# Environmental Evaluation

## Grassy Mountain Gold Project
## Malheur County, Oregon

Calico Resources USA Corp. 2015. Geology and Soils Baseline Study. Grassy Mountain Project. Cover Photo. February 2015.

**August 16, 2024**

Prepared for:

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# Table of Contents

## Tables

## Figures

## Appendices

# Acronyms and Abbreviations

| | |
|---|---|
| μg/m$^3$ | micrograms per cubic meter |
| °C | degrees Celsius |
| °F | degrees Fahrenheit |
| ACDP | Air Contaminant Discharge Permit |
| AERMOD | American Meteorological Society/Environmental Protection Agency Regulatory Model |
| amsl | above mean sea level |
| ANFO | ammonium nitrate/fuel oil |
| APE | area of potential effects |
| Applicant | Calico Resources USA Corp. |
| AQS | Air Quality System |
| ASI | Air Sciences, Inc. |
| Ausenco | Ausenco Canada Inc. |
| BDR | baseline data report |
| bgs | below ground surface |
| BLM | Bureau of Land Management |
| BMP | best management practice |
| CAA | Clean Air Act |
| CAO | Clean Air Oregon |
| CFR | Code of Federal Regulations |
| cfs | cubic feet per second |
| $CH_4$ | methane |
| CIL | carbon-in-leach |
| CO | carbon monoxide |
| $CO_2$ | carbon dioxide |
| $CO_2$e | $CO_2$-equivalent |
| CPA | Consolidated Permit Application |
| CWA | Clean Water Act |
| cy | cubic yard(s) |
| dB | decibel |
| dBA | A-weighted decibel |
| DEQ | Department of Environmental Quality |
| DLCD | Department of Land Conservation and Development |
| DOGAMI | Department of Geology and Mineral Industries |
| DPM | diesel particulate matter |

| | |
|---|---|
| DSL | Department of State Lands |
| EA | environmental assessment |
| e-cell | evaporation cell |
| EE | environmental evaluation |
| EFU | Exclusive Farm Use |
| EIS | environmental Impact Statement |
| EM Strategies | EM Strategies Inc. |
| EPA | Environmental Protection Agency |
| ERU | Exclusive Range Use |
| ESA | Endangered Species Act |
| FEMA | Federal Emergency Management Agency |
| FTA | Federal Transit Administration |
| g | acceleration of gravity |
| G | ground absorption factor |
| GCL | geosynthetic clay liner |
| GHG | greenhouse gas |
| GIS | geographic information system |
| GMF | Grassy Mountain Formation |
| gpm | gallons per minute |
| GWP | global warming potential |
| HAP | hazardous air pollutant |
| HDPE | high-density polyethylene |
| HLP | heap leach pad |
| HMA | habitat mitigation area |
| HQT | Oregon Sage-Grouse Habitat Quantification Tool |
| HSEC | Health, Safety, and Environmental Compliance |
| HVAC | heating, ventilation, and air conditioning |
| ICMC | International Cyanide Management Code |
| ILF | in-lieu fee |
| IPaC | Information for Planning and Consultation |
| ISO | International Organization for Standardization |
| km | kilometer(s) |
| kV | kilovolt |
| kW | kilowatt |
| $L_1$ | sound level exceeded for 1 percent of the measurement time |
| $L_{10}$ | sound level that occurs 10 percent or more of the time of the measurement |
| $L_{50}$ | sound level that occurs 50 percent of the time of the measurement |
| lb | pound |

| | |
|---|---|
| $L_{DN}$ | day-night sound level over a 24-hour period |
| $L_{eq}$ | equivalent continuous sound level |
| $L_n$ | statistical percentile sound levels |
| Lorax | Lorax Environmental Services |
| $m/s^2$ | meters per second squared |
| Ma | millions of years before present |
| MCE | Maximum Considered Earthquake |
| MERPs | modeled emission rates for precursors |
| mg/L | milligram(s) per liter |
| mil | one thousandth of an inch |
| mm | millimeter(s) |
| MMT | million metric tons |
| mph | miles per hour |
| MST | million short tons |
| $N_2O$ | nitrous oxide |
| NAAQS | National Ambient Air Quality Standards |
| NEI | National Emissions Inventory |
| NEPA | National Environmental Policy Act |
| NESHAP | National Emission Standards for Hazardous Air Pollutants |
| ng/L | nanograms per liter |
| NHD | National Hydrography Dataset |
| NHPA | National Historic Preservation Act |
| $NO_2$ | nitrogen dioxide |
| $NO_x$ | nitric oxide |
| NRCS | Natural Resources Conservation Service |
| NRHP | National Register of Historic Places |
| NSPS | New Source Performance Standards |
| NWI | National Wetlands Inventory |
| $O_3$ | ozone |
| OAR | Oregon Administrative Rule |
| ODA | Oregon Department of Agriculture |
| ODFW | Oregon Department of Fish and Wildlife |
| ODOT | Oregon Department of Transportation |
| OHV | off-highway motorized vehicle |
| ORBIC | Oregon Biodiversity Information Center |
| ORS | Oregon Revised Statutes |
| oz | ounces |
| Pb | lead |

| | |
|---|---|
| PCC | Project Coordinating Committee |
| Permit Area | Mine and Process Area and the Access Road Area |
| PGA | peak ground acceleration |
| $PM_{2.5}$ | particulate matter with a diameter of 2.5 µm or less |
| $PM_{10}$ | particulate matter with a diameter greater than 2.5 µm and less than approximately 10 µm |
| POX | pressure oxidation |
| ppb | parts per billion |
| ppm | parts per million |
| Project | Grassy Mountain Gold Project |
| PSD | Prevention of Significant Deterioration |
| RBC | risk-based concentrations |
| REER | Risk Equivalent Emission Rate |
| RHS | representative hypothetical source |
| RIL | resin-in-leach |
| ROM | run-of-mine |
| ROW | right-of-way |
| SEORMP | Southeastern Oregon Resource Management Plan and Record of Decision |
| SER | significant emission rate |
| SETs | significant emission thresholds |
| SHPO | State Historic Preservation Office |
| SIC | short interval control |
| SIP | State Implementation Plan |
| SLR | SLR International Corporation |
| $SO_2$ | sulfur dioxide |
| SPCC Plan | Spill Prevention, Control, and Countermeasure Plan |
| SPF | SPF Water Engineering |
| SRCE | Standardized Reclamation Cost Estimator |
| stpd | short tons per day |
| s.u. | standard units |
| SWPPP | Stormwater Pollution Prevention Plan |
| t | tons |
| TDS | total dissolved solids |
| tpy | tons per year |
| TRT | Technical Review Team |
| TSF | tailings storage facility |
| TWRSF | temporary waste rock storage facility |
| US | United States |

| | |
|---|---|
| USACE | US Army Corps of Engineers |
| USFS | US Forest Service |
| USFWS | US Fish and Wildlife Service |
| USGS | US Geological Survey |
| UV | ultraviolet |
| VOC | volatile organic compounds |
| VRM | Visual Resources Management |
| w/w | weight by weight |
| WAD | weak acid dissociable |
| WEG | Wind Erodibility Group |
| WRD | Oregon Water Resources Department |

# 1.0 CHAPTER 1: INTRODUCTION

Calico Resources USA Corp. (the Applicant) proposes the Grassy Mountain Gold Project (Project) to construct, operate, reclaim, and close an underground mining and indoor precious metal processing facility to develop Grassy Mountain gold and silver resources. The Project is located in Malheur County, Oregon, about 22 miles south-southwest of Vale, and consists of two areas: the Mine and Process Area and the Access Road Area, together termed the “Permit Area” (Figure 1-1).

The Permit Area includes both private and public lands managed by the US Bureau of Land Management (BLM). The proposed Project consists of underground mine and ore processing facilities, including a temporary conventional mill, a permanent tailings storage facility (TSF), and a temporary waste rock storage area, as well as other support facilities. Section 1.1 provides a brief overview of the proposed Project, while Chapter 2 provides greater detail.

Environmental review of the proposed Project is being carried out by state agencies, federal agencies, and local governments pursuant to the Oregon chemical process mining Consolidated Permit process described in Oregon Revised Statutes (ORS) 517 because cyanide would be used to process the mineral resources. The consolidated environmental review efforts also respond to specific policy requirements in ORS 517 and 468B and in Oregon Administrative Rules (OAR), including OAR Chapter 632, Division 37; Chapter 340, Division 43; Chapter 635, Division 420; and Chapter 660, Division 23. The Oregon Department of Geology and Mineral Industries (DOGAMI) is the lead facilitating agency and is coordinating the Technical Review Team (TRT[1]) and permitting, cooperating, and commenting state agencies (see Section 1.2 for more detail). All participating state agencies are required to coordinate with the federal government in the processing of applications (OAR 632-037-0005(1)(b) and OAR 632-037-0015). Federal environmental review is being conducted by the BLM as the lead agency pursuant to the National Environmental Policy Act (NEPA), which is a separate but connected environmental review process.[2] The Consolidated Permit rules referenced above stipulate that the state permitting process and federal application process should be coordinated to the fullest extent possible, including:

- Coordinating the timelines for preparation and content of the state environmental evaluation (EE) and federal environmental assessment (EA) or environmental impact statement (EIS);
- Ensuring that all state-process data, information, and documents also satisfy to the fullest extent possible the requirements of corresponding portions of NEPA; and
- Coordinating federal and state financial security requirements to the fullest extent possible.

Per OAR Chapter 632, Division 37, the EE should address specific impacts of the proposed Grassy Mountain gold mining operation in order to allow affected agencies to make decisions on whether to issue or deny a permit and develop permit conditions. This EE focuses on significant environmental issues and

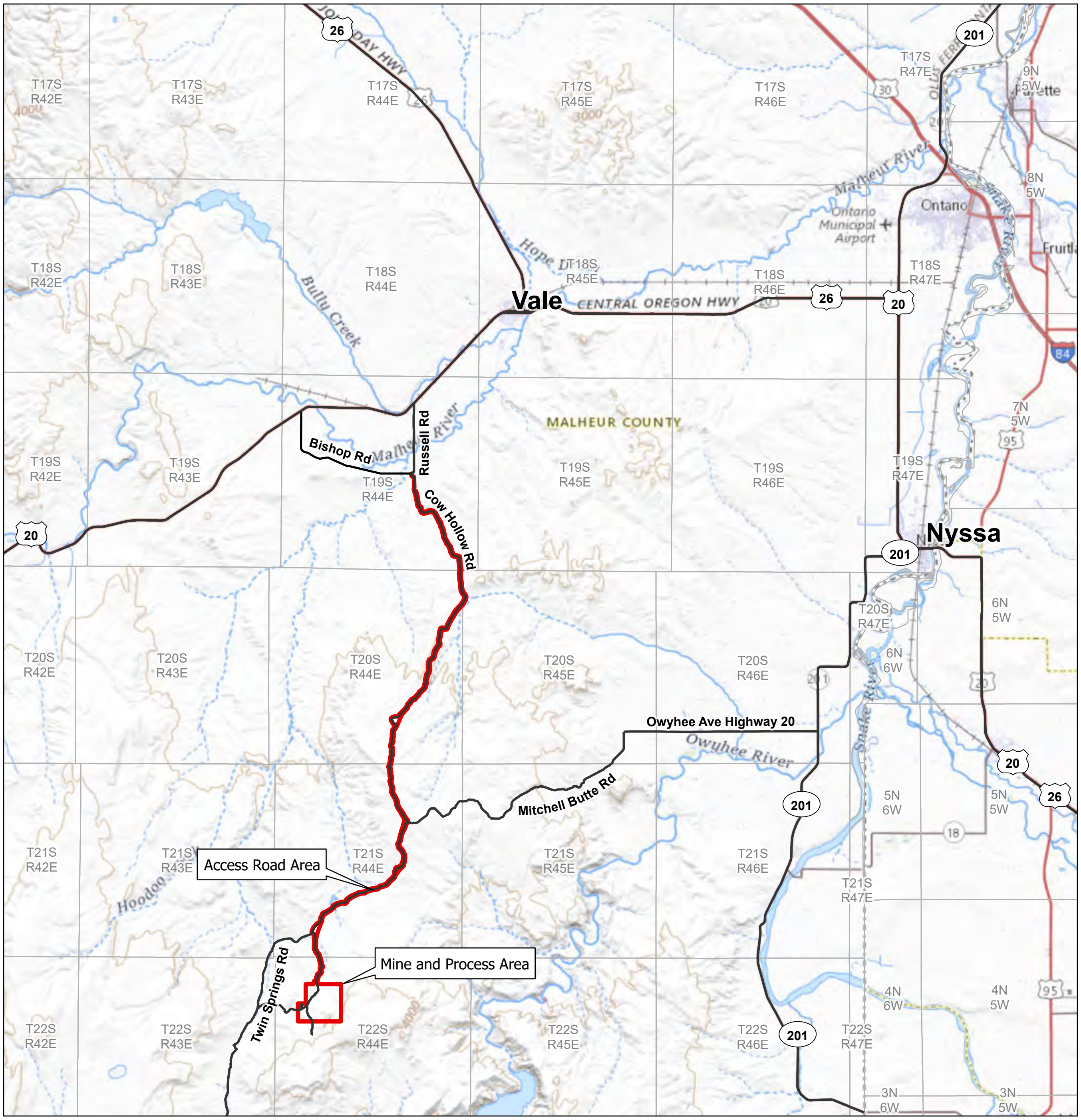
[1] The TRT has many roles in the Consolidated Permit process, including determining the study area for a project, verifying baseline data, identifying reasonable alternatives, determining completeness of a Consolidated Permit Application, and determining compliance of proposed mining operations with regulatory requirements.

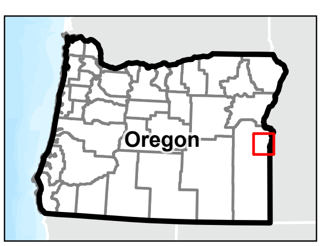
[2] The information contained in the NEPA EIS can be used in partial fulfillment of the Oregon Consolidated Permit requirements.

Project alternatives and provides specific analyses required by regulation and/or requested by the TRT, including:

- Evaluating alternatives to the proposed Project to ascertain whether there are less impactful mining strategies (Section 2.2), including a *No Action Alternative;*
- Assessing the direct and indirect impacts of the proposed Project to environmental resources (Chapter 3);
- Identifying other projects in the area and assessing potential cumulative impacts of such projects that, in combination with impacts from the Project, could create significant effects (Chapter 4);
- Identifying mitigation measures that would minimize detected effects of the proposed Project to environmental resources, including evaluating best management practices (BMPs) and adaptive management strategies from other chemical process mining projects;
- Reviewing best available, practicable, and necessary technologies (Appendix A), which are used by the TRT as the foundation of recommendations to DOGAMI with regard to compliance with environmental standards and permitting decisions;
- Analyzing a series of credible accidents and anticipated outcomes for the proposed Project (Appendix B);
- Analyzing general cyanide chemistry (Appendix C), the application of cyanide in gold mining, and the specific role of cyanide in the proposed Project, including capabilities and technologies evaluated in the Applicant's 2018 pre-feasibility study (Mine Development Associates 2018), 2020 feasibility study (Ausenco Canada Inc. [Ausenco] 2020), updated feasibility study (Ausenco 2022), and standards and practices used by the State of Nevada for cyanide use in chemical process mining;
- Analyzing the potential for acid rock drainage (Appendix D), including an assessment of acid rock drainage monitoring and analyses to detect acid rock drainage formation and to inform mitigation in underground workings and the TSF; and
- Evaluating the Applicant's ecological risk assessment (SLR International Corporation [SLR] 2023).

The remainder of this chapter addresses the applicable environmental regulations and permit requirements for the Project. Chapter 2 provides a concise description of the Applicant's proposed Project and alternatives evaluated in this EE, and Chapter 3 provides discussions of the affected environment and analyses of potential environmental consequences of each alternative, including a summary of effects table. Chapter 4 addresses potential cumulative impacts of the proposed Project in combination with other projects, plans, and actions that may occur in a similar timeframe. Chapter 5 discusses measures designed to reduce potential Project effects including monitoring and mitigation. All references used in this EE are provided in Chapter 6.




Legend

- Permit Area
- Existing Roads

0 1.5 3 Miles

(At original document size of 8.5x11)
1:300,000

N

Stantec

*Project Location*
Malheur County, OR

Prepared by LL on 2023-10-04
TR by AU on 2023-10-10

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**1-1**

*Title*
**Location Map**

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources:
**3.** Background: USGS Topo

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## 1.1 PROJECT OVERVIEW

The Project is proposed in southeastern Oregon, in Malheur County, primarily on BLM federal land with some smaller portions on private lands. The nearest major city is Vale, Oregon, about 22 miles away from the Project. Access to the Project would be via public land administered by the BLM and private land controlled by other entities. The access road for the mine would be an existing road that begins at the intersection of US Route 20 and Russell Road and continues south along Cow Hollow Road and Twin Springs Road until reaching the Project area.

The ore-bearing and waste rock would be extracted from an underground mine using conventional underground mining techniques including drilling, blasting, mucking, loading, and hauling. Haul trucks would transport the waste rock to the lined temporary waste rock storage facility (TWRSF) near the TSF and transport the ore-bearing rock to the run-of-mine (ROM) ore stockpile adjacent to the mill. The ore would be crushed and leached in a closed-circuit carbon-in-leach (CIL) processing plant. The leached tailings (waste slurry) would go through a detoxification process and then be pumped to the dedicated TSF, where surface supernatant solution (i.e., the clear liquid that separates from a solid residue after settling) would be recovered and pumped back to the mill for reuse.

The rock would be extracted at a rate of approximately 1,200 short tons per day (stpd), 4 days per week. The ore would be processed at a rate of 750 stpd, 7 days per week. The Project would disturb approximately 488 acres of land to process approximately 2.07 million short tons (MST) of mill-grade ore, with an additional 0.27 MST of waste rock extracted for a mine life of approximately 8 years.

Infrastructure that would be developed for the Project includes:

- An underground mine, with mine portal, decline, monitoring instrumentation, and ventilation shaft;
- A lined TSF with embankments, impoundments, a reclaim pond, and leak detection and leachate collection systems, all dedicated to the Project;
- A lined TWRSF with underflow collection and leak detection and leachate collection systems;
- A process plant area with the process plant building, control room, crushing facilities, conveyors, ore bins, control rooms, CIL processing plant, reagent/chemical storage building, gold room, and collection pond;
- Ancillary facilities including a main gate and guard house, perimeter fence, rock quarries and rock crushing facilities, parking areas, administration buildings, septic system, assay laboratory and sample preparation area, truck maintenance shop and warehouse, vehicle wash bay, process plant workshop and warehouse, meteorological station, explosive magazine, solid and liquid hazardous waste storage, and fuel storage and dispensing area;
- Roads, including upgrades to Twin Springs and Cow Hollow Roads and construction of the mine access road and internal access and mine haul roads;
- Yards, laydown areas, ore stockpiles, quarry, growth media stockpiles, and reclamation borrow areas;
- Cement rock fill batch-plant or cement mixing facility;

- Water supply, including a water production wellfield, water pipelines, raw water storage tank, potable water treatment plant, and potable water tank;
- Power supply that includes a power substation, upgraded and new 14.4-kilovolt (kV) overland power transmission systems, onsite power lines, and onsite generators (to be used during construction of the powerlines and initial mining stages and for emergency power outages); and
- Permanent and temporary stormwater diversion channels.

Closure and reclamation would be conducted in stages over approximately 4 years, with 29 years of post-closure monitoring and inspections or over timeframes as may be required in regulatory permits. The stages of reclamation are shown in Table 1-1, with activities being performed in the general sequence listed in the table.

### Table 1-1 Reclamation Schedule and Sequencing

| Phase | Schedule | Reclamation Actions |
|---|---|---|
| Stage 1 | Begins immediately following the cessation of mining operations | • Cessation of ore processing and placement of tailings<br>• Removal of underground mine equipment and chemicals and reagents<br>• Closure of the mine portal<br>• Closure of the ventilation shaft<br>• TSF underflow passive evaporation on the surface of the TSF (12-month period)<br>• Placement of growth media and seeding/revegetation of the TSF embankment<br>• If present, removal of waste rock from the TWRSF<br>• Closure of the TWRSF<br>• Closure of the ore stockpiles<br>• Removal and disposal of hazardous waste, chemicals, and reagents<br>• Closure of the fuel storage and dispensing area<br>• Closure of the process plant buildings and ancillary facilities including foundations and offsite disposal (except the administration building, which will remain through Stage 4)<br>• Closure of the collection pond<br>• Closure of the parking areas (except the parking lot adjacent to the administration building, which will remain through Stage 4)<br>• Closure of the internal access and haul roads not required for Stage 2 and Stage 3 reclamation activities |
| Stage 2 | Begins approximately 1 year following Stage 1, at the time when the surface of the TSF is suitable for construction activities | • Regrading of the entire TSF surface<br>• Closure of approximately 75 percent of the surface of the TSF (the remaining 25 percent will be utilized for evaporation of seepage collected in the reclaim pond) |

| Phase | Schedule | Reclamation Actions |
|---|---|---|
| | | • TSF underflow passive evaporation on the surface of the TSF (12-month period) |
| Stage 3 | Begins approximately 2 years following Stage 1, at the time when the flow rate from the tailings underflow can be passively managed within the evaporation cell, resulting in the final closure of the TSF | • Closure of the remaining 25 percent of the surface of the TSF<br>• Conversion of the reclaim pond to the evaporation cell<br>• Closure of the quarry<br>• Closure of the perimeter fence<br>• Closure of the administration building and adjacent parking lot<br>• Closure of the remaining internal mine roads<br>• Reduction of the mine access road from two lanes to one lane with the exception of the county road, which will remain<br>• Closure of the water supply, including the water production wellfield and associated pipelines, raw water storage tank, and potable water treatment unit<br>• Closure of the power supply, including lines and poles<br>• Closure of the growth media stockpiles and reclamation borrow areas |
| Stage 4 | Begins approximately 3 years following the completion of Stage 1 and consists of post-closure monitoring and inspections | • Post-closure monitoring and inspections, including monitoring of vegetation, groundwater, noxious weeds, and TSF tailings underflow to the evaporation cell |
| Stage 5 | Begins approximately 29 years following the completion of Stage 1, at the conclusion of post-closure monitoring for all mining facilities | • Closure of the groundwater monitoring wells, as permits allow<br>• Closure of the mine access road |

Section 2.1 provides greater detail on the proposed Project.

## 1.2 PURPOSE OF THE ENVIRONMENTAL EVALUATION

This EE has been created to satisfy requirements of the Consolidated Permit procedures and will be used to provide agencies, tribes, local governments, and the public a full and fair discussion of significant environmental impacts of the proposed Project, Project alternatives, and the measures identified to avoid, minimize, and mitigate those impacts.

The Consolidated Permit process:

- Ensures coordination between state agencies, federal agencies, and local governments;
- Consolidates baseline data requirements for needed state permits;
- Provides for a single comprehensive EE and socioeconomic impact analysis, including robust assessment of impacts to environmental justice and environmental justice communities;

- Ensures compliance with Oregon's Statewide Land Use Planning Program and Statewide Planning Goals and land use law;
- Provides a clear path for application processing including transparent/consolidated state agency collaboration, required opportunities for public input, and an efficient schedule with specified deadlines;
- Designates a single lead agency, DOGAMI, to provide coordination, accountability, and mediation of disagreements between agencies[3]; and
- Ensures environmental standards are met.

Under state law, Oregon uses a consolidated application process for administering state regulatory requirements for chemical process mines. The process is overseen by DOGAMI and includes permits from DOGAMI, the Oregon Department of Environmental Quality (DEQ), the Oregon Water Resources Department (WRD), the Oregon Department of State Lands (DSL[4]), and local government entities such as Malheur County, as shown in Table 1-2. The process engages with other cooperating agencies that are involved with statutory environmental review of the proposed Project to achieve compliance with Oregon state standards and policies via conditions to the DOGAMI Consolidated Permit. Cooperating agencies include the Oregon Department of Fish and Wildlife (ODFW) and the Oregon Department of Agriculture (ODA). Several other state agencies are considered commenting agencies, which may make recommendations to permitting agencies regarding permit conditions or whether to issue or deny a permit. Commenting agencies include the Oregon State Historic Preservation Office (SHPO). Many of these agencies are also part of the Project Coordinating Committee (PCC) and/or the TRT, which were formed to oversee application, permitting, and environmental review of the proposed Project, as described below.

**A PCC shares information and ideas** and coordinates county, state, and federal permitting requirements to avoid contradiction and duplication. The PCC for this Project is made up of the following entities: DOGAMI, DEQ, WRD, DSL, ODFW, ODA, SHPO, Oregon Department of Land & Conservation Development (DLCD), City of Vale, City of Nyssa, Malheur County, BLM, US Environmental Protection Agency (EPA), US Mine Safety and Health Administration, US Fish and Wildlife Service (USFWS), and the Burns Paiute Tribe.

**A TRT provides interagency and interdisciplinary review of technical permitting issues, serves in an advisory capacity to the PCC,** establishes methods and guidelines and coordinates with the applicant in the collection and verification of baseline data, determines the study area for a project, identifies any reasonable alternatives that were not analyzed by the applicant in a Consolidated Permit Application (CPA) or directs staff or a third-party contractor to analyze such alternatives (per OAR 632-037-0045(5)), determines whether a CPA and EE are complete (OAR 632-037-0025(1)(f)), and determines compliance of proposed mining operations with regulatory requirements. The TRT for this Project is made up of DOGAMI, DEQ, WRD, DSL, ODFW, ODA, SHPO, and DLCD. Both the BLM and the USFWS are ex-officio (non-voting) members of the TRT.

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[3] Per ORS 517.981, DOGAMI shall ensure that the conditions imposed in the permits by cooperating agencies do not conflict. If the department finds a conflict exists, the TRT shall resolve the conflict.

[4] For this Project, DSL has no permits to issue since no DSL lands would be affected by the Project.

Together the PCC and TRT will work to identify potential impacts from the Project, identify mitigation strategies to eliminate, reduce, and/or compensate for the environmental effects, and ensure that the Project meets all regulatory requirements.

Other entities with no standards and policies that need to be enforced during the permitting process may comment on the proposed Project, such as the State Fire Marshal. In addition, public participation is an important component of the environmental review process, and the public is kept informed of the Project status and opportunities for public involvement. Information on the proposed Project can be found at the DOGAMI Project website. The DOGAMI Project website includes links to all Project documents submitted to DOGAMI throughout the permit review process, including notices of intent and readiness to collect baseline data, meeting materials and notes, the CPA, and supporting documentation. Information is also provided to the public via an email notification list dedicated to the Project, a physical mailing list, notices in local and state newspapers, and information posts on the Oregon Transparency website.[5]

## 1.3 REGULATORY FRAMEWORK

Under Oregon law, a consolidated permitting process is used for administering state regulatory requirements for chemical process mines, and requirements are consolidated into a Consolidated Permit issued by DOGAMI. A CPA is submitted to DOGAMI and is reviewed by DOGAMI, the PCC, and the TRT. The PCC shares information and coordinates local, state, and federal permitting requirements to avoid contradictory requirements, facilitates the exchange of ideas, promotes interdisciplinary decision-making, and optimizes communication. The TRT interdisciplinary team of state agencies reviews the CPA, determines its completeness, and develops Consolidated Permit conditions that conform to Oregon regulations. The PCC then resolves any conflicting permit conditions and ensures that the final permit(s) meets applicable standards.

There are 10 steps to the Consolidated Permit process; the Applicant performs the first four, with review and permitting process described in steps 5 through 10 being undertaken by the cooperating agencies. Multiple provisions for public comment and review are incorporated.

1. **Step 1.** Notice of intent to submit a CPA
2. **Step 2**. Notice of applicant’s readiness to collect baseline data
3. **Step 3.** Collection of baseline bata
4. **Step 4.** Filing of a CPA including an operating plan, baseline data, reclamation and closure plan, and an alternatives analysis
5. **Step 5.** Review of CPA for completeness and baseline data accuracy verification
6. **Step 6.** Notice to proceed if the application is complete
7. **Step 7.** Preparation of a complete EE and socioeconomic analysis
8. **Step 8.** State agency preparation of draft permits and permit conditions
9. **Step 9.** Preparation of final permits
10. **Step 10.** Consolidated contested case (if requested)

Part of the environmental review of the proposed Project under Oregon chemical process mining regulations includes consideration of environmental performance standards in order to minimize unacceptable environmental damage and protect the health and safety of humans, livestock, fish, and wildlife. These standards include minimizing environmental damage through use of best available,

[5] ORS 276A.250–276A.262 addresses the Transparency Commission and the Oregon Transparency Program and website.

practicable, and necessary technology (see Appendix A), providing adequate site reclamation conditions, providing for adequate financial assurances in operations, reclamation, closure, and post-closure, including for credible accidents, and providing fish and wildlife protections. DOGAMI, the TRT, and the PCC reviewed these environmental performance standards for the proposed Project, which have been incorporated into this EE.

## 1.4 PERMITS/DECISIONS TO BE ISSUED BY AGENCIES

The Applicant completed steps 1 through 4 of the chemical process mining permitting process, as follows:

- **Step 1. Notice of intent to submit a CPA.** On February 28, 2017, the Applicant filed a notice of intent to proceed with permitting under Oregon's chemical process mining laws and regulations.
- **Step 2. Notice of Applicant's readiness to collect baseline data.** On May 17, 2017, the Applicant filed Environmental Baseline Study Work Plans, which proposed baseline data collection methodologies, study areas, and timing/duration of baseline data collection and verification. Public comments were accepted during informational meetings in Ontario and Bend and during a public comment period. Review of the plans identified needed revisions and clarifications. The Applicant filed revised Environmental Baseline Study Work Plans on September 22, 2017.
- **Step 3. Collection of baseline data**. Between May 2017 and January 2023, the Applicant submitted baseline data reports (BDRs) to DOGAMI in support of the CPA. On February 2, 2023, the final BDRs were accepted as complete by the TRT.
- **Step 4. Filing of a CPA**. On November 15, 2019, the Applicant filed a CPA under Oregon's chemical process mining laws and regulations, and in December 2021, the Applicant filed an updated CPA. DOGAMI provided copies of the applications to affected governments and agencies.

DOGAMI, the PCC, the TRT, and stakeholders completed steps 5 through 7 of the consolidated permitting process, as follows:

- **Step 5. Agencies review CPA for completeness.** Between November 2019 and October 2023, DOGAMI and the permitting and cooperating agencies reviewed the BDRs and CPA for completeness. This involved periodic meetings attended by the PCC and TRT, which were open for the public to attend.

  On February 12, 2020, DOGAMI conducted a public hearing and accepted written comments on the completeness of the CPA. Additional information was requested, and a revised CPA was submitted by the Applicant in December 2021. Additional information submitted by the Applicant was made available for public review and comment from January 2021 through October 2023.
- **Step 6. Notice to proceed.** On, October 4, 2023, all members of the TRT concurred that the CPA was complete. On November 6, 2023, DOGAMI issued the notice to proceed with the permitting process.
- **Step 7. Preparation of an EE and socioeconomic analysis**. The EE was published in August 2024 and public notice of its availability was provided on the DOGAMI Project website. The approved EE will be used to inform agencies, tribes, local governments, and the public about the direct and indirect

environmental impacts of the proposed Project and the measures identified to avoid, minimize, or mitigate those impacts.

The next steps in the permitting process include receipt of public comments on this EE, state agency preparation of draft permits, holding of a public hearing on the draft permits for the Project, and completion of final permit decisions.

Permits, certificates, and other approvals from state and local agencies are being coordinated as part of the EE process. These are shown in Table 1-2 below. Federal permits would also be required and are addressed in the BLM federal NEPA EIS.

### Table 1-2 Oregon Consolidated Permit and Other Regulatory Requirements

| Agency | Permit | Statutory Authority |
|---|---|---|
| Oregon Department of Geology and Mineral Industries | Consolidated Permit, which includes:<br>• Quarry Operating Permit<br>• Closure Cover Borrow Areas Operating Permit | Oregon Revised Statute (ORS) 517.971 (Section 13, Chapter 735, 1991 Oregon Laws) |
| | Certification of self-sustaining ecosystem | Oregon Administrative Rule (OAR) 635-420-0110 |
| Oregon Department of Justice | Statewide Planning Goal Findings of Fact:<br>Federally managed public lands area of Project | OAR 660-015 |
| Oregon Department of Environmental Quality | Chemical Mining Permit | ORS 340.043 |
| | Water Pollution Control Facility Individual Permit, which includes:<br>• Industrial Stormwater Pollution Control Plan | ORS 340.045 |
| | • Water Pollution Control Facility Permit for the process plant, TSF, wastewater recycling system, ore storage areas, TWRSF, and all related works, including all applicable solid waste provisions | OAR 430-045-0010<br>OAR 340-095 |
| | • Water Pollution Control Facility Permit for On-site Sewage Disposal System | OAR 340-071 |
| | • 1200-Z National Pollutant Discharge Elimination System | OAR 340-045-0033 |

| Agency | Permit | Statutory Authority |
|---|---|---|
| | (NPDES) Industrial Stormwater General Permit | |
| | • 1200-C Construction Stormwater General Permit | OAR 340-045-0033 |
| | • General Discharge Permit (Stormwater) | ORS 340.048 |
| | • Oregon Title V Operating Permit | ORS 340.218 |
| | • Air Contaminant Discharge Permit | ORS 340.216 |
| | • Hazardous Waste Storage Permit per Resource Conservation and Recovery Act | OAR 340-100 |
| Oregon Water Resources Department | Permit to Appropriate Water (Granted April 5, 1990) | ORS 537.130<br>OAR 690-310 |
| | Water Rights Amendment (Granted December 11, 2019) | ORS 537.211 |
| | Dam Safety Permit (for TSF) (Permit G-18337 granted July 7, 2020, and valid for 5 years with option to extend) | ORS 540.350-540.390<br>OAR 690-020-0080 |
| Oregon Health Authority | New public water system plan review (conditional approval granted March 2, 2020) | OAR 333-061 |
| Oregon Department of Fish and Wildlife | Greater Sage-Grouse Conservation Strategy for Oregon, including requirements for a Compensatory Mitigation Plan | OAR 635-140 |
| | Chemical process mining CPA and permit review standards, including development of a Wildlife Protection Plan, Wildlife Mitigation Plan, and conditions for protection of wildlife and their habitat to further the Wildlife Policy and Food Fish Management Policy | OAR 635-420 |
| | Fish and Wildlife Habitat Mitigation Policy | OAR 635-415 |

| Agency | Permit | Statutory Authority |
|---|---|---|
| | Wildlife Policy | ORS 496.012 |
| | Scientific Taking Permit (required to collect and process wildlife carcasses, which would be a requirement of the Consolidated Permit) | OAR 635-043 |
| | Requirements for Mining Operations | ORS 517.956<br>ORS 517.988 |
| Oregon State Historic Preservation Office | Protection of Historic Properties | ORS 358.653 |
| Oregon Department of State Lands | Removal-Fill Permit (wetlands) | ORS 196.795–990 |
| Oregon Department of Agriculture | Specific permit conditions to reduce unwanted vegetation and protect grazing (as part of the Consolidated Permit) | ORS 517.971 |
| Malheur County Planning Department | Land Use Compatibility Statement (granted August 6, 2021) | Malheur County Code |
| Malheur County Planning Commission | Conditional Use Sage-Grouse Rule Permit (granted May 24, 2019) | OAR 660-023-0115 |
| Malheur County Building Department | Plumbing Permit | Oregon Plumbing Specialty Code |

# 2.0 CHAPTER 2: PROJECT DESCRIPTION AND ALTERNATIVES

## 2.1 PROJECT DESCRIPTION

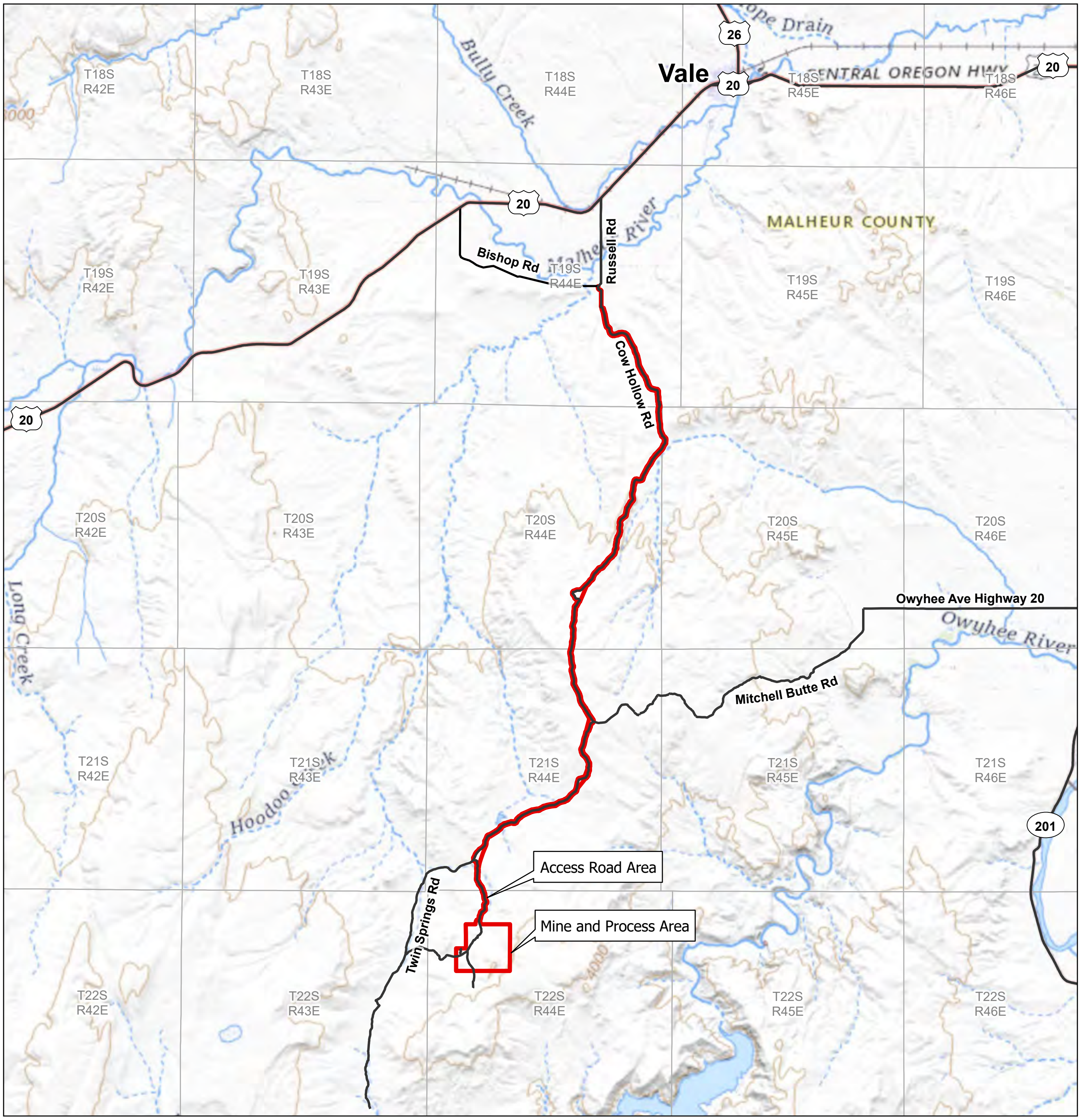
A brief summary of the mining process is provided in this section, followed by greater detail in the subsections that follow.

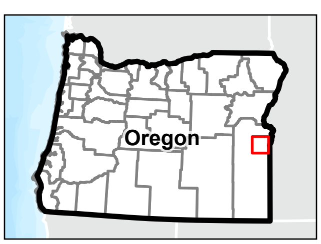
The Applicant proposes to construct, operate, reclaim, and close an underground mining and indoor precious metal processing facility to develop Grassy Mountain gold and silver resources. The Project is located in Malheur County, Oregon, about 22 miles south-southwest of Vale, and consists of two areas: the Mine and Process Area and the Access Road Area, together termed the “Permit Area” (Figure 2-1).

The Applicant proposes to mine approximately 2.07 MST of mill-grade ore and 0.27 MST of waste rock over approximately 8 years at a rate of approximately 1,200 stpd, 4 days per week. The ore would then be processed at a rate of 750 stpd, 7 days per week.

The ore and waste material would be extracted from an underground mine using conventional underground mining techniques, including drilling, blasting, mucking, loading, and hauling. Hydraulic loaders would load the ore and waste into haul trucks, which would transport the waste rock to the TWRSF and the ore to the ore stockpile adjacent to the crushing circuit. The crushing circuit would include a jaw crusher as the primary stage and a cone crusher for secondary size reduction. The crushed ore would then be transported to the mill and ground in a ball mill in closed circuit with a hydro-cyclone cluster. The hydro-cyclone overflow would flow to a CIL recovery circuit via a pre-aeration tank. Gold and silver leached in the CIL circuit would be recovered onto activated carbon, eluted[1] in a pressurized circuit, and then recovered by electrowinning in the gold room. This gold–silver precipitate would be dried in a mercury retort oven, mixed with substances to promote fluidity, smelted in a furnace, and then poured into doré bars (a semi-pure alloy of gold and silver). Used carbon from the electrowinning process would be reactivated in a carbon regeneration kiln and returned to the CIL circuit for reuse. The leached tailings (waste) from the process plant would go through a cyanide detoxification process, be amended with lime, and then be pumped in a slurry to the TSF (see Section 2.1.6). The supernatant solution collected at the TSF and underflow from the reclaim pond would be recovered and pumped back to the mill for reuse.

[1] Removed (an adsorbed substance) by washing with a solvent.




Legend

- Permit Area
- Existing Roads

0 1 2 Miles

(At original document size of 8.5x11)
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Stantec

*Project Location*
Malheur County, OR

Prepared by LL on 2023-10-04
TR by AU on 2023-10-10

*Client/Project*
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

2378001753

*Figure No.*
**2-1**

*Title*
**Project Permit Area**

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources:
**3.** Background: USGS Topo

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The Project would result in approximately 488 acres of proposed surface disturbance (Table 2-1; Figure 2-2).

### Table 2-1 Acreages of Disturbance for Mine Components

| Mine Component | Acres of Disturbance |
|---|---|
| Underground mine (located on private lands) | 6.7 |
| Tailings storage facility | 99.8 |
| Temporary waste rock storage facility | 5.7 |
| Process plant and associated facilities (includes process plant building, truckshop and warehouse, mill building, reagent storage area, gold room, assay laboratory, administrative building, parking lot, guard house, and substation) | 2.5 |
| Infrastructure and ancillary facilities (includes perimeter fence and 20-foot construction disturbance width) | 17.8 |
| Roads | 34.9 |
| Yards and laydown areas | 10.0 |
| Growth media stockpiles | 7.7 |
| Water supply (includes pipeline, a 20-foot construction disturbance width, and well locations) | 7.9 |
| Power supply (includes 20-foot area of disturbance along powerline) | 61.1 |
| Stormwater diversion channels | 11.8 |
| Quarry | 48.2 |
| Reclamation borrow areas | 55.9 |
| Exploration | 10.0 |
| Disturbed areas (includes a 50-foot buffer on mining facilities excluding reclamation borrow areas) | 107.8 |
| **Total** | **487.8** |

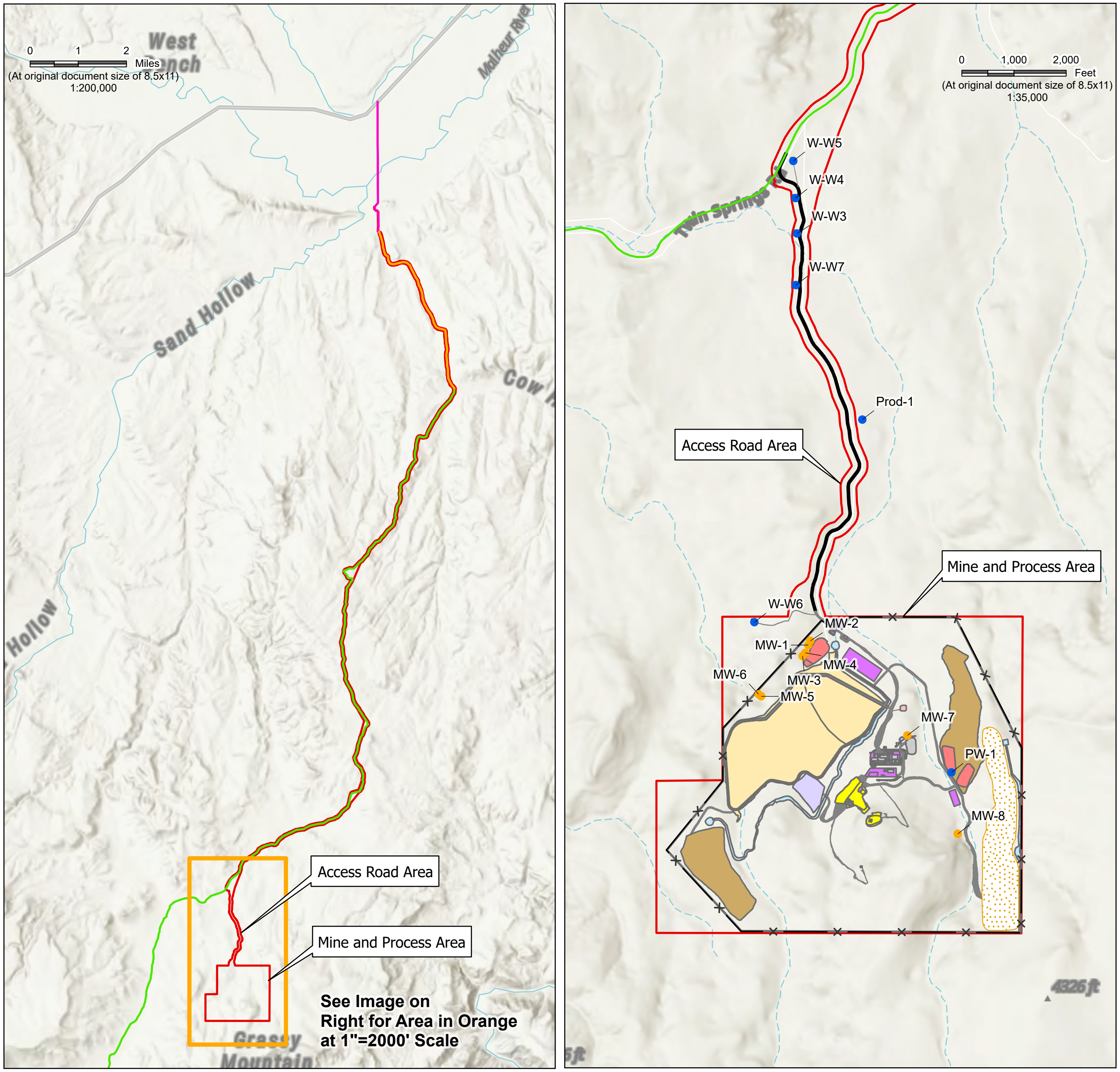


*Figure No.*

**2-2**

*Title*

**Grassy Mountain Gold Project Map**

*Client/Project* 2378001753

DOGAMI

Grassy Mountain Gold Project

Environmental Evaluation Report

*Project Location* Prepared by LL on 2023-10-04

TR by AU on 2023-10-10

Malheur County, OR

N

Legend

- Permit Area
- Monitoring Well
- Production Well
- Russell Road (2.75 Mi.)
- Cow Hollow Road (4.05 Mi.)
- Twin Springs Road (13.46 Mi.)
- Fence Line
- Mine Access Road (2.48 Mi.)
- Roads
- Growth Media Stockpiles
- Infrastructure & Ancillary Facilities
- Power Supply
- Process Plant
- Quarry
- Reclamation Borrow Areas
- Stormwater Diversion Channel
- Tailings Storage Facility
- Temporary Waste Rock Storage Facility
- Underground Mine
- Water Supply
- Yards, Laydown Areas, and Stockpiles

***Notes***

**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources:
**3.** Background: USGS Topo

Stantec

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### 2.1.1 Site Preparation and Construction of Surface Facilities

Surface facilities include the process plant, reagent storage area, process plant workshop and warehouse, gold room, assay laboratory, electrical rooms, administration building, truckshop and warehouse, vehicle wash-bay, guard house, and explosives magazine, some of which are shown in Figure 2-3.

