF. Other plant populations of tribal traditional and cultural significance not already specifically identified would not be available within the Operations Area Boundary for the life of the mine. While offsite presence of plants means the impact to overall access to a specific type of plant would be negligible to minor, this would still constitute a localized, long-term, and moderate to major impact to tribal treaty rights specific to those resources in their specific locations including those associated with potential historic properties, sacred sites or places, TCPs, and CLs.

Vegetation clearing could also impact pasturing treaty rights. While pasturing locations would be available in other offsite locations, this would still constitute a localized, long-term, and negligible to moderate impact.

Reclamation would include revegetation with short-lived grass species intended to help stabilize the reclaimed surfaces from erosion as well as long-lived native bunch grasses and forbs. The goal of the revegetation mix is to establish healthy native bunch grass communities that are structurally diverse and allow succession of native species over time. Other native forbs, shrubs, and trees could be seeded or planted in clusters where they are most likely to establish. Some plant species of tribal traditional and cultural significance would be included.

Noxious Weeds and Invasive Species

Non-native plant and noxious weed control measures for preventing and controlling noxious weed infestations would be utilized for the SGP as described in **Section 4.10**. Perpetua would implement Forest Service-required design features (**Section 2.4.9**) that meet the intent of all applicable noxious weed and

non-native species standards from the Payette and Boise Forest Plans (Forest Service 2003, 2010a). With the implementation of these measures, potential for colonization and spread of noxious weeds and invasive species in disturbed areas would be reduced. Despite weed management by Perpetua, the disturbance at the SGP would cause an increased threat of weed infestation at and near the SGP which would be a localized, long term, and negligible to minor impact to tribal use of vegetation.

Wildlife

Big Game

Impacts to big game would involve displacement and alterations of normal movement routes. Although there are no identified wildlife migration corridors between winter and spring ranges, elk are predicted to use the area for calving in the summer, and big game animals likely use the wildlife analysis area to migrate. If big game must reroute around disturbances, it could increase their energy expenditures during migration, potentially decreasing survival or productivity. However, given the relatively small size of the mine site in context of the region and available habitat, any direct effect on survival or productivity would likely be negligible. Roadways under the 2021 MMP may displace elk and mule deer or increase the possibility of vehicle-wildlife collisions. The 2021 MMP may directly and indirectly impact big game species individuals and habitat. Tribal members could continue to pursue hunting on adjacent lands to which these species would likely migrate when SGP activities commence. While offsite presence of big game means the impact to overall hunting access is negligible to minor, this would still constitute a localized, long-term, and moderate to major impact to tribal treaty rights specific to those resources in their specific locations including those associated with potential historic properties, sacred sites or places, TCPs, and CLs.

Rocky Mountain Bighorn Sheep

There would be a direct loss of habitat which would displace any individuals that occur in those areas. The mine site and associated infrastructure may displace sheep around the perimeter of the disturbances. Rocky Mountain bighorn sheep are very mobile and able to avoid localized direct threat of injury or mortality. Although additional roadways near the mine site could expose individuals to direct vehicle collisions and mortality. Because bighorn sheep are known to occur in the FCRNRW area, they could potentially be affected by loss of potential habitat along the Burntlog Route. The 2021 MMP would result in localized, short-term to permanent, minor impacts to bighorn sheep.

Gray Wolves

Wolves may alter their normal movement patterns to avoid the SGP, but no direct impacts to individuals or populations are expected. There would be a long-term, localized, minor impact to habitat. Displacement could expose them to increased competition with other wolf packs as they seek new territory and would be a potential indirect effect. Vehicle traffic associated with the Burntlog Route could increase the risk of wildlife-vehicle collisions. The 2021 MMP may directly and indirectly impact gray wolf individuals and habitat (i.e., general habitat types), but would not likely contribute to a trend towards ESA listing or loss of viability of the species within the planning area. Therefore, the SGP would result primarily in localized, short-term to permanent, minor impacts to the gray wolf.

Wolverine

Wolverines have been well documented in the analysis area (**Section 4.13**). The 2021 MMP may directly or indirectly impact wolverine individuals and habitat resulting in adverse impacts but would not jeopardize the continued existence of the species. The 2021 MMP would result primarily in localized and long-term impacts to the wolverine, particularly the local population (part of larger Central Idaho sub-populations).

Small Mammals and Birds

Any bird individuals in the mine area would be displaced, and noise or increased human presence may cause moderate effects to birds in the vicinity for the duration of active mining and reclamation activities. No direct mortality is expected. Some individual small mammals such as rabbits, yellow-bellied marmots, and squirrels in the disturbance areas would be displaced or killed. Displaced individuals may cause increased competition in adjacent populations that may lead to increased mortality or decreased reproductive rates. While offsite presence of small mammals and birds means the impact to overall hunting access is negligible to minor, this would still constitute a localized, long-term, and moderate to major impact to tribal treaty rights specific to those resources in their specific locations including those associated with potential historic properties, sacred sites or places, TCPs, and CLs. The 2021 MMP would result primarily in localized, short-term to long-term, negligible to minor impacts for small mammals and bird species.

Treaty Rights Access

Due to their unique tribal rights, cultural relationships, and uses of the lands within the local area, the Tribes could potentially be impacted more specifically and widely by changes in access, use, and resource conditions in the SGP mine area. The Tribes have multiple and inter-related interests and associations with the local area resources (e.g., religious, traditional, and subsistence uses). Many of these interests also are inherently incompatible with any resource changes, including increased presence or alternate use of the local area by non-tribal individuals or entities. Access, or the continued availability of the traditional natural resources, would be affected by the SGP. There would be a long-term loss of approximately 13,441 acres of federal land within the 14,221-acre Operations Area Boundary associated with land occupancy from mining activities under the 2021 MMP, which represents less than one percent of the PNF. After reclamation, fishing, hunting pasturing, and gathering areas would be restored through revegetation of disturbed areas (except for approximately 278 acres of unreclaimed areas) and wildlife would return. Tribal members would regain access to the federal lands. There are no known types of natural resources available for exercising treaty rights in the SGP area that are not available on the surrounding NFS lands. It is difficult to quantify or otherwise determine the impact of a temporary loss of a right. While offsite presence of tribal resources means the impact to overall fishing, hunting, pasturing, and gathering access would be negligible to minor, this would still constitute a localized, long-term, and moderate to major impact to tribal treaty rights specific to those tribal resources in their specific locations including those associated with potential historic properties, sacred sites or places, TCPs, and CLs. In consultations with the Tribes, they noted that any loss of treaty rights is significant to them and could potentially affect all tribal members. The Tribes would not be able to exercise treaty rights in the Operations Area Boundary for the life of the SGP, which would be a localized, long term, moderate to major impact on tribal treaty rights.

The Tribes have multiple and inter-related interests and associations with the local area resources (e.g., religious, sacred site, traditional, and subsistence uses). Many of these interests also are inherently incompatible with any resource changes, including increased presence or alternate use of the local area by non-tribal individuals or entities. In general, the SGP impacts to subsistence resource availability on tribal communities with environmental justice concerns could potentially be adverse and would be localized, long term to permanent, and moderate to major.

Noise

There would be noise impacts at the SGP and associated SGP components during construction. Noise would likely displace larger wildlife and change recreational or traditional use experiences including viewsheds and sense of solitude in areas proximate to construction activities. The Burntlog Route would be in close proximity to the FCRNRW and construction noise would impact closer areas of the FCRNRW but would gradually attenuate to being unnoticeable with distance. Topography and vegetation would help to attenuate noise. However, noise impacts during construction would generally be localized, temporary to short-term, and negligible to moderate depending on proximity to activity. Mine and associated infrastructure development and associated noise during the construction phase would be limited to daytime hours (between 7:00 a.m. and 10:00 p.m.).