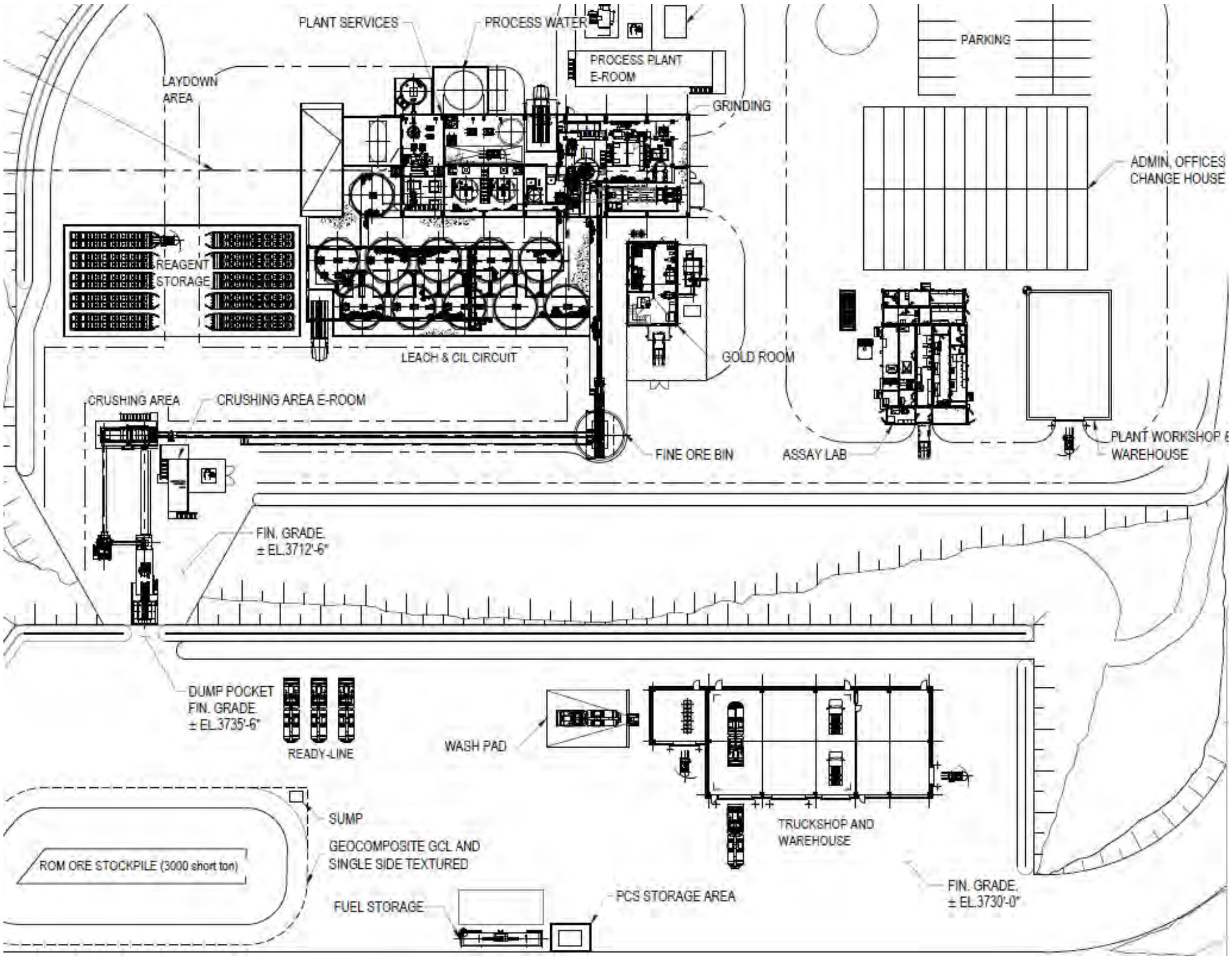


**Figure 2-3 Grassy Mountain Gold Project Surface Facilities Layout**

#### 2.1.1.1 Site Preparation

In general, surface structures would be founded on conventional shallow foundations, supported by undisturbed native alluvium/colluvium, weathered sandstone, or properly placed engineered fill. Topsoil, soil supporting plant growth, or loose soils are not considered suitable for the support of floor slabs, footings, or mat foundations and would be removed from the site prior to grading. Viable growth media would be salvaged during construction for use at reclamation and stored in growth media stockpile areas (see Section 2.1.1.3).

#### 2.1.1.2 Construction of Surface and Ancillary Facilities

The Applicant is proposing to construct nine buildings to support mining, processing, and administrative activities, as described below. There would also be a fuel storage depot, vehicle wash-bay facility, parking areas, yards and laydown areas, an electrical substation, a meteorological station, guard house, and an explosives magazine.

**The process plant** would be located on a cast in-situ concrete slab, with bund walls providing secondary containment. It would include the reagent mixing area, grinding circuit (mill building), acid wash and elution, carbon regeneration, and cyanide detoxification processes. The mill building would be a steel frame and metal-clad structure containing process equipment. The pre-aeration tank, two CIL tanks, and seven adsorption tanks would be located in a separate secondary containment area, immediately south of the process plant. Power supply for the mine would be managed via an **electrical substation** located at the process plant.

**A fuel storage depot** would be located at the process plant and receive fuel via highway-legal trucks. Spill containment with a sump pump would be used to contain and dispose of spilled fuels. A fuel truck would be used to fuel underground and aboveground equipment.

The **reagent storage area** would include ten 40-foot intermodal containers for dry storage of reagents, located west of the CIL tank containment area.

The **process plant workshop and warehouse building** would be a pre-engineered steel frame and metal-clad building of approximately 40 feet by 60 feet used for maintenance of process equipment and storage of equipment spare parts.

The **gold room** would be located east of the process plant and would house the electrowinning cell, mercury retort, smelting furnace, and associated support equipment with security to limit access to authorized personnel.

The **assay laboratory** would be situated adjacent to the process plant and consist of a number of single-level steel containers that can be hauled away and reused. The laboratory would include areas for sample receiving and preparation, fire assay, weighing room, wet analytical laboratory, dry instrument room, and utilities and storage. The laboratory would house equipment for assaying, metallurgical, and environmental requirements including crushers, ball mill, sieve screens, laboratory flotation cells, balances, and pH meters. Dust collection and gas scrubbing equipment would be located external to the laboratory building. The laboratory would be serviced with power, water, air conditioning and heating, communications, air, and fume hoods.

Two **electrical rooms** are planned for the facility—one in the crushing area south of the reagent storage area and the other on the north side of the process plant. The electrical rooms would be modular structures that can be hauled away and reused.

The **administration building** would house the site management team, including general management, commercial and administration management, engineering, mine operations, senior processing, and maintenance personnel. The building would be a modular wood-frame structure that breaks down into component parts to be hauled away and reused. The building would also include a reception area, offices for administrative staff, a first aid clinic, and a meeting/training room. A septic field with the capacity to treat up to 3,920 gallons per day of domestic wastewater and backwash from the potable water treatment system would be installed close to the administration building. The administration building would also be used during reclamation and post-reclamation monitoring.

The **truckshop and warehouse building** would be a pre-engineered steel frame, metal-clad structure that can be dismantled and reused elsewhere. The truckshop area would also consist of an enclosure and concrete pad of appropriate size and an oil/water separator. An overhead bridge crane would be included within the truckshop.

**Yards** and **laydown** areas would be established for the staging of materials. Their locations are shown in Figure 2-2.

The **vehicle wash-bay facility** would be an open-air, 30-foot by 40-foot concrete slab with a fluid-collection sump located adjacent to the truckshop and warehouse.

A **meteorological station** was installed in August 2014 to monitor wind speed and direction, temperature, humidity, barometric pressure, solar radiation, and precipitation.

A **guard house** would be located at the main gate located at the perimeter fence northwest of the process plant.

The **explosives magazine** would be located south of the mine portal. It would consist of leased powder magazines with earthen berms placed around the magazines for additional security.

#### 2.1.1.3 Growth Media Storage

Growth media consists of soils and alluvium stripped prior to surface-disturbance activities. Suitable growth media would be salvaged and stockpiled during development of mine facilities and during construction of the TWRSF, TSF, quarry, and stormwater diversion channels. Soil would be salvaged to a depth of up to 0.5 foot, and approximately 147,436 bank cubic yards (cy) of growth media would be salvaged from the footprints of the Project facilities.

Growth media would be stored in three disturbance areas, located such that they would not be disturbed by mining operations (Figure 2-2). The surfaces of the growth media stockpiles would be contoured with slopes and seeded with an interim seed mix to reduce soil erosion. Diversion channels and/or berms would be constructed around the stockpiles to prevent erosion from overland runoff, and BMPs (such as silt fences or staked weed-free straw bales) would be used as necessary to contain sediment in runoff.

#### 2.1.1.4 Reclamation Borrow Areas

Two growth media borrow areas would be developed to obtain adequate material to support the reclamation of the Project (Figure 2-2). These borrow areas would encompass approximately 56 acres and generate up to approximately 1,089,000 bank cy of growth media. In addition to growth media, borrow material generated from the quarry would also be required.

#### 2.1.1.5 Quarry

Borrow material generated from the quarry would be required for areas that need prepared subgrade materials, drainage materials, pipe bedding materials, road surfacing materials, retarding layer materials, closure cover materials, growth media, underground mine backfill, and riprap. The estimated volume of material to be excavated is 3.16 million bank cy, and the basalt quarry would cover approximately 48 acres (Figure 2-2).

The quarry would be developed in single benches consisting of 40-foot vertical faces separated by 60-foot horizontal benches. Rock from the quarry would be mined using drilling and blasting, similar to the method described for underground mining (Section 2.1.2.1). Water would be used for dust control. Mining equipment would not be restricted by the dimensions of underground spaces allowing for larger equipment for the loading and hauling of materials at the borrow areas.

Permanent stormwater diversion channels and surface water run-on diversion berms are included in the design of the quarry to divert stormwater from catchment areas upgradient of the quarry. Precipitation that falls directly onto the quarry footprint would be managed using internal sloping, retention berms, and a stormwater management sump that pumps water to the process plant for reuse. The borrow material from the proposed basalt quarry has no potential for acid generation with total sulfur values below the detection limit of 0.01 percent for all samples. The primary stormwater diversion channel associated with the quarry would remain at reclamation.

#### 2.1.1.6 Invasive Species Control

Noxious weed species are present in the Project area, which require management. A Noxious Weed Monitoring and Control Plan was included as part of the CPA. Actions contained in the plan include:

- Seed areas of long-term disturbance: Road berms, sediment basins, growth media stockpiles, and other sites that will have exposed soil for more than one growing season will be seeded with an interim seed mix.
- Eradicate weeds on roads to be maintained: Treat infestations prior to conducting road maintenance activities if weeds are present.
- Minimize disturbance to existing vegetation: Confine vehicles to existing roadways and ensure that personnel and contractors avoid travel through known noxious weed areas to reduce the spread of noxious weeds.
- Maintain desired plant communities: Resist weed establishment by maintaining vegetation communities with native and desirable species.
- Conduct effective reclamation: Conduct earthwork and reclamation seeding within the same year to allow the seeded species to establish before invasive species can dominate reclaimed surfaces.
- Use certified weed-free materials: Seed and mulch used in reclamation and straw bales used for sediment control will be certified weed free.
- Apply seed to treated areas: Seed locations treated for noxious weeds during the fall after treatment.
- Decontaminate vehicles: Wash vehicles and equipment to minimize the spread of noxious weed seeds.

- Segregate topsoil: In areas where noxious weeds have been identified, clear the topsoil contaminated with noxious weeds first and use in TSF development (which will be covered) or dispose of appropriately.

See Section 3.6 for more details on invasive species.

### 2.1.2 Underground Mining Methods

The mining operation would cover approximately 48 acres at the surface, with a maximum depth of 125 feet and a lowest elevation at 3,790 feet above mean sea level (amsl). The ore would be mined using a mechanized cut-and-fill method, which involves excavating waste rock and ore and backfilling the area with cemented rock fill as support.

The mine would be accessed via a main mine portal (tunnel entrance) and decline (a spiral-shaped excavation in waste rock material; see Figure 2-4). The mine portal and decline would lead to each of five level stations below the surface at elevations of 3,420 feet, 3,360 feet, 3,285 feet, 3,210 feet, and 3,135 feet amsl. From the decline, the first level station would be mined, followed by multiple level access ramps, which provide multiple mining locations for each level. After the level access ramps are mined, the ore in the production levels would be mined using topcuts and undercuts that are typically 15 feet high and vary from 15 to 30 feet wide. The excavated areas would be backfilled with a cemented rock fill (7 percent cement mix) and/or rock fill for stability so that the mineralized zone under that area can be mined. Rock used as fill would be mostly basalt borrow material with some waste rock (approximately 10–15 percent). Figure 2-4 illustrates this general underground mining process.

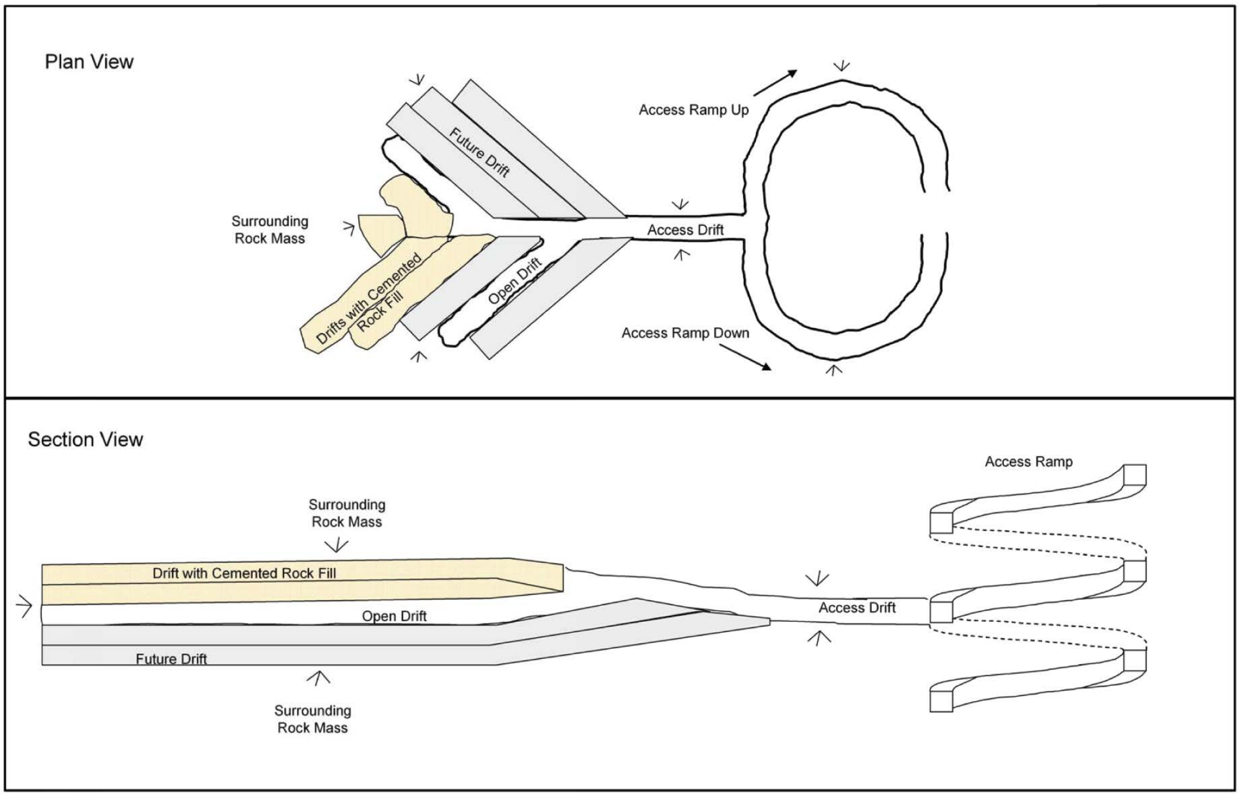


**Figure 2-4 Conceptual Diagram of Underground Mechanized Cut-and-Fill Mining Method**

The material on each level would be mined in primary and secondary areas. The primary areas would be mined and backfilled and the cemented rock fill allowed to cure. Then the secondary areas would be similarly mined and backfilled. After the entire level is complete, the level access ramps would be backfilled and left to cure for a minimum of 28-day delays. After the cure time is complete, the same sequence would begin at the next level below. Ground support for haul trucks would be provided with sprayed concrete lining (fiber-reinforced shotcrete) with bolts installed through the concrete.

Levels would be ventilated through a series of vent raises, which would connect each level to a ventilation shaft that exits at the surface and also provides for a secondary means of egress via an escape ladder. In addition, two emergency refuge stations would be available in case of fire or rockfalls that block access and prevent full evacuation of personnel. These protected mobile refuge stations would allow 20 staff to remain safe in the underground mine for 48 hours and be located no more than 1,000 feet from mine operation personnel. Inside the mine, a leaky-feeder very high frequency radio system would be used as the primary means of communication, allowing for communications between underground mine and surface operation personnel.

A backfill plant would be constructed near the mine portal. The basalt generated from the quarry and waste rock from underground operations would be used for cemented rock fill. The mix design has not been finalized but is expected to be composed of 85 to 90 percent basalt/waste rock and approximately 7 percent cement, with a water to cement ratio of 0.70 to 0.85. Future work would be performed to assess the strength of fly ash (i.e., fine solid particles consisting of ashes, dust, and soot) added to the cemented rock fill mixture.

#### 2.1.2.1 Drilling and Blasting

Excavation of the underground material involves drilling, blasting, and transporting the material out of the mine. Holes are drilled into the rock and are then blasted using an emulsion blasting agent. Before blasting occurs, any affected areas would be cleared of personnel and the blasting location announced over the mine communication system. After the blast, an appropriate amount of time must pass to provide adequate ventilation to any affected areas before mining can resume.

Blasting plans would be developed and followed for the quarry and would include site-specific engineering controls (e.g., blast pattern design) and blasting protocols (e.g., sirens, restricting access, visual inspections, weather conditions) to reduce blasting-related risks including impacts from flyrock (i.e., the fragments of rock thrown and scattered during blasting) impacts.

The blasted material would be transported to the underground stockpile located at each level station, loaded into haul trucks, and transferred to the surface ore stockpile near the mine portal. The haul trucks would then load cemented rock fill, transport it underground, and place it at a level backfilling location for use in backfilling open mine spaces.

At the mine portal ore stockpile, haul trucks would transport the waste rock to the TWRSF near the TSF and transport the ore to the ROM ore stockpile adjacent to the crushing and milling facilities.

#### 2.1.2.2 Underground Dewatering

Water at the working mine level face would be pumped to the level station sump. From the station sump, the water would undergo sediment removal and be used for equipment water supply or pumped out to the process plant for use in the process circuit. See Section 2.1.9 for additional detail on water management and supply.

### 2.1.3 Temporary Waste Rock Storage Facility

Waste rock generated from underground mining operations would be temporarily stored at the TWRSF before being mixed with cement and a proportion of basalt from the borrow quarry and used as backfill in the working mine. One hundred percent of the temporarily stored waste rock would be removed from the TWRSF and used as backfill in the working mine. A haul road would connect the mine portal with the TWRSF.

The TWRSF is a geomembrane-lined storage area sized to accommodate approximately 0.27 MST of waste rock. It is designed to capture and convey precipitation infiltrating the waste rock. It would include both primary and secondary lining systems, similar to the TSF, to provide dual containment of leachate with an underflow collection system. Collected underdrain flows would be routed to the TSF reclaim pond through a solid wall pipe for independent monitoring and sampling. An independent leak detection and leakage collection and recovery system would be installed to monitor and manage potential leakage between primary and secondary containment layers within the TWRSF.

### 2.1.4 Run-of-mine Ore Stockpile

Gold-bearing ore would be transported directly to the ROM hopper or stockpiled temporarily in the outdoor ROM ore stockpile adjacent to the crushing and milling facilities. A front-end loader would move ore from the stockpile to the ROM hopper. Material in the ROM ore stockpile would be typically stored for less than 1 week. The ROM ore stockpile would have a lined base pad (geosynthetic clay liner and an 80-mil high-density polyethylene [HDPE] geomembrane covered with 300-millimeter [mm] surfacing gravel), with containment berms along each edge of the stockpile and a sump to collect the contact runoff. The ROM ore stockpile has a nominal design capacity of approximately 3,000 tons.

### 2.1.5 Ore Processing

#### 2.1.5.1 Crushing, Grinding, and Classification

Crushing and grinding would be conducted in the mill building in crushing and grinding circuits, respectively. The crushing circuit includes a primary jaw crusher and a secondary cone crusher. Ore would be placed in the ROM hopper to continuously feed the primary vibrating feeder, which would discharge into the primary jaw crusher. Then the ore conveyor would bring the crushed ore to a coarse ore screen. Oversized material from the coarse ore screen would be transferred by conveyor to the secondary crusher surge bin, where it would pass over the secondary vibrating feeder and into the secondary cone crusher. Then this ore would be transferred to the coarse ore screen along with adequately sized ore crushed in the primary jaw crusher. Undersized material from the coarse ore screen would be moved by a product conveyor to the fine-ore bin. The fine-ore-bin discharge feeder would feed ore from the fine-ore bin onto the ball mill feed conveyor and over to the grinding circuit.

The grinding circuit consists of a ball mill and a cyclone cluster in a closed circuit. Crushed ore would travel along the ball mill feed conveyor and discharge directly into the ball mill via the mill feed chute. Process water would be added to the crushed ore to create an ore slurry, which would then be transferred through the ball mill and discharged to the cyclone feed pump box. Additional process water would be added to the slurry in the cyclone feed pump box to achieve the correct density. The ore slurry would then be pumped to the hydro-cyclone cluster. Process water captured in the cyclone underflow would recirculate to the mill feed chute. After being processed through the hydro-cyclone cluster, the ore slurry would be discharged at 45 percent solids to a trash screen. Oversized material on the trash screen would be sent to a trash bin. The remaining slurry would then flow by gravity to the pre-aeration tank.

#### 2.1.5.2 Carbon-in-leach Cyanide Circuit

The CIL cyanide circuit would be housed in the CIL process plant. The pre-aeration tank would reduce consumption of cyanide and improve gold recovery. Low-pressure air would be bubbled through the ore slurry in the pre-aeration tank. Ore slurry would overflow to the first leach tank, where lime would be added, and into the next leach tank. Cyanide would be added to both leach tanks, together with low-pressure air. The ore slurry would then overflow from the leach tanks into a series of seven CIL tanks. The first four CIL tanks would also be fed low-pressure air. Barren activated carbon would be added to the last CIL tank and would travel up through the circuit tanks in the opposite direction from the slurry flow (counter-current flow). Carbon (with precious metals absorbed) would be pumped from the first CIL tank to the elution loaded-carbon screen, which separates the carbon from the slurry. This carbon would then be fed to the elution circuit.

The leached tailings (waste) would overflow from the last CIL tank to the detox tank, which in turn would overflow to the carbon safety screen; the safety screen would collect carbon that would otherwise be lost to the tailings in the event of a hole in one of the inter-stage screens.

#### 2.1.5.3 Elution

Gold and silver would be stripped from the carbon in the elution circuit, which is a pressure Zadra circuit. Strip solution (eluate) would be created in the strip-solution tank using raw water dosed with 2 percent sodium hydroxide and 0.2 percent cyanide to form an electrolyte for the electrowinning process. This strip solution would be circulated through the elution column via an eluate heater, which would heat the solution, the carbon, and the column to 275 degrees Fahrenheit (°F). The elution circuit would be pressurized to keep the solution from turning into steam in the heater or elution column. The solution would then be cooled in a heat exchanger and sent to the electrowinning circuit in the gold room. The stripped/barren carbon would be sent to a kiln for reactivation and recycled through the CIL circuit in the CIL process plant.

#### 2.1.5.4 Electrowinning Recovery

Electrowinning recovery would be conducted in the gold room, which houses the electrowinning cell, smelting furnace, and associated support equipment within a secured area. One day per week, the electrowinning cell would be opened and gold-bearing sludge cleaned out manually with a high-pressure water hose. This gold-bearing sludge would flow to the sludge settling tank and into the gold room sludge filter press to be dewatered. Dewatered sludge would then be transported manually to the mercury retort oven for mercury removal (mercury would be extracted from ore during the refining process) and drying. Elemental mercury collected from the mercury retort oven would be securely contained and temporarily stored for transport to a mercury waste processing facility for cleaning.

Dried gold-bearing sludge would be removed from the oven the following day and combined with fluxes (substances used to promote fluidity and remove impurities) in a flux mixer before being placed in the smelt furnace. Once the mixture has fully melted, the slag (waste) would be poured into a conical slag pot, and the liquid metal would be poured into molds. The cooled doré bars (bars of semi-pure gold and silver) would then be cleaned, weighed, stamped, and stored in a vault to await shipment to a refinery.

### 2.1.6 Cyanide Detoxification

Cyanide detoxification would be performed in the cyanide-destruction circuit to reduce the cyanide concentration of the tailings slurry prior to disposal in the TSF. The CIL leached tailings (waste) from the CIL cyanide circuit would be pumped to the cyanide detoxification tank, where lime would be added to buffer pH, followed by copper sulfate, which would be added as a reaction catalyst, and sodium meta-bisulfite, which would be added as a sulfur dioxide source. Detoxified slurry would overflow to the tailings pump box and then be pumped to the TSF. A cynoprobe device (Process IQ Inc. n.d.) or similar would be used to measure cyanide concentrations in the tailings, which would allow for continuous cyanide measurements.

Cyanide would be further degraded in the water collected in the supernatant pool of the TSF through exposure to ultraviolet (UV) light from the sun and metabolic processes of microorganisms native to the environment in the water of the supernatant pool.

### 2.1.7 Tailings Disposal and Storage

Tailings from the processing of ore and waste rock would be pumped to the TSF for permanent storage. Tailings would be deposited in the TSF via the tailings distribution pipeline using spigot manifolds positioned along the rim of the impoundment. The position of the spigot manifolds would be moved periodically to produce an even beach and create a supernatant pool. Wastewater from the supernatant pool would be pumped via a floating barge containing a decant-return water pump through the tailings reclaim water pipeline to the process water tank at the process plant for reuse.

The TSF is designed to fill an existing valley at the site and requires staged embankment construction on two sides. The embankments would be constructed of soil and basalt generated from the quarry and during grading operations. The embankments would be constructed in stages to provide incremental increases to the facility’s storage capacity (Table 2-2).

The TSF would be 100 percent geomembrane-lined with continuous primary and secondary leakage collection and leak detection systems where process solutions are expected to be localized. There would be two independent return water systems that return collected process water from the TSF back to the process plant for reuse in the process circuit: (1) wastewater at the TSF surface would be collected and managed at the supernatant pool via a floating barge, and (2) underdrain flows would be conveyed via a tailings leakage collection system (above the primary geomembrane liner) to the reclaim pond and the process water would be pumped back to the process plant for reuse. A secondary leakage detection system located between the primary and secondary geomembrane liners would also convey underdrain flows via gravity to the reclaim pond for reuse. The supernatant pool would be maintained away from TSF embankments.

### Table 2-2 Tailings Storage Facility Stages and Capacity

| Stage | Main Embankment Crest Elevation (feet) | Maximum Tailings Surface Elevation (feet) | Maximum Tailings Surface Area (acres) | Stage Storage Capacity (MST) | Cumulative Storage Capacity (MST) |
|---|---|---|---|---|---|
| 1A | Varies (Max. 3,583) | 3,581 | 42.0 | 0.40 | 0.40 |
| 1B | Varies (Max. 3,595) | 3,593 | 44.7 | 0.58 | 0.98 |
| 2 | Varies (Max. 3,609) | 3,607 | 59.5 | 1.06 | 2.04 |
| 3 | Varies (Max. 3,622) | 3,620 | 83.0 | 1.60 | 3.64 |

An independent leakage collection and recovery system would be installed to monitor and manage potential leakage between the primary and secondary containment layers within the TSF. Each leak detection pipe would be connected to an independent leak detection riser near the reclaim pond to provide access for monitoring of leakage flows and to allow for the installation of small submersible pumps to evacuate any observed flows if necessary. All piping and pumping systems would comprise HDPE pipes that are dual containment pipelines or located within geomembrane-lined channels. Leak detection would be performed by visually monitoring flows within the secondary containment systems.

The TSF is designed as a zero-discharge facility capable of storing the 500-year, 24-hour storm and would have an allowance for wave action above the anticipated normal operation pool. Permanent stormwater diversion channels would collect and divert stormwater runoff around the TSF to a natural drainage north of the TSF or released to the environment. Stormwater that contacts tailings would be contained within the supernatant pool and managed along with used process water.

The TSF is sized at 3.64 MST and designed to contain more tailings than the proposed Project requires, in order to process more materials in the event that additional reserves are identified. The TSF would have an ultimate approximate design operating life of 15 years, although the current plan anticipates 8 years of active operation.

One groundwater well, the BLM Well, is currently located within the footprint of the TSF and is currently used as a water supply for livestock. Prior to construction of the TSF, the BLM Well would be abandoned in compliance with State of Oregon regulations to prevent potential contamination of water resources.

At closure, once the tailings have consolidated and the closure cover installed, precipitation falling on the tailings surface would be routed through a closure spillway at the eastern abutment of the north embankment. The impoundment surface and dam crest would be at the same relative elevation so that the final closed TSF would not provide any water retention capacity above the closure cover.

### 2.1.8 Tailings Storage Facility Reclaim Pond

The reclaim pond is a double-lined pond designed to contain the TSF and TWRSF underdrain flows. It would receive water from underdrain flows in the TSF via a tailings leakage collection system, underdrain flows from the secondary leakage detection system via gravity, and underdrain flows from the TWRSF underflow collection system.

Water collected at the reclaim pond would be pumped back to the process plant for reuse, along with water collected in the TSF supernatant pool. Prior to discharging into the reclaim pond, each underdrain pipe would enter a monitoring flume. Valves located upstream of the monitoring flumes would restrict flows or close in the event that flows need to be limited for short periods of time for maintenance or emergencies.

### 2.1.9 Water Management and Supply

#### 2.1.9.1 Water Needs

Water is required for mining, ore processing, fire protection, potable use, dust suppression, and various other uses. Water would be sourced from dewatering the underground mine, precipitation in the Project area, and site production wells. A nominal 237,000-gallon water storage tank (total volume) would be installed to address peak water demands and provide 78,000 gallons of water for fire suppression.

A site water balance summary was developed that identified an average annual makeup water requirement of approximately 54 gallons per minute (gpm).[2] This requirement would vary during operations based on variable seepage flows in the underground mine and on meteoric contributions at the surface facilities. Early in the mine operation, dewatering rates would be high as the underground mine is developed and dewatered, so the requirement for supplemental water would be lower. Over time, makeup water requirements would increase as the aquifer in the mine area is dewatered.

There are three existing wells at or near the Project site, which have a combined long-term capacity of approximately 200 gpm, with 150 gpm derived from Well 3 and the remainder from Well 1 and Well 2. Raw water for the Project is expected to be required during the summer months when water cannot be reclaimed from the TSF. The estimated daily raw makeup water demand is 350 gpm for 12 hours, the estimated daily process water demand is 230 gpm for 22 hours, and the estimated daily potable water

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2 Note that the impact analysis in this EE is based on a higher initial estimated pumping rate of 400 gpm.

demand is 10 gpm for 24 hours, plus other minor water demands. The approximate 250-gpm deficit in raw groundwater supply requires a minimum of two (possibly three) new water supply wells to serve as primary supply wells, with Well 3 serving as a backup supply.

#### 2.1.9.2 Raw Water from Wellfields

The three existing production wells are not sufficient to meet the water supply needs of the Project. Well 1 and Well 2 would be used as local sources of water for dust suppression and other water needs due to their low long-term water yields. Well 3 would be modified and used as a backup water supply for mining, ore processing, fire protection, and various other uses at the mine.

The Applicant has proposed a minimum of two new production wells as water supply for the Project. Well 4 and Well 5 would be located close to existing Well 3 along the access road within the Permit Area, where hydrological conditions are most favorable, and the location provides the best opportunity for developing a reliable and long-term groundwater supply for the proposed mine. An additional water source, Well 7, may be used if the long-term sustainable water yield from Wells 4 and 5 are determined to be less than 400 gpm after construction and testing.

Raw water would be pumped and piped from the production wellfield through a combination of underground and aboveground steel and HDPE piping to the raw water tank for distribution throughout the mine. Raw water in the tank would be used to supply:

- Process water storage tank for reagent preparation and tailings slurry pumps;
- Potable water treatment plant;
- Fire suppressant water; and
- Vehicle wash station.

Dust suppression water would be supplied directly from existing wells.

#### 2.1.9.3 Process Water

Process water is the water used in various steps in the mining process such as in the process plant for ore processing and transportation of tailings slurry to the TSF. As tailings are deposited into the TSF impoundment, the solids would separate from the slurry and the water would form a supernatant pool within the TSF. Water within the deposited tailings would drain down through the underdrain collection and lining system to the reclaim pond. A return water pipe would pump the flows from the supernatant pool and the reclaim pond to the process plant for reuse.

In addition to process water from the TSF supernatant pool and reclaim pond, process water would be sourced from stormwater, groundwater from underground mine dewatering, and recycling of process water at the process plant. Additional process water needs would be met from the raw water tank. Process water would be pumped to, and stored in, the process water storage tank and distributed to mine operations by process water pumps.

#### 2.1.9.4 Potable Water

Potable water would be delivered from the raw water tank through the potable water treatment plant (with adsorptive media for arsenic removal followed by chlorination) and stored in the potable water tank. The potable water tank would be located at the process plant and used for safety showers and eyewash stations.

#### 2.1.9.5 Fire Suppression Water

Fire suppression water would be delivered from the raw water tank. Approximately 78,000 gallons of water would be dedicated for fire suppression.

#### 2.1.9.6 Vehicle Wash Water

The vehicle wash-bay facility is designed as an open-air, 30-foot by 40-foot concrete slab with a fluid-collection sump located adjacent to the truckshop and warehouse. Used vehicle wash water would be collected in a sump, where settling of solids would occur prior to the water being recirculated back to the wash system. An oil-water separation system is included in the facility to recover hydrocarbons prior to reuse of the wash water. The recovered hydrocarbons would be collected and shipped offsite for disposal in accordance with applicable environmental regulations.

#### 2.1.9.7 Stormwater and Sediment Control Structures

Precipitation that lands outside of the Project facility footprint would not contact mine infrastructure and would be diverted away from Project facilities and discharged. Precipitation that lands within Project facilities would be captured, used, and managed within the closed process water system.

Permanent and temporary stormwater diversion channels are included in the design to convey surface water runoff from upgradient catchment areas around the TSF to decrease the amount of water that would need to be managed within the TSF. Stormwater diversion ditches would also be constructed above process plant infrastructure where required to prevent runoff from entering the process plant areas. Primary stormwater diversion channels would remain as permanent features after final reclamation and mine closure including the stormwater diversion channel upgradient of the TSF and the quarry.

Precipitation that falls directly within the process plant area would be collected in a system of ditches and culverts and directed by gravity toward the collection pond. The collection pond is sized to contain the runoff from a 100-year, 24-hour storm event and would be dual lined. A leak detection zone of drainage gravel would be included between the liners along with a leak detection system connected to leak monitoring wells and sumps, provided with sensors and the capacity to recover the leaked solution.

Runoff control structures include silt traps and fences constructed of certified weed-free straw bales, or geotextile fabric, and sediment retention basins. Sediment control measures are used to reduce soil movement. These structures would be maintained throughout the mine life. Soil collected in these structures would be periodically removed and placed in growth medium stockpiles for future use during reclamation.

## 2.1.10 Process Materials and Waste

### 2.1.10.1 Chemicals and Reagents

Chemicals and reagents to be used in mining operations are shown in Table 2-3 below.

**Table 2-3 Mine Chemicals and Reagents**

| Chemical/Reagent | Onsite Storage | Anticipated Stored Amount |
|---|---|---|
| **Mill Ore Processing** | | |
| Sodium cyanide, liquid—mixed to 30% NaCN | 13,000 gallons | 13,000 gallons |
| Lime—dry pebble at 90% CaO | 25-ton truckload to bulk storage silo | 100-ton silo |
| Anti-scalant (liquid surfactant) | 240-pound (lb) carboy | 2 carboys |
| **Carbon Acid Wash and Neutralization** | | |
| Hydrochloric acid (HCl)—liquid 33% | 330-gallon HDPE totes | 14 totes 3,000 gallons in tank/vessel |
| Acid wash vessel | 2,320 working gallons | |
| Acid mix tank | 282 working gallons | |
| Caustic soda: sodium hydroxide (NaOH)—liquid, 50% | 330-gallon totes | 11 totes |
| **Cyanide Detoxification** | | |
| Copper sulfate pentahydrate—98% by weight, used at 15% strength | 2,750-lb bulk bags<br>2,955 working gallons | 2,955 gallons |
| Sodium metabisulfite | 2,750-lb bulk bags | 16 bags |
| **Fluxes** | | |
| Borax (pentahydrate) —dry | 50-lb sacks | 20 sacks |
| Silica ($SiO_2$) —dry | 50-lb sacks | 10 sacks |
| Niter ($NaNO_3$)—dry | 50-lb sacks | 5 sacks |
| Feldspar—dry | 50-lb sacks | 5 sacks |
| **Mercury Control** | | |
| Sulfide-impregnated carbon—dry | 50-lb sacks | 40 sacks |
| Mercury | 80-lb flask | |
| Sodium hydroxide (NaOH)—dry | 20-lb sacks | 10 sacks |
| **Assay and Metallurgical Laboratory** | | |
| Sulfuric acid ($H_2SO_4$), reagent grade | 1 gallon | 6 gallons |
| Nitric acid ($HNO_3$), reagent grade | 1 gallon | 10 gallons |
| Hydrofluoric acid (HFl), reagent grade | 1 gallon | 2 gallons |
| Hydrochloric acid (HCl), reagent grade | 1 gallon | 4 gallons |
| Sodium cyanide (NaCN), reagent grade—dry | 5-lb box | 10 boxes |
| Buffer solution, reagent grade—dry | 5-lb box | 10 boxes |
| Lead nitrate ($PbNO_3$)—dry | 20-lb bag | 1 bag |
| Acetylene | Size 45 industrial acetylene cylinder | 3 in lab/15 in shop |

| Chemical/Reagent | Onsite Storage | Anticipated Stored Amount |
|---|---|---|
| Fluxes | | |
| Borax penta—use plant source | 50-lb sacks | 20 sacks |
| **Silica—Use Plant Source** | | |
| Lead oxide, reagent grade | 80-lb pail | 1 pail |
| Methyl ethyl ketone | 5-gallon pail | 1 pail |
| Silver inquart | 10-lb package | 1 package |
| **Fuel/Lube/Oil** | | |
| Diesel—truckshop | 8,250 gallons | Up to 8,250 gallons |
| Ammonium nitrate/fuel oil | 2,800-lb totes | 7 totes |
| 30WT motor oil | 4,000 gallons | Up to 4,000 gallons |
| Used motor oil | 4,000 gallons | Up to 4,000 gallons |
| Antifreeze | 2,000 gallons | Up to 2,000 gallons |
| Hydraulic fluid | 2,000 gallons | Up to 2,000 gallons |
| 90WT gear lube | 2,000 gallons | Up to 2,000 gallons |
| Used antifreeze | 2,000 gallons | Up to 2,000 gallons |
| Grease bins | 4 × 120-gallon totes,<br>4 × 30-gallon drums | Up to 4 totes,<br>Up to 4 drums |

#### 2.1.10.2 Sodium Cyanide

Aqueous sodium cyanide would be delivered to the Project in 6,400-gallon bulk tankers. The fluid would be transferred to a 13,000-gallon storage tank in the cyanide storage area, which would be completely fenced and secured, and placed on an impervious concrete slab with walls providing 110 percent containment. The cyanide solution would be metered at various points throughout the plant.

The cyanide preparation area is located away from incompatible reagents and in a low-traffic area of the process plant. The cyanide preparation area would also be separated from the acidic reagents preparation area by the alkaline reagents, which act as a buffer to prevent mixing of acidic reagents and sodium cyanide, which would lead to the generation of cyanide gas.

#### 2.1.10.3 Explosives

The primary explosive used would be an ammonium nitrate/fuel oil (ANFO) mixture. Explosives-storage facilities would be constructed at the southwest side of the Project, which has a hill that would serve as a natural barrier between the explosives-storage facility and other mine infrastructure. Explosive agents, boosters, primers, detonators, detonation cord, and other ancillary blasting supplies would be stored within a secure powder magazine. Boosters and detonators would be stored in separate storage magazines. Earthen berms would be placed around the magazines for additional security.

#### 2.1.10.4 Waste Management

There are three types of waste generated by the mine that would require management:

- Solid waste—includes garbage, ashes, paper, septic tank contents, discarded construction materials, discarded equipment, and household items.

- Hazardous waste—includes some solvents and oils, mining sludges and wastewaters, pesticides, and used chemical products. Hazardous waste does NOT include mining overburden returned to the mine site and solid wastes from the extraction and processing of ores and minerals (e.g., tailings).
- Universal waste—includes batteries, pesticides, mercury-containing equipment, lamps, and aerosol cans.

Waste reduction strategies for the mine include bulk deliveries (to avoid the use of individual containers), use of low-toxicity solvents and low-mercury fluorescent lamps, returning containers to vendors for reuse, waste segregation and container management, and managing inventory appropriately. Materials used at the mine would be reused and recycled whenever possible. Recyclable materials include cardboard, electronics, and scrap metal. Materials that cannot be managed onsite, such as liquid wastes, hazardous wastes, certain items to be recycled or reused, and wastes prohibited from disposal in landfills, would be shipped offsite for reuse, recycle, treatment, or disposal at appropriate facilities.

### 2.1.11 Electrical Power

The power demand would be approximately 5 megawatts throughout the mine life with a reduced power demand during reclamation activities. Electrical power for the Project would be supplied via a powerline owned and maintained by Idaho Power. This existing powerline would be upgraded, and a new powerline constructed along and on either side of the BLM and county roads and the mine access road for approximately 25.2 miles (Figure 2-5). The Idaho Power powerline would connect to the Project substation located at the process plant. New powerline construction would consist of approximately 525 poles, approximately 40 feet in height.

Both the upgraded existing line and newly constructed transmission lines would meet Idaho Power's Zone 3 standard for avian protection from electrocution, and new power poles located within 3.3 kilometers (km) of sage-grouse habitat would be fitted with predation deterrent structures. The powerline would be constructed to avoid any wetlands or sensitive plant species and would be constructed, maintained, and reclaimed using the right-of-way (ROW) allowance from the roads.

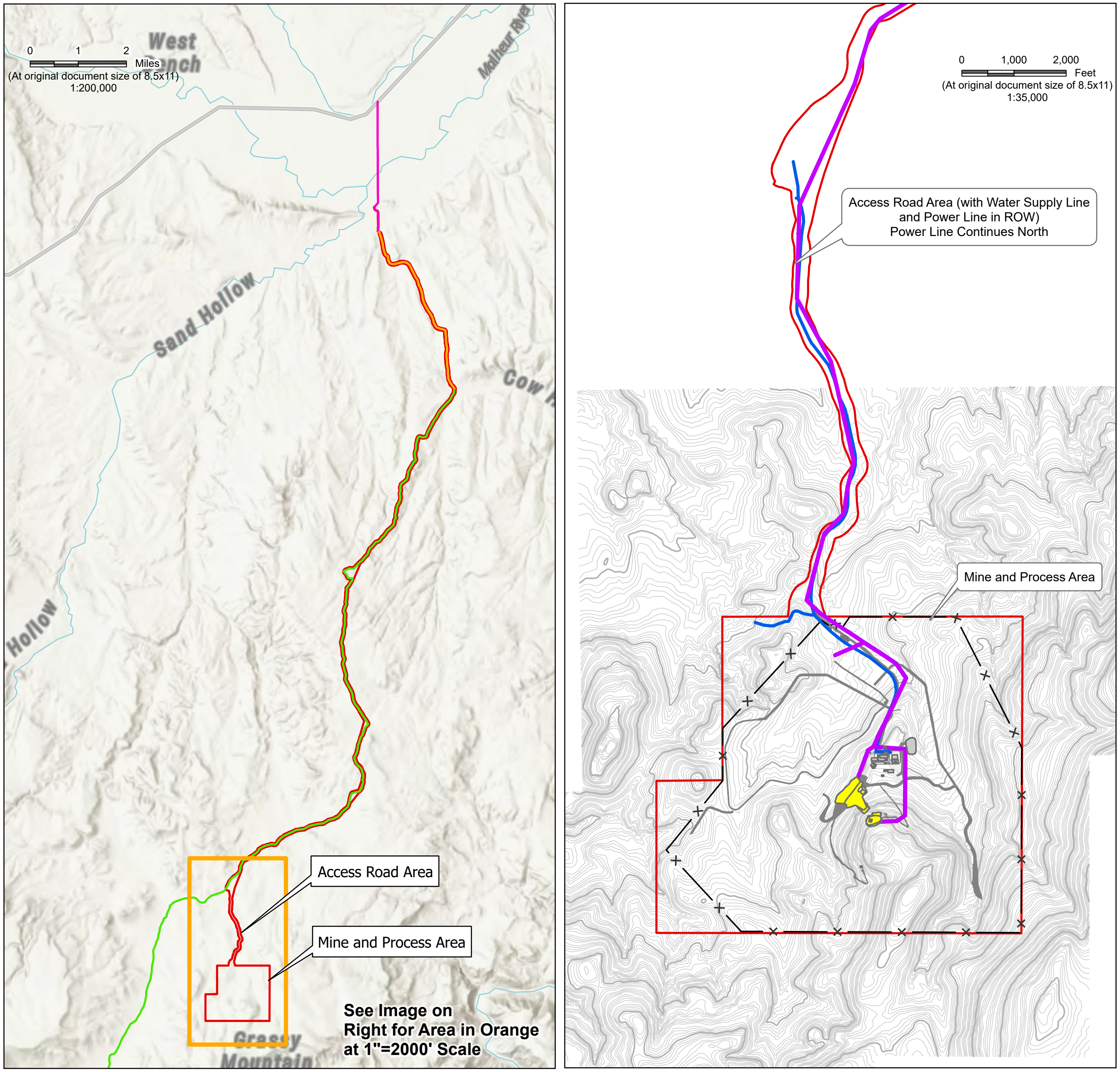


*Figure No.*
**2-5**

*Title*
**Proposed Power Supply**

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Project Location*
Malheur County, OR

Prepared by LL on 2023-10-04
TR by AU on 2023-10-10

N

Legend
- Permit Area
- Power Line
- Water Supply Line
- Russell Road (2.75 Mi.)
- Cow Hollow Road (4.05 Mi.)
- Twin Springs Road (13.46 Mi.)
- Fence Line
- Roads
- Power Supply
- Process Plant
- Underground Mine
- Existing 25ft Contour
- Existing 5ft Contour

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources:
**3.** Background: USGS Topo

Stantec

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Power distribution from the Project substation would be via overhead powerlines. There would be a combination control-room and motor-control-center room, which would be prefabricated and loaded with electrical equipment prior to delivery to the site.

During construction of the powerline, one emergency diesel generator capable of producing 2,000 kilowatts (kW) would be located at the process plant. It would be used during construction and initial mining of the decline. After the powerline is built, this generator would provide sufficient emergency power to operate critical components of the mine in the event of a power outage.

At the start of mining, a 480-volt transformer would be placed near the entrance to the mine portal to supply power for electrical equipment used to develop the main decline and operate portable fans. Once development has advanced (after approximately 1 year), the transformer would be moved underground and connected to a new main powerline installed along the rib of the decline to carry 1.4 kV. This powerline would also connect to the ventilation shaft to supply power to the ventilation fans. Upon completion of the decline to the 3,420-foot-amsl elevation level, and the initiation of production-mining activities, a second underground transformer would be installed for use in lower areas of the mine.

After mining is completed, power supply would be retained through Stage 4 of reclamation (see Section 2.1.16) to provide required energy for reclamation activities.

### 2.1.12 Access and Haul Roads

The access road for the mine would be an existing road that begins at the intersection of US Route 20 and Russell Road and continues south along Cow Hollow Road and Twin Springs Road until reaching the mine (Figure 2-6). Some areas of road improvements would be required including some roadway realignments, road widening, and installation of 11 cross drain culverts. The road corridor would be approximately 30 feet wide, which includes a 20-foot-wide road travel width (10 feet on either side of the road centerline), 2-foot-wide shoulders on each side of the road, minimum 1-foot-wide ditches on each side of the road, and appropriate cut and fill. The access road area totals approximately 876 acres.

Internal access and mine haul roads to be constructed onsite to connect the various mine facilities are shown in Figure 2-2. In total there would be approximately 35 acres of roads onsite developed for the Project.

An emergency access road would be located on a portion of Oregon State Route 201 and county-owned Mitchell Butte Road and Owyhee Avenue (Figure 2-7). Owyhee Avenue is part of the main access to Owyhee Reservoir.

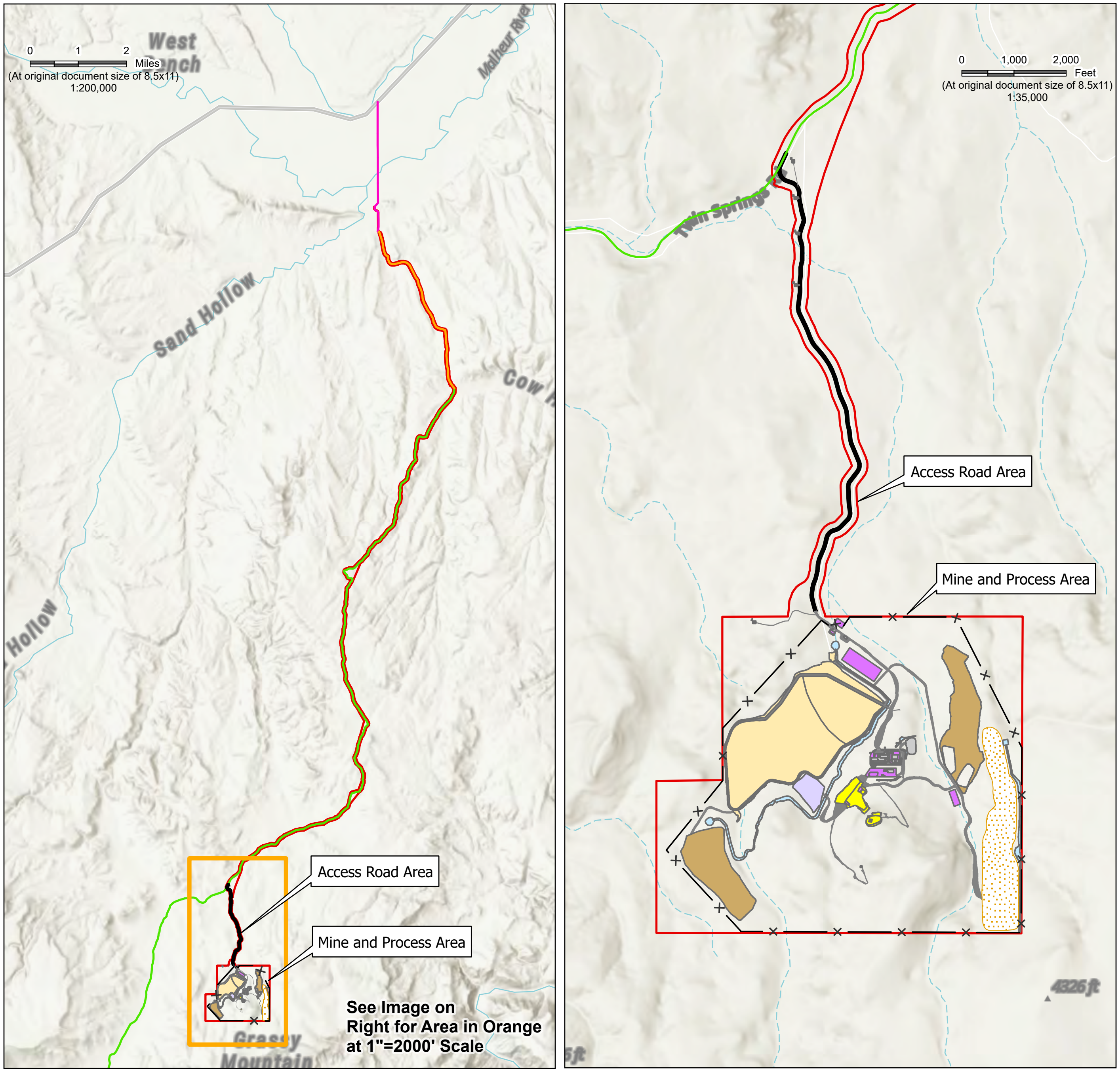


*Figure No.*
**2-6**
*Title*
**Proposed Main Access Road**

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Project Location*
Malheur County, OR

Prepared by LL on 2020-10-04
TR by AU on 2020-10-10

N

Legend

- Permit Area
- Russell Road (2.75 Mi.)
- Cow Hollow Road (4.05 Mi.)
- Twin Springs Road (13.46 Mi.)
- Fence Line
- Mine Access Road (2.48 Mi.)
- Roads
- Process Plant
- Quarry
- Reclamation Borrow Areas
- Stormwater Diversion Channel
- Tailings Storage Facility
- Temporary Waste Rock Storage Facility
- Underground Mine
- Water Supply
- Yards, Laydown Areas, and Stockpiles

__Notes__
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources:
3. Background: USGS Topo

Stantec

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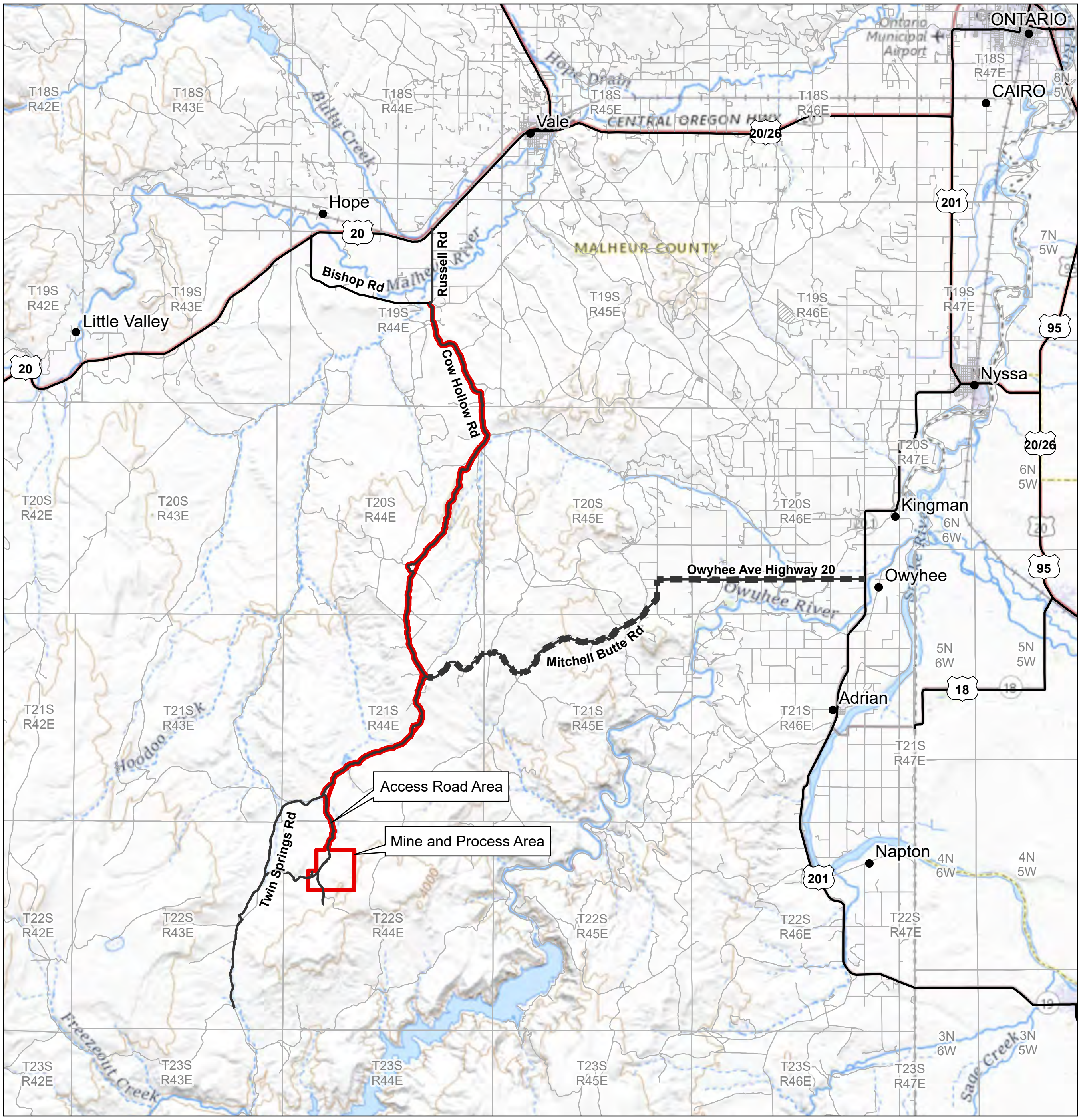


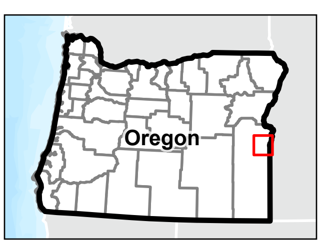


Legend
- Permit Area
- Emergency Access Road
- Roads

0 1.5 3 Miles
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*Notes*
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources:
3. Background: USGS Topo

Stantec

*Project Location* Prepared by LL on 2023-10-04
TR by AU on 2023-10-10
Malheur County, OR

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**2-7**

*Title*
**Proposed Emergency Access Road**

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### 2.1.13 Communications, Security, and Fencing

Onsite communications would consist of interconnected mobile and fixed systems, including a landline telephone network (installed on the powerlines), portable two-way radios, and internet. Internet and corporate network connection would be via satellite connections.

A perimeter fence, approximately 22,176 feet in length, would be constructed around the mine and process plant area to prevent access by the public, livestock, and wildlife. The perimeter fence would consist of an 8-foot-high chain-link fence with a 0.5-inch galvanized hardware cloth mesh that extends a minimum of 18 inches below the ground surface and 30 inches above the ground surface (total height 48 inches) and include signage related to mine operations and public safety. Chain-link fences would also be constructed within the perimeter fence in areas where a higher level of security is needed such as the gold room. Chain-link fences would also be constructed around the water production wellfield and include signage.

### 2.1.14 Equipment and Schedule

Mobile mining equipment suitable for underground mines would be used, as well as equipment for aboveground, as presented in Table 2-4 below. Equipment would be powered by diesel fuel except where noted.

**Table 2-4 Mine Mobile Equipment**

| Equipment | Model | Quantity |
|---|---|---|
| Four-wheel drive twin cab truck | Ford F-150—diesel | 1 |
| Four-wheel drive twin cab utility | Light vehicle four-wheel-drive twin cab utility ½ ton | 1 |
| All-terrain crane | Terex RT 35-1 or equivalent | 1 |
| Articulated haul trucks | CAT 745C | 1 |
| Blast hole drill | CAT MD5150C | 1 |
| Crushing area Bobcat | Bobcat S7 or equivalent | 1 |
| Diamond drilling | Hydracore Gopher | 1 |
| Dozer | CAT D6T | 1 |
| Dual (drill + bolter) | Resemin Troidon 88 Dual (electric) | 3 |
| Elevated work platform | ZX-135/70 Genie, or equivalent | 1 |
| Emulsion loader | CAT 440 | 1 |
| Forklift | CAT DP30NM | 1 |
| Front-end loader | CAT 962H | 2 |
| Hiab truck | SINOTRUK Small Truck Mounted Crane, 5–10 tons | 1 |
| Load haul dump loader | CAT R1600 5.2 cubic yards | 4 |
| Lube truck | Normet Multimec MF 100 | 1 |
| Mine rescue truck | Ford F-150 | 1 |
| Mine rescue truck | Ford F-150—diesel | 1 |
| Motor grader | Paus PG5HA | 1 |
| Motor grader | Cat 160M | 1 |

| Equipment | Model | Quantity |
|---|---|---|
| Pipe fusing machine | McElroy TRACSTAR® 28 SERIES 2 or equivalent | 1 |
| Shotcrete sprayer | Normet Spraymec 8100 VC (electric) | 1 |
| Shotcrete truck | Normet Utimec SF 300 | 1 |
| Telehandler | JCB 540-170 (electric) | 2 |
| Truck with ejector bed | CAT AD22 | 3 |
| Van man - transport | Ford SPLODER—diesel | 3 |
| Water truck | Normet Multimec MF 100 | 1 |
| Water truck | CAT 777G | 1 |

The Project, which currently is proposed to begin once all permits are in place and financing has been secured—expected in 2026—would be active for approximately 10 years, which includes 2 years of pre-production (including construction activities) and 8 years of mining and processing. Additionally, 4 years of closure and reclamation are estimated, plus an additional 26 years for groundwater monitoring. This schedule may be modified based on the rate of mining and future commodities prices.

### 2.1.15 Workforce

The Project is anticipated to employ approximately 100 to 120 people. This workforce includes mine equipment operators, process plant operators, administrative personnel, security staff, parking attendants, and health, safety, and environmental compliance (HSEC) personnel, as shown in Table 2-5.

Mining and milling jobs are expected to be sourced to local communities where possible, and the Applicant plans to implement a local-hire preference; local contracting and purchasing where practicable; and mine-worker job training. Partnerships with local community colleges and vocational schools is planned, including Treasure Valley Community College in Ontario, Eastern Oregon University in LaGrande, and the College of Western Idaho in Boise.

Underground mining would occur in two 12-hour shifts per day so the mine would operate 24 hours per day, 4 days per week. Production-related mining personnel (e.g., operators, fitters, electricians, and assistants) would work a shift system of 4 days on and 3 days off in two teams.

Ore processing at the process plant would operate two shifts per day, 365 days per year. Administrative personnel would work 10 hours per day in a shift system with 4 days on and 3 days off.

The parking lot at the mine would accommodate up to 24 light vehicles, consisting of operations vehicles and a minimal number of authorized offsite vehicles. Employees would be required to use the shuttle bus when regularly commuting to the mine. Approximately 8 to 31 vehicles are expected to travel roundtrip to the Project site on a daily basis, including the shuttle bus, some company mining vehicles, delivery vehicles, and other authorized vehicles. No personal vehicles would be allowed at the site, and most workers would be transported to the site by shuttle bus.

### Table 2-5 Proposed Mine Workforce

| Job Type | Number of Positions |
|---|---|
| **Administrative Personnel** | |
| Mine general manager | 1 |
| Administrative assistant | 1 |
| Human resources | 1 |
| Warehouse purchasing | 2 |
| **Mine Operators** | |
| Mine superintendent | 1 |
| Mine shift foreman | 2 |
| Mining operators | 50 |
| Mining engineer | 1 |
| Mine surveyors | 2 |
| Mine surveyors' assistants | 2 |
| Geologist | 1 |
| Samplers | 4 |
| **Process Plant Operators** | |
| Processing superintendent | 1 |
| Process shift foremen | 4 |
| Plant operators | 12 |
| Plant electrician labor | 8 |
| Metallurgy engineer | 1 |
| Gold room operator | 2 |
| Chief assayer | 1 |
| Technician | 4 |
| **Health, Safety, and Environmental Compliance (HSEC) Personnel** | |
| HSEC superintendent | 1 |
| HSEC specialist | 1 |
| Environmental technician | 2 |
| Safety personnel | 4 |
| Security personnel | 2 |
| **Total** | **111** |

### 2.1.16 Closure and Reclamation

No temporary or seasonal closures of the facility are planned. However, temporary closure of the facility may be required due to seasonal activity, weather events, major system failure, or other interruptions. In this instance, procedures and controls would be put in place to maintain and control process components and process fluids including adherence to management plans (e.g., stormwater, waste, and monitoring plans). Standard security procedures would remain in place for the duration of a temporary closure.

After mining has completed, mine components would be closed and reclaimed as follows:

- **Mine.** The mine portal would be plugged with rock, with slopes returned to near their original grade, covered with 12 inches of growth media, and revegetated. The ventilation shaft would be sealed with a reinforced concrete plug, covered with 12 inches of cover material followed by 12 inches of growth media, and revegetated.
- **Underground Equipment.** Underground piping, pumps, tanks, fans, motors, pumps, compressors, power supply, electrical distribution equipment, ventilation curtains and ducts, other equipment, remaining fuel, lubricants, and explosives would be removed for use at another facility, recycled, or disposed of at approved offsite waste disposal facilities.
- **ROM Ore Stockpile.** All ore would have been processed by the time of closure. However, a minor volume of ore may remain at the time of closure, which would be removed and placed on the TSF surface prior to closure of the TSF. If necessary, the rock may be amended with lime to address pH issues. The stockpile foundation area would be regraded, covered with 12 inches of growth media, and revegetated.
- **TSF.** The embankment would be sloped appropriately for long-term stability, covered with 12 inches of growth media, and revegetated. The tailings distribution pipeline and tailings reclaim water pipeline would be removed and disposed of offsite. After approximately 1 year, the tailings are expected to consolidate sufficiently to allow for surface regrading and cover placement, which consists of a geomembrane, 12 inches of granular drainage, woven geotextile covering, and 12 inches of growth media.
- **Reclaim Pond.** After processing has ended and no more tailings are deposited to the TSF, tailings underflow would be managed through passive evaporation within the supernatant pool, pumping of solution from the reclaim pond to the TSF for passive evaporation, and passive evaporation in the reclaim pond, which would be converted to an evaporation cell (e-cell) by covering the geomembrane-lined pond with 12 inches of growth media and revegetated. The e-cell would be maintained until the TSF is fully drained and there is no tailings underflow, estimated to take 20 years.
- **Quarry.** The quarry would be developed in single benches during operations. No growth media or vegetation would be placed on the side slopes. At reclamation, 12 inches of growth media would be placed over the quarry floor and revegetated. An earth berm would be constructed along the perimeter of the high walls to reduce access. The quarry stormwater diversion channel berm and surface water run-on diversion berms would remain in place. Large boulders uncovered during operations that are not used for development of the Project would be placed along the quarry stormwater diversion channel and berm to provide long-term wildlife habitat and act as a public access deterrent following reclamation.
- **TWRSF.** No waste rock is planned to be present on the TWRSF at closure since waste rock would be used as rock fill, amended with cement, and placed back underground as cemented rock fill during operations. However, if some waste rock remains at closure, it would be removed and placed on the TSF surface prior to closure of the TSF. The TWRSF lining system, underdrain, and leak detection and recovery system would removed and disposed of offsite. The TWRSF embankment would be regraded to promote natural drainage, covered with 12 inches of growth media, and revegetated.

- **Collection Pond.** The process plant collection pond would be pumped dry and the lining system folded in on itself and buried in place. The ground surface would be regraded, 12 inches of growth media would be placed over the surface, and it would be revegetated.
- **Surface Facilities.** Buildings and structures erected during the mining operation would be decommissioned and dismantled, and materials salvaged, sold, used elsewhere, or removed and disposed of offsite in an authorized landfill. These buildings and structures include the process plant building, workshop, and warehouse; reagent storage area; gold room; assay laboratory; electrical rooms; truckshop and warehouse; main gate and guard house; meteorological station; crushing facilities; conveyors; and ore bins. The administration building would remain for staff use during reclamation and initial stages of post-closure monitoring, after which the buildings would be removed and the area reclaimed. Concrete foundations and slabs would be broken using a trackhoe-mounted hydraulic hammer, buried in place under approximately 36 inches of material, covered with 12 inches of growth media, and revegetated.
- **Storage Tanks and Pipelines.** Storage tanks and surface pipelines would be removed and salvaged or disposed of offsite in accordance with applicable local, state, and federal regulatory requirements. Buried water pipelines would be drained, ends cut and capped a minimum of 12 inches below grade, covered with 12 inches of growth media, and revegetated.
- **Perimeter Fence.** The perimeter fence would be removed and disposed of offsite, and the perimeter fence road would be ripped, revegetated, and reclaimed. A fence would be installed around the perimeter of the reclaim pond/e-cell until it is no longer needed, at which point the fence would be removed and disposed of offsite.
- **Roads and Parking Areas.** Cow Hollow and Twin Springs Roads, including all improvements and upgrades, would be transferred to Malheur County and not reclaimed. At the Project site, the reclamation of roads would occur in phases, based on the use of the roads for reclamation and post-closure monitoring activities. The mine access road, which would connect Twin Springs Road to the mine, would remain in place during reclamation to allow for contractor access. Upon reclamation of the TSF and quarry, the final two major facilities to be reclaimed, the mine access road would be reclaimed from a two-way gravel road to a one-way primitive road to allow for the post-closure monitoring of the Project. The mine access road would be completely removed and reclaimed at the completion of the groundwater and e-cell post-closure monitoring activities. Reclamation consists of regrading or ripping of compacted areas and revegetating. The parking lot area would remain available for use during reclamation and closure, after which it would be reclaimed.
- **Utilities.** The substation and upgraded transmission line, including all improvements and upgrades, would be transferred to the local power authority and not reclaimed. The new 14.4-kV overland power transmission system and onsite power lines would be demolished and disposed of offsite. Power poles would be cut off at the ground surface and disposed of offsite. The two onsite generators would be salvaged or removed for offsite disposal. The septic system would be closed by a qualified contractor by pumping out the sanitary waste and then filling with sand to the top of the openings. The buried drain field would be closed in place. Fuel tanks would be decommissioned and salvaged or disposed of offsite according to federal and state standards and regulations. The potable water treatment unit would be decommissioned and dismantled and its materials salvaged or removed and disposed of offsite in an authorized landfill. Water supply wells would be permanently abandoned by a

licensed water supply well constructor, and well fencing would be removed and disposed of offsite. All new power poles and lines constructed for the Project would be demolished and salvaged or disposed of offsite.

Disturbed areas would generally be regraded and recontoured to provide long-term stability, mimic adjacent landforms, facilitate revegetation, control drainage, and minimize erosion. Where practicable, the natural pre-mining drainage patterns will be re-established. Where the post-closure landform does not allow for the re-establishment of pre-mining drainage patterns, drainage will be engineered so that natural drainage is complemented.

After grading and contouring, growth media would be placed at sites to be reclaimed. Next, the ground/ growth media surface would be scarified and a site-specific, native seed mix applied to establish native plant growth. Seed would be applied with a rangeland drill or a mechanical broadcaster and harrow, depending on accessibility. Seedbed preparation and seeding would take place in the fall after grading and growth media application in the area to be reclaimed.

The proposed post-closure land uses for the Project are livestock grazing or rangeland, wildlife habitat, and recreational land, with opportunities to consider mineral exploration and development when feasible. Where practical, areas impacted by the Project would be returned to conditions that existed prior to mining and mineral processing through the placement of adequate growth media and revegetation to provide for these post-closure land uses.

Final closure and reclamation would be conducted in stages over approximately 4 years, with 29 years of post-closure monitoring and inspections. The stages of reclamation are shown in Table 1-1 in Chapter 1, with activities being performed in the general sequences as listed in the table.

### 2.1.17 Financial Assurances and the Reclamation Bond

“Financial assurance” refers to the basic concept that a company or corporation affecting public lands or resources needs to provide assurance that funds will be available during and after a project to complete the necessary activities to prevent or repair environmental damage. In mining, financial assurances are arrangements made to guarantee the costs of reclaiming lands affected during mining in order to prevent or repair environmental damage at the end of a mine’s life. These financial assurances may also be referred to as a reclamation bond. Financial assurance measures help to provide a guarantee to governments and communities that financial resources will be available for a range of circumstances.

Financial assurance instruments may include cash deposits, an insurance policy (typically used in conjunction with other measures), or sureties (e.g., fidelity bonds, surety bonds, performance bonds, and letters of credit). Sureties are guarantees issued by a bonding company, an insurance company, a bank, or another financial institution that agrees to hold itself liable for the acts or failures of a third party (in this case, the Applicant).

In preparation for closure and reclamation, preliminary closure and reclamation plans are updated to reflect changes in environmental conditions and in mine operations as the Project progresses. Similarly, arrangements for financial assurances are designed to be revisited and revised during the life of the mine to reflect such changes. Detailed reclamation and closure plans, and adjustments to financial assurances, should be completed and approved before the outset of mining and should be revised as appropriate during the mine life so that sufficient funds are available for reclamation and closure.

A reclamation cost estimate has been developed for the Project that assumes the TSF would be constructed to Stage 2 (see Table 1-1 in Chapter 1). In the event that Stage 3 of the TSF is constructed, the bond would be updated accordingly. The cost estimate was created with a reclamation cost-estimating tool used in Nevada (Nevada SRCE [Standardized Reclamation Cost Estimator] Beta Version 2.0.) that uses built-in worksheets and standardized cost data for reclamation areas and volumes, labor, and equipment rates for reclamation activities specific to a mining project. The reclamation cost estimate for the Project is $12,416,573.

The actual reclamation security amount, as required by federal and state regulations, would be determined at the time permits are issued based on discussions with state regulators and the BLM, and would be assessed annually.

## 2.1.18 Monitoring and Applicant-proposed Mitigation

### 2.1.18.1 Operations Monitoring

As part of the mine operating plan, a variety of environmental aspects would be monitored as required by state and federal regulations. Monitoring plans for the Project are shown in Table 2-6.

**Table 2-6 Operations Monitoring**

| Monitoring Plan | Affected Resource / Project Component |
|---|---|
| Wildlife Protection Plan | Wildlife |
| Noxious Weed Monitoring and Control Plan | Noxious weeds, vegetation |
| Stormwater Pollution Control Plan | Stormwater |
| Monitoring plan for groundwater and leakage detection systems | Groundwater |
| Waste Management Plan | Hazardous and non-hazardous wastes |
| Spill Prevention, Control, and Countermeasures (SPCC) Plan[1] | Petroleum storage containers including planned diesel fuel tanks |
| Tailings Chemical Monitoring Plan | Tailings |
| Monitoring plan for groundwater and leakage detection systems | TSF, TWRSF leak detection system monitoring, groundwater |
| Air Quality Monitoring[2] | Fugitive dust and process air emissions, air quality |
| Public Drinking Water System Permit | Potable water |

1 SPCC Plan would be prepared in the future per the requirements of the Emergency Response Plan.

2 Air quality monitoring would be conducted pursuant to conditions of pending facility air permits.

### 2.1.18.2 Post-closure Monitoring

Post-closure monitoring and maintenance consists of the following actions:

- Routine inspections of the fence surrounding the e-cell and maintenance until closure has been approved and the bond released. Post-closure e-cell fence monitoring would be conducted in three phases:
  - Phase 1 includes quarterly monitoring for a period of 5 years.

  - Phase 2 includes semi-annual monitoring for a period of 10 years.
  - Phase 3 includes annual monitoring for a period of 15 years.

- Photo-documentation of vegetation during the "peak green" spring season 5 years after revegetation activities have been completed. Reclaimed areas not meeting regulatory standards would be evaluated and corrective actions implemented including soil amendments, reseeding, and installation of erosion control measures. This vegetation monitoring and maintenance would cease when reclamation goals and requirements have been achieved and upon release of all related reclamation bonds.
- Routine monitoring of flow rate of the tailings underflow from the TSF to the reclaim pond/e-cell.
- Testing of groundwater quality including routinely collecting, testing, and reporting to respective regulatory agencies to demonstrate reclamation compliance, including acid rock drainage effects, in the 15 monitoring wells. This groundwater testing would be conducted until closure has been approved and the bond released, estimated to be a period of approximately 30 years. Groundwater monitoring would be conducted in three phases:
  - Phase 1 includes quarterly monitoring for a period of 5 years.
  - Phase 2 includes semi-annual monitoring for a period of 10 years.
  - Phase 3 includes annual monitoring for a period of 15 years.
- Implementing noxious weed monitoring and control during operations and for a period of 5 years following the cessation of operations.
- Inspecting stormwater diversion channels during the reclamation monitoring period to ensure that sediment and debris has not accumulated and lining in the channels (riprap, concrete, etc.) has not been compromised.
- Testing of surface water by collecting, testing, and reporting to respective regulatory agencies to demonstrate reclamation compliance where necessary.

#### 2.1.18.3 Applicant-proposed Mitigation

The Applicant has proposed various avoidance and minimization mitigation strategies for Project impacts:

- Concurrent reclamation could occur during mining operations, when a portion of mining activity is complete and final reclamation can be safely performed. This reduces the overall disturbance area for the Project.
- Traffic control measures would be implemented to reduce the number of road users and potential road accidents, including carpooling, use of a shuttle bus for employees, setting lower speed limits, and environmental training.
- Cultural resources mitigation is being discussed between SHPO, the BLM, and the Burns Paiute Tribe to address potential effects to cultural resources that may be affected by Project operations.

- Category 2 wetlands would be avoided to the extent possible.
- The amount of greater sage-grouse habitat that would be used for mining would be minimized.
- Seasonal restrictions[3] would be implemented in vegetation clearing to avoid effects to nesting hawks, eagles, and burrowing owls.
- Seasonal restrictions would be implemented for ground-disturbing activities (road construction or widening) from December 1 to March 31 to reduce effects to mule deer winter range habitat and from March 1 to June 30 in greater sage-grouse habitat.
- Environmental training would be conducted by a qualified biologist to address reporting of injured or dead wildlife on the site, adherence to site speed limits, trash control, and other subjects.
- Backfilling of underground mine production drifts would use a cement rock fill to eliminate acid rock drainage effects.
- An erosion and sediment control plan would be developed with practices to be followed such as the use of straw wattles, silt fences, rock check dams, or ditching to control erosion and avoid contamination of discharged stormwater.
- BMPs would be used, including spraying water in high traffic areas to reduce fugitive dust, correct management and disposal of hazardous waste, washing out of concrete trucks in designated plastic-lined collection pits to prevent alkaline runoff.
- Noise reduction components would be incorporated for machinery to reduce noise impacts.
- Noxious weeds would be controlled with herbicides and mechanical methods per the noxious weed monitoring and control plan.
- Skyward lighting would be avoided where practical, stationary external lights would be shielded, and motion detectors, timers, or dimmers would be installed that minimize skyward light on exterior lights.
- The power transmission line would be designed and constructed to adhere to the Avian Power Line Interaction Committee’s suggested practices for avian protection. Perching and nesting deterrence structures would be installed on powerline structures located within 3.3 km of greater sage-grouse habitat.
- Trenches would be closed overnight by filling or covered in a way that prevents animals from entering, or a wildlife escape ramp would be installed to ensure no wildlife become trapped in trenches.

#### 2.1.18.4 Compensatory Mitigation

Compensatory mitigation is the restoration, establishment, enhancement, and/or preservation of resources for the purposes of offsetting unavoidable adverse impacts that remain after all appropriate and

[3] If an activity needs to occur within one of the restrictive buffers during one of the timing restrictions, the Project’s Environmental and Safety Superintendent would coordinate with the ODFW (or the USFWS in the case of golden eagles) prior to completing the activity to determine the appropriate course of action (e.g., pre-activity nesting surveys to determine current occupancy prior to completing the activity, activity timing adjustments, or additional mitigation).

practicable avoidance and minimization has been achieved. The Applicant's wildlife mitigation plan presents direct and indirect impacts to wildlife habitats and the measures taken to avoid or reduce impacts. The Project must meet the standard of "no overall net loss" of fish and wildlife habitat through compliance with the ODFW Fish and Wildlife Habitat Mitigation Policy. Impacts resulting from the Project that remain after avoidance and reduction measures have been implemented would be addressed through mitigation credits created through proposed compensatory mitigation projects. The Applicant followed the ODFW Fish and Wildlife Habitat Mitigation Policy to determine the appropriate compensatory mitigation for impacts to wildlife habitats that are expected to remain following implementation of all avoidance and minimization measures. Approximately 450 acres would be required as compensatory mitigation for direct effects to wildlife habitat, and approximately 113 acres would be required for indirect impacts to mule deer winter range habitat. Appropriate compensatory mitigation for impacts to greater sage-grouse were separately determined by following the Oregon Greater Sage-Grouse Conservation Strategy. Approximately 770 acres would be required as compensatory mitigation for effects to greater sage-grouse.

Options for compensatory mitigation include one or more of the following:

1. **ODFW In-Lieu Fee (ILF) Program for Greater Sage-Grouse**. Through the ILF option, the Applicant can pay a project-specific calculated fee to the ODFW Sage-Grouse Mitigation Program. Any liability therein would be assumed by the state and the mitigation managed by the mitigation program. This would only apply to the compensatory mitigation requirements for greater sage-grouse.

2. **Third-Party Payment-to-Provide: Wildlife Habitat Management and Greater Sage-Grouse Mitigation Bank**. Greater sage-grouse mitigation credits can be purchased from a conservation bank whereby landowners can permanently protect and manage land for particular species of interest at a per-acre cost. There is an approximately 32,000-acre upland habitat conservation bank under development in Malheur County, which may be suitable. However, the per-acre cost has not yet been determined.

3. **Third-Party Payment-to-Provide: Habitat Management.** Under this option, the Applicant would provide funds to a third-party entity to perform compensatory mitigation projects and provide ongoing success monitoring and adaptive management activities on offsite compensatory mitigation areas.

4. **Permittee-Implemented Mitigation: Habitat Mitigation Area (HMA).** The Applicant would obtain and manage one or more offsite HMAs for the life of the Project or the duration of the Project's impacts. In this case, the Applicant would be responsible for developing and adhering to site-specific habitat management and restoration objectives for the HMAs over the long term.

At this time, the Applicant has not selected a compensatory mitigation option and would continue to work with ODFW and other regulatory agencies as appropriate to select the specific mix of compensatory mitigation options for the Project.

# 2.2 ALTERNATIVES

## 2.2.1 Methods of Analysis

This section describes the process used to identify and evaluate potential reasonable alternatives to the Project to be considered further in this EE. Reasonable alternatives do not include remote or speculative alternatives or alternatives that would not achieve the Project purpose. Reasonable alternatives include those that are practical or feasible from a technical and economic standpoint using common sense and that meet the purpose and need of the Project.

The Applicant's alternatives were assessed and then alternative mining components were identified, with a focus on analyses of alternative locations for mine facilities, designs, processes, operations, scheduling, water supplies, power supplies, and reclamation procedures. In addition, non-cyanide ore processing techniques were evaluated, and best available, practicable, and necessary technologies for projects using underground extraction, chemical processing, and permanent tailings disposal were also thoroughly reviewed, evaluated, and analyzed (Appendix A). This effort is intended to directly support the TRT in its task of (1) determining necessary technologies; (2) determining the availability of best technologies; (3) determining the practicability of the necessary and available technologies; (4) ranking the technologies by their potential environmental benefits; and (5) developing a recommendation of the suite of technologies that have been determined to be the best available, necessary, and practicable to ensure compliance with environmental standards (OAR 632-037-0018). Individual mine case studies using comparable examples from the US and around the world were reviewed generally to identify potential alternative mining components and strategies for all aspects of the proposed gold mining process.

The alternative mine components and strategies were evaluated at a high level for anticipated effects as compared to the Applicant's proposed mining methods to determine if these alternatives should be carried forward for detailed analysis in this EE. Section 2.2.5 summarizes the alternative mine components and strategies that are addressed in detail in the EE.

## 2.2.2 Applicant's Alternatives

The Applicant submitted an alternatives assessment as part of its CPA. The analysis included mining alternatives (open pit and underground), processing alternatives (TSF and heap leach[4] pad [HLP]), alternative TSF locations and management options, water supply alternatives (onsite wells and municipal water supply), power alternatives (overhead transmission lines, buried transmission lines, and onsite generators), and reclamation alternatives. These alternatives are summarized in the following subsections.

### 2.2.2.1 Mining Method Alternatives

A brief summary of three major mining method alternatives is provided in Table 2-7.

[4] Heap leaching involves crushing the mined rock, placing it on an impermeable lined leach pad, and applying a leach solution (including cyanide) to dissolve the valuable metals. The leach solution is then collected, treated in a process plant to recover the minerals, and recycled to the heap after reagent levels are adjusted.

### Table 2-7 Summary of the Applicant's Alternatives

| | Mining Method Alternatives | | |
|---|---|---|---|
| | **Applicant's Proposed Project** | **Alternative 1A** | **Alternative 1B** |
| Description | Underground mine with TSF | Open-pit mine with TSF | Open-pit mine with HLP |
| Volume of Rock Extracted (MST) | 2.34 | 79.9 | 108.6 |
| TSF or HLP (acres and volume) | 99.2 acres<br>3.7 MST | 216.0 acres<br>22.5 MST | 147.0 acres<br>53.3 MST |
| Waste Rock Storage Areas (acres) | 8.4 | 215.0 | 219.0 |
| Mine Area (acres) | 0.5 | 74.1 | 97.1 |
| Total Disturbance Area (acres) | 319.6 | 716.6 | 674.6 |
| Mine Life (years) | 7.8 | 12.7 | 10.0 |
| Workforce Requirements (no. of people) | Approximately 100 | Approximately 100 | Approximately 130 |
| Potential Impacts | • Lowest air emissions of all alternatives and least noise from smallest fleet of equipment.<br>• Smallest footprint of all alternatives so least disturbance to wildlife species and habitats and vegetation communities. | • Greater air emissions and noise than the Applicant's proposed Project from more mining equipment required and greater noise from blasting in an open pit.<br>• Larger footprint than the Applicant's proposed Project and so greater amount of disturbance to wildlife species and habitats and vegetation communities. | • Greatest air emissions and noise of all alternatives from greatest mining equipment required and greater noise from blasting in an open pit.<br>• Larger footprint than the Applicant's proposed Project and so greater amount of disturbance to wildlife species and habitats and vegetation communities. Also, HLP and process ponds associated with exposure of wildlife to cyanide. |
| Potential benefits | Smallest workforce and time period of all alternatives. | Approximately the same workforce as the Applicant's proposed Project for 5 years longer. | Approximately 30% larger workforce than the Applicant's proposed Project for 2 years longer. |

MST – million short tons (US)

As the summary in Table 2-7 shows, although it would create the smallest number of jobs, the Applicant's proposed Project (underground mine with TSF) would result in the least impact to environmental resources and was chosen as the preferred mining method by the Applicant.

#### 2.2.2.2 Tailings Storage Facility Management/Dewatering Alternatives

The Applicant considered different levels of pre-disposal dewatering technologies for aboveground tailings disposal including:

1. Conventional tailings slurry (25 to 60 percent solids, weight by weight [w/w]); a pumpable slurry.
2. Filtered tailings (75 to 85 percent solids w/w); vacuum or pressure filtration removes water to create the consistency of a solid material.
3. Paste or high-density thickened tailings (50 to 80 percent solids w/w); paste tailings are dewatered to a non-segregating but pumpable slurry that typically has minor bleed water after placement.

The analysis found that the filtered and paste tailings options would require the construction of additional infrastructure to mechanically dewater the tailings prior to storage/disposal (including a large aboveground waste disposal area and additional stormwater management and diversion structures) and would also require additional geotechnical design and closure and reclamation planning and design. Additionally, mechanical dewatering of the tailings would likely create a net excess water scenario that would require water treatment prior to discharge (Golder Associates 2019a). The conventional tailings slurry option was therefore considered to be the preferred alternative for tailings management and is included in the Applicant's proposed action.

In an attempt to reduce the volume of tailings stored in the TSF, the use of paste tailings was further considered in the TRT's analysis of potential alternatives to TSF management in Section 2.2.3.5.

#### 2.2.2.3 Tailings Storage Facility Location Alternatives

The Applicant prepared an options analysis to identify a preferred location for the TSF. The analysis included five possible locations for the TSF. The advantages and disadvantages of each option were analyzed with regard to volume of earthworks material required (for embankment fill), ease of construction, stormwater management, efficiency of tailings movement to the TSF and water back to the mill, disturbance area, geotechnical stability, and post-closure reclamation among others (Golder Associates 2019a). Option 2 offered the greatest advantages for these factors and was selected as the preferred location for the TSF. Option 2 is the chosen location for the TSF in the Applicant's proposed Project (see Appendix H of the CPA for greater detail on this analysis).

#### 2.2.2.4 TSF and TWRSF Liner Alternatives

Alternative lining systems for the TSF and TWRSF were evaluated. Oregon regulations at OAR 340-043-0130 (Guidelines for Disposal of Mill Tailings) state the minimum requirements for permeability and thickness of secondary containment for tailing disposal facilities. These requirements are "a composite double liner consisting of a flexible-membrane synthetic top liner in tight contact with an engineered, stable, soil/clay bottom liner (maximum coefficient of permeability of $10^{-7}$ centimeters per second) having a minimum thickness of 36 inches" (OAR 340-043-0130).

The Applicant evaluated three alternative lining systems:

1. A soil/clay secondary layer (OAR minimum requirement).
2. A standard geosynthetic clay liner (GCL) consisting of a sodium bentonite layer between two geotextiles needle-punched together.
3. An enhanced GCL consisting of a sodium bentonite layer between two geotextiles needle-punched together plus an additional laminated thin flexible-membrane barrier.

The potential fluid travel time through all three lining systems was evaluated to assess the efficacy of these secondary containment systems. The standard GCL did not meet the same performance standard as the OAR minimum requirement, but the enhanced GCL exceeded the performance standard with the lowest fluid travel times of all three lining systems. Therefore, the chosen lining system for the TSF and TWRSF for the Applicant's proposed Project is an enhanced GCL, which consists of (from bottom to top) a 6- to 12-inch-thick native prepared subgrade, a 300-mil-thick enhanced GCL, an 80-mil HDPE geomembrane liner, an 18-inch-thick drainage layer, and a 6-inch-thick filter layer. Perforated piping would be located within the drainage layer to promote drainage of the tailings.

#### 2.2.2.5 Water Supply Alternatives

The Applicant assessed two water supply options:

1. Onsite water wells. Within the proposed permit boundary, up to four water production wells would pump raw water via a 2.8-mile-long buried pipeline to a raw water tank and would then be piped for use at the Project as needed.
2. Municipal water supply. Water would be conveyed to the Project via an 8-inch-diameter buried pipeline approximately 25.3 miles long installed along existing roads from the city of Vale with two pump stations.

Option 1 would have a far smaller disturbance area due to the reduced pipeline size, with associated reduction in effects from construction activities and ground disturbance. The length and location of the pipeline within the proposed permit boundary would also result in reduced effects to wildlife and rangeland as opposed to installing a longer pipeline from Vale to the Permit Area. Noise from the two pump stations in Option 2 would have an increased impact in areas outside of the permit boundary. Option 1, onsite water wells, was therefore selected as the preferred water supply alternative and is included in the Applicant's proposed Project.

#### 2.2.2.6 Power Supply Alternatives

The Applicant considered three power supply alternatives:

1. Overhead transmission line. Power would be provided to the Project site from Idaho Power via a 25.3-mile-long overhead transmission line. Approximately 5.2 miles of the existing transmission line would be upgraded, and approximately 20.1 miles of new transmission line would be constructed.
2. Combination upgraded overhead and buried transmission line. Power would be provided to the Project site from Idaho Power via a 25.3-mile-long combination overhead and buried transmission line. Approximately 5.2 miles of the existing overhead transmission line would be upgraded, and approximately 20.1 miles of new buried transmission line would be constructed along the same roads as Option 1.

3. Onsite generators. Power would be generated onsite using diesel generators.

Options 1 and 2 would both have short-term effects to wildlife from disturbance along the road ROW during construction of overhead or buried transmission lines. Option 1 would also add 20.1 miles of new overhead transmission line with associated potential effects of potential mortality or injury of birds from electrocution and line strikes. However, all overhead powerlines along existing routes and new routes would meet Idaho Power's Zone 3 standard and Avian Power Line Interaction Committee's suggested practices with a design that protects birds including eagles from the risk of electrocution. In addition, to reduce the risk of corvid predation on sage-grouse, new power poles located within 3.3 km of sage-grouse habitat would be fitted with deterrent structures (e.g., triangular avian perch and nest diverters). Option 2 would disturb 58.3 additional acres of land than Option 1 from construction of buried powerlines and may require engineering controls to prevent effects to waterway crossings and associated aquatic species. Option 3, as proposed, would have the largest air quality and noise impacts from the use of diesel-powered onsite generators, and emissions generated may result in non-compliance with the Cleaner Air Oregon rules. Therefore, the overhead transmission line was selected as the preferred option and is included in the Applicant's proposed Project.