During operations there would be long-term but periodic noise impacts due to SGP operations and road maintenance activities. Access road traffic and maintenance would impact some areas of the FCRNRW, with impacts diminishing with distance from the wilderness boundary. Impacts from operations would not extend as far into the wilderness area as they would during construction. Overall, noise impacts would be localized, temporary to long term, and negligible to moderate for tribal resources (i.e., wildlife), tribal treaty rights and traditional use experiences, and solitude including aspects associated with potential historic properties, sacred sites or places, TCPs, and CLs within the analysis area and proximate portions of the FCRNRW.

Visual Resources

There would be new disturbances in the Operations Area Boundary which would change the local landscape character. However, scenic integrity is low where there are existing disturbances from historical mining activities as the landscape has been heavily altered. Construction of the Burntlog Route would result in the greatest change in landscape character and scenic quality. During construction and operations, where these changes could be seen from traditional use or ceremonial sites, visual contrasts would be a localized, long-term, and negligible to major impact to tribal treaty rights and traditional use experiences including those associated with potential historic properties, sacred sites or places, TCPs, and CLs. After reclamation, visual impacts would lessen.

Recreation

There would be impacts to solitude, and the temporary to long-term loss of dispersed recreation opportunities in the area disturbed by the SGP during construction. Although, as described previously, current tribal recreation opportunities in the Operations Area Boundary are very limited due to the existing mine disturbance and inaccessible private property that occur within or immediately adjacent to the mine area. The limited opportunity for tribal treaty rights and traditional use experiences would be re-established in the Operations Area Boundary following reclamation. Recreation impacts to the Tribes

would be localized, temporary to permanent, and negligible to major including practices associated with potential historic properties, sacred sites or places, TCPs, and CLs.

Air Quality

Air quality impacts would not exceed NAAQS (**Section 4.2**). The change in atmospheric visibility would be less than the 5 percent change in light extinction that is considered the significance criteria for Class I areas (FLAG 2010). Consequently, the level of regional haze impact would be localized, long term, and minor. Impacts to tribal treaty rights and tribal resources associated with potential historic properties, sacred sites or places, TCPs, and CLs due to haze would be localized, long term, and negligible to minor.

Socioeconomics

Construction period usage of the Johnson Creek Route would increase traffic and activity on an existing roadway along portions of Johnson Creek where the Johnson Creek Artificial Propagation Enhancement fisheries restoration program is active. The socioeconomic components for the fisheries restoration program (e.g., road access, employment) would observe short-term, negligible effects from the increased use of the Johnson Creek Route during construction. There could be direct socioeconomic impacts from restricted or denied tribal treaty rights associated with harvest opportunities in the Operations Area Boundary and/or areas where construction activities are taking place. Lost opportunities during construction would be localized, short-term, and negligible to minor as subsistence resources are available in other areas of the Boise and Payette National Forests. Impacts would be localized, long-term, and negligible to minor within the Operations Area Boundary for the same reason.

Environmental Justice

The SGP area is within the traditional subsistence range of tribal communities with environmental justice concerns. Tribal members are more susceptible and likely to be impacted by local area resource changes due to both their use of the area and their long-established cultural connections and attitudes to the local area resources. For these reasons, if there are adverse impacts to water, fisheries, and wildlife resources, tribal members would have a greater potential to be affected than the general population.

None of the SGP components are on reservation lands, and no significant adverse biological impacts (e.g., wildlife and vegetation resources), public health impacts (e.g., contamination of fish in local streams), or other physical impacts (e.g., air quality and noise) are identified that would directly impact reservation lands and their Tribal environmental justice communities that are located outside of the SGP area. However, the SGP could affect Tribal members' access to subsistence or traditional use of the lands within the SGP area. Currently, there is no restricted access on NFS lands in the SGP area. Some restrictions are in place on private lands. As a result, the potential for any adverse and disproportionate SGP-related impacts to the tribal environmental justice communities would be limited to changes in access for tribal members, and subsistence or traditional use of the lands, such as fishing in usual and accustomed places. Under the 2021 MMP, impacts to subsistence resource availability on tribal communities with environmental justice concerns could potentially be adverse and would be localized, long-term to permanent, and moderate.

There are no substitute resources or replacement opportunities for location-specific tribal interests and use of the local area. As a result, tribal members are more likely to be impacted by local area resource

changes than the general public. However, specific information from the Tribes regarding the exact nature, duration, and location of impacts on tribal populations resulting from the excluded areas for the SGP and/or resource impacts is not available in the public domain. Based on the restricted ethnographic information provided to the Forest Service by the Tribes, it is expected that the SGP-related impacts would be of a type and/or magnitude to represent an adverse environmental justice impact to the tribal environmental justice communities.

4.24.2.3 Johnson Creek Route Alternative

Tribal Historical/Archaeological Sites

Within the Operations Area Boundary, impacts to Native American archaeological sites would be the same as described under the 2021 MMP. Under the Johnson Creek Route Alternative, the Burntlog Route would not be constructed. Rather, the Johnson Creek Route (Johnson Creek and Stibnite roads) would require upgrade and widening to improve the road for operations traffic. There are six previously identified Native American archaeological sites within the physical APE along Johnson Creek Route that could be potentially affected by the SGP. However, physical impacts to these sites would be avoided through design or protective measures. Consultation with the Tribes would be ongoing; therefore, if additional potential impacts are identified such as discoveries of cultural significant sites or resources during or post construction, formal government-to-government consultation would occur. If sites could not be avoided or another type of impact were identified (visual, auditory, or vibratory), the impact to Native American archaeological sites would be localized, temporary to permanent, and negligible to minor.

Sacred Sites or Places, Traditional Cultural Properties, and Cultural Landscapes

Impacts to non-archaeological tribal sites including sacred sites, TCPs, and CLs, could occur during all phases of the SGP including construction, operations, exploration, and reclamation. Currently, there are no known sacred sites within the Operations Area Boundary, however tribal consultation and the preparation of the confidential tribal ethnographies have identified a TCP District within the analysis area. Portions of the Johnson Creek Road in the Nez Perce Tribe's ethnography has been identified as a traditional travel route. Further documentation and the evaluation of the site as a historic property informed by tribal consultations is ongoing. In addition, consultation regarding sacred sites or places, the identified TCP District, and CLs is ongoing with all tribal partners.

Impacts to sacred sites or places, TCPs, and CLs would be the same as described for the 2021 MMP for the Operations Area Boundary. As the Burntlog Route would not be constructed under the Johnson Creek Route Alternative, there would be no change to the landscape along that route. Overall, there would be fewer changes to the landscape under the Johnson Creek Route Alternative. However, changes to the landscape relating to the Johnson Creek Route Alternative resulting from the SGP would have localized, long term, and negligible to moderate impacts on sacred sites, TCPs, or CLs that may exist depending on whether the changes could impact the integrity of said properties and the tribal experiences associated with them.

Traditional Use Sites

Impacts to traditional use sites would be the same as described under the 2021 MMP within the Operations Area Boundary. As the Burntlog Route would not be constructed, there would not be any changes to the local landscape or traditional use areas along that route. The Johnson Creek Route would be widened and improved to accommodate operations traffic but generally would not cause additional changes to the landscape, therefore it would have localized, long-term, and negligible to moderate impacts on nearby ceremonial or traditional use sites that may exist along that route or depending on whether impacts and alterations could be seen from other locations where additional ceremonial and traditional use sites may occur.

Land Status and Access

There would be no change in land ownership status. The federal portion of the affected land would remain under federal ownership and access would remain the same. The impact to federal land available for treaty rights access from the Johnson Creek Route Alternative would be localized, long term, and negligible.

Water Resources

Impacts from construction and operations at the SGP would be the same as the 2021 MMP. However, the Burntlog Route would not be constructed and therefore there would be 21 fewer stream crossings. The Johnson Creek Route would be upgraded and improved for use during operations which would increase the potential for additional sediment load and inadvertent spills into Johnson Creek and the East Fork SFSR as well as the other streams crossed by this route. The effects of the Johnson Creek Route Alternative of sedimentation would be localized, long-term, and moderate.