#### 2.2.2.7 Reclamation Alternatives

The Applicant assessed two post-closure land uses:

1. Livestock grazing or rangeland, wildlife habitat, and recreational land. Reclamation of all mining facilities and decommissioning of all buildings, facilities, and infrastructure.
2. Industrial land use. Reclamation of major mining facilities and retaining infrastructure and buildings for access and industrial use.

The post-closure industrial land use option (Option 2 above) would have greater air emissions, noise, and wildlife disturbance from vehicular traffic and post-reclamation commercial industries. This option would also have greater impacts to vegetation communities and wildlife habitat since retaining buildings and infrastructure would prevent re-establishment of vegetation communities post-mining. Therefore, post-closure land use of livestock grazing or rangeland, wildlife habitat, and recreational land was selected as the preferred option and is included in the Applicant's proposed Project.

### 2.2.3 Alternative Components Evaluated

This section describes reasonable alternatives to the proposed Project including alternative locations for mine facilities, alternative designs, processes, operations, and scheduling.

#### 2.2.3.1 Alternative Locations for Mine Facilities

The area designated for the underground mine contains the highest concentrations of valuable mineral resources within the Project area. There are no reasonable alternatives to locating the underground mine in the Project area because the precious metal resources are located beneath this area. The locations of underground mine-associated facilities—including the mine portal, ventilation shafts, and haul roads—depend on the location of the underground mine and thus cannot be relocated.

The TSF, as proposed, would be located in the broad valley immediately west of the mine portal and would have embankments constructed on the north and west sides. This location requires smaller volumes of embankment fill (as compared to a TSF located outside of the valley) and relatively short haul distances between the mine portal, processing mill, and TSF. Alternative locations for the TSF were analyzed in detail in the Applicant's alternatives analysis and no reasonable alternatives were identified (see Section 2.2.2.3).

The process plant area is situated close to the mine portal and the TSF to minimize hauling and piping distances between these facilities. Similarly, the TWRSF is located between the mine portal and the TSF to minimize hauling of waste rock. No preferred alternative locations for these facilities have been identified.

The reclamation borrow areas are located in proximal areas with suitable material to be used for construction and reclamation, and no preferred alternative locations for these facilities have been identified.

Surface water diversion channels are proposed to be constructed along the upslope boundaries of the TSF, TWRSF, quarry, and stockpiles as needed to divert stormwater runoff away from these areas. No alternative stormwater routes are proposed to achieve this objective.

Haul and internal roads have been designed by the Applicant to the BLM and American Association of State Highway and Transportation Officials design standards, with adequate slopes, alignments, widths, and ditches. The alignment takes into consideration drainage patterns and associated culvert requirements and minimizes distances between facilities. No alternative haul or internal road designs or locations are proposed.

#### 2.2.3.2 Alternative Mining Strategies

Two general methods of ore extraction are used for gold mining: open-pit mining and underground mining. Open-pit mining is the most cost-effective method when the mineral-bearing ore has a low concentration of gold and is near the surface and when a large volume of ore must be removed to extract economic quantities of gold. Underground mining methods are typically used where the concentration of gold in the mineral-bearing ore is relatively higher and smaller volumes of ore can be removed to yield economic quantities of gold, since underground mining methods are commonly far more expensive than surface mining methods. Thus, the intrinsic properties of the ore deposit determine which mining method would be most effective; in this case, underground mining is the proposed method.

Conventional underground mining requires installation of electric power, water, and ventilation underground but results in far less direct surface impact than open-pit mining and results in less waste since much of the waste rock could be used for backfilling mined-out areas and the ore does not have to be accessed via excavation of a large open pit. However, working conditions can be more hazardous due to operating in enclosed spaces. Effects of both underground and open-pit mines may include changes in the quantity of surface and underground water and its quality in the event of acid rock drainage.

Open-pit mining requires development of stable pit wall slopes, requiring a greater area of land for the open pit and storage of greater volumes of waste rock. The mine is open to the elements, which can affect stability of slopes and the ability to continue operations in inclement weather. Effects of open-pit mines may include pit wall failures (i.e., material slides), vegetation removal, soil erosion, changes in existing topography, and visual impacts of an open pit and waste dumps.

Of the two mining methods, underground mining would have the lower environmental impact since it requires far less surface area for extraction and would produce less waste.

#### 2.2.3.3 Alternative Tailings Storage Facility Designs

While alternatives for tailings storage facility locations were evaluated (see Section 2.2.2.3), the design of the tailings facility is largely prescribed by regulation and industry standards with limited alternatives, as described below.

The tailing facility design criteria were based on:

- WRD, Dam Safety Regulations in OAR 690, Division 20;
- DOGAMI, Chemical Process Mine Regulations, OAR 632, Division 37;
- DEQ, Chemical Mining, OAR 340, Division 43; and
- ODFW, Chemical Process Mining Consolidated Application and Permit Review Standards, OAR 635, Division 420.

The Applicant consulted with the WRD regarding the applicable requirements for a tailings dam at this location. The Applicant proposed and the WRD designated the proposed tailings conceptual design as a low hazard dam, and its design criteria (e.g., stability factors of safety) conform to that classification. The WRD hazard designation process is based on consideration of the effects of a dam in releasing stored water rather than tailings. The consideration of media impounded behind a dam (e.g., water, tailings) in establishing hazard designations varies by regulatory jurisdiction. However, the different systems for hazard designations commonly focus on dam failure risks to human life, public health, infrastructure damage, property losses or damage, and losses or damage to surface waterbodies regardless of the impounded media. Water quality effects associated with release of tailings via a dam breach are not a component of the hazard designation as WRD does not have the statutory authority to designate a hazard rating based upon water quality.

The Applicant's TSF design includes a dam breach analysis with forecasting of effects in the event of a dam breach through examination of the potential tailings runout. The flow path would be controlled by sloping topography. The infrastructure predicted to be affected by a full-depth breach is limited to segments of Rock Canyon Road and Twin Springs Road, but such a breach has a potential runout distance of 12 miles from the TSF. No habitations are predicted to be affected, and there are no known major water tributaries by which the flood route would be controlled. The results of the dam breach analysis would be incorporated into a facility-specific Emergency Action Plan prepared prior to construction of the facility (Golder Associates 2019b).

The proposed TSF is designed as a zero-discharge facility, which would contain all process solutions during operations and closure. The design includes double lining or containment for the impoundment, channels, piping, and other systems that would contain or convey process solutions. Facilities that would contain process solution would be equipped with leak-detection and collection infrastructure.

No subsurface water at depths shallower than 120 feet was encountered during the site investigation. Therefore, upward pressure from groundwater on TSF facilities is unlikely. Also, any uncontained seepage or releases from the facility would need to infiltrate at least that distance through the naturally occurring massive clay in the subsurface before contacting groundwater. This clay layer has been determined to have a permeability value of at least, and perhaps lower than, the liner system proposed (Golder Associates 2021, Appendix A). As such, this distance to groundwater and this naturally occurring clay represent additional protections against groundwater contamination from any seepage or releases of process solutions from the TSF. Such seepage or releases would still be a “release to the environment” but would need to infiltrate to depths greater than 120 feet to result in a release to groundwater (requiring more than 1,000 years under a unit gradient to infiltrate that distance).

The engineered earthen-embankment design of the TSF is the industry standard because these designs make use of materials mined during construction, which reduces the requirement for alternative materials with associated reductions in ground disturbance, transportation emissions, and cost. The technologies required to design, build, operate, and monitor a tailings facility with the specifications of the Project are available, practical, and necessary as demonstrated by their effective use at numerous regional tailings facilities constructed in accordance with the regulatory requirements of their respective jurisdictions. When installed to design specifications, synthetically lined facilities using prepared subgrades, embankment dams designed for seismic conditions, and leak-detection, monitoring, and inspection equipment and procedures have been as protective or more protective of water resources compared to other designs in use as assessed by operational upset conditions including tailings excursions, process water releases, and facility leakage from existing facilities in the arid western US. Generally, the US has the most stringent regulations with regard to lined facilities and leak detection. Specific liner designs are not always required even in Canada and Australia, which allow sub-aqueous and unlined TSFs when there is no neighboring water use.

Until recently, there have been no global standards in the design, construction, or operation of TSFs, with many countries having differing rules regarding dams that are rarely updated (Nelson 2023). However, on August 5, 2020, the Global Industry Standard on Tailings Management was launched, which aims to achieve strong social, environmental, and technical outcomes with a goal of zero harm to people and the environment. The standard covers the entire tailings facility lifecycle—from site selection, design, and construction, through management and monitoring, to closure and post-closure (International Council on Mining and Metals 2020). See Section 2.2.3.8 for further information on cyanide management.

#### 2.2.3.4 Alternative Lining Systems

Lining systems for mine waste storage facilities generally use a combination of materials and components that complement each other to achieve the desired performance outcome—primarily to contain waste and waste solutions and prevent releases to the environment. These include:

- Single liners, either from natural materials or geosynthetic materials;
- Composite liners, which are generally two types of liners that complement each other and can consist of natural materials with one geosynthetic liner or geosynthetic materials for both components; and
- Dual liners, which are two liners (either single or composite) that are separated by a drainage system.

Single-liner systems are typically employed at locations where the storage facility is not located near surface water or groundwater resources. The dual-liner systems are typically employed when the depth to groundwater below the storage facility is shallow (i.e., less than 100 feet).

There are many different natural and geosynthetic materials available for lining systems. Natural liners typically use clay-like materials, and geosynthetic materials available consist of polyethylene, polyvinyl chloride, elastomeric bituminous, polypropylene, or GCL. The use of compacted clay can result in issues with material variability, drying and shrinkage cracking of compacted layers, and increases in permeability from geochemical reactions with tailing residues. Many of the geosynthetic liners are thin and thus susceptible to damage during storage, transport, installation, and possibly operation, and they can also be affected by chemical and temperature effects.

Manufactured GCLs are basically dry, and when they encounter water, the bentonite in the GCL structure hydrates and swells, becoming a gel with a low permeability. In the early stages of construction when the GCL may be exposed to the weather, the bentonite in the GCL is subject to possible erosion from rainfall. However, once the GCL is covered, this issue does not generally exist. Wetting–drying and freezing–thawing cycles have the potential to affect the density, hydraulic permeability, and, hence, the performance of GCLs that are exposed at ground surface to climatic conditions. However, when paired with geomembrane liners, which are not susceptible to these climatic conditions, the GCL provides a very low-permeability layer that is less susceptible to mechanical defect than its companion geomembrane liner. When being placed, a defective wrinkle in a liner allows seepage to enter the void under the geomembrane, making the geomembrane less effective over that part of the liner system. Defects and wrinkles can be reduced in the liner system through effective quality control inspections during construction.

If not suitable for local conditions, or if not properly placed with adequate inspections, geomembrane-lined structures can leak. Leakages have occurred at numerous mines throughout the world with geomembrane-lined structures. For example, leakages were detected in 2008, 2010, 2012, and 2013 at the Talvivaara mine in Finland, which opened in 2008, and leakages were reported after 3 years of operation at Kokoya Gold Mine in Liberia, which opened in 2014 (Tuomela et al. 2021). The engineering process to develop an optimum lining system requires creating a site-specific design that accounts for local factors including climate, geology, hydrogeology, seismicity, and vegetation (Purdy et al. 2017), and placement of the liner is extremely important to ensure that there are no defects in the materials or deviations from the liner’s design. Liner repair is generally not feasible once a section of liner is covered by tailings. If a potential leakage is identified in an area of liner that is covered by tailings, operational measures are generally employed to minimize that leakage such as creating a tailings beach to minimize ponded solution in the area with leakage.

The liner design proposed by the Applicant has been developed with consideration of local climate conditions, geology, hydrogeology, seismicity, and vegetation. Field and laboratory geotechnical programs were conducted to characterize the subgrade materials along with a seismic analysis to examine the types of strain that could be placed on those materials (i.e., settlement and differential settlement of the tailings load on the liner system and subgrade materials). The proposed TSF lining system consists of a 6- to 12-inch-thick native prepared subgrade which would be sufficiently thick to meet the OAR requirements for permeability and stability. The quality control elements for the subgrade at the time of construction would verify that the design was implemented. A thicker subgrade would also meet criteria but would not necessarily reduce liner failure risk.

The types of leakage detection and collection systems incorporated in the TSF design are effective in identifying liner seepage so that tailings management can be implemented to limit the rate of seepage with the potential to affect receiving water quality. This includes evacuating leakage via the collection and underdrain system (located between the primary and secondary liners) plus relocating ponded areas away from zones where leakage has been detected. Evacuation of leakage would continue until the leakage rate (measured in gallons per day) is reduced to a permit-specified threshold.

An alternative lining system could involve the use of electromagnetic leak-detection mechanisms, which are not dependent on the size of a leak for detection. Electromagnetic leak-detection methods typically use either a two-electrode method or an electrode grid method. Both methods check for variability in an induced electric field on a facility and its liner system. When a liner is functioning without leaks or defects, the flow of electricity is inhibited by the liner. When leaks or defects are present, electrical current is able to flow into the subjacent material below the liner. Within limitations, both the two-electrode and the electrode grid methods can detect potential leaks and defects, although the electrode grid method provides better spatial resolution as to the leak or defect location than the two-electrode method. Both methods are durable and typically usable through the life of a facility but require interpretation of their indirect detection results based on changes in atmospheric electrical activity and the changing electrical properties of the facility as it is loaded with solids and liquids placed above the liner. The primary advantages of an electromagnetic leak-detection method are that it can detect potential leaks during the construction and commissioning phase of a liner (prior to loading of the liner), and it is less expensive to implement in a single-liner system than implementation of a double-liner system with leak collection. However, the use of drain pipes and liner ties embedded into a concrete layer underneath the TSF may disrupt the ability of the electrodes to function as intended.

Electrode grid leak-detection methods have been used for monitoring leaks in landfills since the 1990s. They are typically employed because they provide potential leak location observations at a lower cost than double-liner and groundwater monitoring systems. They have typically not been employed for double-liner systems in mine impoundments because their monitoring information would be redundant to the double-liner leak collection (when both systems are functioning correctly) without the double liner’s capacity to collect leakage.

In summary, both the alternative electromagnetic leak-detection and Applicant-proposed double-liner system can be developed in ways to locate leaks during use of a lined facility, but only the double-liner system is designed to collect leakage during operations. Therefore, the utility of an electrode grid applied to a double-liner system would be confirmation of leak-detection observations. The proposed double-liner system with leak-detection and collection systems incorporated has been designed to contain waste and waste solutions and prevent releases to the environment and is considered the preferred lining system for the proposed Project.

#### 2.2.3.5 Alternative Tailings Management

Filtered and stacked tailings would be an alternative to conventional tailings disposal and would reduce the volume and water management requirements of the TSF. However, generation of process water from tailings filtration may negatively affect the process water balance, producing a large volume of process water that would require storage in a separate water storage facility and/or water treatment and discharge, resulting in a facility that is no longer zero discharge. Therefore, filtered and stacked tailings are not considered to be a reasonable alternative to conventional tailings disposal.

Paste tailings (i.e., tailings mixed with cement and placed underground as backfill) would be an alternative to conventional tailings disposal and would reduce the volume of tailings to be stored in the

TSF. The use of paste tailings requires the tailings material to be dewatered, mixed with cement, and transported or pumped down into the underground mine workings. This method is often used when a TSF is full, when environmental restrictions on surface storage make it necessary, or when the tailings are clean and do not pose a risk of groundwater contamination. Paste tailings are typically used in overhand mining. The proposed Project design utilizes underhand mining methods because the bedrock at the mine is relatively weak.

Based on laboratory results, the tailings would be fine-grained, with high water content. Structural integrity of the underground workings may be compromised due to the low particle size of the tailings versus the basalt. The amount of cement required to create structurally stable paste tailings is higher than that required to create the appropriate strength for the cement rock fill, resulting in greater use of resources and higher emissions from the manufacturing and transportation of concrete. Also, the addition of a large amount of cement decreases the amount of tailings that would be used by backfilling.

Additional processing facilities would need to be constructed to use the paste tailings method, including a filtration plant to partially dewater the tailings; additional concrete mix plant facilities; additional pumps and piping systems or mobile equipment to convey the tailings underground; and staging and storage areas with engineered containment systems to stockpile mill tailings and reagents. Additional mining crews would also be required for installing and removing pilings. These additional facilities would result in greater use of materials, greater energy use, and greater land disturbance than the proposed storage of tailings in a TSF.

There is no containment or leak detection for this option, so groundwater would not be protected as compared to tailings storage in a lined TSF facility. The arsenic levels in the groundwater surrounding the Project are lower than the arsenic levels in the tailings decant solution water would be. More robust treatment for cyanide and acid generation would be required to use the tailings as backfill, including strict monitoring of groundwater for contamination. Should monitoring show elevated cyanide, metals contamination, or acid rock drainage effects, there would be no effective strategy to mitigate this, resulting in groundwater effects that could last for many years.

A TSF would still be required under this alternative, which would not eliminate the risks to wildlife from ingestion of supernatant water. The use of tailings as backfill would reduce the overall volume of the TSF but would not eliminate it. A reduced TSF may encompass the same footprint as the Applicant’s proposed facility without raising the embankments or could encompass a smaller area. However, there would still be a TSF and supernatant pond under this alternative.

Finally, the cutoff grade for ore would be increased, resulting in less extraction of mineral reserves and in a less efficient process overall. In the event that the cutoff grade is increased substantially, the Project may not be economically viable.

In summary, due to the greater risks to health and safety, increased environmental effects, higher resource use, and continued need for a TSF under this alternative, the use of paste tailings is not a viable alternative to the proposed tailings disposal method.

#### 2.2.3.6 Alternative Gold Extraction Processes

The geology of the gold deposit and the mineralogy of the ore generally determine the selection of the best gold extraction method for a particular ore. Alternative gold extraction and recovery methods include the following:

- **Gravity concentration** creates movement between the gold and host rock particles in a manner that separates the heavy particles (gold) from the lighter particles of rock, much like a prospector's gold pan. It is used mainly for recovery of gold from placer deposits that contain coarse native gold and is often used in combination with flotation and/or cyanidation. Gravity concentration has a lower overall cost per ounce produced compared to cyanide leaching and froth flotation because the equipment is cheaper to purchase and is less expensive to run on a day-to-day basis (Sepro Mineral Systems 2023). Gravity concentration would not be suitable for the type of gold ore found at the Project site.

- **Hydrometallurgical methods** involve the use of aqueous solutions for the recovery of metals from ores, concentrates, and recycled or residual materials. They are normally employed for recovery of gold from oxidized deposits (heap leach), low-grade sulfide ores (cyanidation, carbon-in-pulp, CIL), and refractory gold ores (autoclave, biological decomposition followed by cyanidation).

- **Pyrometallurgical methods** use roasting to extract gold. Pyrometallurgical and hydrometallurgical methods in combination are used for highly refractory gold ores (carbonaceous sulfides, arsenical gold ores) and the ores that contain impurities that have to be removed before cyanidation, which results in a high consumption of cyanide. The ore at the Project site has not been oxidized in an HLP, is low in sulfide content (Ausenco 2022), and does not have ultra-fine particles, so these methods would not work well to extract the type of gold ore found at the site.

- **Flotation** separates and concentrates ores by altering their surfaces to a hydrophobic or hydrophilic condition—that is, the surfaces are either repelled or attracted by water. Flotation is widely used for the recovery of gold from gold-containing copper ores, base metal ores, copper nickel ores, platinum group ores, and many other ores where other processes are not applicable. It is also used to remove interfering impurities before hydrometallurgical treatment, for upgrading of low-sulfide and refractory ores for further treatment. Flotation is considered to be the most cost-effective method for concentrating gold. However, different flotation methods are used for the recovery of gold from different ores. Selection of a flotation technique for gold preconcentration depends on ore mineralogy and gold particle size. The process is tailored to the ore characteristics, and a specific reagent scheme and flowsheet are required for each ore type (Bulatovic 2010). Flotation would not be suitable for the type of gold ore found at the Project site.

- **Froth flotation** is similar to the flotation method described above with the addition of reagents that create a froth with additional air bubbles in the process to promote flotation of lighter particles to the surface. As with flotation, the process is tailored to the ore characteristics and a specific reagent scheme and flowsheet are required for each ore type. This would not be suitable for the type of gold ore found at the Project site.

- **Whole mud cyanide leaching** is a gold recovery technique that involves grinding gold-bearing ores into a fine-grained particle size (i.e., similar to flour particle size). Cyanide solution is added to the ground ore along with activated carbon material (e.g., burned coconut shells, charcoal) in CIL tanks. The cyanide solution liberates the gold from the ground ore and deposits it on the organic carbon material. After liberation of the gold, the ground ore is separated from the activated carbon material. The ground ore is deposited as tailings in the TSF, while the activated carbon material is retained for additional processing steps (e.g., elution, electrowinning, refining) to produce the gold metal.

- **Heap leaching** involves stacking of metal-bearing ore into a heap on an impermeable pad, irrigating the ore for an extended period of time with a chemical solution to dissolve the precious metals, and collecting the leachate as it percolates from the base of the heap. Gold and silver are leached with a dilute alkaline solution of sodium cyanide, and the recovery method is dependent on the type of ore being processed. Although heap leaching can be less expensive than processing ore in tanks, it is less efficient at extracting gold than the tank system, and open heap leaching systems increase the risk of environmental exposure to cyanide. For these reasons, heap leaching is not identified as a preferable alternative to conducting cyanide leaching in tanks, where all finely ground ore, leaching chemicals, active carbon, and other materials would be contained and isolated from the environment.

- **Pressure oxidation (POX)** is a process that uses elevated temperatures (roughly 230 degrees Celsius), elevated pressures (roughly 35 bar or 510 pounds per square inch), and oxygen to liberate gold from ore. It is typically used when the gold particles within the ore are ultra-fine and difficult to recover using standard cyanidation and carbon adsorption processes. The POX process releases encapsulated gold grains and makes the ore more amenable for gold recovery by cyanidation in a subsequent leaching step. Pressure oxidation of gold ores is therefore a pretreatment leaching step to enhance gold recovery and is useful when the concentration of gold is low within the ore body. Challenges of using the POX method are corrosion and erosion of system parts, difficulties maintaining autoclave level control, complex operating and maintenance procedures, and plant availability. Considering these difficulties and given that POX is a pretreatment method for ultra-fine gold in ore that would still require cyanidation and carbon adsorption processes, POX is not considered to be a reasonable alternative to be considered further.

- **Offsite ore shipment** for processing at an existing gold extraction facility involves loading ore into over-the-road trucks for transport to another location for processing. Truck transportation of ore typically employs tandem side-dump trailers (40-ton combined capacity) towed by an over-the-road truck. The nearest existing processing plants suitable for processing Grassy Mountain site ore are east of Winnemucca, Nevada, approximately 150 miles from the Project area primarily via US 95 and Interstate 80. These processing plants are owned by third parties, and their availability for processing Project ores is not known. Processing ore at a different location does not remove the need for tailings disposal and process solution management using containment and lined facilities. Furthermore, transporting large volumes of ore over long distances would increase effects of the Project to some resources including air quality and greenhouse gases (GHGs) and noise. Therefore, offsite ore shipment for processing at an existing gold extraction facility is not considered to be a reasonable alternative to the proposed Project.

The gold ores to be mined at the Project site consist of high-grade ores of between 0.22 and 0.35 ounces of gold per ton and low-grade ores of between 0.06 and 0.21 ounces of gold per ton. Additional gold deposits are present in smaller concentrations but are not economically viable to process. The Applicant's proposed Project using a crushing plant, ball mill, CIL circuit, elution circuit, electrowinning plant, and smelting operation is a suitable process for the type of gold deposit found at the Project site. No alternative gold extraction processes have been identified as reasonable alternatives to the proposed Project.

#### 2.2.3.7 Alternative Cyanide-Destruction Techniques

The Applicant's proposed Project uses a sulfur dioxide/air process in the cyanide-destruction circuit. In the cyanide detoxification tank, lime would be added to the tailings to buffer pH, copper sulfate would be added as a reaction catalyst, and then sodium metabisulfite would be added as a sulfur dioxide source. There are a number of other cyanide-destruction processes including alkaline chlorination, Caro's acid, hydrogen peroxide, biological treatment, and ozone oxidation.

- **Alkaline chlorination** is a chemically heavy process, using approximately 23 gallons of 12.5 percent sodium hypochlorite solution to destroy 1 ounce of cyanide. The end result is ammonia and carbonates (Deal 2019). While this process can be used to remove high-concentration cyanide, it cannot completely accomplish degradation of cyanide (Hou et al. 2020). The primary application of the alkaline chlorination process is with solutions rather than slurries due to the high consumption of chlorine in slurry applications (Botz n.d.), so this would not be a suitable alternative for destruction of cyanide in the tailings slurry for the proposed Project.
- **Caro's acid** or peroxymonosulfuric acid, was introduced in the early 1990s as a cyanide-destruction agent. It is produced by a reaction involving hydrogen peroxide and sulfuric acid, which is very unstable, and needs to be used immediately since as the cyanide destruction occurs within a few minutes. The highly reactive chemistry is a major disadvantage in using this technology at a commercial scale (Deal 2019). This technique is therefore not considered to be a reasonable alternative for cyanide destruction.
- **Hydrogen peroxide** can be used in place of sulfur dioxide/air, and soluble copper is also required as a catalyst in the process. The process is typically applied to treat relatively low levels of cyanide to achieve cyanide levels that may be suitable for discharge. The primary application of the hydrogen peroxide process is with solutions rather than slurries due to the high consumption of hydrogen peroxide in slurry applications (Botz n.d.), so this would not be a suitable alternative for destruction of cyanide in the tailings slurry for the proposed Project.
- **Biological treatment** of cyanide is where a large number of microorganisms are used to remove cyanide in mine tailings. In this process, the cyanide is converted to ammonium and, carbon dioxide. Alternative bacteria can be used in the process, which can create ammonia and bicarbonates as an end result. Other microorganisms can degrade cyanide to ammonia under aerobic conditions, which then oxidizes to nitrate (Kuyucak and Akcil 2013). Ammonia, suspended solids, and copper are important contaminants in gold mining effluents, and since many of these biological treatment processes convert cyanide to ammonia, concentrations of ammonia may exceed regulatory limits. Other byproducts of biological treatment processes, including nitrate, can be relatively non-toxic but at high concentrations can cause harm to humans (Kuyucak and Akcil 2013). For these reasons, biological treatment is not considered a safe alternative to the Applicant's proposed use of a sulfur dioxide/air process in the cyanide-destruction circuit.
- **Ozone oxidation process** involves bubbling cyanide-bearing process solution through a reactor charged with 1.2 to 1.4 moles of ozone per mole of cyanide in solution. The ozone acts as an oxidizing agent similar to the other methodologies described above. However, this method has not been implemented on a commercial scale due to the high capital and operating costs associated with

ozone generation and is therefore not considered an effective alternative to the Applicant's proposed cyanide-destruction circuit.

The proposed Project design includes equipment and infrastructure for the detoxification and neutralization of cyanide in the mill tailings. When combined with personal protective equipment and industrial hygiene controls during operations, the Applicant's cyanide control measures are typical for mill facilities that effectively reduce or remove cyanide concentrations in process solutions to acceptable regulatory levels. None of the alternative techniques identified would achieve greater levels of cyanide destruction than the proposed use of a sulfur dioxide/air process in the cyanide-destruction circuit, and some of these alternative techniques may have greater environmental effects such as highly reactive chemistry or chemical exceedances of regulatory limits.

#### 2.2.3.8 Alternative Cyanide Management and Use Strategies

Participation in the International Cyanide Management Code (ICMC) and obtaining certification would provide best practices for the transport, management, and disposal of cyanide at the Project site. The ICMC is a voluntary certification program for companies that manufacture, transport, and use cyanide in the production of gold and silver, to help them improve their safe management of cyanide in order to limit the risks to human health and the environment (International Cyanide Management Institute 2023). Participation is open to gold and silver mining companies, manufacturers of cyanide, and transporters of the chemical.

The Applicant has designed Project cyanide facilities to align with the guidelines of the ICMC and would develop Project-specific cyanide handling and storage design criteria and operating procedures required by the ICMC during future phases of the Project. The Applicant would also follow ICMC guidelines during detailed design and construction and aims toward certification during operations (Ausenco 2023). The training involved in obtaining ICMC certification during operations would increase awareness of the risks and consequences of cyanide transportation and management, and the development of operating procedures consistent with ICMC guidelines would reduce potential inadvertent releases or exposures to the chemical, resulting in improved human health and safety and environmental protection.

An alternative cyanide use strategy would be to reduce the amount of cyanide used to process gold and silver, which may reduce the concentration of cyanide in the tailings. The concentration of cyanide required to optimize a metal-recovering cyanidation process depends on the quantity of cyanide-complexing metals available in the crushed ore. The metal reaction for metal-cyanide complexes typically follows:

$$4Metal + 8NaCN + 2H_2O + O_2 \geq 4NaMetal(CN)2 + 4NaOH$$

Two cyanide molecules are required for each metal molecule extracted from the ore. Hence, an ore with abundant concentrations of cyanide-complexing metals (e.g., gold, silver, copper) would need a higher concentration of cyanide to beneficiate those metals than an ore with lower concentrations of metals (such as gold ore with no copper present). Therefore, using lower concentrations of cyanide in process solution for the proposed Project would result in less gold and silver production.

Alternatively, managing cyanide concentrations in process solution following the removal of gold from ore (cyanide levels in tailings) would be environmentally protective without affecting gold and silver production. Cyanide concentrations in tailings and process solution are proposed to be managed via cyanide destruction before being transferred to the TSF. In practice, the cyanide concentration in process waters is well known and maintained at a specified level to optimize gold recovery. As a result, the amount of lime, copper sulfate, and sodium metabisulfite required to reduce cyanide concentrations is also well known. Therefore, rather than using lower concentrations of cyanide in process solution, the use of chemical components to reduce cyanide concentrations after metals processing is the preferred alternative.

Monitoring of cyanide concentrations in process waters in the environment (e.g., the TSF) is a common compliance monitoring requirement, and variability in these concentrations is generally low under normal operating conditions. Conventionally, compliance samples are analyzed by a certified analytical laboratory to ensure quality and consistency with the monitoring data. The Applicant proposes to monitor cyanide levels from samples collected from the TSF and reclaim pond during operations (Ausenco 2023).

An additional cyanide monitoring method would be use of an in-line device such as a Cynoprobe™, which generates more frequent monitoring data capable of capturing fluctuations in the process cyanide solution. The Applicant has indicated that the Cynoprobe™ equipment would be used to monitor the cyanide prior to going into the tailings (Van Treek, pers. comm. 2023). This equipment would allow for adjustments to be made in the cyanide-destruction process (e.g., adding more or less ferric sulfate). However, such cyanide device measurements typically do not replace compliance monitoring using analyses by a certified analytical laboratory because data from such devices do not follow an agency-certified, auditable methodology. The Cynoprobe™ equipment device measurements could be used to confirm the range of cyanide concentrations from the compliance sampling and laboratory analyses and could assist with slight adjustments in metal recovery and in cyanide-destruction management but should not be a replacement for stringent compliance sampling and laboratory analyses. Therefore, the use of both sampling and laboratory analyses and an in-line device, as the Applicant proposes, is preferred.

#### 2.2.3.9 Non-Cyanide Gold Extraction Processes

Cyanidation is the leading industrial process for extracting gold from different origins because it provides high selectivity for gold over other elements. However, there are disadvantages of using cyanide as a leaching agent, including prolonged leaching time (commonly 24–72 hours for gold ores in tank leaching systems), high costs of the cyanide reagent, and potential for cyanide leakage into groundwater or exposure of cyanide to humans and wildlife (Jorjani and Sabzkoohi 2022). Many organizations and countries around the world have issued effective cyanide management policies, and some countries have banned the use of cyanide in gold extraction, including Germany, Costa Rica, Argentina, the Czech Republic, and Turkey (Hou et al. 2020). For the proposed Project, alternative methods of processing gold from ore without the use of cyanide are considered in this section.

- **Gravity separation** separates minerals according to their relative density (specific gravity). There are various types of equipment that can be used to separate the crushed heavier gold from the waste rock. These include jigging machines, shaking tables, chutes, spiral concentrators, and separating cones. These types of equipment are generally used for placer deposits and small gold particles and would not be suitable for the type of gold ore found at the Project site and are dismissed from further consideration.
- **Microbial leaching** is the process by which metals are dissolved from ore-bearing rocks using microorganisms. Microbial technology can assist in the recovery of low-grade ores that cannot be

economically processed with chemical methods. This leaching method has been used to recover metals including copper, uranium, gold, silver, and silica. On a large scale, the microbial leaching process may cause environmental problems if not managed properly, causing seepage of leach fluids containing large quantity of metals and low pH into the environment (Bioencyclopedia 2023). The microbial leaching method would therefore not be a suitable alternative for processing the large quantities of high-grade gold at the Project site and is dismissed from further consideration.

- **Biological gold retrieval methods** used to biomine gold include bioleaching, bio-oxidation, bio-precipitation, bio-flotation, bio-flocculation, bio-sorption, bio-reduction, bio-electrometallurgical technologies, and bioaccumulation (Rana et al. 2020). These complex biomining processes involve various microbial communities with different compositions and functions. They are being used to retrieve gold and other precious metals from e-waste or low-grade ores and are still experimental, although commercial implementation of microbial-assisted gold recovery has commercially been applied using heaps, dumps, and stirred tank bioreactors (Rana et al. 2020). These biological gold retrieval methods would not be suitable for the extraction of gold at the Project site due to the large quantities of high-grade ore that would need to be processed and are dismissed from further consideration.

- **Alternative non-cyanide lixiviants** (leaching agents) have been developed and tested, including chloride, thiourea, and thiosulfate. Some chemicals used in these alternative processes, such as ammonia, or elements leached from ore such as mercury, pose health, safety, and environmental concerns. Alternative non-cyanide lixiviants are described below.

  - **Chloride** is a potential alternative leaching agent, and there have been pilot tests for chlorination in the recovery of gold by various processes. It requires sulfide breakdown using elevated temperature and pressure, and decantation and neutralization before leaching. The leaching residues can contain high levels of copper and arsenic, which could be hazardous waste (Rinne et al. 2021). Furthermore, the high chloride content is a problem that could be addressed by filtering and washing, but this would result in increased water consumption and processing costs. Direct chloride leaching may be environmentally competitive for raw materials where only partial oxidation of sulfides is required to liberate gold. Considering that the use of chloride for gold recovery is still in the experimental stages, that there are additional hazardous wastes that must be managed, and that additional costs and resources would be required for this process, this alternative non-cyanide gold extraction process is not considered to be a reasonable alternative to the proposed use of cyanide.

  - **Thiourea** containing various oxidants, including iron, hydrogen peroxide, oxygen, and formamidine disulfide, can dissolve gold into solution. However, some of these oxidants can cause excessive consumption of thiourea, which makes it unattractive for use at a large scale due to high costs. The use of thiourea for gold recovery is not well developed, and additional costs and resources would be required for this process. Thiourea as an alternative leaching agent is not considered to be a reasonable alternative to the use of cyanide in the proposed Project.

  - **Thiosulfate** is considered the most promising alternative to cyanide due to its non-toxicity, low price, high leaching rate, and excellent characteristics in dealing with carbonaceous and copper-bearing gold ores (Xie et al. 2021). However, the chemistry involved in the thiosulphate leaching process is more complex and less robust than the cyanide leaching process and is therefore more difficult to optimize and more sensitive to operate (SGS Mineral Services 2008).

Thiosulfate leaching has been largely developed by Newmont Mining, Placer Dome, and Barrick Gold (Aylmore 2016). In Australia, the process has been tested at a demonstration plant in the Western Australian goldfields town of Menzies with promising results (CSIROscope 2018). In the US, Barrick Gold Corporation developed and commercialized a copper-calcium thiosulfate process, which was in use at Goldstrike, Nevada, until 2024. As part of the thiosulphate process at Goldstrike, gold-bearing ore was heated as a thick slurry of ore, air, water, and limestone in large pressure chambers and then pumped into a “resin-in-leach” circuit inside large stainless steel tanks. Within the tanks, the slurry interacts with thiosulfate and resin (a fine, bead-like material) that collects the gold. At full capacity, 13,400 tons of ore was processed daily, with leaching taking place simultaneously in two sets of seven tanks (CSIRO 2015). The thiosulfate leaching process was used at Goldstrike for “double refractory” ore, which is rock containing fine-grained gold with both sulfide and organic carbon. In 2024, the double refractory ore was depleted, and the mine was converted to a cyanide leach process. The type of ore found at Grassy Mountain is not “double refractory.”

Gold recoveries from the thiosulfate leaching process are difficult to achieve and sustain in practice due to the complexity of reactions, which rely on narrow ranges of pH and oxidation conditions to be effective. Variability in ore feed and processing conditions results in loss of gold recovery unless actively balanced in the process. While thiosulfate does not have the same toxicity as cyanide, use in gold production still results in a process solution containing high concentrations of metals and other analytes. Therefore, the process solution still needs to be managed and contained to prevent exposure to the environment.

Of all the non-cyanide gold extraction processes identified, only the thiosulfate leaching process may be a feasible alternative to the use of cyanide. Thiosulfate leaching does not remove the need for tailings disposal and process solution management using containment and lined facilities. When compared to a cyanide process equipped with cyanide destruction, the environmental effects associated with thiosulfate may be similar. Further analysis is required to understand the potential effects of using thiosulfate leaching in the extraction of gold as an alternative to the proposed Project. The remaining gold extraction processes would not be suitable for the type of gold deposit found at the Project site and/or could create greater environmental effects than the proposed use of cyanide.

#### 2.2.3.10 Alternative Operations and Scheduling

Alternative operations and scheduling actions include **short interval control (SIC)**, which is a structured process for identifying and acting on opportunities to improve effectiveness and efficiency of mining processes (production, development, and services). The intended outcome is a continual improvement loop of increased productivity and minimized waste. SIC improves use of equipment, personnel, and rock extraction by reducing waste in the following areas:

- Transportation (moving rock piles several times);
- Inventory (too much/too little of what is required/not required; difficulty locating supplies);
- Motion (multiple moves for drill set-up);

- Waiting (for other tasks to be completed, in fueling lines/congested traffic);
- Overproduction (overusing equipment for one purpose, potentially putting another sector behind);
- Overprocessing (making processes more complicated than necessary); and
- Defects (having to complete re-drills or placing redrill in the wrong location).

Many industry leaders who have implemented the concept have seen significant productivity and cost improvements, at limited expense (the cost of installing wireless infrastructure and associated software). However, each mine needs to be set up specifically for that operation (Global Mining Guidelines Group 2019). SIC as an alternative to mine operations and scheduling may increase productivity and revenue and potentially minimize waste and transportation emissions, which would have minor beneficial effects to the environment. However, this process is just one method of managing the gold extraction process at the Project site, and other options exist that have similar benefits. The use of this technology is not considered to be an alternative to the proposed Project, but rather it, or similar technology, can be incorporated into the proposed Project voluntarily by the Applicant or through a permit condition set by DOGAMI.

#### 2.2.3.11 Alternative Water Supplies

Mining and processing require consumptive uses of water for ore processing, dust control, and drilling operations. Therefore, water is required for consumptive use from a permitted source per its water right authorization. Water management at the site includes maximizing recycling and re-use to minimize water use. There are no surface water supplies suitable for this Project, and therefore, the two groundwater sources identified in Section 2.2.2.5 are considered. There is no net environmental benefit associated with conveying water from a source 25.3 miles away compared to utilizing a local source. There are no alternative water supplies identified for the proposed Project.

#### 2.2.3.12 Alternative Power Supplies

Mining and processing require an electrical power source for operation of mills, pumps, ventilation fans, and other equipment installed in the processing facility and underground mine. This equipment operates on conventional power available from regional power distributors stepped down or up to the required voltage for each specific use. Conventional sources of electrical power are identified in Section 2.2.2.6.

During closure, onsite power infrastructure would be removed, and power would not be available for monitoring purposes during the post-closure period. However, compliance monitoring has low power requirements that could be satisfied by local solar panels with contingent short-term generator backup, and sampling equipment would have battery power from the equipment itself.

Onsite power generation utilizing diesel or natural gas for fuel is less efficient than purchase of line power from a regional power supplier because it requires transport and/or conveyance of those fuels to the Project location prior to generation to meet the same power demand, resulting in greater effects to some resources including air quality and GHGs, among others. Onsite generation from fuels also does not benefit from the use of renewable energy sources included in the regional power supply.

#### 2.2.3.13 Alternative Fuel Supplies

**Biodiesel** can be used in underground mines to reduce the buildup of emissions in enclosed spaces. Heavy equipment used to haul ore and waste rock through the Project area would typically use diesel, which generates diesel particulate matter (DPM). Miners can be exposed to more than 100 times the typical amount of DPM found in aboveground air (Clean Cities 2009). A number of strategies can be used to reduce miners' exposure to harmful particulates by improving ventilation, using vehicles with specially sealed and pressurized cabs, improving maintenance, installing emission control devices, and using biodiesel. Biodiesel is produced from renewable sources such as new and used vegetable oils and animal fats, and it is cleaner burning, non-toxic, and biodegradable. Biodiesel fuel produces less particulate matter when it burns, making it a safer option for miners working underground, and is compatible with most diesel vehicles and equipment. Although biodiesel is more expensive than petroleum diesel, costs may be offset since there would be no requirements for emission control devices or costly ventilation system modifications to reduce emissions to acceptable levels (Clean Cities 2009). Biodiesel is considered to be a viable alternative fuel supply for diesel-operated Project vehicles and equipment.

#### 2.2.3.14 Alternative Reclamation Strategies

Alternative reclamation objectives are identified in Section 2.2.2.7. Site reclamation to industrial use is speculative at this time as no potential future post-reclamation industrial uses have been developed for consideration.

The Applicant's reclamation plan calls for the dismantling, salvage, sale, or authorized offsite disposal of mill infrastructure. Non-movable mill components such as slabs and foundations would be broken, buried, and then recontoured in place. In addition to these proposed measures, a closure-period inspection of process facility components for contamination is common practice prior to closing those components in place. If contamination is identified, appropriate remediation would be undertaken prior to recontouring the components in place.

The Applicant proposes to remove and store topsoil for a number of years, regrade disturbed surfaces, re-spread 12 inches of the stored growth media, and revegetate using seeds. This strategy would likely result in a revegetated area over time. However, the depth of the stockpile and the length of time for which it is stored affects the quality of the soil at replacement, with longer times and deeper soils being less effective. An alternative may be to supplement the 12-inch growth media layer with additional topsoil mixed with manure to provide a more fertile soil environment for seeds to grow. The additional of topsoil and manure would aid in bringing essential nutrients back to the system, which are essential for an ecosystem to be sustainable over the long term. The State of Nevada encourages using irrigation to establish seedlings more quickly if water rights are available (Sagebrush Ecosystem Council 2019).

Planting sagebrush shrubs and other native vegetation plants (in areas not covered by permanent liners) would aid in establishing multi-layered ecosystems more quickly and would replace the sagebrush habitats lost from construction and operations. Developing a vegetation plan in collaboration with the ODFW and the BLM and other regulatory agencies to include shrubs as well as seeds would assist in more quickly restoring disturbed areas. These additional restoration actions would improve vegetation establishment and restore habitats more quickly in order to achieve a self-sustaining ecosystem comparable to undamaged ecosystems in the area.

The State of Nevada requires compensatory mitigation for impacts to sage-grouse habitat for current mining operations in the state (Sagebrush Ecosystem Council 2019). Oregon has a similar requirement to ensure net conservation benefit to sage-grouse habitat when habitat is impacted. The Applicant proposes to follow the ODFW's Fish and Wildlife Habitat Mitigation Policy to comply with the compensatory mitigation standard for direct and indirect impacts to wildlife habitat. This includes a combination of obtaining and managing one or more offsite HMAs for the duration of the Project's impacts and purchasing credits from a mitigation bank. Alternatively, for greater sage-grouse habitat, the Applicant may choose the ODFW Sage-Grouse Mitigation Program In-Lieu Fee (ILF) option. See Section 5.5 for information on compensatory mitigation for the Project.

#### 2.2.3.15 Review of Best Available, Practicable, and Necessary Technology

A review of best available, practicable, and necessary technology has been conducted for Project components and has been incorporated into the discussions of various alternatives above (Appendix A). The application of best available technologies for environmental protection extends to the following Project features:

- Mine construction methods, including extracting ore, backfilling, and transporting mined materials;
- Mill operations, including chemical processing, cyanide management, air quality controls, process solution containments, wildlife exclusion, and mill closure;
- Tailings management, including disposal, TSF design, leak detection, long-term pollution prevention controls, wildlife exclusion, and TSF closure;
- Operations management, including water management, fugitive dust control, equipment maintenance, and operations monitoring;
- Acid rock drainage management;
- Hazardous materials handling, storage, and management; and
- Spill and emergency response.

The identification of alternative technologies for each of these is described in Section A-3, and a summary of recommendations is provided in Section A-4 of Appendix A.

### 2.2.4 Alternatives Eliminated

Alternative Project components are evaluated in Section 2.2.3. Of these, the following alternatives have been eliminated from further analysis:

- **Alternative locations for mine facilities.** No alternative locations for mine facilities were identified that would practicably reduce the footprint of aboveground facilities in the Project area or minimize transportation of materials throughout the site.
- **Alternative mining strategies.** An open-pit mining alternative would require a larger surface area for gold extraction, would produce more waste than under the proposed underground mining method, and would result in a permanent landscape feature requiring additional compensatory mitigation.