Similar to the 2021 MMP, effects of impacts to water resources on tribal treaty rights and resources, in particular fisheries, would be localized, long-term to permanent, and major.

Wetlands

Impacts from construction and operations at the SGP would be the same as the 2021 MMP. However, the Burntlog Route would not be constructed and therefore there would be no impacts to wetlands along that route. Impacts to wetlands and riparian areas associated with widening, maintenance, and use of the Johnson Creek Route would be similar to the wetland impacts associated with the Burntlog Route. These include direct loss, fragmentation, and indirect effects such as dust. Wetlands and riparian areas along Johnson Creek are lower in their respective watershed (i.e., further downstream) as the route is largely located along the East Fork SFSR (**Section 4.11**). Thus, the road impacts would affect wetlands and riparian areas at the confluences of several drainages that feed into the East Fork SFSR, which would have a larger effect on the river. The impact to wetlands would be localized, temporary to permanent, and major which could result in localized, temporary to permanent, and major impacts to tribal treaty rights and resources including those associated with potential historic properties, sacred sites or places, TCPs, and CLs depending on the wetland and the type of tribal use.

Fisheries

Impacts to fisheries and aquatic resources from construction and operations of the SGP would be the same as the 2021 MMP within the Operations Area Boundary. However, the Burntlog Route would not be constructed and therefore there would be no impacts to fisheries or aquatic resources along that route. The Johnson Creek Route would be upgraded and improved for use during operations which would increase the potential for impacts due to sedimentation and inadvertent spills to Johnson Creek and the East Fork SFSR. Additional impacts from the Johnson Creek Route Alternative to specific fish is detailed in **Section 4.12**. Impacts to fisheries would be a localized, long-term to permanent, and major to tribal treaty rights and tribal resources including those associated with potential historic properties, sacred sites or places, TCPs, and CLs.

Vegetation

Impacts to vegetation within the Operations Area Boundary would be the same as those described under the 2021 MMP. There would be additional impacts along the Johnson Creek Route as it would be used for access during mine construction, operations, and closure and reclamation; therefore, it would require substantial upgrades. Under this alternative, the Burntlog Route would not be constructed, therefore there would not be the associated vegetation impacts along that route, such as those related to whitebark pine, limber, pine, lodgepole pine, and the one known occurrence of sweet grass. The Johnson Creek Route Alternative would impact 108.4 acres of occupied whitebark pine habitat and remove 767 individual trees of which 23 would be mature and cone-bearing. The one known occurrence of bitterroot, located in the transmission line corridor, could be indirectly impacted during construction of the transmission line upgrade the same as the 2021 MMP. The impact would be localized, long term, and negligible to moderate. While offsite presence of plants means the impact to overall access to a specific type of plant would be negligible to minor, this would still constitute a localized, long-term, and moderate to major impact to tribal treaty rights specific to those resources in their specific locations including those associated with potential historic properties, sacred sites or places, TCPs, and CLs.

Noxious Weeds and Invasive Species

Impacts from noxious weeds and invasive species would be similar to that discussed under the 2021 MMP. Since the Burntlog Route would not be constructed, there would be no potential for the SGP to introduce noxious weeds and invasive species along that route. The increased threat of weed infestation at and near the SGP would be a localized, long term, and negligible to minor impact to tribal use of vegetation.

Wildlife

Impacts to wildlife under the Johnson Creek Alternative would be similar to those described under the 2021 MMP. Under this alternative, the Burntlog Route would not be constructed, therefore there would not be the associated habitat fragmentation or wildlife displacement along that route, lessening impacts. This would shift disturbance away from the FCRNRW area where gray wolf packs are known to occur. Impacts would be localized, short term to permanent, and minor to moderate. There would not be any effects to the availability or populations of game species that would affect tribal hunting rights, except for a slight decrease in the amount of land available for tribal hunting due to restricted access in the Operations Area Boundary.

Treaty Rights Access

Impacts to treaty rights access would be the same as discussed under the 2021 MMP, except the Burntlog Route would not be constructed; therefore, there would be no change in treaty rights access in that area. Impacts along Johnson Creek Road and Stibnite Road would be long term as opposed to short term under the 2021 MMP. While offsite presence of tribal resources means the impact to overall fishing, hunting, pasturing, and gathering access would be negligible to minor, this would still constitute a localized, long-term, and moderate to major impact to tribal treaty rights specific to those tribal resources in their specific locations including those associated with potential historic properties, sacred sites or places, TCPs, and CLs. In consultations with the Tribes, they noted that any loss of treaty rights is significant to them and could potentially affect all tribal members. The Tribes would not be able to exercise treaty rights in the Operations Area Boundary for the life of the SGP, which would be a localized, long term, moderate to major impact on tribal treaty rights.

Noise

Noise impacts would be similar to those described under the 2021 MMP except that the Burntlog Route would not be constructed therefore, there would be no construction, road maintenance, or traffic noise in that area. Noise impacts along the Johnson Creek Route related to the SGP would continue through closure and reclamation. Overall, noise impacts would be localized, temporary to long term, and negligible to moderate for tribal resources (i.e., wildlife), tribal treaty rights and traditional use experiences, and solitude including aspects associated with potential historic properties, sacred sites or places, TCPs, and CLs within the Operations Area Boundary and along the Johnson Creek Route.

Visual Resources

Visual impacts at the mine site would be the same as described under the 2021 MMP. Since the Burntlog Route would not be constructed, there would be no visual impacts related to that route. This area near the FCRNRW would retain is scenic integrity. The Johnson Creek Route would be widened and improved to accommodate operations traffic but generally would not cause additional changes to the landscape. During construction and operations, those areas adjacent to the Operations Area Boundary where these changes could be seen from traditional use or ceremonial sites, these visual contrasts would be a localized, long-term, and negligible to major impact to tribal treaty rights and traditional use experiences including those associated with potential historic properties, sacred sites or places, TCPs, and CLs.

Recreation

Impacts to tribal recreation would be the same as discussed under the 2021 MMP, except SGP-related traffic impacts would be long term along the Johnson Creek Route, as this route would be used during construction, operations, closure, and reclamation. Recreation impacts to the Tribes would be localized, temporary to permanent, and negligible to major including practices associated with potential historic properties, sacred sites or places, TCPs, and CLs.

Air Quality

Impacts to air quality would generally be the same as discussed under the 2021 MMP. Impacts to tribal treaty rights and tribal resources associated with potential historic properties, sacred sites or places, TCPs, and CLs due to haze would be localized, long term, and negligible to minor.

Socioeconomics

Socioeconomic impacts would be similar to that discussed under the 2021 MMP. Usage of the Johnson Creek Route through construction, operations, closure, and reclamation would increase traffic and activity for the long term (20+ years). Usage of the Johnson Creek Route for the duration of the SGP would increase traffic and activity on an existing roadway along portions of Johnson Creek Road where the Johnson Creek Artificial Propagation Enhancement fisheries restoration program is active. The socioeconomic components for the fisheries restoration program (e.g., road access, employment) would observe long-term, negligible to minor effects from the increased use of the Johnson Creek Route during construction, operations, reclamation, and closure of the SGP.

Environmental Justice

Environmental justice impacts would be similar to those discussed under the 2021 MMP; the potential for any adverse and disproportionate SGP-related impacts to the tribal environmental justice communities are expected to be limited to changes in tribal member access and subsistence or traditional use of the lands for the SGP mine area. However, the Burntlog Route itself would not be constructed and mine operations would continue to use the Johnson Creek Route for access. Upgrades to the Johnson Creek Route and its use as the access route to the mine site during operations would have the potential for impacts to tribal resources along this route due to increased noise, traffic, and potential sedimentation in Johnson Creek affecting water quality, fisheries, and displacement of wildlife for the life of the SGP. Tribal members may avoid these areas for a longer period of time. Therefore, impacts to subsistence resource availability under the Johnson Creek Route Alternative on tribal communities with environmental justice concerns would be localized, long term to permanent, and moderate.