- **Alternative TSF designs.** Tailings management using filtered tailings and paste tailings options would require construction of additional infrastructure for tailings disposal, water management, and stormwater diversion while generating process waters that would require treatment and discharge instead of operating as a zero-discharge facility.
- **Alternative lining systems for the TSF and TWRSF.** The proposed liner design has been developed with consideration of local climate conditions, geology, hydrogeology, seismicity, and vegetation, and no alternative lining systems have been identified that would improve liner performance.
- **Alternative gold extraction processes.** The proposed crushing plant, ball mill, CIL circuit, elution circuit, electrowinning plant, and smelting operation are suitable for processing the type of gold deposit found at the Project site, and no practicable alternative gold extraction processes using cyanide have been identified. Offsite ore processing is not considered to be a reasonable alternative since large quantities of ore would need to be shipped long distances, which would increase deleterious effects to some resources as compared to proposed onsite processing.
- **Alternative cyanide-destruction techniques.** None of the alternative techniques identified would achieve greater levels of cyanide destruction than the proposed use of a sulfur dioxide/air process in the cyanide-destruction circuit, and some of these alternative techniques may have greater environmental effects such as highly reactive chemistry or chemical exceedances of regulatory limits.
- **Alternative cyanide management strategies.** No alternative cyanide management strategies have been identified that would result in reduced net environmental effects.
- **Non-cyanide gold extraction processes.** With the exception of the thiosulfate leaching process, the remaining non-cyanide gold extraction processes would not be suitable for processing the type of gold deposit found at the Project site and/or could create greater environmental effects than the proposed use of cyanide.
- **Alternative water supplies.** No reasonable water supply alternatives have been identified that would result in reduced net environmental effects.
- **Alternative power supplies.** No reasonable power supply alternatives have been identified that would result in reduced net environmental effects.
- **Alternative reclamation strategies.** Reclamation of the site to future potential uses beyond current livestock, wildlife, and recreational uses would be speculative and is therefore not considered further. No alternative reclamation strategies have been identified for the proposed Project.

### 2.2.5 Project Component Alternatives Considered in the Environmental Evaluation

Alternative Project components are described in Section 2.2.3. Of these, the following have been identified as potentially practicable alternatives to proposed Project components:

- **Alternative operations and scheduling.** Use of SIC as an alternative to mine operations and scheduling may increase productivity and revenue and potentially minimize waste and transportation emissions, which would have some beneficial effects to the environment. However, this process is just one method of managing the gold extraction process at the Project site, and other options exist that have similar benefits. The use of this technology is not considered to be an alternative to the proposed Project per se, but rather it, or similar technology, can be incorporated into the proposed Project voluntarily by the Applicant or as mitigation through a permit condition set by DOGAMI. For purposes of this evaluation, SIC or similar technology will be considered as a BMP rather than as an alternative to mine operations and scheduling as discussed in Chapter 5 and Appendix A.

- **Alternative fuel supplies.** Biodiesel fuel produces less particulate matter when it burns, providing a safer option for miners working underground, and is compatible with most diesel vehicles and equipment. Although biodiesel is more expensive than petroleum diesel, costs may be offset since there may be no or reduced requirement for emission control devices and costly ventilation system modifications to reduce emissions. For these reasons, the use of biodiesel is considered to be a viable alternative fuel supply for diesel-operated vehicles and equipment. Using biodiesel is not an alternative to the proposed Project to be evaluated in the EE, but instead can be considered a mitigation measure to reduce emissions and associated air quality and GHG effects. As such, using biodiesel is included in Chapter 5.

- **Alternatives to the use of cyanide.** The thiosulfate leaching process was initially considered to be a feasible alternative to the use of cyanide for gold extraction. However, since this EE was initially drafted, further evaluation of the thiosulfate leaching process has been conducted, and this option is no longer considered to be a reasonable alternative to the Applicant's proposed Project. The evaluation of potential effects from using thiosulfate leaching was initially evaluated in this EE as an alternative to the Applicant's proposed Project and is retained for informational purposes.

- **Alternative reclamation strategies.** Additional reclamation actions may aid in establishing a self-sustaining ecosystem more quickly, including supplementing growth media with additional topsoil/manure to provide a more fertile soil environment, planting sagebrush shrubs and other native vegetation plants (in areas not covered by permanent liners), and developing a vegetation plan in collaboration with the ODFW and the BLM to include shrubs as well as seeds.

In summary, there are three alternative mine components to be included as BMPs and/or mitigation as discussed in relevant sections of this EE and one alternative that will be analyzed in detail in the EE. The thiosulfate leaching process may be a feasible alternative to the use of cyanide for gold extraction and is incorporated into this EE as Alternative A (see Section 2.2.6.3).

### 2.2.6 Project Alternatives to be Evaluated in Detail in the Environmental Evaluation

This section describes the alternatives considered for evaluation in this EE including the Applicant's proposed Project, the No Action Alternative, and Alternative A (use of the thiosulfate leaching process) developed through this evaluation.

#### 2.2.6.1 Applicant's Proposed Project

The Applicant's proposed Project is described in detail in Section 2.1.

#### 2.2.6.2 No Action Alternative

Under the No Action Alternative, a Consolidated Permit would be denied, and the proposed mine construction, operation, reclamation, and mitigation would not occur. Under this alternative scenario, the Applicant would not mine gold in the Project area, and the consequences of the continued current use or other likely uses of the Project site are considered.

Paramount (the Applicant's parent company) currently owns the surface rights in the Grassy Mountain deposit area under three patented mining claims, subject to underlying agreements and royalties to subsurface lode claim holders. The surrounding surface rights associated with locations of proposed Project surface facilities are owned by the federal government and managed by the Vale District office of the BLM. The proposed Access Road Area is located on public land administered by the BLM and private land controlled by others.

Under the No Action Alternative, the gold deposit would not be extracted and the Applicant may end its lode mining claim lease agreements with subsurface lode claim holders and may retain or sell its own lode mining claims and/or surface rights at the Project site. The surface rights owned by the BLM would continue to be retained by the federal government. The Project area is currently used for grazing and dispersed recreation and supports an existing road network that provides local access. Future use of the site could include these continued uses, or it could be used for other purposes. However, with no alternative plans suggested, it would be speculative to attempt to identify alternative specific site uses. For the purposes of this EE, it is assumed that the site would not be developed and would continue to be used as it is currently, for grazing and dispersed recreation.

#### 2.2.6.3 Alternative A

Use of a cyanide alternative for processing ores to produce gold would be a modification of the Applicant's proposed Project that would primarily affect the processing components. This replacement of cyanide with a thiosulfate reagent for processing ores is analyzed in this EE as "Alternative A."

The acreages of disturbance associated with Alternative A would remain unchanged compared to the proposed Project (see Table 2-1 and Figure 2-2). However, activities associated with the process plant would be modified for the use of a thiosulfate reagent.

Site preparation, construction, and operation of most surface facilities would be the same as in the Applicant's proposed Project including the process plant workshop and warehouse building, gold room, assay laboratory, administration building, truck shop and warehouse, fuel storage depot, vehicle wash-bay facility, parking areas, yards and laydown areas, electrical substation, meteorological station, guard house, and explosives magazine.

Growth media storage, reclamation borrow areas, and invasive species control would also be the same as under the Applicant's proposed Project. Underground mining methods, including mining drilling and blasting and dewatering would also remain the same. The TWRSF and ROM ore stockpile would operate in the same way as that described for the Applicant's proposed Project.

The **process plant** would be constructed in the same manner and located in the same place as the Applicant's proposed Project, but its interior components would be modified in Alternative A as follows:

- The reagent mixing area would be modified from a cyanide handling area to a thiosulfate manufacturing area. The chemicals used to manufacture thiosulfate would be stored in tanks that feed a series of polysulfide reactors and day tanks where the manufacture occurs and finished thiosulfate is retained for use. The use of ammonia would require specific handling and storage requirements. The thiosulfate manufacturing area would require a **boiler** and **cooling tower**.
- The grinding circuit for ore would not change. The use of thiosulfate may or may not modify the target particle size for grinding.
- Two resin-in-leach (RIL) columns would be used instead of CIL columns. RIL columns contain a rubber-like resin material (instead of activated carbon), which is mixed with the ground ore and thiosulfate reagent with additions of oxygen and lime to control the process's oxidation-reduction state and pH.
- The elution process would be modified to include the addition of copper sulfate reagent. The copper sulfate would be stored as a dry product in bags prior to addition.
- Thiosulfate regeneration would replace carbon regeneration. Recycled process solution from the tailings would be transferred to a newly designed water treatment plant that collects the thiosulfate as a concentrate. The thiosulfate concentrate would be mixed with regenerating reagents in a heated process and then added back to the RIL columns.
- Since there would be no cyanide use in Alternative A, there would not be any need for cyanide destruction.
- **Air quality controls and procedures** would need to be added to the process plant to control hydrogen sulfide emissions from the use of sodium bisulfite, molten sulfur, and thiosulfate. Air quality monitoring and controls would also be required to monitor and manage ammonia emissions from the process.

The **mill** building would be a steel-frame and metal-clad structure containing reagent tanks and storage tanks with secondary containment, with power provided via an **electrical substation** located there, the same as under the Applicant's proposed Project. The process would use RIL tanks rather than CIL tanks. The addition of **boilers** under Alternative A **may require natural gas or propane** as a replacement for electricity as the energy source for the boilers, which would require natural gas or propane storage tanks.

Ore processing operations under Alternative A would be modified as follows:

- **Crushing, grinding, and classification**. The same sort of equipment would be used for crushing, grinding, and classification under Alternative A compared to the Applicant's proposed Project. Specific particle size targets for ground ore may or may not change to facilitate gold liberation by thiosulfate in place of cyanide in the process solution.
- **RIL circuit**. The proposed CIL cyanide circuit would be replaced by an RIL thiosulfate circuit for Alternative A. Leach tanks used by the RIL process would be similar to CIL tanks except that they may be fabricated from a different quality of steel and use a synthetic liner. Similar to the CIL process, oxygen and lime would be added to the RIL tanks, and the gold-loaded resin from the RIL tanks would be transferred to the elution circuit. The leached tailing (waste) overflows from the last RIL tank would be transferred to the TSF following a final screening. The RIL thiosulfate tailings would not

require detoxification (i.e., cyanide destruction) like the CIL cyanide tailings. However, a **water treatment plant** would need to be added to the process to reclaim thiosulfate concentrate from recycled process water. Based on monitoring results from a thiosulfate process at the Goldstrike Mine in Nevada, leached constituents by thiosulfate are generally similar to those leached by cyanide (Nevada Department of Environmental Protection 2020). These solutes remain in the recirculating process water until closure when that water is evaporated.

- **Elution**. The Alternative A elution circuit would use copper sulfate as a reagent but would otherwise be similar to the proposed Project.
- **Electrowinning recovery.** There would be no changes in electrowinning recovery under Alternative A.

The TSF would be the same as for the Applicant's proposed Project and would include fencing, liners, leak-detection controls, and a reclaim pond. While Alternative A process solutions would not contain cyanide, they would contain analyte concentrations in excess of regulatory standards (e.g., copper, selenium, sulfate, total dissolved solids [TDS]). Process water chemistry would contain metal and other analyte concentrations above drinking water standards and at levels that could pose risks to wildlife. Therefore, primary containments, secondary containments, and other processes would still be required to minimize environmental and wildlife exposure to mined and processed materials and process solution. Tailings from the RIL process would be potentially acid-generating and would still require lime addition for pH control. Closure of the TSF facility would still require installation of a revegetated cover and management of residual process solution.

Water management would essentially remain the same as under the Applicant's proposed Project, although the types of water use would vary slightly under Alternative A due to the water needs of boilers and cooling towers associated with thiosulfate manufacture. More water would likely be used in this alternative to replace the water lost in the boiling process. In addition, a **water treatment plant** would need to be added to the process to reclaim thiosulfate concentrate from recycled process water.

Potable water, vehicle wash water, and stormwater and sediment controls would be the same as for the Applicant's proposed Project.

Chemicals and reagents used under Alternative A would be similar to those used by Applicant's proposed Project, with the following primary exceptions:

There would be no liquid sodium cyanide use in ore processing.

Sodium bisulfite, molten sulfur, ammonia, and oxygen would be used to formulate thiosulfate for ore processing. Onsite storage for these chemicals would be at a similar volume as cyanide storage under the Applicant's proposed Project (i.e., 10,000 to 20,000 gallons). Sodium bisulfite and sulfur would be delivered as bulk solids to the thiosulfate manufacturing process. Oxygen would be delivered as a compressed gas in tanks.

Copper sulfate would be used in the elution circuit with a storage volume similar to that of the proposed Project for cyanide detoxification (i.e., 2,750 pounds in bulk bags for 2,955 working gallons).

There would be no copper sulfate and sodium metabisulfite required for cyanide detoxification.

The storage and use of explosives, waste management, access and haul roads, security and fencing, mining equipment and schedule, workforce requirements, and closure and reclamation would remain the same as for the Applicant's proposed Project.

There would be no changes in **electrical power** transmission and distribution under Alternative A, although there would be minor differences in electrical power demand, and natural gas or propane boilers may be used in place of electrical power in the modified process plant.

There would be minor changes in the reclamation closure cost estimate associated with decommissioning and removal of the tanks used for thiosulfate manufacture under Alternative A, along with small changes in operations monitoring. Specifically, monitoring for the presence of cyanide in groundwater and surface water would not be necessary, although monitoring for metals and other constituents related to mined materials and ore processing would be required. Process plant operations would also need to include monitoring for hydrogen sulfide and ammonia to be protective of worker health.

The Applicant-proposed mitigation, compensatory mitigation, and post-closure monitoring would remain the same as for the Applicant's proposed Project.

With regard to economic viability, in practice, thiosulfate use recovers less gold from ores than cyanide processes. In 2019, Barrick Gold Corporation reported a 59 percent recovery from its thiosulfate process at the Goldstrike Mine compared to 86 to 89 percent recoveries at its cyanide processes in the US (Barrick Gold Corporation 2019) and compared to an estimated 95 percent recovery rate using cyanide at the Grassy Mountain Gold Project. While recovery estimates for thiosulfate processing of Grassy Mountain ore have not been specifically developed, recovery rates at other regional mining and processing operations indicate that gold production would decrease potentially by 30 percent or more due to substitution of thiosulfate for cyanide for ore processing. This would result in less extraction of mineral reserves and a less efficient process overall and would likely make the project not viable. In 2023, the thiosulfate facilities at Goldstrike Mine were converted to a CIL process using cyanide, which increased gold extraction (Barrick Gold Corporation 2023).

Further development of this alternative would require a new feasibility study to establish the economic performance of the mine and additional process plant design, which would extend the schedule for implementation.

# 3.0 CHAPTER 3: IMPACT ANALYSIS

Chapter 3 provides discussions of the affected environment and environmental consequences of each alternative to environmental resources, along with potential impact reduction measures, monitoring, and mitigation measures to monitor and reduce effects. A summary of potential effects from the Applicant's proposed Project is provided in Table 3-1 below. See Chapter 5 for discussions of monitoring and mitigation actions for environmental resources.

**Table 3-1 Summary of Effects of the Proposed Grassy Mountain Gold Project**

| Environmental Resource | Anticipated Impacts from the Proposed Grassy Mountain Gold Project |
|---|---|
| Geology and Minerals | • Permanent extraction and consumption or temporary relocation of approximately 3.4 million tons of ore and waste rock would occur. Extraction of approximately 362,000 ounces of gold and 517,000 ounces of silver, which is approximately 17 percent of the currently identified regional gold resources, would occur.<br>• There would be permanent and temporary relocation/mobilization of metals contained in extracted ore and waste rock. |
| Soils | • Approximately 488 acres of soil within the proposed Project boundary would be disturbed.<br>• There would be changes in the physical and chemical properties of soils and decrease in the quality of stockpiled topsoil.<br>• Onsite movement of soils through wind and water erosion would occur, and there may be potential contamination from spills or leaks of chemicals. |
| Water Resources | • The Project would result in water drawdown greater than 10 feet within 0.5 mile of pumping areas and localized groundwater drawdown extending toward springs and stock tanks approximately 1 to 1.5 miles from the underground mine.<br>• No perennial streams or river segments are located within the predicted drawdown area associated with Project dewatering and groundwater production, and there are no floodplains in the affected area.<br>• The Deposit Stock Tank used by grazing animals would be removed.<br>• There would be permanent changes in surface water drainage patterns due to construction of the TSF and stormwater drainages.<br>• Waste rock and ore that generate acid and leach metals including arsenic, selenium, and other constituents under long-term weathering conditions would be contained within lined facilities or mixed with cement in underground mine. |
| Vegetation and Wetlands | • Vegetation and soil would be removed from surface layers for use in later reclamation activities, and destruction of native and non-native plant communities could occur.<br>• Post-closure reclamation of vegetation would establish a sustainable ecosystem similar to pre-mining conditions, including big sagebrush communities, which may take many years to re-establish post-mining.<br>• Effects to Mulford's milkvetch, a state-listed endangered plant species, would occur in two areas within the Access Road Area proposed for widening and upgrades, which would necessitate a permit and/or consultation with the ODA.<br>• Two wetlands, totaling 0.29 acre, located in the Access Road Area, could be avoided with minor road realignment or may be filled to accommodate road improvements, resulting in permanent adverse effects.<br>• Additional surveys for potential wetlands and an unnamed intermittent tributary (2b) within the Mine and Process Area are recommended, with the results submitted to the DSL for review and to develop appropriate mitigation as required. |

| Environmental Resource | Anticipated Impacts from the Proposed Grassy Mountain Gold Project |
|---|---|
| Wildlife and Special-Status Species | • Direct and indirect impacts would occur to approximately 739 acres of land containing wildlife habitats, including habitat fragmentation and loss resulting from removal of vegetation and development of mine facilities.<br>• Effects to ODFW Habitat Categories 2 through 6 and low-density greater sage-grouse habitat would require avoidance or mitigation. A Wildlife Mitigation Plan and compensatory mitigation are required to offset effects.<br>• Indirect effects would occur to approximately 113 acres of mule deer habitat, including the northernmost 5 miles of the proposed main access route, which would pass through ODFW-designated mule deer winter range.<br>• There is potential for injury or mortality of animals through direct contact with construction equipment and vehicles during the construction phase and wildlife disturbance from noise and dust from equipment and vehicles during operations. Blasting for construction would be avoided from March 1 through June 30 to reduce noise effects to wildlife.<br>• There may be potential exposure of wildlife and special-status raptors to metals and low levels of cyanide in the TSF supernatant pond. Maintaining WAD cyanide levels at 1 mg/L would prevent cyanide exposure effects, and contingency measures would be put into place in the event that concentrations of cyanide in the TSF exceeded regulatory limits. Fencing and wildlife deterrents would be established to prevent access to the TSF.<br>• Anthropogenic disturbance, noise, and light pollution impacts could occur to bats and bird species including raptors and greater sage-grouse. Night-lighting reduction measures would be used to reduce lighting effects, and new power poles located within 6 miles of sage-grouse low-density habitat would be fitted with perch/nest deterrent structures as recommended by the ODFW.<br>• Indirect effects to sage-grouse habitat would be offset by compensatory mitigation in coordination with ODFW.<br>• Post-closure, the Mine and Process Area would be reclaimed and converted back into rangeland, which would provide habitat for re-establishment of wildlife species that occurred prior to mining |
| Non-native and Invasive Plants | • There is potential for spread of 13 existing non-native and invasive plant species as soils are disturbed for access road improvements and construction of Project facilities within the Mine and Process Area.<br>• There is potential for spread of 13 existing non-native and invasive plant species from vehicles traveling within and outside of the Permit Area. |
| Cultural Resources | • There may be potential direct adverse effects to 10 cultural sites that are currently recommended as eligible or unevaluated for listing on the National Register of Historic Places (NRHP) under Criterion D. Consultation is ongoing to avoid or mitigate effects to historic properties.<br>• Consultation is ongoing between the BLM and affected tribes to outline the process and procedures for mitigation for adverse effects to cultural resources. |
| Rangeland Management | • Approximately 739 acres of land would be fenced and removed from grazing, including 1 pasture (the 1.8-acre Nyssa Owyhee Ridge Trough Enclosure).<br>• Three troughs, two springs, and two water wells that occur within the Mine and Process Area would be unavailable for use by grazing animals.<br>• Pumping of groundwater from production wells has the potential to lower groundwater levels in these areas, which could affect livestock watering areas.<br>• Injury or mortality of grazing livestock is possible through direct contact with vehicles on roadways.<br>• Post-closure, the Mine and Process Area would be reclaimed and converted back into rangeland. |
| Lands, Land Use, and Realty | • Approximately 488 acres of land inside the Permit Area would change from livestock grazing and dispersed recreation to mining use for approximately 14 years.<br>• Post-closure reclamation would return the land back to grazing and dispersed recreation use. |

| Environmental Resource | Anticipated Impacts from the Proposed Grassy Mountain Gold Project |
|---|---|
| | • Development on BLM-owned lands requires BLM review and approval through the NEPA process, which is underway. The identification and mitigation of Project effects on BLM-administered land would occur as part of this environmental review process. |
| Air Quality and GHG | • Emissions from the proposed Project would be in compliance with state air quality regulations.<br>• Project emissions would produce approximately the same amount of GHG emissions (6,313 tons per year of carbon dioxide equivalent) as the energy used by 722 households and 1,274 gasoline passenger cars driven for a year. |
| Noise | • Project construction and operations would have negligible to minor noise effects at local noise receptors and would comply with DEQ noise regulations.<br>• Blasting and vibration effects are expected to be negligible at local noise receptors and noise-sensitive properties. |
| Visual Resources | • Development of the TSF would be a large change in the landscape but its location within a valley would reduce visual effects from surrounding areas. Project building and structures would not be visible from many locations in surrounding hills and valleys.<br>• The TSF, aboveground buildings, new perimeter fencing, presence of construction vehicles and equipment, and potential dust emission from road use by construction vehicles would be visible to travelers along Twin Springs Road and surrounding pastures.<br>• Post-closure, the TSF would be covered and vegetated and would ultimately appear as a hill on the landscape; buildings would be removed.<br>• Measures including minimizing the use of skyward lighting (unless needed to maintain safe conditions), installing motion detectors or timers and hoods/shields to avoid and minimize skyward lighting on exterior lights (to the extent practical), and directing all lighting only onto the active work areas would reduce night glow effects during operations. |
| Recreation | • Approximately 488 acres of land within the Permit Area would be fenced off and closed to dispersed recreation for the 14-year expected life of the mine. Post-closure the site would be reclaimed and returned to dispersed recreational use.<br>• Mine closure is estimated to be a period of approximately 30 years, during which time access restrictions may continue to limit dispersed recreation in some areas such as the covered TSF.<br>• Traffic restrictions during road upgrades would impact users of these roads when accessing recreation areas (e.g., Twin Springs Campground) during the approximate 1 year of road upgrade actions.<br>• Construction traffic including oversize vehicles and trucks would travel along Twin Springs Road during the 1- to 2-year construction and pre-production period and could obstruct and/or delay other users of the road.<br>• During an emergency, access via the emergency egress road may be delayed due to a large volume of traffic as personnel and vehicles exit the site, although this road would be used on an emergency basis only.<br>• After mine closure and reclamation, the majority of the site would be available for dispersed recreation.<br>• Improved road conditions may result in higher recreational use of the area, with increased traffic along Twin Springs Road as people are able to access Twin Springs Campground and other nearby recreational opportunities more easily. |

Discussions of the affected environment and analyses of expected and potential environmental consequences of each alternative are provided in the following sections.

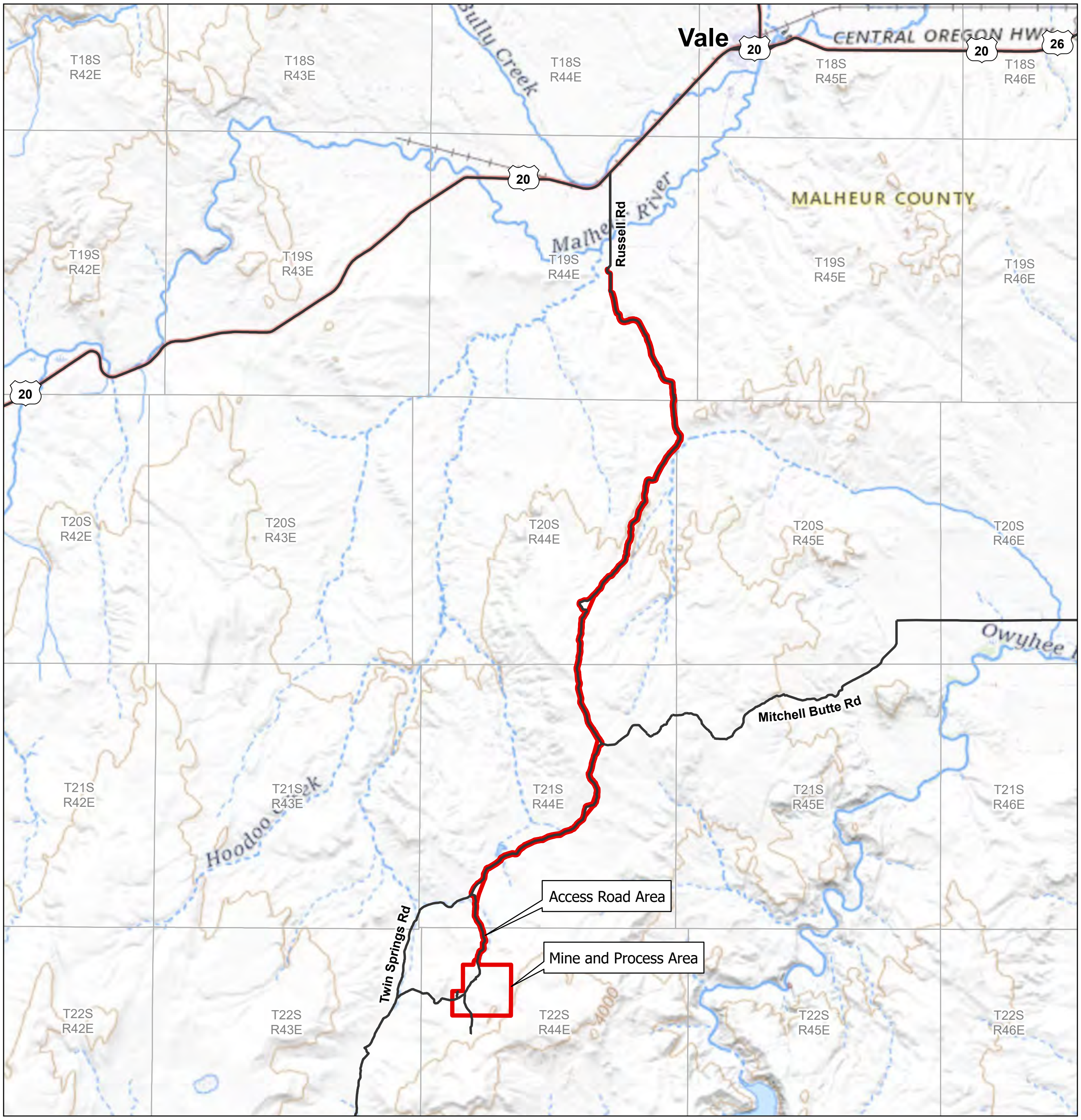
# 3.1 GEOLOGY AND MINERALS

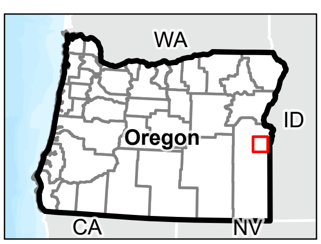
The geology and minerals study area includes the Mine and Process Area and the Access Road Area as shown in Figure 3.1-1.

## 3.1.1 Regulatory Context

BLM manages federally owned land in the geology and minerals study area under the Southeastern Oregon Resource Management Plan (SEORMP), which identifies the Grassy Mountain area as being in the Oregon – Idaho Graben, the structural feature with the highest potential for hosting large gold deposits in the region.

The Oregon Mined Land Reclamation Act of 1971, administered by the DOGAMI Mineral Land Regulation and Reclamation Program, prescribes the protocols for obtaining mine operating and reclamation permits, reclamation standards, and reclamation surety. Its primary purpose is to ensure the proper reclamation of lands affected by mining operations. Reclamation is necessary to prevent adverse impacts to land and water conditions that would be detrimental to the general welfare, health, safety, and property rights of the citizens of Oregon.




Legend
- Study Area
- Existing Roads

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(At original document size of 8.5x11)
1:220,000

N

Stantec

*Project Location*
Malheur County, OR

Prepared by LL on 2023-10-23
TR by MW on 2023-10-25

*Client/Project*
2378001753
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*Figure No.*
**3.1-1**

*Title*
**Geology and Minerals Study Area**

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources:
**3.** Background: USGS Topo

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### 3.1.2 Method of Analysis

Analyzing the direct impacts on geology and minerals from the Applicant's proposed Project includes consideration of the amount of rock to be excavated and placed elsewhere, the quantity of salable ounces of gold removed from the area, and the number of acres proposed to be disturbed. Estimates of each of these quantities were provided by the Applicant in their revised CPA (Calico Resources USA Corp. 2023).

Indirect impacts on geology and minerals were derived from published technical literature, historical data, and Project-specific background studies. The primary resources for this analysis include geology baseline studies conducted by McGinnis and Red Quill Ventures (2015) and Abrams (2018) and technical reports on a feasibility study prepared to comply with the requirements of Canadian National Instrument NI 43-101 (Ausenco 2020) and the United States Securities and Exchange Commission Rule S-K 1300 (Ausenco 2022), each prepared in the context of standards for disclosure/reporting of mineral resources and economic valuations in their respective jurisdictions.

Consideration of geologic hazards is also provided for earthquakes, landslides, and volcanic hazards. Information on the potential for these hazards to occur in the study area is based on the Geology and Soils Baseline Report (Abrams 2018) and publicly available information.

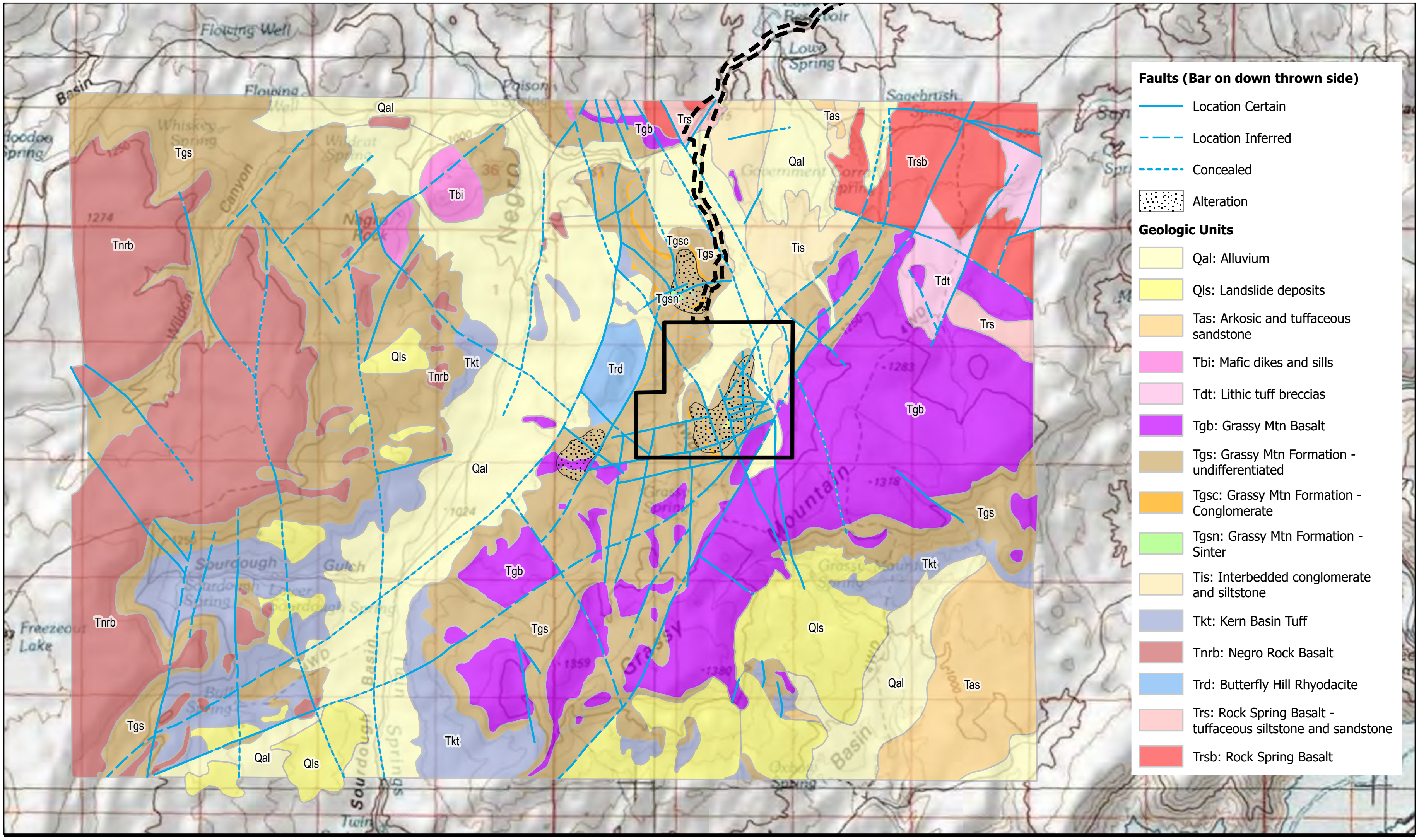
The potential for excavated rock at the Project site to generate acid conditions and to leach metals was evaluated using the results of geochemical testing conducted by the Applicant (SRK Consulting 2021) and is described in Section 3.3.

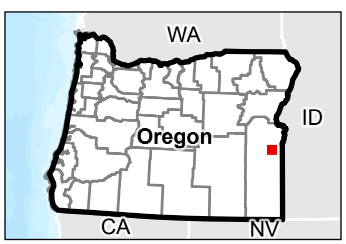
### 3.1.3 Affected Environment

The Lake Owyhee volcanic field of Miocene age blankets much of this part of eastern Oregon. Hot springs activity during the late stages of the Lake Owyhee volcanic field led to alteration and mineralization of sedimentary units at several sites regionally, including Grassy Mountain (Ferns 1991). Grassy Mountain is a low-sulfidation epithermal gold-silver deposit and is the largest of 12 similar deposits identified so far in the Lake Owyhee volcanic field (Ausenco 2020). Gold and silver mineralization occurs in veins, emplaced fissures, and fractures associated with large northerly-trending extensional faults in the central part of the systems (Ausenco 2020, 2022). Gold occurs as electrum and native gold, and silver is present as electrum and in sulfide minerals. Figure 3.1-2 shows the regional surface geology.

The geology of the Mine and Process Area is presented in Figure 3.1-3, and the geology of the Access Road Area is presented in Figure 3.1-4.

The stratigraphic relations (layers) of the general physical characteristics of rocks at the Mine and Process Area are depicted in Figure 3.1-5. Middle Miocene to Quaternary-age siliciclastic sediments and landslide deposits are underlain by Miocene volcanic sediments and volcanic flows, as presented in greater detail in Table 3.1-1.




Legend

Mine Process Area

Access Road Area

N

0 0.5 1 Miles

(At original document size of 8.5x11)

1:80,000

***Notes***

1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI
3. Background: USGS Topo

*Project Location*

Malheur County, Oregon

Prepared by LL on 2023-10-23
TR by MW on 2023-10-25

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Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*

**3.1-2**

*Title*

**Regional Surface Geology**

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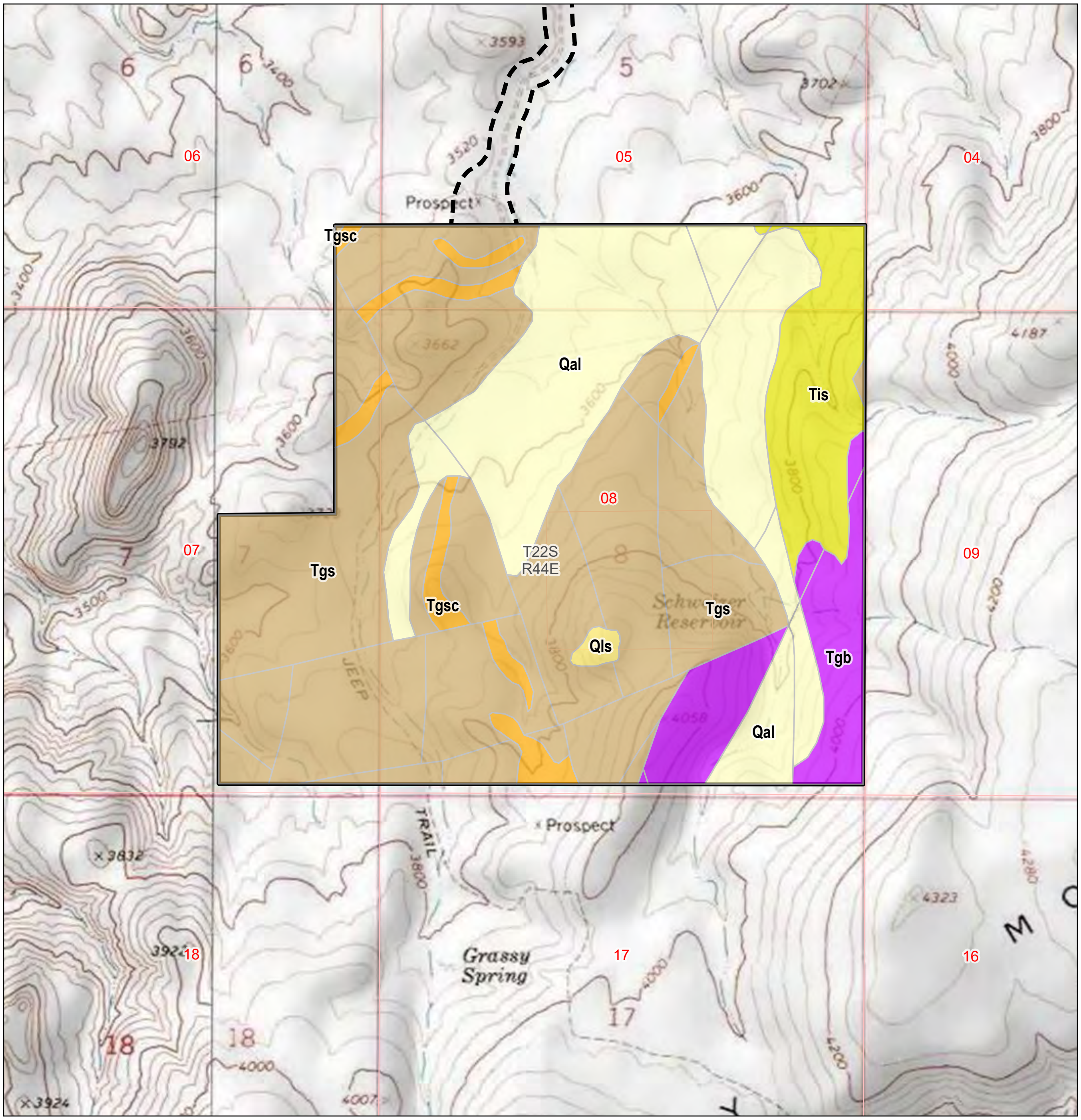


***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI
3. Background: USGS Topo

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*Project Location*
Malheur County, OR

Prepared by LL on 2023-10-23
TR by MW on 2023-10-25

*Client/Project* 2378001753
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Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.1-3**

*Title*
**Geology of the Mine and Process Area**

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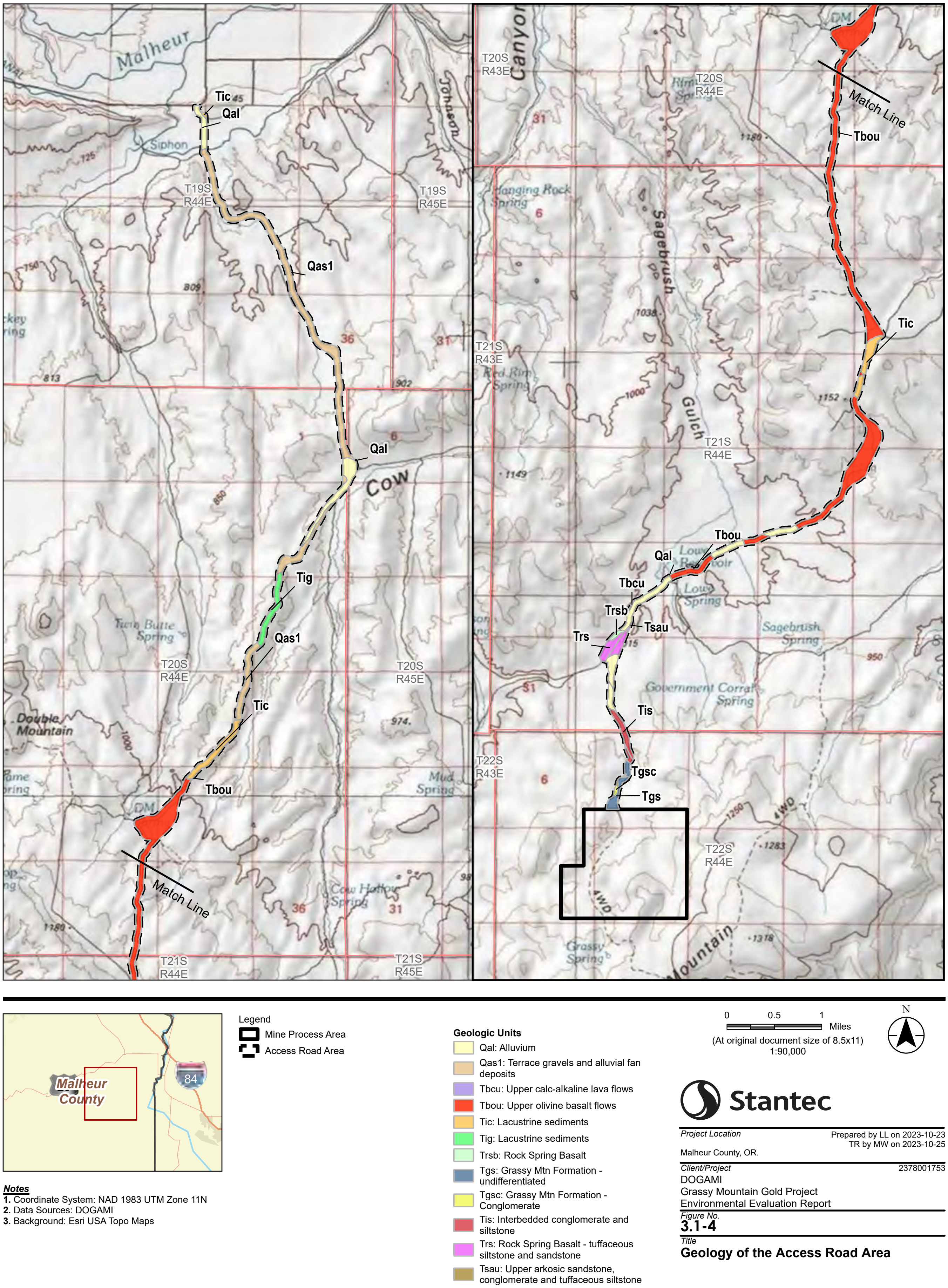



*Notes*
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI
3. Background: Esri USA Topo Maps

Project Location: Malheur County, OR.

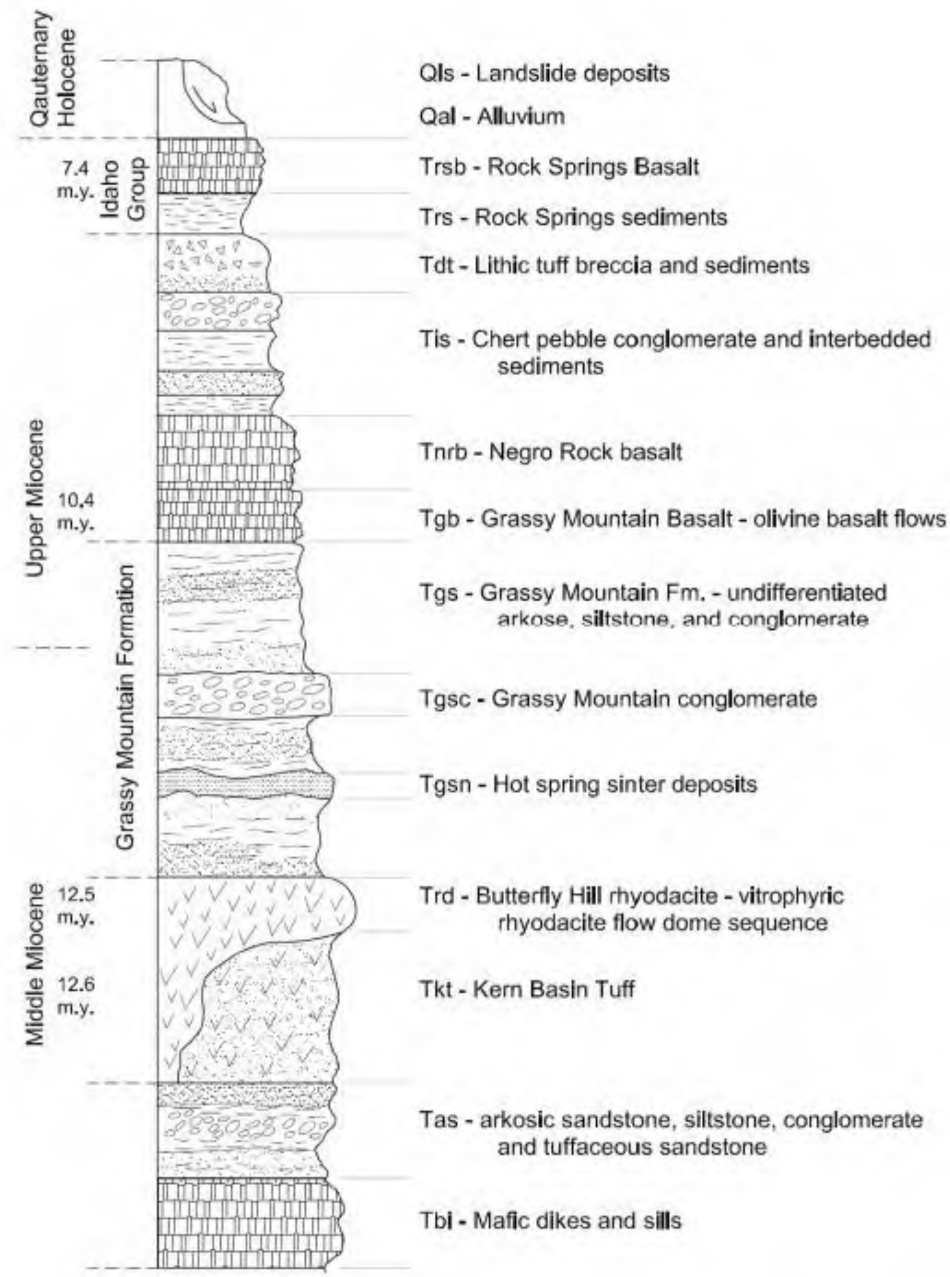
Prepared by LL on 2023-10-23
TR by MW on 2023-10-25

Client/Project: 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

Figure No. 3.1-4

Title: **Geology of the Access Road Area**

\\xdchi1-xenprd-cifs\shared_projects$\2378\237800175303_data\gis_cad\gis\ArcPro\DOGAMI_GrassyMountain_GeologyMineralResource\GrassyMountain_Geology.aprx Revised: 2024-03-20 By: gmontague




***Notes***
**1.** Data Sources: Abrams (2018)

Stantec

*Project Location*
Malheur County, OR

Prepared by LL on 2023-10-23
TR by MW on 2023-10-25

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.1-5**

*Title*
**Stratigraphic Relations of Rock Units at the Mine and Process Area**

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**Table 3.1-1 Stratigraphic Column Descriptions**

| Map Symbol | Rock Unit | Age (millions of years before present in parentheses) | Description |
|---|---|---|---|
| Qal | Alluvium | Pleistocene and Holocene | Unconsolidated deposits of gravel, sand, and silt |
| Qls | Landslide deposits | Pleistocene and Holocene | Landslide and slump deposits of unconsolidated and unstratified soil and angular rock fragments |
| Trsb | Rock Spring Basalt | Upper Miocene (7.4 Ma) | Snake River–type olivine basalt flows and interbedded deposits of tuffaceous siltstone and sandstone |
| Trs | Rock Spring Basalt—tuffaceous siltstone and sandstone | Upper Miocene | Sandstone and tuffaceous siltstone interbeds in Trsb |
| Tdt | Lithic tuff breccias | Upper Miocene | Mafic clast lithic tuff, airfall tuffs, and overlying reworked tuffaceous silt and sandstones. Breccia clasts include yellow inflated pumice and basaltic scoria. |
| Tnrb | Negro Rock Basalt | Upper Miocene | Dark brownish gray, locally flow banded basalt. Dikes, plugs, and sills are common. |
| Tgb | Grassy Mountain Basalt | Upper Miocene (10.4 Ma) | Flow on flow sequence of olivine basalts capping the summit of Grassy Mountain; includes somewhat younger intra-canyon flows. Maximum thickness of 200 feet; individual flows are up to 40 feet thick. |
| Tis | Interbedded conglomerate and siltstone | Upper Miocene | Chert pebble conglomerate and interbedded diatomaceous siltstone. Mainly tuffaceous and arkosic sandstone and siltstone with interbedded conglomerate. |
| Tgs | Grassy Mountain Formation (GMF)—undifferentiated | Upper and Middle Miocene | Arkosic sandstones and channel-fill granite clast conglomerates. Hot spring activity contemporaneous with the deposition of the arkoses is indicated by sinter beds Tgsn, and sinter boulders containing silicified reeds and wood near the Grassy Mountain gold deposit. Host for both the Grassy Mountain and Crabgrass gold deposits |
| Tgsc | GMF—conglomerate | Upper and Middle Miocene | Conglomerates occurring in the upper portion of Tgs—mapped individually where possible |
| Tgsn | GMF—sinter | | Hot spring sinter deposits within Tgs—mapped individually where possible |
| Trd | Butterfly Hill Rhyodacite | Middle Miocene (12.5 Ma) | Rhyodacite flow dome complex |
| Tkt | Kern Basin Tuff | Middle Miocene | Fine-grained, white to pale-yellow lithic tuffs containing basalt, banded rhyolite, |

| Map Symbol | Rock Unit | Age (millions of years before present in parentheses) | Description |
|---|---|---|---|
| | | | and white pumice clasts. Unconformably overlies unit Tas. |
| Tas | Arkosic and tuffaceous sandstone | Middle Miocene | Arkosic and tuffaceous sandstone, siltstone, and conglomerate |
| Tbi | Mafic dikes and sills | Middle Miocene | Mafic dikes and sills |

Sources: Abrams 2018; Ausenco 2020, 2022; McGinnis and Red Quill Ventures 2015

#### 3.1.3.1 Mineral Resources

The Grassy Mountain deposit is the largest of 12 gold-silver mineralized sites identified to date within this part of southeastern Oregon. These gold-silver deposits are mostly hosted within the Oregon – Idaho Graben, a structural zone approximately 125 miles long extending from the greater Durkee area to the greater Jordan Valley area, identified by the US Geological Survey (USGS) as having the greatest potential for hosting large gold deposits in the region.

The Grassy Mountain gold-silver deposit is hosted in the Grassy Mountain Formation (see Figure 3.1-5 and Table 3.1-1). All references to “ounces” in this study describe “troy ounces,” units of weight that are approximately 10 percent larger than avoirdupois or imperial ounces. All references to tons (t) in this study describe short tons, which weigh 2,000 pounds.

The dimensions of the Grassy Mountain deposit at depth are approximately 1,600 feet long by 1,000 feet wide by 600 feet thick. There is an envelope of lower grade mineralization at 200 to 800 feet below ground surface (bgs) that encases a higher-grade zone of mineralization at 500 to 750 feet bgs. The well-defined base of higher-grade mineralization at about 700 feet to 750 feet bgs suggests a strong pressure-temperature control on gold deposition. Visible gold (0.5 mm) has been found within the stockwork quartz veinlets part of the gold deposition zone. The gold mostly occurs as electrum, a naturally occurring gold-silver alloy, along the fracture margins or within microscopic voids. A brassy color is imparted due to the high silver content. The average silver to gold ratio at the Grassy Mountain deposit is 2.5:1.

Mineral resources identified at the Grassy Mountain gold-silver deposit are presented in Table 3.1-2. Mineral reserves are presented in Table 3.1-3. **Mineral reserves** describe a mineralized body of rock with economic parameters that have been characterized—via drilling, sampling, assaying, and metallurgy—to identify with a high degree of certainty the ability to produce a contained and recoverable mineral at a profit. **Mineral resources** describe a mineralized body of rock with some but not enough characterization to be certain of profitable development; however, they do have identified potential greater than barren (unmineralized) rock. An “inferred mineral resource” is the part of the mineral resource for which grade, quantity, and mineral content can be estimated with only a low level of confidence. An “indicated mineral resource” is an economic mineral resource that has been sampled in enough detail that its contained metal content, grade, tonnage, shape, and other physical characteristics can be estimated at a reasonable level of confidence. “Measured mineral resources” are indicated mineral resources that have undergone additional detailed sampling by a professional such that the grade, amount, shape, and other physical characteristics of the mineral deposit can be estimated with a high degree of confidence.

**Table 3.1-2 Grassy Mountain Gold and Silver Resources—Exclusive of Mineral Reserves**

| Confidence Level for Value (increasing confidence from bottom to top) | Tons (t) | Gold Grade (oz/t) | Silver grade (oz/t) | Gold Equivalent[1] Cut-off grade (oz/t) | Assumed Metallurgical Recovery |
|---|---|---|---|---|---|
| Measured mineral resources | 21,153,000 | 0.017 | 0.072 | Inside pit: 0.011 Outside pit: 0.085[2] | Gold – 80% Silver – 60% |
| Indicated mineral resources | 12,902,000 | 0.030 | 0.115 | Inside pit: 0.011 Outside pit: 0.085 | Gold – 80% Silver – 60% |
| Measured + indicated mineral resources | 34,055,000 | 0.022 | 0.088 | Inside pit: 0.011 Outside pit: 0.085 | Gold – 80% Silver – 60% |
| Inferred mineral resources | 1,151,000 | 0.037 | 0.109 | Inside pit: 0.011 Outside pit: 0.085 | Gold – 80% Silver – 60% |

Note: Mineral resources that are not mineral reserves do not have demonstrated economic viability.

1 Gold equivalent grade = [gold oz/t] + [silver oz/t/106]

2 Gold equivalent values $\geq$ 0.011 oz/t gold equivalent that fall within designed financial parameters for an open-pit mine model + zones $\geq$ 0.085 oz/t gold equivalent grades outside that design pit. The resources were assessed assuming an open-pit mining scenario that can access more of the deposit and a wider range of gold and silver grades.

Source: Ausenco 2022

The identified mineral resources exclusive of mineral reserves contain 363,000 ounces (oz) of gold and 1,529,000 oz of silver classified as measured; 392,000 oz of gold and 1,480,000 oz of silver classified as indicated; and 42,000 oz of gold and 126,000 oz of silver classified as inferred.

#### 3.1.3.2 Mineral Reserves

Mineral reserves identified at the Grassy Mountain gold-silver deposit are presented in Table 3.1-3.

**Table 3.1-3 Grassy Mountain Mineral Reserves Statement**

| Confidence Level for Profitability (increasing from bottom to top) | Tons | Grades | Cut-off Grades | Metallurgical Recovery |
|---|---|---|---|---|
| Proven mineral reserves | 259,600 | 0.181 oz/ton gold 0.264 oz/ton silver | 0.10 oz/ton gold equivalent | 92.8% gold; 73.5% silver |
| Probable mineral reserves | 1,651,900 | 0.202 oz/ton gold 0.294 oz/ton silver | 0.10 oz/ton gold equivalent | 92.8% gold; 73.5% silver |
| Total mineral reserves | 1,911,400 | 0.199 oz/ton gold 0.290 oz/ton silver | 0.10 oz/ton gold equivalent | 92.8% gold; 73.5% silver |

Note: Mineral reserves do have demonstrated economic viability.

Metallurgical recovery is measured by laboratory testing.

Source: Ausenco 2022

The mineral reserves contain approximately 380,370 oz of gold and 554,300 oz of silver. The estimated salable products, based on 97 percent mine recoverable tons, 92.5 percent gold metallurgical recovery, and 73.5 percent silver metallurgical recovery, would be approximately 341,000 oz of gold and 395,000 oz of silver (Ausenco 2022).

The metals budget of a mineral system consists of the sum of the reserves, the resources, and outlier unquantified but identified areas of anomalous amounts of metalliferous minerals. Not all of this budget is extractable at this time—but it may be at some point in the future. The full precious metals budget of the Grassy Mountain system identified to date is estimated to be 1,177,370 oz of gold and 3,689,300 oz of silver. From this budget primarily the reserves are being targeted for production from an underground operation.

#### 3.1.3.3 Geologic Hazards

Oregon is a seismically active western state; however, seismic activity in the Grassy Mountain region is limited. The nearest Quaternary fault of potential concern is located approximately 5 miles southwest of the Project along Twin Springs Creek. The National Quaternary Fault and Fold Database identifies the lineament as “Faults near Owyhee Dam,” a Class B fault (Personius 2002). Class B faults are defined as having geologic evidence that demonstrates the existence of a fault or suggests Quaternary deformation, but either (1) the fault might not extend deeply enough to be a potential source of significant earthquakes, or (2) the currently available geologic evidence is too strong to confidently assign the feature to Class C but not strong enough to assign it to Class A.[1]

At Grassy Mountain, there is a 2 percent chance of exceedance of a seismic event with a peak ground acceleration (PGA) of 0.1244 g (g is the acceleration rate of gravity and is 9.8 meters per second squared [$m/s^2$]) in any given 50-year period according to the Unified Hazard Tool on the USGS website. PGA is an important parameter (also known as an intensity measure) for earthquake engineering. The Project site therefore appears to have a minor risk of seismic events and is within the quietest seismic zone in Oregon (Oregon Department of Transportation [ODOT] 2016). Figure 3.1-6 shows regional seismic hazards.

There are no known active landslides in the greater Project area (Abrams 2018).

The Project vicinity is downwind from the volcanoes of the Cascade Range. The nearest active volcanoes are at least 200 miles to the west. As such, the only risk from volcanic activity would be regional ash falls if the prevailing wind at the time of eruption were oriented from the eruption to the Project area (Abrams 2018).

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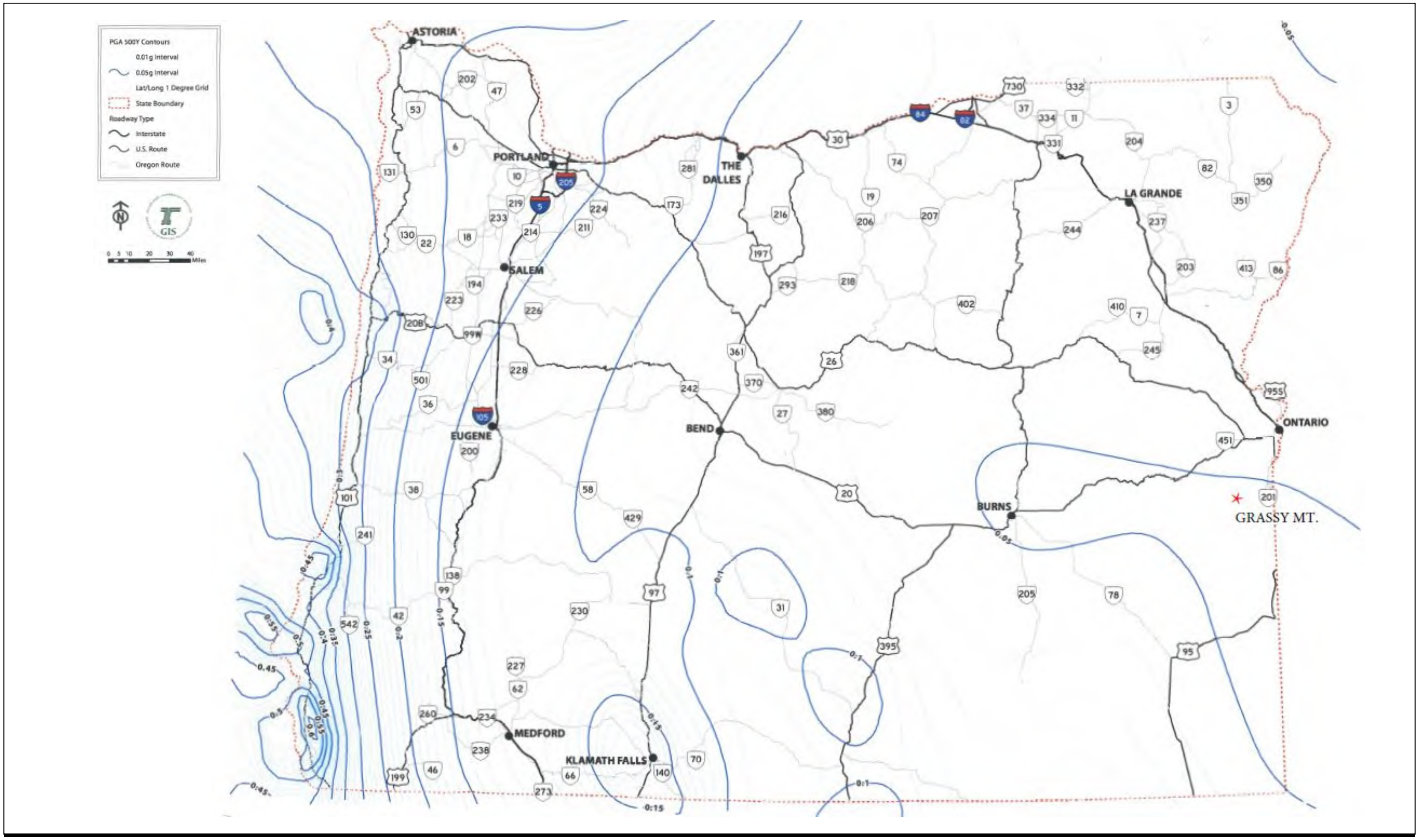
[1] Class A Category: Geologic evidence demonstrates the existence of a Quaternary fault of tectonic origin, whether the fault is exposed for mapping or inferred from liquefaction or other deformational features.




***Notes***
**1.** Data Sources: Oregon Department of Transportation (2016)

*Project Location*
Malheur County, Oregon

Prepared by LL on 2023-10-23
TR by MW on 2023-10-25

*Client/Project*
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

2378001753

*Figure No.*
**3.1-6**

*Title*
**Regional Seismic Hazards**

Stantec

## 3.1.4 Impact Analysis

### 3.1.4.1 No Action Alternative

Under the No Action Alternative, no mining and related loss of access to surface materials would occur. Access to subsurface geology and minerals would not be impacted in the Mine and Process Area. The No Action Alternative would result in no removal of mineral-bearing ore and would not create any new topographic features. The access road would not be widened, resulting in no impacts to surficial geology.

Ongoing permitted exploration activities would continue to further define gold resources in the Project area. Prescribed reclamation would follow cessation of that exploration work. Reclaimed disturbance including wells would be monitored with no loss of access to Project area geology and mineral resources. Overall, impacts to geology and mineral resources would remain the same as under current conditions.

### 3.1.4.2 Applicant's Proposed Project

#### Geology

Moderate, permanent direct effects on the geology and minerals in the study area would be caused by the extraction of approximately 380,000 oz of gold and 550,000 oz of silver from under the ground and from removing surface soils and underlying rock from their existing natural setting and placing this material at other locations (e.g., TSF). Under the Applicant's proposed Project, approximately 410 acres of surface rock units would be disturbed (Tables 3.1-4 and 3.1-5). These disturbances would be in the immediate Mine and Process Area and along the proposed access road.

**Table 3.1-4 Rock Unit Disturbance in the Mine and Process Area**

| Map Symbol | Rock Unit | Acres |
|---|---|---|
| Qal | Alluvium | 142.70 |
| Qls | Landslide deposits | 0.15 |
| Tgb | Grassy Mountain Basalt | 35.90 |
| Tgs | Grassy Mountain Formation (GMF)—undifferentiated | 163.71 |
| Tgsc | GMF—conglomerate | 7.19 |
| Tis | Interbedded conglomerate and siltstone | 22.95 |
| | **Total** | **372.60** |

**Table 3.1-5 Rock Unit Disturbance along the Access Road**

| Map Symbol | Rock Unit | Acres |
|---|---|---|
| Qal | Alluvium | 11.80 |
| Tgs | Grassy Mountain Formation (GMF)—undifferentiated | 10.12 |
| Tgsc | GMF—conglomerate | 1.29 |
| Tis | Interbedded conglomerate and siltstone | 10.81 |
| Trs | Rock Spring Basalt—tuffaceous siltstone and sandstone | 3.76 |
| | **Total** | **37.78** |

Ultimately, the proposed mining would result in permanent extraction and consumption or temporary relocation of approximately 3.4 million tons of ore and waste rock.

Impacts to geologic formations resulting from the Applicant's proposed Project would be moderate to major, long-term to permanent, and localized within the Mine and Process Area and Access Road Area. The geologic formations extend outside the Permit Area boundary for dozens of miles, so any individual formation would not be impacted by substantial reduction of that resource due to the Applicant's proposed Project.

### Mineral Resources

The Applicant's proposed Project would target approximately 380,370 oz of gold and 554,300 oz of silver for production and removal from the Project area. The identified mineral budget of the Grassy Mountain deposit to date consists of approximately 1,177,370 oz of gold and 3,689,300 oz of silver. Additional resources, approximately 67.7 percent of identified gold resources at the Grassy Mountain deposit, would remain for future access.

Production and removal of the targeted gold and silver at the Grassy Mountain deposit would result in major, permanent, and localized impacts to the identified gold and silver resources. There is potential for more than 99 acres of the remaining resources to be covered on the surface by the TSF and other remanent facilities. Future surface access for mineral exploration and development equipment would likely be hindered but not prevented.

In addition to the Grassy Mountain deposit, gold mineralization of similar age and hosted in similar strata occurs at 11 other known sites in the region. These other sites include Red Butte, Quartz Mountain, Katie West, Mahogany, and Milestone, all of which have identified gold values of economic interest. In particular, Quartz Mountain has been investigated by Alamos Gold Incorporated and found to contain at least 339,000 oz of gold (combined as measured and indicated resources) as well as 1,147,000 oz of gold as inferred resources. The Applicant's proposed Project would result in the removal of approximately 17 percent of the currently identified regional gold resources.

### Geologic Hazards

Parameters set by the International Building Code have been used for seismic design purposes for proposed facilities. Site Class D, a stiff soil profile, is recommended for the design of Project facilities. The maximum considered earthquake (MCE) has a magnitude of 6.09 on the Richter scale, with a PGA on bedrock of 0.111949 accelerograms and a soil amplification factor of 1.583, and a PGA at surface of 0.271 accelerograms (Abrams 2018; McGinnis and Red Quill Ventures 2015). The MCE, the design event, would have a 2,500-year recurrence interval, a very-low-probability event. Project facilities have been designed to have no permanent structural damage from vibration or from ground movement or failure. Human safety would be addressed with structural design protocols. These design protocols would evolve if different conditions were encountered in underground workings than are anticipated—for example, if hydrothermal alteration of the host rocks in the ore zone is greater and creates greater risk than that identified currently.

Since there are no known active landslides in the study area, there is no risk associated with landslides for Project facilities. Furthermore, since the nearest active volcanoes are at least 200 miles to the west, there is a small risk from regional ash falls if the prevailing wind at the time of eruption were oriented in the direction of the Project (Abrams 2018).

### 3.1.4.3 Alternative A

#### Geology

Impacts to geology under Alternative A would be the same as impacts that result from the Applicant’s proposed Project. The surface acreage disturbed would be the same amount, and the disturbances would be in the same proposed areas.

#### Mineral Resources

Impacts to mineral resources under Alternative A would be similar to those encountered during the Applicant’s proposed Project, with one important difference. The thiosulfate extraction process would extract approximately 59 percent of the contained gold from the ore based on results from other projects. The Applicant’s proposed Project, which uses cyanide, would extract approximately 92.5 percent of the contained gold from the ore, or approximately 33.5 percent more than the thiosulfate extraction process. As such, some gold and silver would be delivered to the TSF, which would be covered and vegetated during reclamation.

#### Geologic Hazards

Risks associated with geologic hazards would be the same as for the Applicant’s proposed Project.

## 3.2 SOILS

The study area for soils consists of the entire Permit Area (i.e., the Mine and Process Area and the Access Road Area; Figure 3.2-1).

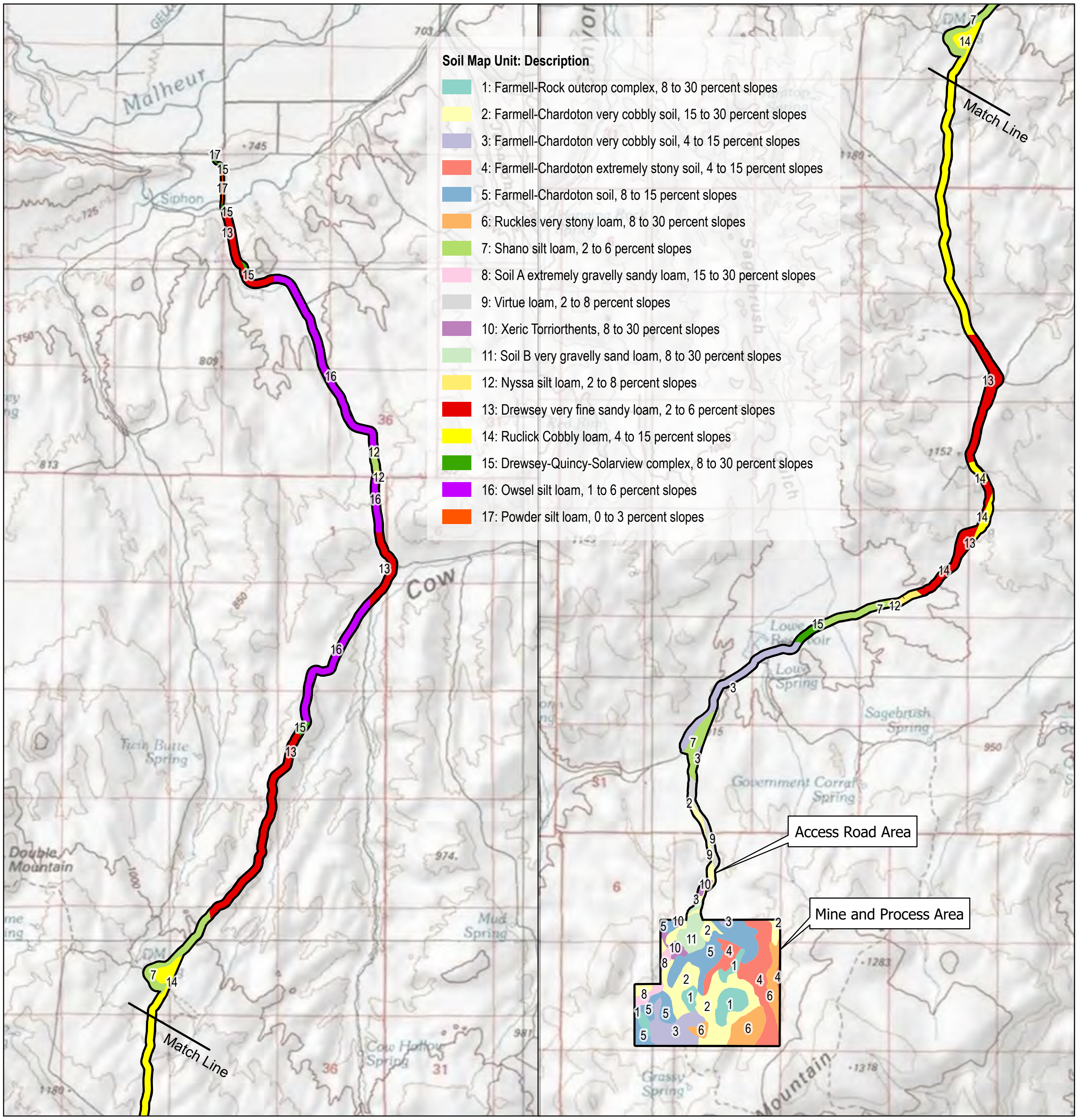
### 3.2.1 Regulatory Context

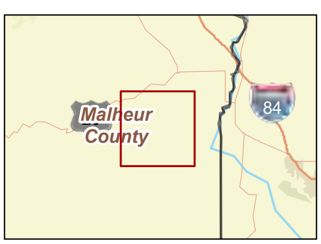
The State of Oregon stipulates that the primary purpose of the Oregon Mined Land Reclamation Act of 1971 is to ensure the proper reclamation of lands affected by surface mining operations to prevent adverse impacts to land and water conditions that would be detrimental to the general welfare, health, safety, and property rights of the citizens of the state. This act applies to all land in Oregon, except tribal land inside a reservation and certain federal lands—including lands managed by the BLM and the United States Forest Service (USFS; OAR 2022).

Oregon's Soil and Water Conservation Districts are special districts that provide for the conservation of the renewable resources of the state. They work with local landowners and residents, natural resource organizations, natural resource users, and local, state, and the federal government to conserve natural resources, control and prevent soil erosion, conserve and develop water resources and water quality, preserve wildlife, conserve natural beauty, and promote collaborative conservation efforts to protect and enhance healthy watershed functions (ODA 2023).

DOGAMI and Washington Division of Geology and Earth Resources released a report in 1997 specifically discussing BMPs for reclamation of surface mines in Washington and Oregon (Norman et al. 1997). While these BMPs are generally focused on protecting water quality, an indirect result can be the conservation of soil resources.

On a federal level, the BLM has defined its rules for mining claims under general mining laws including surface management to prevent unnecessary and undue degradation of public lands by operations authorized by the mining laws. Reclamation should begin at the earliest feasible time and shall include, but not be limited to, (1) saving of topsoil for final application after reshaping of disturbed areas has been completed; (2) measures to control erosion, landslides, and water runoff; (3) measures to isolate, remove, or control toxic materials; (4) reshaping of the area disturbed, application of topsoil, and revegetation of disturbed areas, where reasonably practicable; and (5) rehabilitation of fisheries and wildlife habitat. The BLM is independently reviewing the Applicant's proposed Project under NEPA.




Legend

Study Area

0 0.5 1 Miles

(At original document size of 8.5x11)

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N

Stantec

*Project Location* Prepared by LL on 2023-11-15
TR by AU on 2023-11-15

Malheur County, OR.

*Client/Project* 2378001753

DOGAMI

Grassy Mountain Gold Project

Environmental Evaluation Report

*Figure No.*

**3.2-1**

*Title*

**Soils Study Area and Resources**

***Notes***

**1.** Coordinate System: NAD 1983 UTM Zone 11N

**2.** Data Sources: DOGAMI

**3.** Background: Esri USA Topo Maps

### 3.2.2 Method of Analysis

The type and severity of impacts on soils depends on the soils present and the extent of soil excavation, movement, damage, and loss from proposed Project actions. The Applicant conducted soil surveys, which are used to describe the existing soil conditions in the soils study area.

Erosion potentials for each of the soil types were estimated in the Applicant's Geology and Soils Baseline Report (Abrams 2018). The Wind Erodibility Group (WEG) is an arbitrary grouping of soils based on texture, structure, and carbonate content. WEG values range from 1 to 8, with lower values indicating greater susceptibility to wind erosion. A K-factor, or soil erodibility factor, indicates the susceptibility of a soil to sheet erosion by water and ranges from 0.00 to 0.70, with the higher factors indicating greater susceptibility to erosion.

In all the areas where mining and processing are proposed, suitable topsoil would be stripped and stockpiled for reclamation. Topsoil suitability for the soil types identified within the proposed study area were tested and the results presented in the Applicant's Geology and Soils Baseline Report (Abrams 2018).

Anticipated changes in the existing conditions for soil resources in the study area under each alternative were identified and assessed quantitatively. Soil excavation and relocation in the soils study area is defined as the measure of direct impact. Mobilization of soil material as sediment by mining, reclamation, and closure activities is discussed qualitatively.

### 3.2.3 Affected Environment

The proposed Project consists of numerous drainages bounded on the east and west by bedrock ridges. The underlying bedrock ranges from volcanic basalt and tuffs to sedimentary conglomerates, sandstones, and siltstones. Soil located on the ridges is typically less than 30 inches deep and high in rock fragments throughout the profile. These soils were formed from the underlying bedrock, which generally consists of conglomerate sandstone and basalt. Soils located in the valleys consist predominately of alluvium, loess (wind-blown silt), and eolian (wind-blown) sand (Abrams 2018).

Based on several soil surveys that were completed for the proposed Project, a total of 17 map units were identified. The map unit descriptions are presented in Table 3.2-1 and shown in Figure 3.2-1. Each map unit description provides basic information including predominant soil(s) of the map unit, slope, and rock fragment content.

**Table 3.2-1 Map Unit Descriptions for the Soils Study Area**

| Map Unit | Name and Description | Reclamation Suitability | Limitations | Recommended Salvage Depth (feet) | WEG Value (1 to 8) | K-Factor (0.00 to 0.70) |
|---|---|---|---|---|---|---|
| 1 | Farmell-Rock outcrop complex, 8 to 30 percent slopes | Unsuitable | Surficial rock | 0 | 8 | 0.10 |
| 2 | Farmell-Chardoton very cobbly soil, 15 to 30 percent slopes | Marginal | Surficial rock | 0.5 | 8 | 0.10 to 0.13 |

| Map Unit | Name and Description | Reclamation Suitability | Limitations | Recommended Salvage Depth (feet) | WEG Value (1 to 8) | K-Factor (0.00 to 0.70) |
|---|---|---|---|---|---|---|
| 3 | Farmell-Chardoton very cobbly soil, 4 to 15 percent slopes | Marginal to Unsuitable | Surficial rock | 0 to 0.5 | 8 | 0.10 to 0.13 |
| 4 | Farmell-Chardoton extremely stony soil, 4 to 15 percent slopes | Unsuitable | Surficial rock | 0 | 8 | 0.10 to 0.13 |
| 5 | Farmell-Chardoton soil, 8 to 15 percent slopes | Marginal | Surficial rock | 0 to 0.5 | 8 | 0.10 to 0.13 |
| 6 | Ruckles very stony loam, 8 to 30 percent slopes | Marginal | Surficial rock, Depth to bedrock | 0.5 | 8 | 0.10 |
| 7 | Shano silt loam, 2 to 6 percent slopes | Good | None listed | 2.0 to 2.5 | 5 | 0.37 |
| 8 | Soil A extremely gravelly sandy loam, 15 to 30 percent slopes | Unsuitable | Surficial rock | 0 | 8 | 0.07 |
| 9 | Virtue loam, 2 to 8 percent slopes | Good | Depth to hardpan | 2.0 | 5 | 0.16 |
| 10 | Xeric Torriorthents, 8 to 30 percent slopes | Unsuitable | Depth to bedrock, slope | 0 | Unknown | Unknown |
| 11 | Soil B very gravelly sandy loam, 8 to 30 percent slopes | Unsuitable | Rock fragments | 0 | 8 | 0.07 |
| 12 | Nyssa silt loam, 2 to 6 percent slopes | Marginal | Soil erodibility | 0.5 | 5 | 0.61 |
| 13 | Drewsey very fine sandy loam, 2 to 6 percent slopes | Marginal | pH | 2.5 | 3 | 0.34 |
| 14 | Ruclick cobbly loam, 4 to 15 percent slopes | Marginal | Surficial rock | 0.5 | 8 | 0.37 |
| 15 | Drewsey-Quincy-Solarview complex, 8 to 30 percent slopes | Marginal | pH, Texture | 0.5 to 2.5 | 3 | 0.34 |
| 16 | Owsel silt loam, 2 to 6 percent slopes | Marginal | Soil erodibility | 0.5 to 2.0 | 5 | 0.46 |
| 17 | Powder silt loam, 0 to 3 percent slopes | Good | None listed | 2.5 | 5 | 0.52 |

Notes:

WEG = Wind Erodibility Group; values range from 1 to 8, with lower values indicating greater susceptibility to wind erosion.

K-factor = Soil erodibility factor; values range from 0.00 to 0.70 with higher factors indicating greater susceptibility to water erosion.

Source: Abrams 2018

Erosion potential for each of the soil types for wind and water erosion is presented in Table 3.2-1. Wind erosion potential ranges from WEG 3 (higher wind erosion potential) to 8 (lower wind erosion potential) and water erosion potential ranges from a K-factor of 0.07 (low water erosion potential) to 0.61 (high water erosion potential).

The soils in the Mine and Process Area of the proposed Project are high in silt and very fine sand content, making them more susceptible to wind erosion. However, high rock fragment content within the soil significantly reduces the K-factor of each unit (Abrams 2018).

In all the areas where mining and processing would take place, suitable topsoil would be stripped and stockpiled for reclamation. Laboratory analyses results showed that topsoil sampled in and near the Mine and Process Area has a higher clay content and is shallower in the soil profile. This soil generally falls in the "marginally suitable" for reclamation category. Thus, topsoil for the proposed Project is generally suitable for reclamation. The main limitation is surficial and subsurface coarse fragments, encountered on ridge sides and summits. The Ruclick soils and Drewsey-Quincy-Solarview Complex exhibited high surface and subsurface coarse fragments. Steep slopes also limit reclamation suitability.

The Drewsey and Owsel soils, which generally occur on the valley floors, exhibited marginal limitations for reclamation due to pH level and/or soil erodibility. The Nyssa soil, also located on valley floors, has unsuitable subsurface soil horizons that are cemented and exhibit increased sodium and carbonate levels.

## 3.2.4 Impact Analysis

### 3.2.4.1 No Action Alternative

Under the No Action Alternative, the proposed Project would not be developed and the associated impacts to soils would not occur. The No Action Alternative would result in no removal of soils and would not create any new topographic features.

Existing uses of the study area would likely continue, including grazing of cattle on BLM-managed rangeland allotments, with no measurable change in the existing status of soil type and cover. The general area may be continuously explored for new mining opportunities, which would have minor disturbance effects to soils in the areas of exploration.

The potential for direct impacts from naturally occurring seismic events would remain the same as existing conditions. In summary, there would be minor impacts to soils from the No Action Alternative.

### 3.2.4.2 Applicant's Proposed Project

Under the Applicant's proposed Project, disturbance of approximately 488 acres of soil within the proposed Project boundary would occur. Impacts to soil resources from the proposed Project include changes in the physical and chemical properties of the soil resources that would lead to a potential decrease in the quality of the topsoil in disturbed areas, movement of soils onsite through erosion, and the potential contamination of soils from spills or leaks of chemicals during transportation, storage, and use.

The effect of removing native soil would cause the mixing of soil horizons, which would result in the degradation or loss of soil function. This disturbance, as well as long-term storage in stockpiles, can alter soil productivity by affecting its permeability, structure, and microbial activity. Applicant measures identified to reduce such effects include managing surface soils and alluvium as a growth media resource to be replaced during reclamation and adding soil amendments during reclamation for soil placed on reclaimed surfaces to enhance vegetation establishment (Calico Resources USA Corp. 2023a). With these measures in place, impacts to soil function would be moderate, long term, and localized.

All surface disturbance to soil resources would be limited to soils within the Permit Area; therefore, no impacts would occur outside of this area. During closure and reclamation, disturbed areas would generally be regraded and recontoured to provide long-term stability, mimic adjacent landforms, facilitate revegetation, control drainage, and minimize soil erosion. Where practicable, the natural pre-mining drainage patterns would be re-established. Where the post-closure landform does not allow for the re-establishment of pre-mining drainage patterns, drainage would be engineered so that natural drainage is complemented (see Section 2.1.16). Therefore, the impacts to soil resources from surface disturbance would be minor, long term, and localized. Due to the proposed reclamation of most of the facility disturbance, impacts are assumed to be long term rather than permanent, as soil function and productivity is anticipated to return after reclamation is completed and established.

Under the Applicant's proposed Project, impacts to soils would also include dispersion and mobilization of soils via wind and water erosion. Twelve soil map units are proposed to be used for reclamation, with the depth listed in the Recommended Salvage Depth column in Table 3.2-1 (Map Units 2, 3, 5, 6, 7, 9, 12, 13, 14, 15, 16, and 17). Of these, seven have a WEG rating of 5 or less, indicating those soils are more susceptible to wind erosion, and seven have a K-factor greater than 0.3, indicating those soils are more susceptible to erosion from water (Table 3.2-1). Stockpiled soils would be susceptible to an increase in water erosion during meteoric runoff. An increase in wind erosion would occur as a result of salvage and reclamation operations due to an increase in susceptibility from the removal of stabilizing vegetation in the top layer of soil, exposing the more fine-grained sediments. The susceptibility to soil erosion would last until stabilizing vegetation were re-established over the long term.

During operations, temporary measures to reduce wind and water erosion on stockpiles until reuse would reduce effects over the short term. The Applicant has proposed a number of measures including seeding growth media kept in stockpiles for one or more planting season to reduce erosion and minimize the establishment of undesirable weeds and installing runoff controls such as silt traps and fences constructed of certified weed-free straw bales or geotextile fabric. The Applicant also proposes to install sediment retention basins to reduce soil movement within the site and to minimize offsite effects. Soil collected in these structures would be periodically removed and placed in growth medium stockpiles for future use during reclamation. Additional measures to reduce the potential for wind and water erosion over the short term may include seeding of growth media stockpiles that would be left for more than 1 month to prevent soil loss through wind erosion and installing stormwater controls to manage stormwater run-on. Soil erosion as a result of the Applicant's proposed Project is expected to be minor, short term, and localized.

Soil resources may be impacted by leaks or accidental spills of contaminants that occur outside of containment, such as a diesel or hydraulic spill from mobile equipment or vehicles. In the event site soils become contaminated with petroleum products due to accidental spills or other activity, the soils will be handled as described in the Petroleum-Contaminated Soils Management Plan (Calico Resources USA Corp. 2022) and Emergency Response Plan (Calico Resources USA Corp. 2023b), which includes cleanup measures for small and large spills. An additional action would be to collect soil samples from the bottom of the excavation after soil cleanup, analyze these samples for total petroleum hydrocarbons, and compare the results to applicable standards to determine whether the excavation effectively collected all soil affected by the spill. Overall, contamination impacts to soils, should they occur, are anticipated to be minor, short term, and localized.

#### 3.2.4.3 Alternative A

Since Alternative A includes the same underground mine and surface facility layout as the Applicant's proposed Project with the same approximately 488 acres of proposed surface disturbance and the same reclamation and closure practices, effects to soils from Alternative A are approximately the same as for the Applicant's proposed Project described above.

# 3.3 WATER RESOURCES

The water resources study area includes the Mine and Process Area as well as the surrounding Negro Rock Canyon and a portion of Oxbow Basin, which lies northwest of the Owyhee Reservoir (Figure 3.3-1). Grassy Mountain acts as a hydrologic divide between the two basins. This study area includes a region approximately 10 miles in length north-south and 8 miles in width east-west.

The water resources study area also includes two isolated locations of interest that represent areas on the Owyhee Reservoir and Owyhee River that would be upstream and downstream of any potential Project effects. These locations are (1) an area on the Owyhee River 4 miles downstream of the Owyhee Dam and approximately 4 miles east of the Project area and (2) an area at the Leslie Gulch segment of the Owyhee Reservoir approximately 15 miles south of the Project area (Figure 3.3-1).

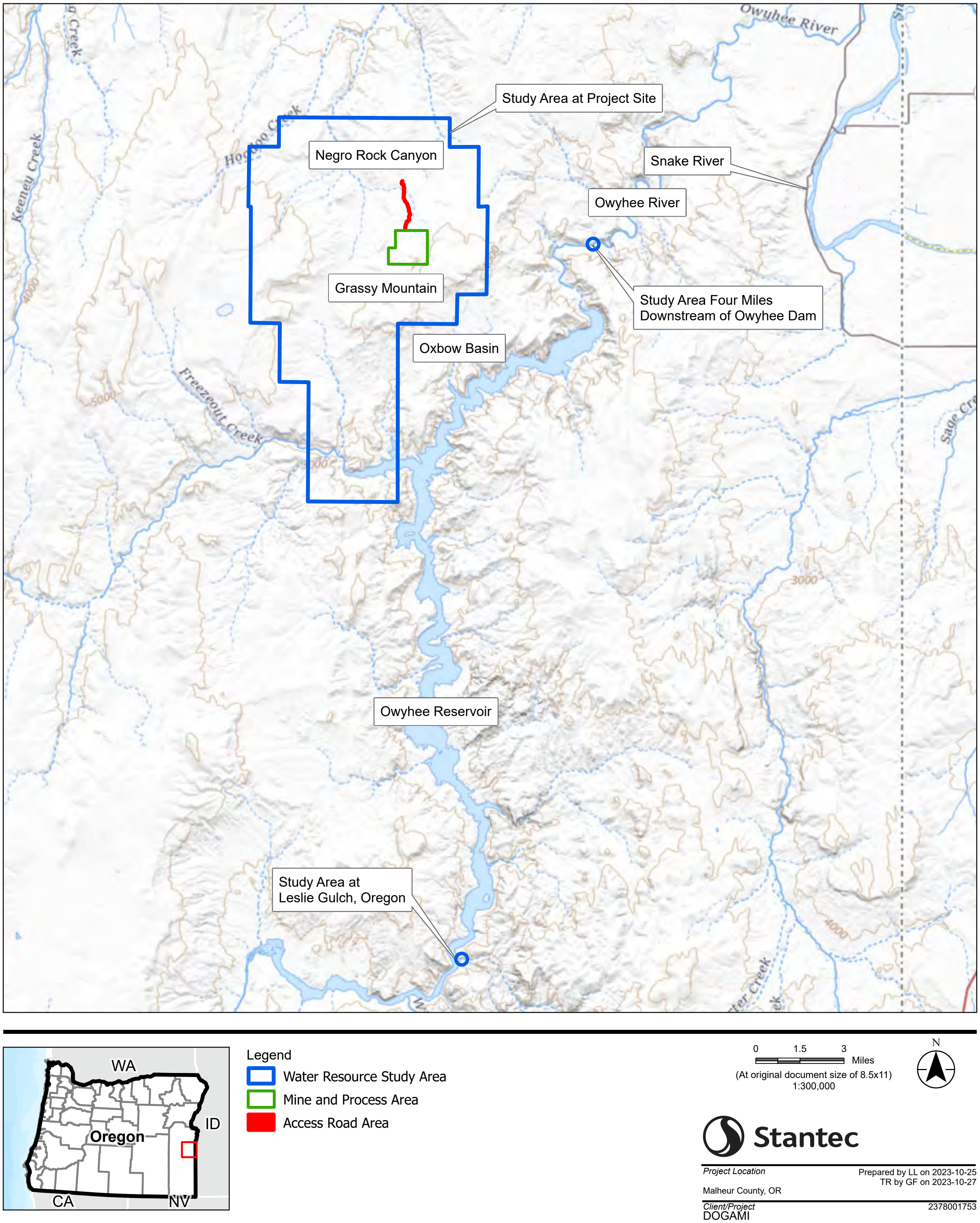
## 3.3.1 Regulatory Context

The regulation, appropriation, and preservation of water in Oregon falls under both federal and state jurisdiction. When a project has the potential to directly or indirectly affect waters under State of Oregon jurisdiction, the state is authorized to implement its own permit programs under the provisions of state law or the Clean Water Act (CWA). The CWA addresses the protection of water quality via federal and state regulations. The CWA is administered at the federal level by the EPA and the US Army Corps of Engineers (USACE). Through Section 404 of the CWA, the USACE has the authority to issue permits regulating the discharge of dredge or fill material into waterbodies under federal jurisdiction. The CWA and Oregon water rights regulations provide the primary regulatory framework for the surface water component of water resources.

The Oregon DEQ is responsible for regulating surface water quality and groundwater protection. Water Pollution Control Facility permits are issued by the DEQ and specify requirements for evaluating stormwater, ore and waste rock storage, tailings storage, wastewater recycling, and sewage disposal.

The WRD regulates water rights and is responsible for the appropriation of surface water and groundwater in the state, changes to water rights, and management activities involving water appropriation and water use in Oregon. Water rights are state regulated through a permitting process. All new water rights are subject to prior existing rights in order to protect the ability of adjacent and downstream water rights to be used without impairment or conflict.

The Malheur County Comprehensive Plan includes actions that address water quality and water rights, including consulting with appropriate state agencies during review of development proposals that might affect surface or groundwater quality, cooperating with the DEQ in protection of surface and groundwater resources, implementing the Malheur County Water Quality Management Plan, considering water rights and potential impacts of proposed development on nearby irrigated lands, and ensuring that physical characteristics of the land that affect sewage disposal, water supply, and water quality are carefully considered in land use proposals within the county (Malheur County 1985).




***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI
**3.** Background: USGS Topo

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*Project Location* Malheur County, OR

Prepared by LL on 2023-10-25
TR by GF on 2023-10-27

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.3-1**

*Title*
**Water Resources Study Area**

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### 3.3.2 Method of Analysis

The type and severity of impacts on water resources depends on existing groundwater and surface water quantities and quality, as well as the characteristics of the rock to be mined with regard to leaching of metals and other constituents that may affect water quality.

The Applicant completed surface water surveys to describe the surface waterbodies in the water resources study area, including creeks, springs, and seeps. Surface water quality was assessed using data from water quality sampling conducted in the study area. Groundwater pump tests and monitoring wells were used to identify groundwater flow paths beneath the surface. A water balance for the study area was developed based on groundwater elevations, aquifer hydraulic properties, and estimated rate of recharge (the amount of precipitation infiltrating to groundwater)[1] using climate and precipitation data for the study area (EM Strategies Inc. [EM Strategies] 2017; SPF Water Engineering [SPF] 2018, 2021a, 2021b).

The Applicant conducted groundwater sampling to determine the existing groundwater quality in the study area. In addition, geochemical testing results of samples of ore in the proposed mine, access road, and quarry areas were analyzed with regard to chemical composition, the potential to generate acid conditions, and leaching of constituents (SRK Consulting 2022).