4.24.3 Mitigation Measures

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 EDFs (**Section 2.4.9**) accounted for in the preceding impact analysis. At this time, no mitigation measures have been identified for Tribal Rights and Interests. Mitigation measures may be added, revised, or refined based on public comment, agency comment, or continued discussions with Perpetua regarding this analysis. The adopted mitigation measures will be finalized in the Final EIS.

4.24.4 Irreversible and Irretrievable Commitments of Public Resources

The destruction of tribal resources, including subsistence resources, gathering areas, sacred sites or places, TCPs, or CLs, is a permanent and irreversible effect. They are generally non-renewable resources that continue to be important to, used by, and relied upon by the Tribes with interest in the area. If tribal treaty rights are disrupted by restricted access due to implementation of the SGP, these uses become unavailable. If traditional use areas and subsistence resources become no longer viable and/or unavailable for use for the foreseeable future by Tribes with rights in the SGP area this would constitute an irretrievable commitment of resources.

4.24.4.1 No Action Alternative

Under the No Action Alternative, the SGP would not occur. Consequently, there would be no project-related irreversible or irretrievable commitment of resources as it relates to tribal rights and interests.

4.24.4.2 Action Alternatives

The consequences associated with irreversible and irretrievable commitments may include significant loss of tribally significant resources and the inability of tribal members to utilize traditionally important resources or access traditionally important places. Specific consequences would be identified through government-to-government consultation.

Traditionally collected or used natural resources of interest to the Tribes as reserved in treaties that could be destroyed by the Action Alternatives and constitute an irreversible commitment, regardless of mitigation. Many of these natural resources, such as salmon, plant populations, and trees, are only renewable over long periods of time. Other traditional use areas, such as usual and accustomed fishing places, TCPs, CLs, or sacred sites or places, that could be destroyed or otherwise altered by the Action Alternatives are often non-renewable, particularly if they are landscape features. Once gone, the resources are no longer available for use by the Tribes with rights and interests in the area.

Under the 2021 MMP, the restriction of public access in the Operations Area Boundary would remove the land from other uses while the mine is in operation, but the use would eventually be reversed through removal of the exclusion area and reclamation.

Implementation of the Action Alternatives could result in irretrievable and irreversible commitment of tribal treaty rights and interests if avoidance measures are not implemented, and access restrictions are enforced. For example, prohibiting use of a culturally important area, such as usual and accustomed fishing places, or a sacred site or a cultural or religious TCP District that is a historic property eligible for listing, for 20 years over the life of the SGP could result in the irretrievable and irreversible loss of cultural practices and identity to a generation of tribal members.

4.24.5 Short-term Uses versus Long-term Productivity

The resilience of tribal resources or tribal interests is very low in comparison to other social or biological resources because actions associated with the SGP (i.e., ground disturbance) that may affect tribal resources, subsistence and gathering areas, usual and accustomed fishing places, historic properties, TCPs, CLs, and sacred sites or places would be irreversible. Short-term uses, even uses such as temporary staging areas for transmission line construction or access roads that would later be returned to their pre-construction state, have the potential to permanently impact tribal resources and use areas of importance to the Tribes. There is the potential for the loss of long-term productivity to any tribal resources subjected to short-term use. The long-term productivity would be damaged due to the length of time of the SGP. Tribes and tribal members would be restricted from accessing their tribal resources within the Operations Area Boundary for a period of 20 or more years potentially impacting their tribal treaty rights.

4.24.5.1 No Action Alternative

Under the No Action Alternative, there would be no project-related short-term use that would affect tribal rights and interests, and no effect on long-term productivity.

4.24.5.2 Action Alternatives

Under the Action Alternatives, all short-term direct impacts to tribal resources and interests including usual and accustomed fishing places, would lead to a loss of long-term productivity. Some short-term protection measures could lead to long-term productivity (use of more tribal resource subsistence or gathering areas following mine closure) of resources. If tribal harvest areas, sacred sites or places, TCPs or CLs are identified, short-term use may be denied while protecting long-term productivity.