Effects to water resources in the study area were considered with regard to changes in groundwater and surface water availability using the projections of Project water requirements and a groundwater numerical model using FEFLOW. The model incorporates geologic, climatological, hydrologic, pedological, and other physical data from various sources in the Project vicinity as well as topography, lithology, structural geology, faulting, quantified recharge and discharge, and natural lateral boundaries. Mining operations for the Project were simulated over a 10-year mine life[2] using pumping wells located around the ore deposit to lower groundwater elevations from approximately the 3,700 feet amsl to 2,950 to 3,100 feet amsl in the deposit area. In addition, groundwater pumping from supply wells would be used to supplement dewatering production water so the model simulated groundwater levels influenced by a combined pumping rate of 200 gpm to mimic groundwater extracted from proposed wells (Lorax Environmental Services [Lorax] 2022).

Results of the geochemical testing were used to describe the potential groundwater and surface water quality effects of extracting and processing mined rock, including consideration of acid generation in the proposed underground mine and in tailings at the TSF (SRK Consulting 2022).

Potential effects to floodplains were assessed by describing existing conditions using the Federal Emergency Management Agency's (FEMA's) mapping of floodplain hazard areas and consideration of changes to floodplains from proposed mine operations (FEMA 2017).

### 3.3.3 Affected Environment

The water resources study area consists of rolling hill terrain within Negro Rock Canyon and a portion of the Owyhee River Canyon. Negro Rock Canyon is a north-south–trending canyon that drains to the north

[1] This rate is a fraction of the total precipitation in the area because most precipitation is removed from the system via evaporation or evapotranspiration by vegetation.
[2] Includes 2 years of construction plus 8 years of operations.

toward the Malheur River (Figure 3.3-1). Grassy Mountain forms the southeastern boundary of the basin, separating it from the Owyhee River drainage.

To the southeast across the Grassy Mountain hydrologic divide, the Owyhee River is the largest surface waterbody in the region. The Owyhee River, along with its associated Owyhee Reservoir, is the predominant drainage feature in the region, flowing south to north toward its confluence with the Snake River near the Oregon-Idaho border (Figure 3.3-1). The Owyhee Reservoir, or Lake Owyhee, was created in 1932 by the construction of the Owyhee River Dam. The US Bureau of Reclamation operates the reservoir, which supplies approximately 500,000 acre-feet for irrigation along the west side of the Snake River. While there is perennial flow in the Owyhee River below the reservoir, tributary stream flows are typically ephemeral or intermittent as sourced by spring runoff and storm events.

#### 3.3.3.1 Climate

The Grassy Mountain area climate is typical of a cold desert environment. Annual precipitation is 10 inches with a pan evaporation rate that exceeds 40 inches in normal years. Most precipitation falls in the winter as snow. Average annual runoff from precipitation is estimated to range from 1.3 to 1.5 inches per year, with most precipitation lost to evaporation and a portion of the remaining precipitation infiltrating to recharge the groundwater system. Peak runoff within Negro Rock Canyon ranges from 5 to 15 cubic feet per second (cfs), typically resulting from the effects of isolated, infrequent thunderstorms. The 100-year, 24-hour storm event is 2.2 inches with the 100-year, 1-hour storm event being 1.0 inches (SPF 2021a).

#### 3.3.3.2 Surface Water Resources

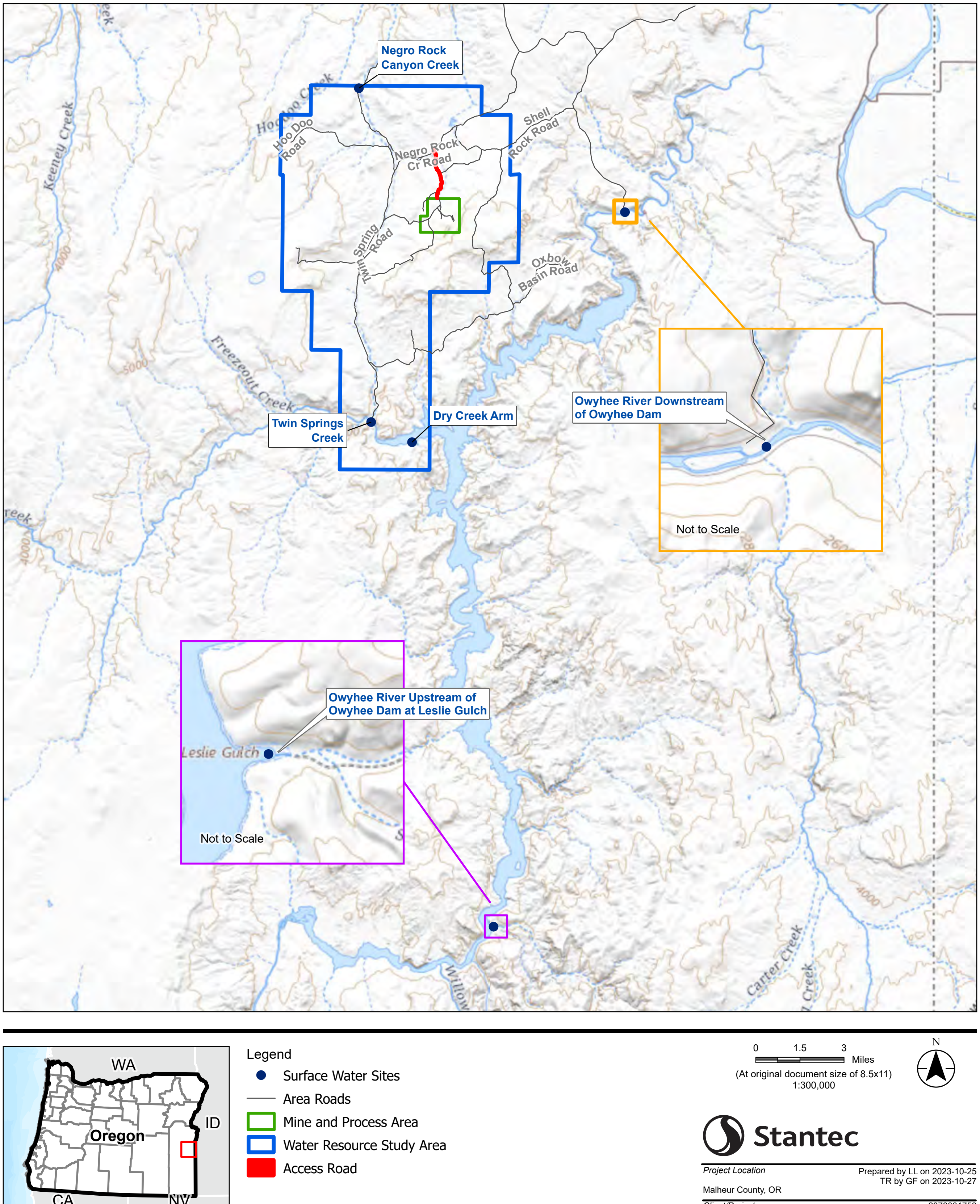
There are no perennial surface water streams in the vicinity of the Project. The Owyhee River and Owyhee Reservoir are located approximately 6 miles southeast of the Project.

There are some ephemeral waterbodies in the study area, including wetlands, springs, creeks, a pond, an artificial waterway, and tributary drainages. The USACE has determined that these ephemeral waterbodies are not jurisdictional waters regulated by Section 404 of the CWA (EM Strategies 2018). Wetlands are further discussed in Section 3.4.

The Negro Rock Canyon drainage contains an intermittent stream referred to as Negro Rock Canyon Creek, which runs south to north along the valley bottom (Figure 3.3-2). Observed flows in Negro Rock Canyon Creek have ranged between 0.01 and 0.04 cfs when present.

Twin Springs Creek is an ephemeral stream that flows from the south end of the Negro Rock Canyon/Owyhee River watershed divide southward to a confluence with Dry Creek, an ephemeral tributary to the Owyhee Reservoir (Figure 3.3-2). During monitoring periods, there has been no observed flow in Twin Springs Creek.

There are 29 springs and seeps in the water resources study area as shown in Figure 3.3-3. Most of these springs discharge from groundwater systems that depend on annual groundwater recharge and are greatly influenced by seasonal and climatic variations in precipitation. The combined rate of seep and spring flows ranges from 35 to 45 gpm.

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Project Location
Malheur County, OR

Prepared by LL on 2023-10-25
TR by GF on 2023-10-27

Client/Project
2378001753
DOGAMI
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Environmental Evaluation Report

Figure No.
**3.3-2**

Title
**Regional Surface Water and Spring Features**

***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI
3. Background: USGS Topo

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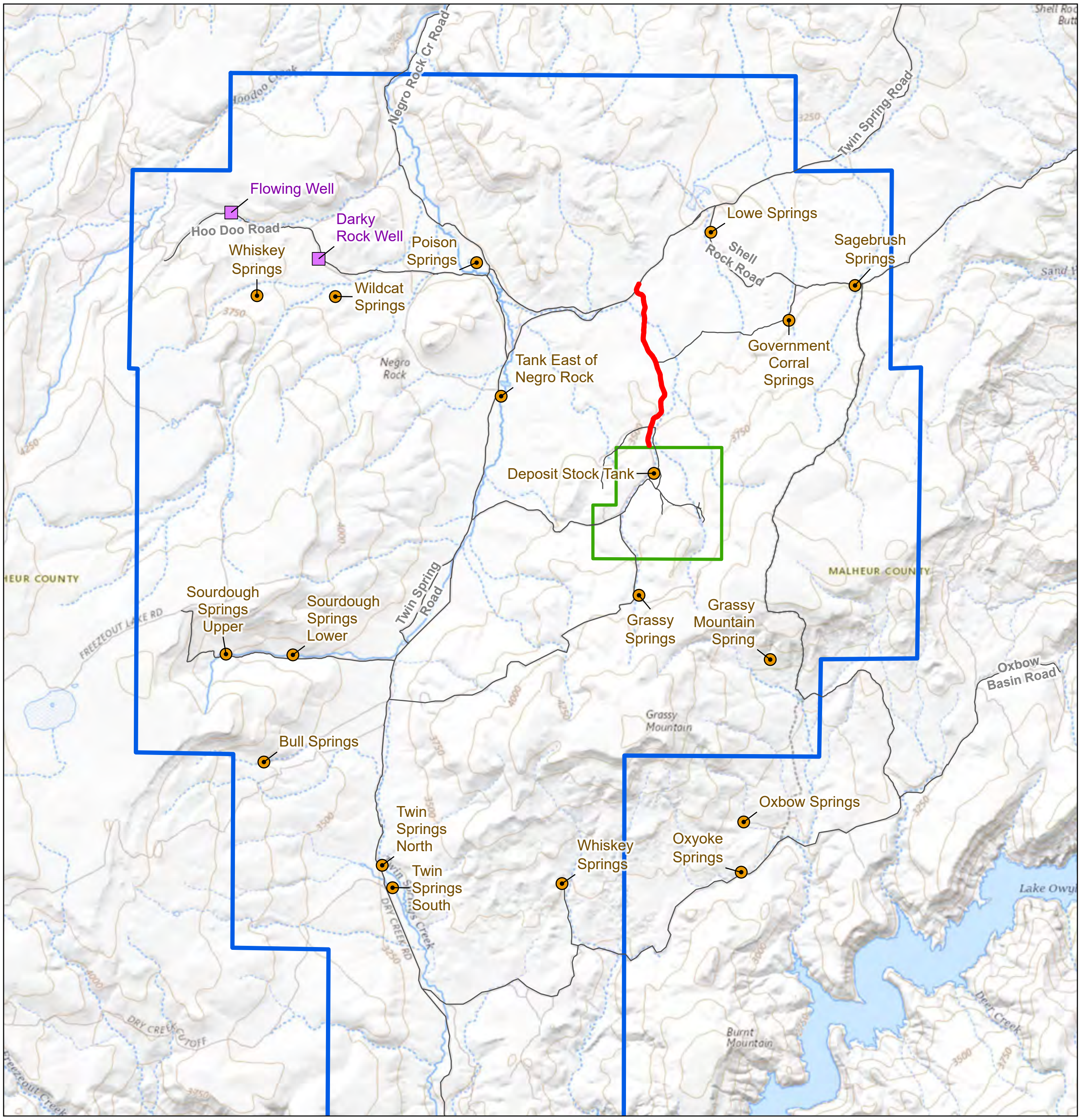


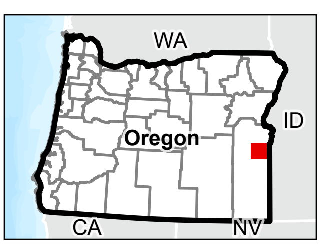


Legend
- Background Springs
- Flowing Wells
- Area Roads
- Mine and Process Area
- Water Resource Study Area
- Access Road Area

0 0.6 1.2 Miles
(At original document size of 8.5x11)
1:100,000

N

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Project Location
Malheur County, OR

Prepared by LL on 2023-10-25
TR by GF on 2023-10-27

Client/Project 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

Figure No.
**3.3-3**

Title
**Spring and Seep Locations**

***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI
3. Background: USGS Topo

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The water resources study area does not contain any floodplains per FEMA's mapping of floodplain hazard areas (FEMA 2017).

#### 3.3.3.3 Groundwater Resources

In-depth discussions of the hydrogeologic baseline conditions in the water resources study area are presented in the Applicant's Grassy Mountain Gold Project Groundwater Reports (SPF 2021a, 2012b, 2021c). Studies in the region have indicated that groundwater is found within permeable sediments and fractured rock consisting of arkosic sandstone, conglomerate, and tuffaceous siltstone (SPF 2021b). Below is a summary of the groundwater hydrogeologic setting and conditions in the water resources study area.

Recharge, storage, and movement of groundwater depend in part on the geologic conditions and the topography of an area. The general stratigraphic and structural framework of the water resources study area has been described in the Geology and Minerals section (Section 3.1). Overall, estimated hydraulic conductivity in bedrock in the water resources study area is low, with the hydraulic conductivity in the gold deposit area being very low. Sub-vertical faults are associated with local variation in groundwater levels or flows.

Groundwater pump tests and monitoring wells were used to identify groundwater flow paths beneath the surface. Groundwater movement in the mine area is inhibited by silicification and structures that reduce bedrock permeability and groundwater inflow into the area. The regional groundwater in the water resources study area flows from Grassy Mountain to the northwest into Negro Rock Canyon or southeast from the mountain toward the Owyhee River and Owyhee Reservoir.

The water balance developed by the Applicant for the Project shows relatively low volumes of water movement through the area, with most inflow resulting from precipitation and most outflow leaving the study area as groundwater outflow (Lorax 2022).

#### 3.3.3.4 Water Rights

The Applicant has water rights issued from WRD (ID 201970) in the amount of 2 cfs, which exceeds the planned water demand for mining, ore processing, dust control, and other water usage by the Project (Calico Resources USA Corp. 2019). In addition, there are nine surface water rights in Negro Rock Canyon that allow the diversion of water primarily for agricultural or wildlife use (WRD 2023).

#### 3.3.3.5 Water Quality

Water quality standards for state waters have been established by the DEQ. Primary standards are based on the potential use as a drinking water source and are established to protect human health, while secondary standards are for aesthetic qualities. These standards are also referred to as maximum contaminant levels and are presented in Table 3.3-1. The DEQ also has groundwater antidegradation regulations (OAR 340-040-0020) to control waste discharges to groundwater so that the highest possible water quality is maintained.

**Table 3.3-1 Oregon State Water Quality Standards**

| Analyte | Reference Value | Analyte | Reference Value |
|---|---|---|---|
| Alkalinity, bicarbonate ($CaCO_3$) | --- | Manganese | 0.05[a] |
| Alkalinity, total (as $CaCO_3$) | --- | Mercury | 0.002 |
| Aluminum | 0.2 | Nitrate + nitrite (as nitrogen [N]) | 10 |
| Antimony | 0.006 | Nitrogen, total (as N) | 10 |
| Arsenic | 0.010 | pH (±0.1 s.u.) | 6.5–8.5[a] |
| Barium | 2.0 | Potassium | --- |
| Beryllium | 0.004 | Selenium | 0.01 |
| Cadmium | 0.005 | Silver | 0.05 |
| Calcium | --- | Sodium | --- |
| Chloride | 250[a] | Sulfate | 500 |
| Chromium | 0.1 | Thallium | 0.002 |
| Copper | 1[a] | Total Dissolved Solids | 500[a] |
| Fluoride | 4.0 | Uranium | 0.03 |
| Iron | 0.3[a] | WAD cyanide[b] | 0.2 |
| Lead | 0.015 | Zinc | 5.0[a] |
| Magnesium | --- | | |

[a] Denotes secondary standard. Entries without an asterisk are primary standards. All units are in milligrams per liter (mg/L), except for pH in standard units (s.u.).

[b] WAD cyanide is weak acid dissociable cyanide, the portion of total cyanide complexes that are broken down under acidic conditions.

Water quality samples were taken from 10 creeks, springs, and seeps with sufficient flow to allow collection of adequate sample volume for laboratory analysis. Results indicate that surface waters in the study area are approximately neutral to alkaline pH (8.0 to 9.0) with TDS between 200 and 400 milligrams per liter (mg/L; SPF 2021a). Individual analyte concentrations are below reference values with the exception of arsenic, which typically exceeds its 0.01 mg/L standard in most surface waters (except for Governmental Corral Springs, Sagebrush Spring, and Lowe Spring) with concentrations ranging between 0.03 and 0.09 mg/L. In addition to arsenic, there are occasional detections of other constituents above the reference values including aluminum, manganese, and TDS. However, these concentrations are not persistent over multiple sampling events and are attributable to seasonal, sampling, and analytical variability.

While baseline selenium concentrations are below drinking water standards, they exceed their aquatic life standard (0.0042 mg/L) in the Deposit Stock Tank (0.0045 to 0.006 mg/L) and Twin Springs South (0.0044 to 0.0049 mg/L) (Figure 3.3-3).

To assess groundwater quality, samples were taken from 15 groundwater wells in the water resources study area. Results indicate that groundwater in the area has approximately neutral pH. Several wells have TDS concentrations greater than the reference value, ranging between 500 and 1,850 mg/L, with the highest observed TDS concentrations in the vicinity of the proposed mine area. Most of these wells exhibited a sodium-potassium sulfate water type, consistent with their proximity to sulfide mineralization in the gold deposit. Groundwater wells farther from the deposit exhibited calcium bicarbonate or sodium-potassium bicarbonate water types with lower sulfate concentrations (SPF 2021a).

With regard to individual constituent concentrations, the groundwater meets drinking water standards with some exceptions. All wells had arsenic concentrations greater than the 0.01 mg/L standard with concentrations ranging from 0.01 to 0.16 mg/L and the highest concentrations in proximity to the ore deposit. Three wells had antimony concentrations greater than the 0.006 mg/L standard with antimony concentrations ranging from 0.022 to 0.298 mg/L. Total aluminum, iron, manganese, and sulfate concentrations were detected above their reference values in approximately half of the wells. Mercury concentrations are typically not detected in groundwater above a method detection limit of <1 nanograms per liter (ng/L) with only periodic detections in groundwater wells at concentrations between 1 and 4 ng/L.

#### 3.3.3.6 Geochemistry of Mined Rock

The potential for excavated rock at the Project site to generate acid conditions is based on its mineral and metal content (see Appendix D of this EE for more details). Acid-base accounting is a laboratory analysis that determines the geochemical metrics of a rock sample to determine the ability of the rock to neutralize acid and the potential for the rock to generate acidity. Results from samples from the mine area and simulated tailings show very low neutralization potential, and most samples were classified as potentially acid generating or uncertain. The borrow material and road cut material were characterized as non–acid generating. Static net acid generation testing was also conducted to determine the maximum potential for acid generation from samples and can provide a better estimate of actual acid generation than the mass-based acid-base accounting testing. For waste rock and ore samples, the net acid generation testing indicated that 7 percent of the materials tested were strongly acid generating, 40 percent of the materials showed a moderate potential for acid generation, and the remainder did not generate acidity. Humidity cell testing was also conducted that confirmed the results of the other tests in that approximately half of the samples showed potential for acid generation. Effluent from more than half of the materials tested contained arsenic and selenium concentrations above standards regardless of whether the effluent was acidic or circumneutral. Other constituents (i.e., cadmium, copper, chromium, lead, mercury, and zinc) were present infrequently in the test results and were associated with acidic leachate in all instances.

### 3.3.4 Impact Analysis

#### 3.3.4.1 No Action Alternative

Under the No Action Alternative, development of the Project would not be authorized, and a new underground mine would not be constructed, operated, and closed. Modifications or reclassification of disturbance would not occur, and current authorized exploration activities may continue. There would be no anticipated effects on water resources under the No Action Alternative because there would be no production of groundwater for dewatering and mining usage to affect groundwater levels and surface waters, and there would be no mined materials with the potential for acid generation and leaching of constituents.

#### 3.3.4.2 Applicant's Proposed Project

The dewatering and groundwater drawdown model developed for the Project predicted the groundwater levels during pumping and after cessation. In practice, regional groundwater flow model predictions for drawdown of 10 feet are considered to be reliable for the assessment of potential impacts (BLM 2019). Drawdown predictions of less than 10 feet tend to be within the range of natural seasonal variability in water levels and below the resolution of numerical groundwater flow models. The uncertainty in model predictions of groundwater drawdown less than 10 feet would be addressed via monitoring and mitigation measures associated with water resources effects. Drawdown greater than 10 feet attributable to the Project would be limited by the relatively low pumping rate associated with the proposed dewatering and groundwater production, occurring primarily within 0.5 mile of the pumping areas. After dewatering and groundwater production pumping end, the subsurface area within which lowered water levels occur would spread laterally as groundwater water re-equilibrates by flowing back toward the drawn down area. After approximately 50 years of recovery, groundwater levels would remain lower in the vicinity of the dewatering and pumping wells due to the low recharge and low permeability of the area, which would slow the recovery of water levels. While the groundwater levels in pumping areas recover toward their baseline elevations, the lateral extent of drawdown greater than 10 feet would increase to approximately 0.75 mile from the pumping areas.

There are two water rights held by the BLM for livestock and wildlife within the predicted area of groundwater drawdown (Water Right IDs 115224 and 126953). Both these water rights involve reservoirs constructed to retain surface water runoff. Because these reservoirs are not related to groundwater, dewatering drawdown in their vicinity would have a negligible effect on their water supply and function. The maximum extent of the combined dewatering 10-foot drawdown of groundwater would occur in approximately 600 acres of the Negro Rock Canyon drainage area. A new groundwater equilibrium is predicted after approximately 100 years of recovery. Impacts to groundwater quantity as a result of the Proposed Action would be major, long term to permanent, and localized. However, impacts to water rights and water supplies based on these groundwater quantity impacts would be negligible.

There are no perennial streams or river segments within the predicted drawdown area associated with Project dewatering and groundwater production. The closest perennial stream and river segments are approximately 4 miles from the predicted groundwater drawdown. Therefore, impacts from groundwater drawdown in these areas would be negligible.

The Deposit Stock Tank within the water resources study area (Figure 3.3-3) would be removed to accommodate development of Project facilities, resulting in direct effects to this water source. However, since this area would be fenced to prevent wildlife access, the stock tank would not be required for its current purpose, for grazing animals. While there are other streams, springs, and seeps in the water resources study area, these are outside of the Mine and Process Area permit boundary (Figure 3.3-3), so there would be no direct surface disturbance of these sites. Localized groundwater drawdown extends toward springs and stock tanks located approximately 1 mile northeast of the mine, toward springs and a stock tank located approximately 1.5 miles west of the mine, and toward a stock tank located approximately 1 mile southeast of the mine. Predicted drawdown ranges between 0.5 and 11 feet. Depending on the depth of the groundwater and the nature of hydraulic connections sourcing these areas, the predicted drawdown may affect flows in some of these springs. Springs that are not fed by groundwater but rather by stormwater runoff and accumulated storage of stormwater in soils would not be affected by groundwater drawdown. The uncertainty in this effect can be resolved through monitoring and potential mitigation of reduced spring flows if a reduction in flow is observed. If there is an observed reduction in flow at a spring location, effects could be mitigated by supplementing flow with groundwater pumped from a new groundwater well installed near the spring or piping groundwater from a nearby existing well. This supplementation measure is commonly applied regionally to mitigate effects of mine dewatering on spring flows (BLM 2019).

The Applicant proposes to monitor groundwater levels and quality. Two groundwater monitoring wells would be installed to collect groundwater elevation data to assess if groundwater levels near select springs are impacted by water supply operations. The monitoring wells are proposed to be screened in the Grassy Mountain Formation, which is the same aquifer from which the mine production wells would draw water. In the event that changes in groundwater are identified, measures would be taken to reduce effects. Immediate mitigation measures would be triggered if any of the following conditions resulted from mining activities:

- Spring or seep water is not present during a 4-month season when it was present during baseline assessment;
- The spring or seep flow is reduced to one-quarter or less of the measured seasonal baseline flow; or
- The overall size of the spring or seep ground surface wetted area (determined through a formal delineation during the baseline survey and monitoring events) is one-quarter or less of the measured season baseline area.

Immediate mitigation measures would consist of consultation with stakeholders (e.g., the BLM, DEQ, DOGAMI, ODFW) followed by the installation of a well or use of a nearby well fitted with a pump to replace the spring or seep flow at the ground surface at or near the location of the spring or seep. Additional mitigative actions are provided in Appendix B of the Spring and Seep Monitoring and Mitigation Plan (SLR 2024). If immediate mitigation measures are anticipated to take more than 90 calendar days from the triggering event, then water would be transported from an alternative potable water source to provide water at the location of the affected spring or seep until the immediate mitigation measures are operating.

Overall, impacts from the Applicant’s proposed Project to surface water quantity are anticipated to be negligible to moderate, long term to permanent, and localized.

Stormwater runoff may mobilize sediment from expanded construction operations and road networks. Project BMPs would be implemented to reduce impacts from sediment mobilization during construction, including the use of erosion control blankets and installation of temporary drainage ditches during construction. In addition, compliance with Oregon’s general stormwater permit and the stormwater pollution prevention plan (SWPPP; WSP USA Inc. 2023) for the Project would reduce such effects. Impacts to stormwater runoff from mobilization of sediment are anticipated to be short term, minor, and localized.

Reduction in alluvial groundwater levels has the potential to result in ground subsidence. Impacts due to subsidence associated with dewatering are discussed in Section 3.1. Subsidence has the potential to affect the volume of water stored in an alluvial aquifer and its hydraulic permeability characteristics if the subsidence resulted in a substantial reduction in alluvial pore space available for groundwater. The volume and duration of groundwater pumping results in drawdown of less than 40 feet in unconsolidated alluvium in the immediate vicinity of the mine. Based on this drawdown, subsidence effects associated with groundwater levels would be limited by partial consolidation of desaturated alluvial materials in that dewatered interval. Alluvial consolidation associated with less than 40 feet of groundwater drawdown typically yields subsidence at the ground surface of less than a few inches (BLM 2019). Impacts from subsidence attributed to the Proposed Action are anticipated to be negligible to minor, permanent, and localized.

Since the water resources study area does not contain any floodplains, there would be no effects to floodplains from the Applicant's proposed Project.

Geochemical characterization of waste rock that would be produced by the Project indicates that the majority of the waste rock and unprocessed ore material would generate acid and leach metals including arsenic, selenium, and other constituents associated with acidic drainage under long-term weathering conditions. Therefore, waste rock would be placed in a lined facility to inhibit contact between the material and its leachate with the environment. The water resources study area has an arid condition and negative water balance, which also inhibits sulfide oxidation and waste rock leaching. Annual evaporation (43 inches) exceeds annual precipitation (10 inches) at the Project site (Calico Resources USA Corp. 2021), limiting the amount of meteoric water in contact with the waste rock. This is consistent with the observations of an existing TWRSF in the region (BLM 2019). Due to the basal liner and reclamation, impacts from the TWRSF on groundwater and surface water quality are anticipated to be negligible, long term, and localized.

With regard to groundwater quality within the underground mine, the proposed backfill consists of a 7 percent cement mix with borrow material composed primarily of basalt from a nearby borrow source. The 7 percent cement far exceeds the average and maximum sulfide concentrations observed in the deposit rock materials (i.e., 0.1 and 2.7 percent, respectively). Therefore, it would supply sufficient neutralization capacity to offset the acid-generating potential of mined material. However, arsenic and selenium could still potentially leach from exposed mine workings into groundwater. Arsenic in leachate from the underground mine workings has the potential to increase local groundwater arsenic concentrations. However, existing arsenic concentrations in groundwater are above the drinking water standard; they would remain above the standard post-mining. Selenium has the potential to increase local groundwater selenium concentrations briefly upon groundwater recovery into the underground mine workings. However, selenium concentrations would return to baseline conditions thereafter. Furthermore, the mine deposit area is contained within a local depression in the groundwater's surface, so transport of these constituents away from the deposit area would be inhibited by the local groundwater gradients and low permeability of the aquifer materials. Based on the potential for leaching of arsenic from underground mine workings, impacts of mine operations and facilities on groundwater quality are expected to be minor, permanent, and localized to the deposit area.

During operations, lime would be added to tailings for pH control and to facilitate recycling of process solution in a cyanide process dependent on maintaining a high pH. Cyanide in process solutions breaks down into its constituent carbon and nitrogen components when the pH is below 9.2, eliminating its utility in gold and silver extraction (see Appendix C for additional details). The addition of lime would mitigate the potential for acid generation by the tailings, but the potential for arsenic and selenium concentrations to go above reference values would persist. The tailings would be placed in a lined facility to inhibit contact between the material, its leachate, and process solution and the environment. Cyanide destruction would also be employed to limit cyanide concentrations in the tailings and in the process water. A tailings management plan would be developed to collect samples of tailings on a routine basis for geochemical testing in order to adjust the amounts of lime to be added during operations (SRK Consulting 2022).

At closure, process waters would be evaporated to remove free water from the tailings impoundment and a geosynthetic cover would be placed over the tailings, followed by a revegetated alluvial cover. The liner and cover system combined with area's arid condition and negative water balance would inhibit contact of tailings with meteoric water and the environment. Residual long-term drainage from the tailings would be routed to the TSF reclaim pond, which would be converted into an e-cell. Impacts from the TSF on groundwater and surface water quality are anticipated to be negligible, long term, and localized. Potential exposure of wildlife to the tailings and process solution is addressed in Section 3.5.

The operational period stormwater controls for proposed facilities would remain in place into the post-closure period. These controls would divert most stormwater away from Project facilities including the closed TWRSF and TSF. Reclamation of the TWRSF and TSF would include an internal drainage swale to route precipitation that falls directly on these reclaimed facilities into a native drainage, where water would evaporate due to the arid conditions of the area (Calico Resources USA Corp. 2023a). Long-term stormwater management via stormwater controls and drainage swale would require that these be durable and functional into the future. While these controls are sized and designed to be constructed from materials that have been used successfully at operating and reclaimed mine sites in the region, they would need to be subject to post-closure monitoring to ensure their physical integrity and performance in managing stormwater. If post-closure monitoring indicated any maintenance or performance issues, maintenance and repair would be needed for the stormwater controls to function effectively in the long term.

A large-volume release of fuels, reagents, and process water to the environment at the mine site is not likely based on the planned infrastructure, which is specifically designed for the storage and management of these materials, and the use of secondary containments (Ausenco 2022; Golder Associates 2021). The mine would have a SWPPP (WSP USA Inc. 2023), under which employees and contractors would receive training on spill prevention and inspections of material storage and handling areas would be conducted. Bulk material storage facilities would be constructed with secondary containment systems in place. Tanks would be aboveground, with lined containment facilities capable of holding a minimum of 110 percent of the largest tank volume within the containment. Process areas would be equipped with spill containment and collection sumps or ponds to retain any leaks of spills of process water or slurries. Process spills would be recycled back into the process circuit without discharge to the environment.

Traffic incidents and spills of materials on access roads typically result in small-volume releases of fuels from the vehicles themselves, which can be contained and recovered. Large-material releases from bulk truckloads have low probability of occurring but could potentially occur due to puncture of a bulk tanker in an incident. Spill response measures such as containment, deployment of absorbent material, and removal of spilled material and affected roadbed would limit effects of the spill.

In the event of a leak or spill, the source of the release would be stopped and released materials would be removed for appropriate disposal per the Project's emergency response plan (Calico Resources USA Corp. 2023b). Under this plan, spills from transporters or mine equipment would be immediately responded to and cleaned up in order to limit the area affected by the release. Since there are no perennially flowing surface waters within or near the mine site and access road, any releases would typically be to surface soils rather than flowing water, facilitating the containment and removal of spilled material.

#### 3.3.4.3 Alternative A

Under Alternative A, groundwater pumping for mine dewatering and water supply would remain the same as under the Applicant's proposed Project. Therefore, the effects on water quantity and water rights would be the same as the Applicant's proposed Project.

Waste rock and exposed rock in the underground mine workings would have the same acid-generating and metal-leaching potential. Therefore, acid generation and leaching effects on surface and groundwater quality would be the same as under the Applicant's proposed Project.

Use of thiosulfate under Alternative A in place of cyanide would modify the chemistry and leaching potential of the tailings material. However, while cyanide would no longer be present in the tailings and process solution, use of thiosulfate as a leaching reagent would still mobilize other constituents from the tailings material, including arsenic and selenium. Leached concentrations of these constituents in process solutions may vary from those in the Applicant's proposed Project but would most likely be above reference values. The tailings material would remain acid generating, with the potential to leach metals associated with acid generation unless lime application is used to control pH. Therefore, under Alternative A, the tailings and process solution would also need to be managed with liner systems, secondary containments, leak detection, and groundwater monitoring to prevent environmental exposure to the tailings and process solution. Lastly, the process solution would need to be managed in the closure and post-closure period to prevent release of water with constituents above standards (e.g., arsenic) to surface and groundwater.

Stormwater controls and spill response would be the same as for the Applicant's proposed Project.

# 3.4 VEGETATION AND WETLANDS

The vegetation and wetlands study area consists of the entire Permit Area (the Mine and Process Area and the Access Road Area) (Figure 3.4-1). The analysis of impacts to vegetation includes consideration of effects to vegetation communities and listed plant species.

## 3.4.1 Regulatory Context

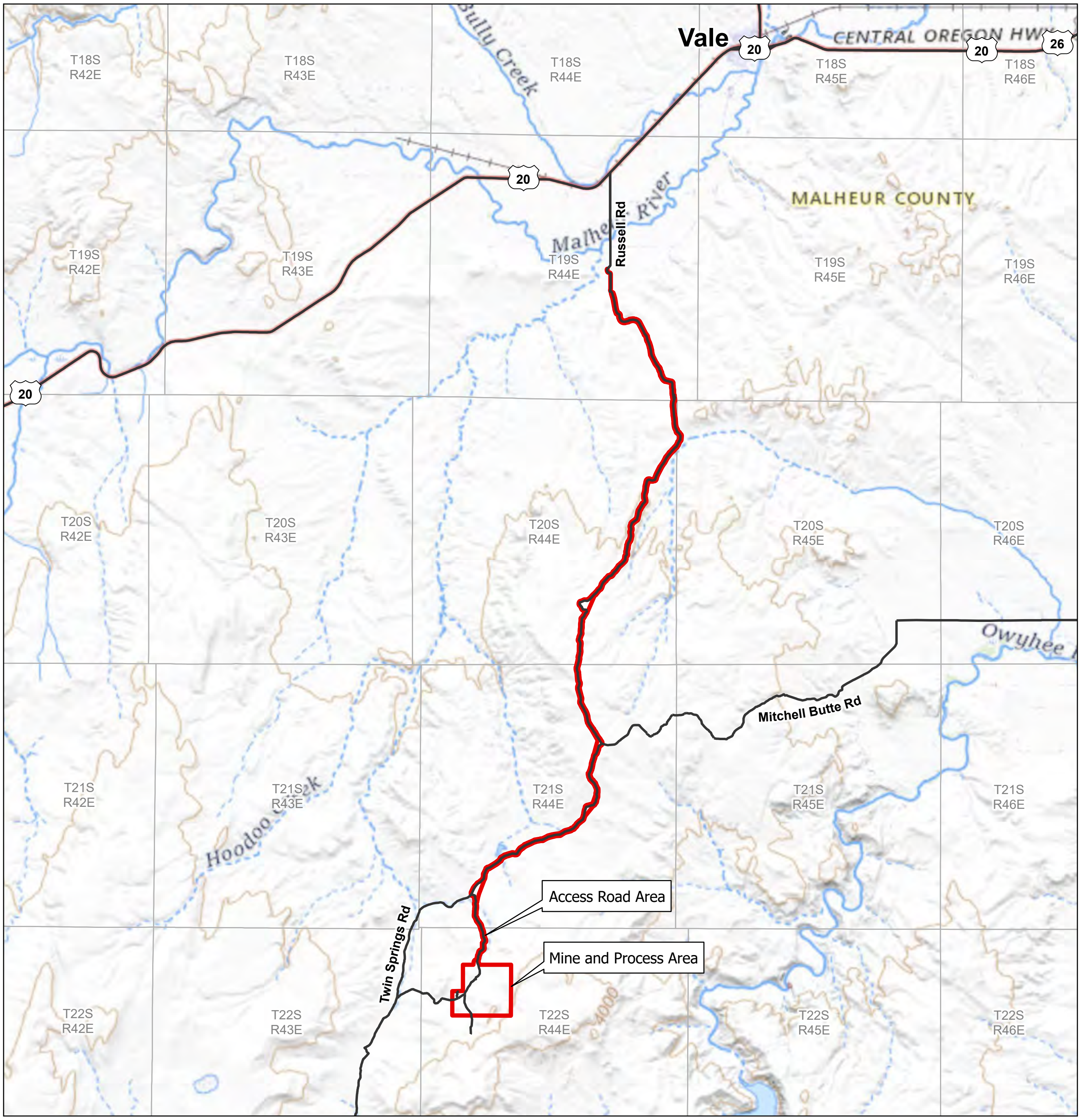
Native plants that are listed as threatened or endangered in Oregon are protected under the Oregon Endangered Species Act on all public non-federal lands. In this instance, Oregon endangered species regulations would not apply to lands in the study area owned or managed by the BLM. The ODA is given the responsibility for conservation of state-listed native plants. Any land action on Oregon non-federal public lands that results, or might result, in the collection or disturbance of a threatened or endangered species requires a permit and/or consultation with staff at the ODA.

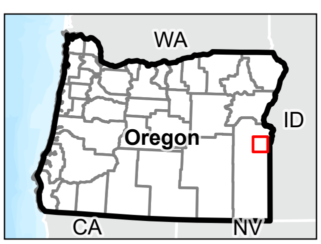
The BLM is reviewing the effects of the proposed Project to federally listed plant species as part of its NEPA environmental review. Results of the analysis will be published in an EIS.

In Oregon, wetlands are regulated through the authority of federal and state laws and, in some cases, city or county ordinances. If development activities involve earthwork (such as filling, excavating, or grading) within a wetland, state, federal, and/or local permits may be required.

The DSL regulates wetlands under the state Removal-Fill Law, which was enacted in 1967 to protect public navigation, fishery, and recreational uses of “waters of the state,” which includes wetlands. The DSL Wetlands Program implements the state Wetlands Conservation Act (1989), which promotes the protection, conservation, and best use of wetland resources, their functions, and values through the integration and close coordination of statewide planning goals, local comprehensive plans, and state and federal regulatory programs.

The DEQ reviews federal permits and licenses affecting wetlands for compliance with Oregon’s water-quality standards under Section 401 of the CWA. In addition, county or city governments may adopt land use ordinances that regulate locally significant wetlands, as identified through Oregon’s Statewide Planning Goals.




Legend
- Study Area
- Existing Roads

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*Project Location*
Malheur County, OR

Prepared by LL on 2023-10-23
TR by MW on 2023-10-25

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.4-1**

*Title*
**Vegetation and Wetlands Study Area**

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources:
**3.** Background: USGS Topo

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### 3.4.2 Method of Analysis

Existing occurrences of state-listed plant species were obtained from the Applicant's baseline vegetation surveys, and available information from county databases was reviewed. The Applicant conducted baseline vegetation surveys in 2014, 2015, 2017, and 2019 as described in the *Terrestrial Vegetation Baseline Report* (EM Strategies 2018a) and *Botanical Survey & Vegetation Community Mapping Report* (Siskiyou BioSurvey LLC 2019). This information was supplemented with spatial information on listed plant observations obtained from the Oregon Biodiversity Information Center (ORBIC; ORBIC 2023). Impacts to vegetation were assessed quantitatively using the acreages for proposed Project facilities that would disturb vegetation generally and at specific areas for listed plants. Impacts to listed plant species were also assessed qualitatively by considering the effects of construction activities, mining operations, and post-reclamation land use on specific plant communities and listed species with respect to their characteristics and sensitivity to potential disturbances.

Information on wetlands in the study area was obtained from wetland field surveys and delineations conducted in 2012, 2015, and 2017 as described in the *Wetland Delineation Report* (EM Strategies 2018b). Effects to wetlands were assessed by considering effects of construction activities, mining operations, and post-reclamation land use on the different wetland types in the study area with respect to their locations and characteristics.

### 3.4.3 Affected Environment

#### 3.4.3.1 Vegetation Communities

Most of the vegetation within the study area is a desert-rangeland type, where sagebrush and grasses are the dominant species. A large portion of the area has been impacted by grazing, fire, and range seeding programs. Cheatgrass (*Bromus tectorum*) was one of the dominant species in every plant community, likely due to disturbance from grazing and wildfire.

In total, nine plant communities were identified during vegetation surveys of the study area as described in Table 3.4-1.

**Table 3.4-1 Plant Communities in the Study Area**

| Plant Community Name | Characteristics | Mine and Process Area (acres affected) | Access Road (acres affected) |
|---|---|---|---|
| Bluebunch Wheatgrass/ Cheatgrass/Annual-Perennial Community | A relatively native vegetation type, where native perennial forbs and grasses are common but also contains some invasive and/or noxious species including bur buttercup (*Ceratocephala testiculata*) and medusahead rye (*Taeniatherum caput-medusae*). | 69.0 | 49.5 |
| Crested Wheatgrass Seeded Community | A non-native vegetation type dominated by crested wheatgrass (*Agropyron cristatum*), with patches of bare ground and non-native restoration seeding that occurred after rangeland fires. | 191.6 | 0.0 |

| Plant Community Name | Characteristics | Mine and Process Area (acres affected) | Access Road (acres affected) |
|---|---|---|---|
| Big Sagebrush/Crested Wheatgrass Community | A mixed native/non-native plant community type where non-native crested wheatgrass (*Agropyron cristatum*) was seeded into Wyoming big sagebrush (*Artemesia tridentata* var. *wyomingensis*), along with a mix of native and non-native annuals and perennial forbs. | 37.6 | 54.1 |
| Yellow Rabbitbrush/ Bluebunch Wheatgrass Community | A native vegetation type, dominated by a sparse to moderate cover of yellow rabbitbrush (*Chrysothamnus viscidiflorus*) with bluebunch wheatgrass (*Agropyron spicatum*) in the understory, with areas where native bunch grass species co-dominate. | 49.9 | 21.9 |
| Big Sagebrush/Bluebunch Wheatgrass Community | A native vegetation type, dominated by a sparse to moderate cover of Wyoming big sagebrush (*Artemesia tridentata* var. *wyomingensis*) and a low to moderate cover of bluebunch wheatgrass (*Agropyron spicatum*), with other native bunch grass and forb species. | 145.4 | 398.1 |
| Annual Weedy Grass-Forb Community | A highly disturbed, weedy, non-native-dominated vegetation type, with extensive areas of noxious medusahead rye (*Taeniatherum caput-medusae*). | 268.6 | 156.3 |
| Big Sagebrush/Weedy Annual Grass-Forb Community | A disturbed native plant community, with native Wyoming big sagebrush (*Artemesia tridentata* var. *wyomingensis*) and an understory dominated by non-native annuals, including cheatgrass (*Bromus tectorum*) and scattered weedy forbs, and extensive areas of noxious medusahead rye (*Taeniatherum caput-medusae*). | 9.3 | 129.1 |
| Mixed Annual Weedy Grass-Forb/Native Bunch Grass Community | A disturbed weedy plant community type with a low cover of native bunch grass species including Sandberg bluegrass (*Poa secunda*). | 42.0 | 47.2 |
| Irrigated Pasture/Agricultural Crop Plant Community | A completely non-native converted plant community with annual crops dominating and weedy species occurring along fence lines and irrigation ditches. | 12.0 | 0.0 |

Source: Siskiyou BioSurvey LLC 2019

#### 3.4.3.2 State-listed Plant Species

Two plant species were reported by ORBIC to occur within the Access Road Area: Cronquist's stickseed (*Hackelia cronquistii*), designated by the state as threatened, and Mulford's milkvetch (*Astragalus mulfordiae*), designated by the state as endangered (ORBIC 2017). These ORBIC occurrences are shown in Figures 3.4-2 through 3.4-10.

Based on conversations with BLM Vale District Botanist Susan Fritts, two additional state-listed plant species were determined to have a high potential to be present in the study area: sterile milkvetch (*Astragalus cusickii* var.*Sterilis*), designated by the state as threatened, and soft blazingstar (*Mentzelia mollis*), designated by the state as endangered (Siskiyou BioSurvey LLC 2019).

The only state-listed plant observed during vegetation surveys in the study area was Mulford's milkvetch. This plant is limited to a region approximately 100 miles by 100 miles in shrub-steppe and desert shrub communities west of the Snake River Plain in eastern Oregon and adjacent southwest Idaho. It occurs from the Owyhee Uplands of Malheur County, Oregon, east to the Owyhee Front and to the Boise Foothills of Idaho. Mulford's milkvetch was observed in 2019 along the access road at multiple locations (Figure 3.4-4). At one site, these plants were observed within 3 meters of the road, and at a second site they were observed within 10 meters of the road. Other observations were farther than 10 meters from the study area.

#### 3.4.3.3 Wetlands

National Wetlands Inventory (NWI) data show that there are two wetlands in the study area (USFWS 2023). One NWI-mapped palustrine emergent wetland was confirmed though field investigations in the study area and is labeled Wetland 1 in Table 3.4-2. The second NWI-mapped wetland does not meet wetland criteria (EM Strategies 2018b) according to the soil data from the field surveys. During the field surveys, a palustrine emergent wetland was identified, labeled Wetland 2 in Table 3.4-2, although this is not included in the NWI database. The two field-confirmed wetlands (Wetlands 1 and 2) are located within the Access Road Area, as shown on Figure 3.4-8, and are associated with groundwater seeps/springs located in the immediate area, but do not appear to be connected to any downstream waters. These two wetlands do not demonstrate a significant nexus to a traditional navigable water of the United States and therefore are presumed not jurisdictional under USACE. However, they do meet the requirements for state DSL jurisdiction, and, as such, any proposed filling of these wetlands requires a permit from DSL.

NWI mapping shows two freshwater ponds within the northern portion of the study area. Field investigations found that one of these ponds did not contain water at the time of investigation and appeared to be a small, bermed area that was used to capture water from seeps that feed Wetland 1 but had since been abandoned. However, a new wetland delineation is recommended to attempt to identify the NWI-mapped and non-NWI-mapped wetlands and waterbodies in the study area as the extent, condition, and function of these resources can change over time, so that adequate avoidance and mitigation measures can be identified for all resources.

The second NWI-mapped pond is an existing stock water pond that was mapped outside of the study area during the field investigation and not inside as indicated by NWI mapping. NWI maps also indicate that numerous intermittent, temporarily flooded streambeds are located within the study area that generally flow from south to north. However, field surveys found that these areas are ephemeral stream channels, not riverine wetlands.

Ten unnamed tributary drainages and one artificial waterway (J-H Canal) also occur within the study area. These areas were investigated in the field. A portion of one of the 10 drainages (2b) was determined to be intermittent, and the remaining tributary channels (1 through 10) are considered ephemeral. The one tributary drainage portion determined to be intermittent is located in the north portion of the Mine and Process Area as shown on Figure 3.4-10. This intermittent tributary would fall under state jurisdiction,1 and any placement of fill in this tributary would require a DSL permit.

The J-H Canal crosses the proposed access road approximately 0.4 mile from the northern boundary of the study area (Figure 3.4-2) and is used for irrigation of adjacent agricultural fields. An earthen berm, approximately 10 feet in height, occurs on the right bank of the canal, and a water control structure was observed on the left bank. Currently, NWI classifies the canal as a riverine wetland; however, this is an artificial waterway.

Two springs (Springs 1 and 2), and one impounded area (Schweitzer Reservoir) were also identified during field investigations (EM Strategies 2018b) as shown in Table 3.4-2 and in Figure 3.4-8. Bubbling water was observed at the surface of both springs. A soil investigation confirmed that the Schweitzer Reservoir did not meet wetland criteria.

A total of two wetlands, two springs, one pond (Schweitzer Reservoir), one artificial waterway (J-H Canal), and 10 tributary drainages occur within the study area. Table 3.4-2 and Figures 3.4-2 through 3.4-10 show these wetlands and non-wetland waterbodies in the study area.

### Table 3.4-2 Wetlands and Non-wetland Waterbodies in the Study Area

| Wetland Name | NWI-Mapped Characteristics | Field Survey Results | State Wetland Status |
|---|---|---|---|
| Wetland 1 | PEM1B[1]: palustrine, emergent, persistent, and saturated | • 0.25 acre in size<br>• 1 inch of surface water observed, associated with a small spring complex<br>• High water table<br>• Located in Access Road Area (Figure 3.4-8) | Wetland, water of the state |
| Wetland 2 | Unmapped | • 0.04 acre in size<br>• 2 inches of surface water observed, associated with a small spring complex<br>• High water table<br>• Located in Access Road Area (Figure 3.4-8) | Wetland, water of the state |
| Spring 1 | Unmapped | • Bare soil and no vegetation observed<br>• Located in Access Road Area (Figure 3.4-8) | Non-wetland waterbody |
| Spring 2 | Unmapped | • Water was observed bubbling from Spring 2 and flowing into Wetland 2<br>• Located in Access Road Area (Figure 3.4-8) | Non-wetland waterbody |

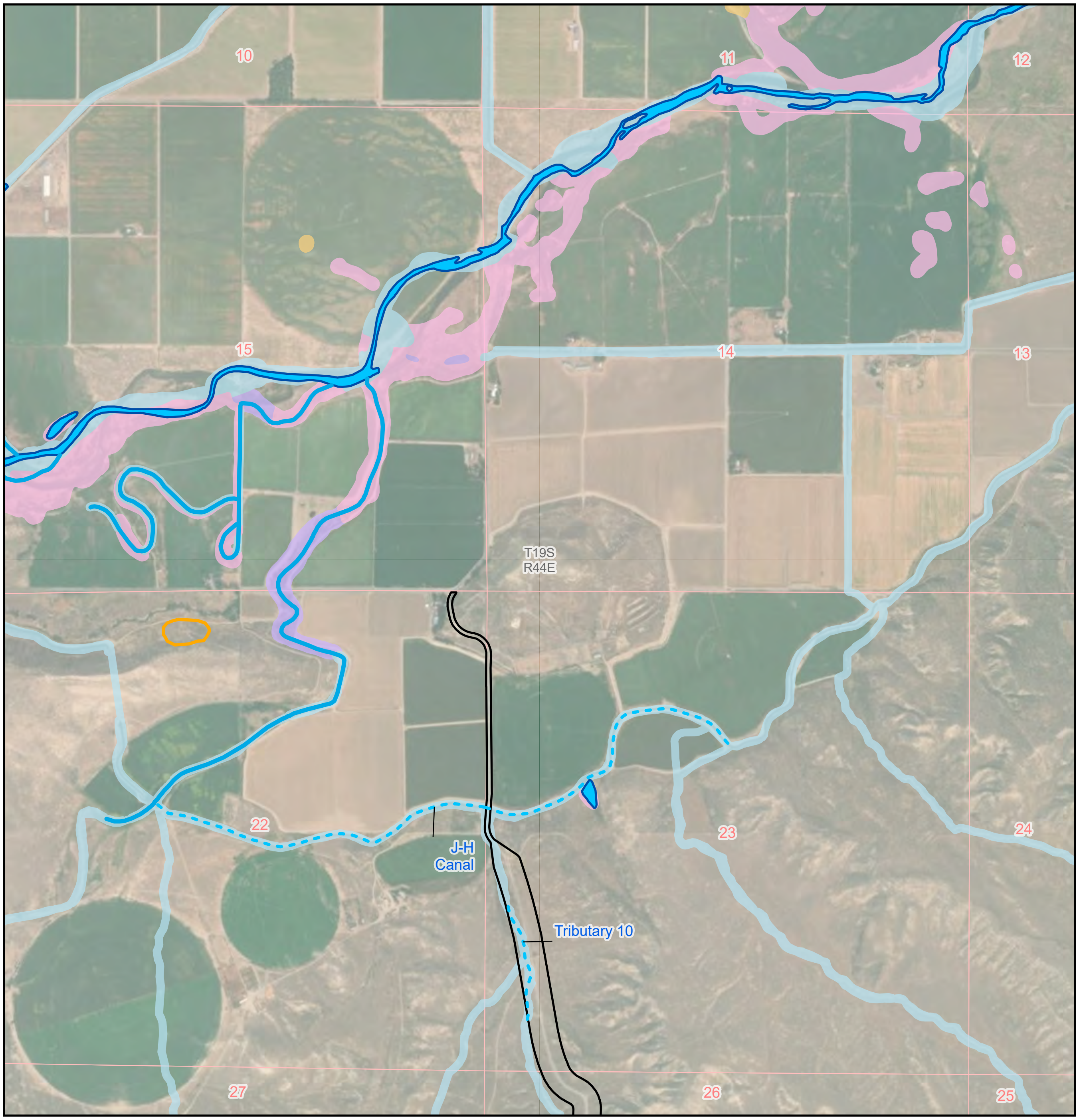
1 All 10 drainages may be considered jurisdictional by the USACE if a connection to the Malheur River is confirmed via additional field studies.

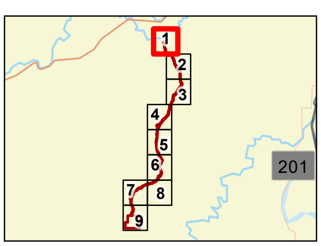
| Wetland Name | NWI-Mapped Characteristics | Field Survey Results | State Wetland Status |
|---|---|---|---|
| Schweitzer Reservoir<br>(pond) | PUSCh[2]: palustrine, unconsolidated shore, seasonally flooded, diked/impounded | • Does not meet wetland criteria<br>• Located in Mine and Process Area (Figure 3.4-10) | Non-wetland waterbody |
| J-H Canal<br>(artificial waterway) | Riverine wetland | • Non-wetland artificial waterbody<br>• Located in Access Road Area (Figure 3.4-2) | Non-wetland waterbody |
| Ten tributary drainages<br>(1 through 10) | Unmapped | • 9 ephemeral waterbodies<br>• Located in Access Road Area and Mine and Process Area (Figures 3.4-2 through 3.4-10) | Non-wetland waterbodies |
| One portion of one tributary drainage<br>(2b) | Unmapped | • 1 intermittent waterbody; wetland<br>• Located in north section of Mine and Process Area (Figure 3.4-10) | Wetland, waters of the state |

1 0.09 acre extends outside of the study area.

2 These wetlands have been created or modified by an anthropogenic barrier or dam that obstructs the inflow or outflow of water.

Two wetlands (Wetlands 1 and 2) and one portion of one tributary drainage (2b) within the study area were determined to be waters of the state (Table 3.4-2; Figures 3.4-2 through 3.4-10). Figures 3.4-2 through 3.4-10 show NWI and National Hydrography Dataset (NHD) identified waterbodies from desktop reviews and waterbodies identified during the wetland field surveys.




Legend

- Study Area
- Perennial Stream

**NWI Wetland Type (2022)**

- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Riverine
- NHD Waterbody (2022)

**Surveyed Waterbodies**

- Waterway

**Known Occurrences**

- Cronquist's Stickseed (ORBIC Report)

0 0.1 0.2 Miles
(At original document size of 8.5x11)
1:20,000

N

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI, ORBIC, USFWS, NWI
**3.** Background: Esri USA Topo Maps

Stantec

*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-14
TR by AF on 2023-12-14

*Client/Project*
2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.4-2**

*Title*
**Vegetation and Wetlands - Map 1**

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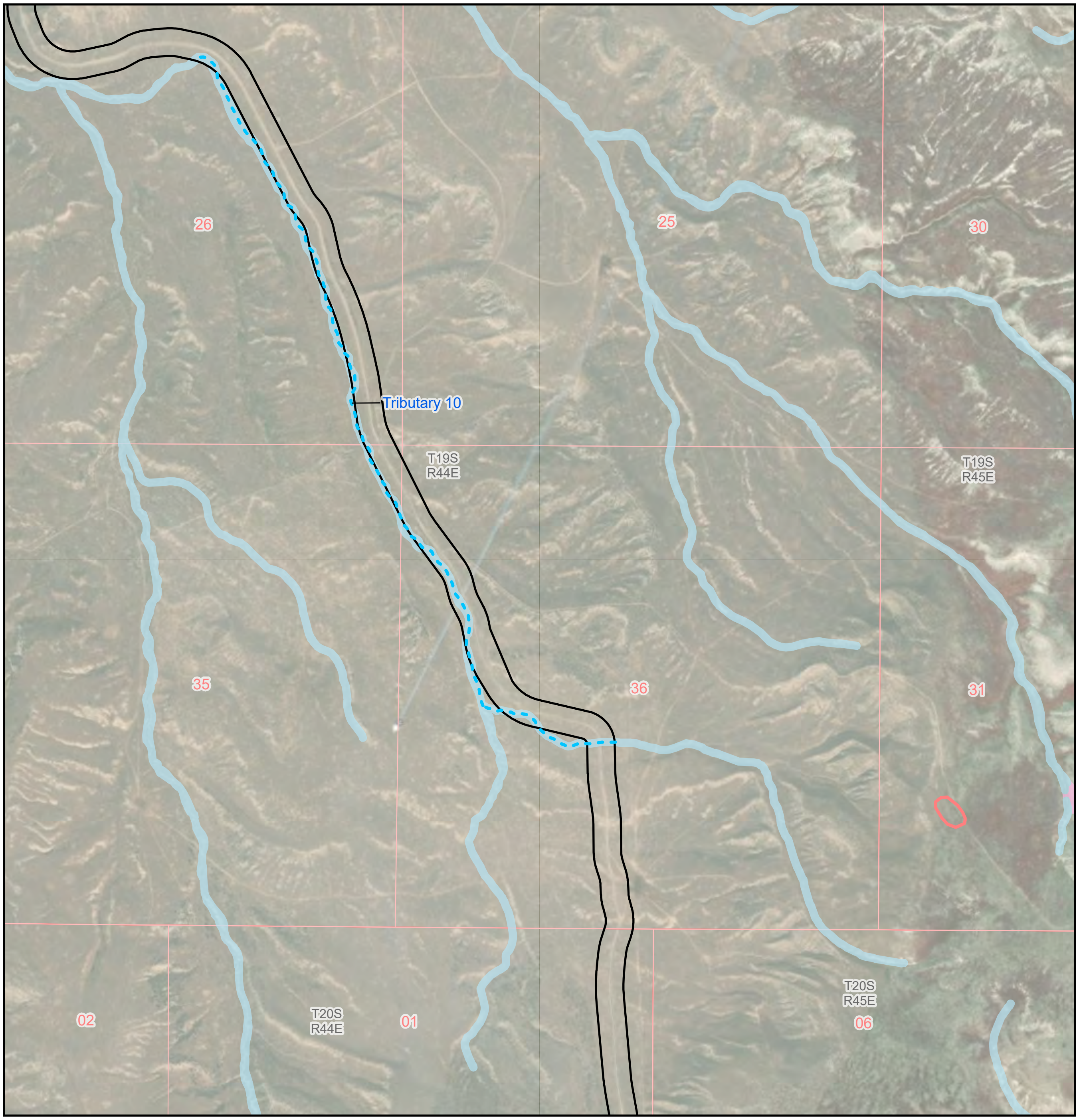


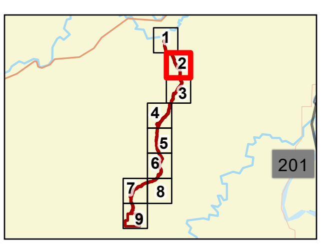


Legend
- Study Area

**NWI Wetland Type (2022)**
- Freshwater Emergent Wetland
- Riverine

**Surveyed Waterbodies**
- Waterway

**Known Occurrences**
- Mulford's Milkvetch (Observed)

0 0.1 0.2 Miles
(At original document size of 8.5x11)
1:20,000

N

Stantec

*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-14
TR by AF on 2023-12-14

*Client/Project*
2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.4-3**

*Title*
**Vegetation and Wetlands - Map 2**

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI, ORBIC, USFWS, NWI
**3.** Background: Esri USA Topo Maps

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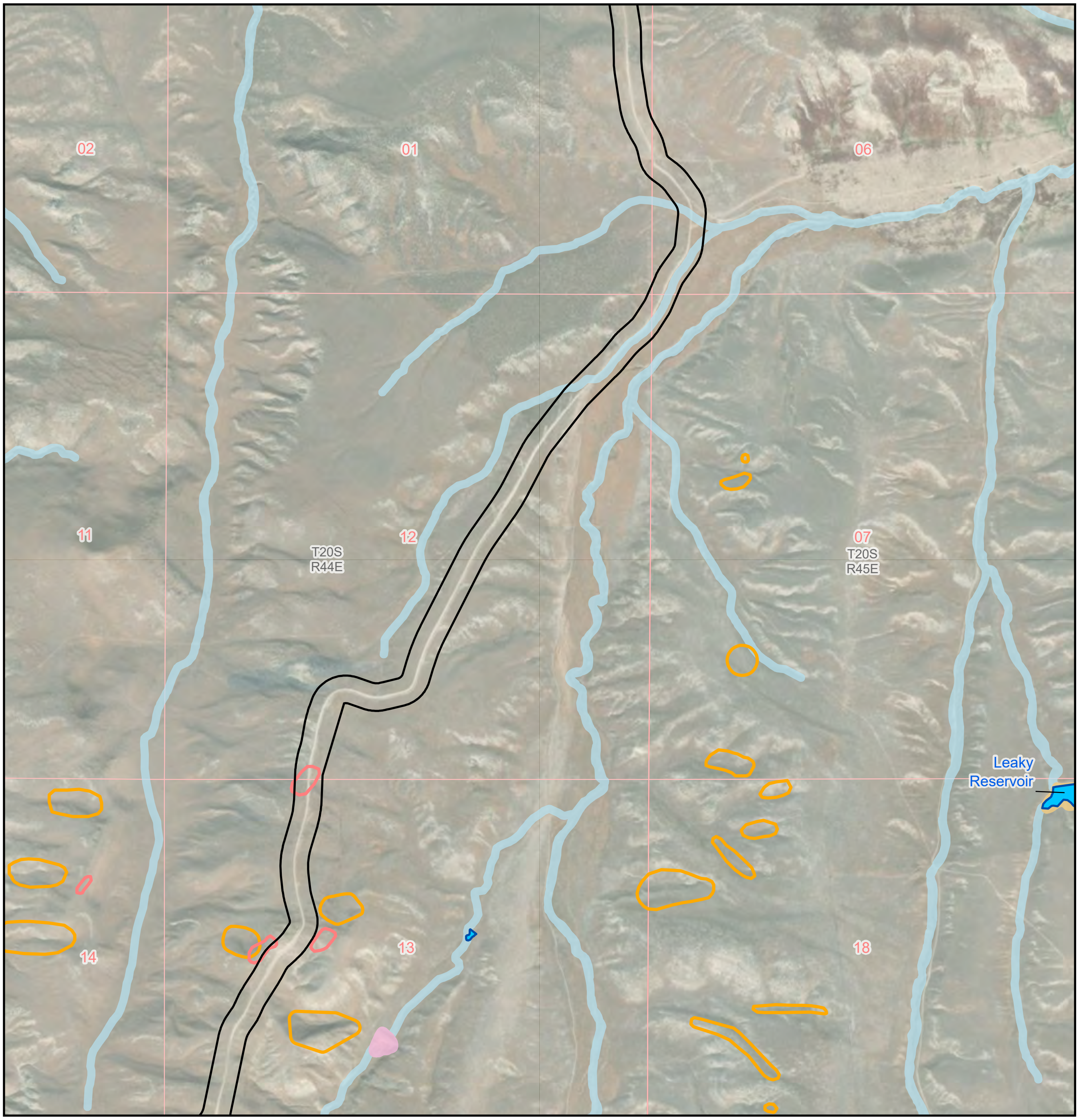


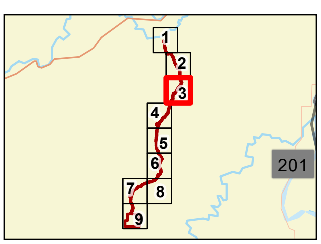


Legend

Study Area

**NWI Wetland Type (2022)**

Freshwater Emergent Wetland

Freshwater Pond

Riverine

NHD Waterbody (2022)

**Known Occurrences**

Cronquist's Stickseed (ORBIC Report)

Mulford's Milkvetch (Observed)

0 0.1 0.2 Miles

(At original document size of 8.5x11)
1:20,000

N

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI, ORBIC, USFWS, NWI
**3.** Background: Esri USA Topo Maps

Stantec

*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-14
TR by AF on 2023-12-14

*Client/Project*
2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.4-4**

*Title*
**Vegetation and Wetlands - Map 3**

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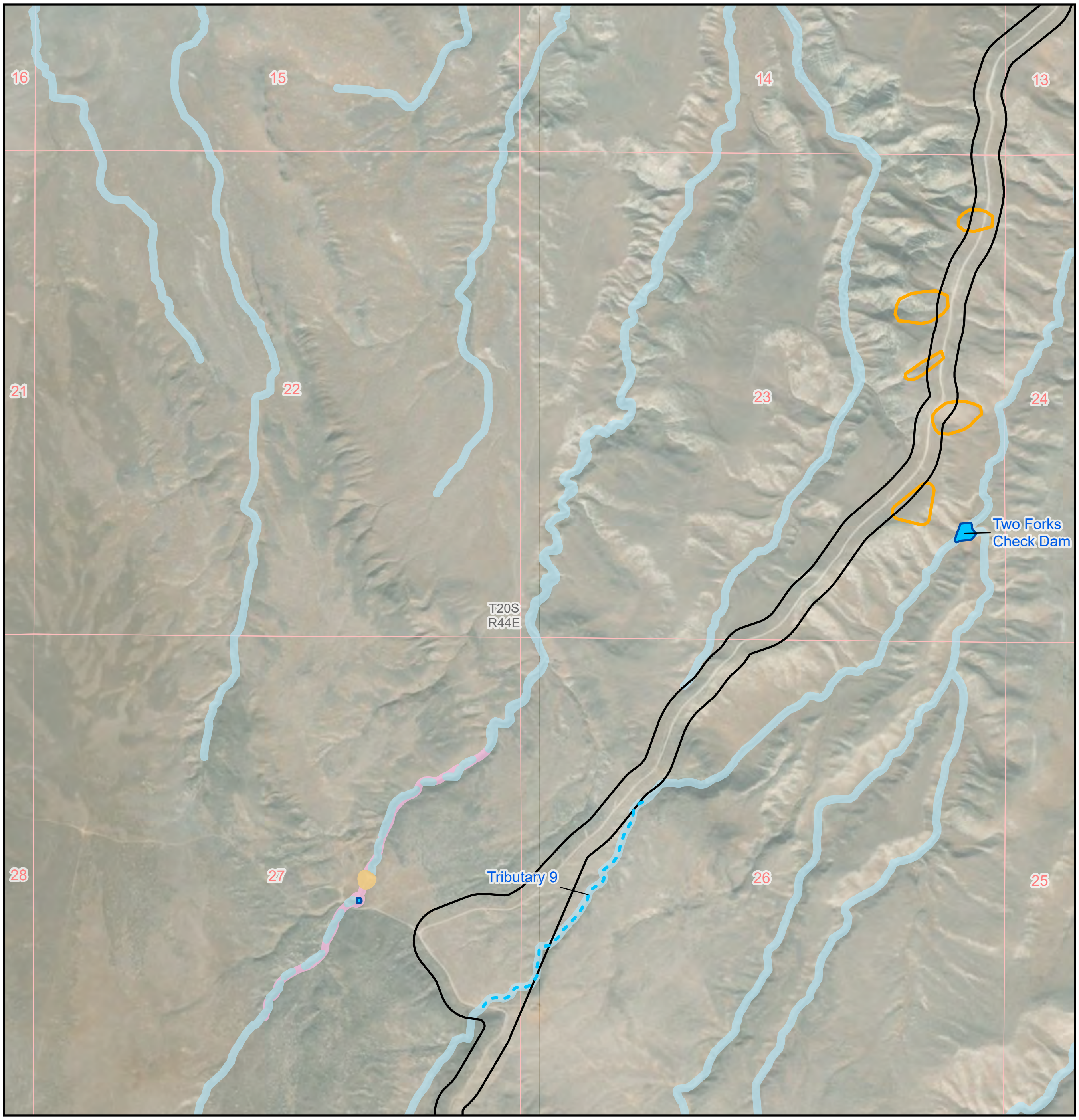


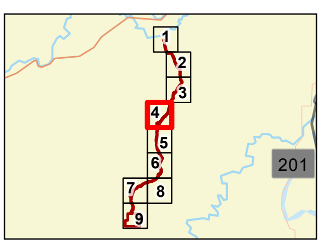


Legend

- Study Area

**NWI Wetland Type (2022)**

- Freshwater Emergent Wetland
- Freshwater Pond
- Riverine
- NHD Waterbody (2022)

**Surveyed Waterbodies**

- Waterway

**Known Occurrences**

- Cronquist's Stickseed (ORBIC Report)

0 0.1 0.2 Miles

(At original document size of 8.5x11)
1:20,000

N

Stantec

*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-14
TR by AF on 2023-12-14

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.4-5**

*Title*
**Vegetation and Wetlands - Map 4**

***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI, ORBIC, USFWS, NWI
3. Background: Esri USA Topo Maps

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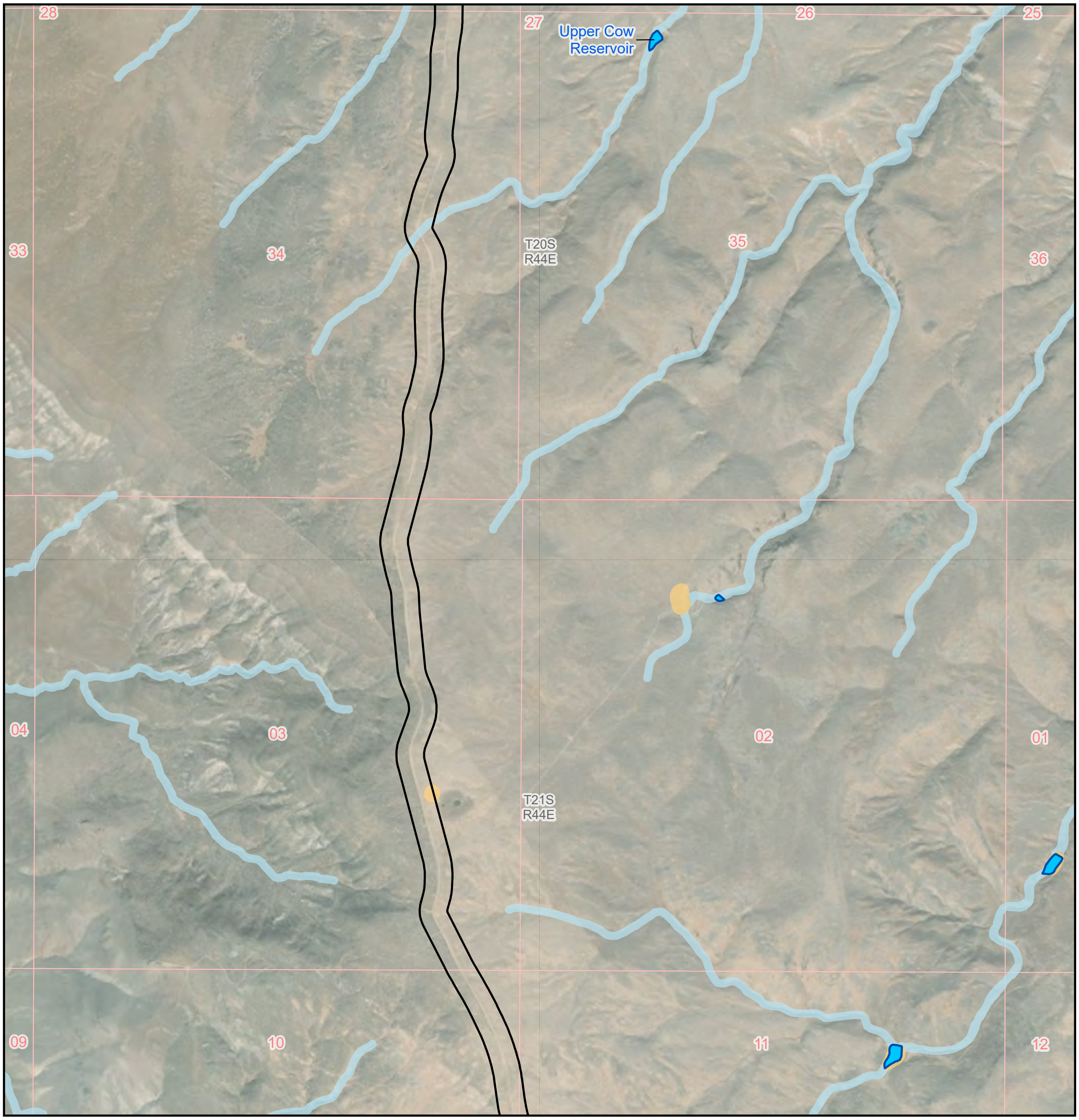


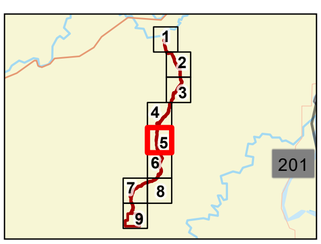


Legend

Study Area

**NWI Wetland Type (2022)**

Freshwater Pond

Riverine

NHD Waterbody (2022)

0 0.1 0.2 Miles

(At original document size of 8.5x11)
1:20,000

N

Stantec

*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-14
TR by AF on 2023-12-14

*Client/Project*
2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.4-6**

*Title*
**Vegetation and Wetlands - Map 5**

***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI, ORBIC, USFWS, NWI
3. Background: Esri USA Topo Maps

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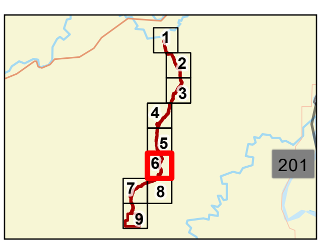


Legend

Study Area

**NWI Wetland Type (2022)**

Riverine

**Surveyed Waterbodies**

Waterway

**Known Occurrences**

Cronquist's Stickseed (ORBIC Report)

0 0.1 0.2 Miles

(At original document size of 8.5x11)
1:20,000

N

***Notes***

**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI, ORBIC, USFWS, NWI
**3.** Background: Esri USA Topo Maps

Stantec

*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-14
TR by AF on 2023-12-14

*Client/Project*
2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.4-7**

*Title*
**Vegetation and Wetlands - Map 6**

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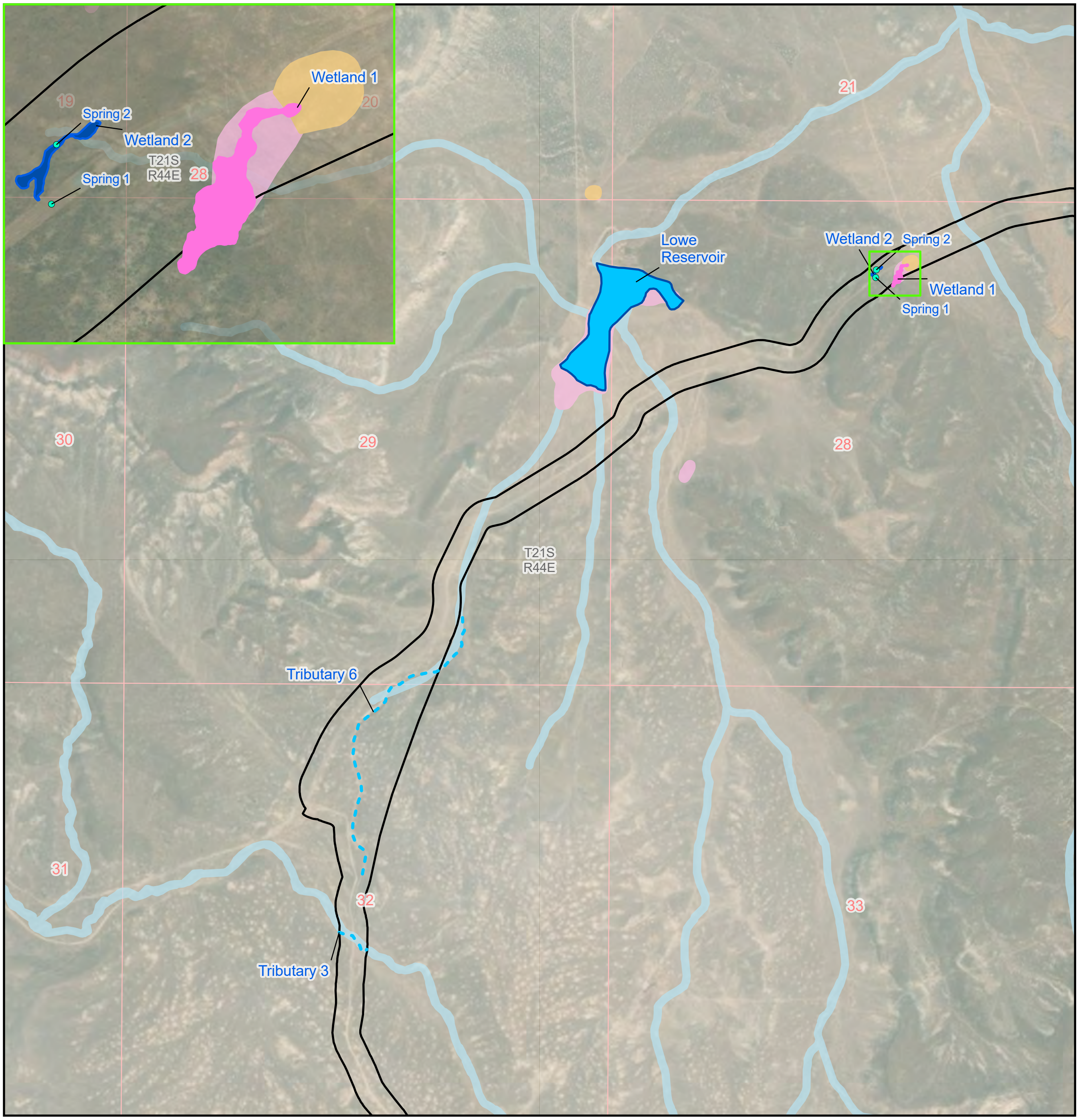


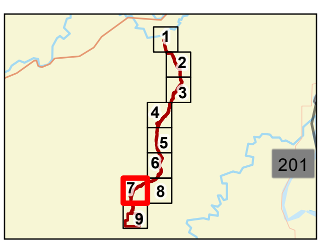


Legend

**NWI Wetland Type (2022)**

- Freshwater Emergent Wetland
- Freshwater Pond
- Riverine
- NHD Waterbody (2022)

**Surveyed Waterbodies**

- Waterway
- Emergent Wetland
- Unmapped Wetland
- Spring

0 0.1 0.2 Miles

(At original document size of 8.5x11)
1:20,000

N

*Notes*

1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI, ORBIC, USFWS, NWI
3. Background: Esri USA Topo Maps

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*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-14
TR by AF on 2023-12-14

*Client/Project*
2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.4-8**

*Title*
**Vegetation and Wetlands - Map 7**

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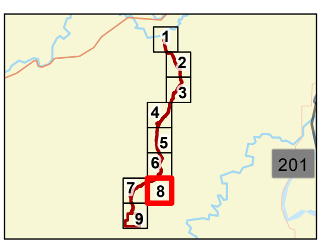


Legend

- Study Area

**NWI Wetland Type (2022)**

- Freshwater Emergent Wetland
- Freshwater Pond
- Riverine
- NHD Waterbody (2022)

**Surveyed Waterbodies**

- Waterway

***Notes***

1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI, ORBIC, USFWS, NWI
3. Background: Esri USA Topo Maps

0 0.1 0.2 Miles

(At original document size of 8.5x11)
1:20,000

N

Stantec

*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-14
TR by AF on 2023-12-14

*Client/Project*
2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.4-9**

*Title*
**Vegetation and Wetlands - Map 8**

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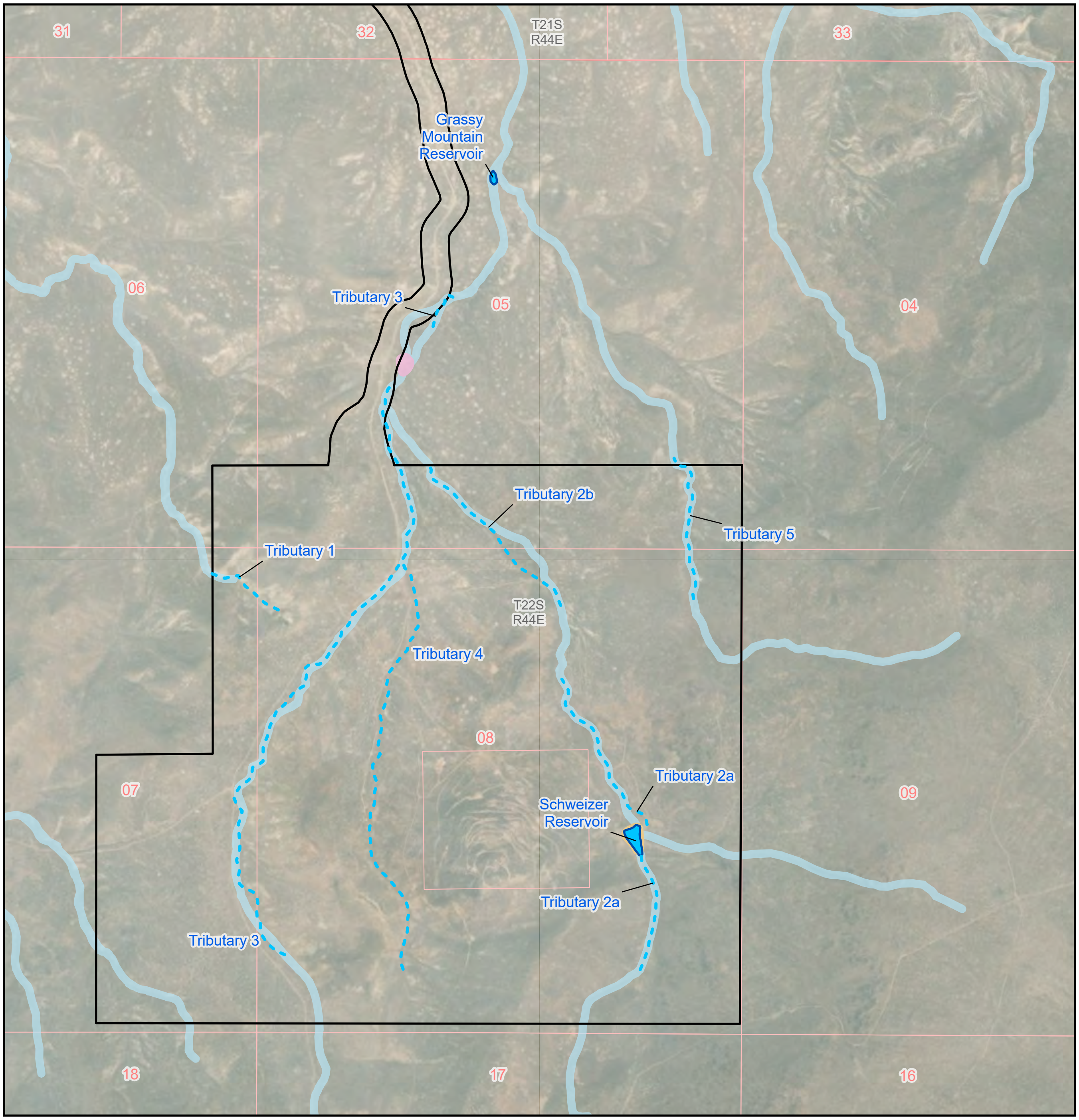
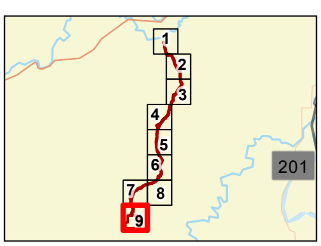



Legend

- Study Area

**NWI Wetland Type (2022)**

- Freshwater Emergent Wetland
- Freshwater Pond
- Riverine
- NHD Waterbody (2022)

**Surveyed Waterbodies**

- Waterway

***Notes***

1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI, ORBIC, USFWS, NWI
3. Background: Esri USA Topo Maps

0 0.1 0.2 Miles

(At original document size of 8.5x11)
1:20,000

N

Stantec

*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-14
TR by AF on 2023-12-14

*Client/Project*
2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.4-10**

*Title*
**Vegetation and Wetlands - Map 9**

\\xdchi1-xenprd-cifs\shared_projects$\2378\237800175303_data\gis_cad\gis\ArcPro\DOGAMI_GrassyMountain_Vegetation\GrassyMountain_Vegetation.aprx Revised: 2024-04-22 By: gmontague

## 3.4.4 Impact Analysis

### 3.4.4.1 No Action Alternative

Under the No Action Alternative, the study area would not be developed for mining purposes, with no associated changes in vegetation communities and no disturbance of listed plant species or wetlands. Existing uses of the study area would likely continue, including grazing of cattle on BLM-managed rangeland allotments. Vegetation communities may be altered through management actions on allotments classified as “improve” within the study area (see Section 3.8), resulting in minor beneficial effects to vegetation within these areas.

The general area may be continually explored for new mining opportunities, which could have minor disturbance effects to vegetation communities and wetlands in the areas of exploration. In summary, there would be minor impacts to vegetation and wetlands from the No Action Alternative.

### 3.4.4.2 Applicant’s Proposed Project

#### Vegetation Communities

Under the Applicant’s proposed Project, the study area would be developed for mining and processing of gold and silver mineral resources. Effects to vegetation from construction of site facilities would include removal of vegetation and soil from surface layers for use in later reclamation activities. Existing plant communities in these areas would be destroyed. Of the nine plant communities present within the study area (Table 3.4-1), two are native communities, four are mixed native/non-native, and three are non-native and/or highly disturbed. Effects to native and well-established plant communities (Yellow Rabbitbrush/Bluebunch Wheatgrass Community and Big Sagebrush/Bluebunch Wheatgrass Community) that take time to establish would be greater than for highly disturbed communities containing noxious, invasive, and/or non-native species (Crested Wheatgrass Seeded Community and Annual Weedy Grass-Forb Community) that establish more easily.

Post-reclamation, surface facilities would be removed, and disturbed areas (e.g., building foundations, the TWRSF, laydown yards, parking areas) regraded, with 12 inches of growth media placed over regraded surfaces and revegetated. The goal of reclamation is to establish a sustainable ecosystem similar to pre-mining conditions that supports defined land uses of livestock grazing or rangeland, wildlife habitat, and recreational land. Depending on the seed mix used and re-establishment success of new vegetation, some existing non-native plant communities may be replaced with more desirable native vegetation, resulting in minor improvements over the long term. For more native communities, such as the Big Sagebrush/Bluebunch Wheatgrass Community, it would take many years to re-establish post-mining, resulting in moderate long-term negative effects during the construction and active mining stages of the Project.

While sagebrush species have developed ways to adapt to the somewhat harsh environmental conditions in the arid southeast of the state, sagebrush habitats do not return easily after human disturbance and can take years to re-establish. For example, sagebrush has not returned to some areas of the Columbia Basin burned by a large fire 40+ years ago (Pacific Northwest National Laboratory 2019). Mitigation for effects to sagebrush habitats includes placing soil and amendments as necessary and planting sagebrush plugs/seedlings, perennial grasses, and perennial forbs in appropriate quantities/ratios to achieve viable sagebrush habitats. Considering that sagebrush recovery and restoration are slow processes with high risks of failure, a robust monitoring program specifically designed to address re-establishment of sagebrush communities would assist with restoration success. A Sagebrush Habitat Monitoring Plan should be developed with ODFW oversight that incorporates adaptive management measures to address sagebrush plug failures, prevention of invasive grasses, alternate strategies for restoration, and extension of post-closure monitoring to a period of 20 to 30 years to confirm re-establishment of sagebrush communities.

#### State-listed Plant Species

One state-listed plant species occurs in the study area. Mulford's milkvetch was observed within 3 meters of the access road, and at a second site it was observed within 10 meters of the access road. Since the access road is proposed to be widened, the two sites containing a state-listed plant species would likely be affected. Since Mulford's milkvetch is a state-listed endangered plant species, road upgrades as part of the Applicant's proposed Project would necessitate either a permit or a consultation with staff at the ODA. Other observations of this plant were farther than 10 meters from the study area and are not expected to be affected by proposed road widening.

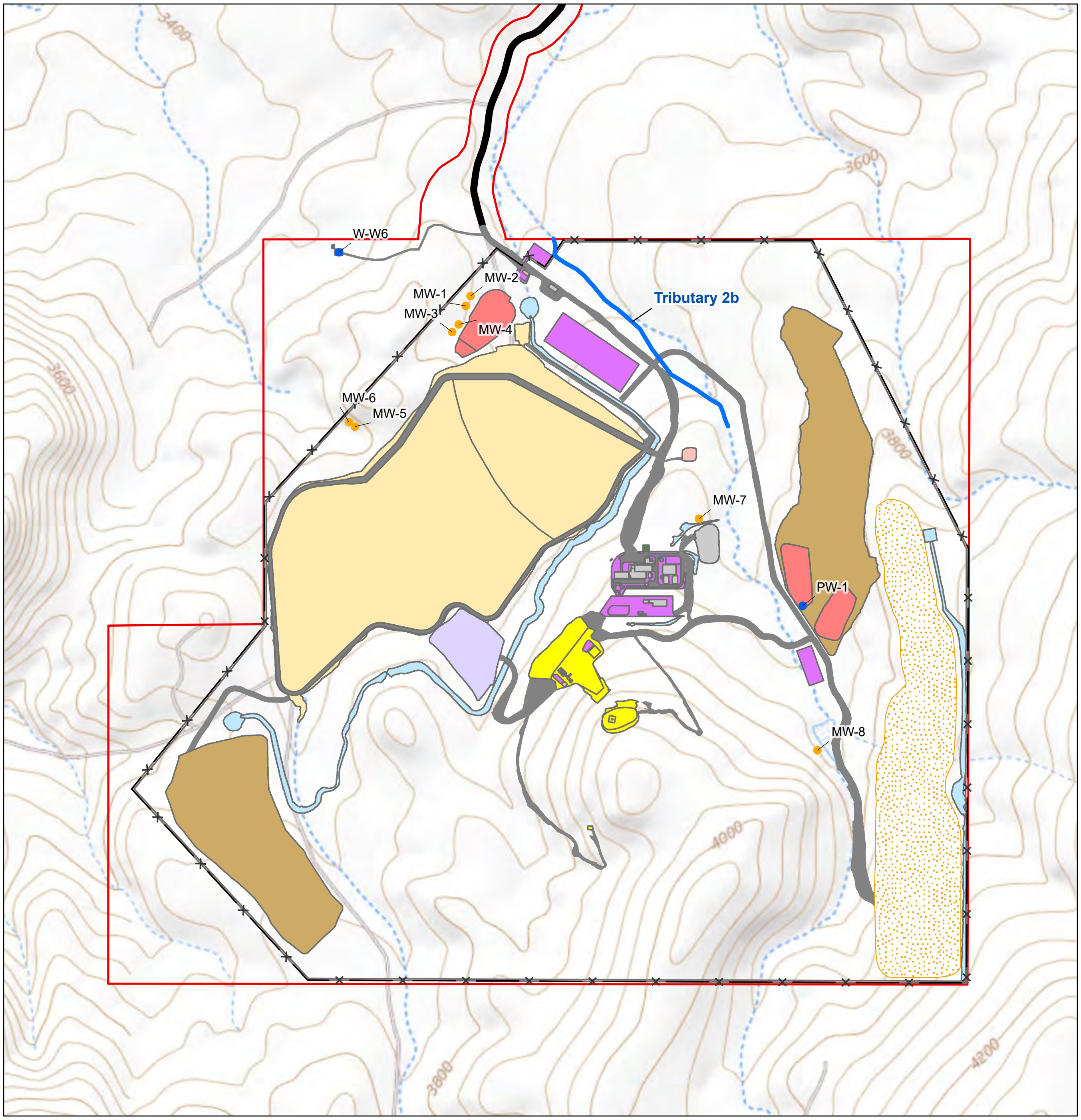
#### Wetlands

Two wetlands and one portion of one tributary drainage that occur within the study area are determined to be waters of the state (Table 3.4-2). The two wetlands, totaling 0.29 acre, are located in the Access Road Area (Figure 3.4-11) and could be avoided with minor road realignment or may be filled to accommodate road improvements, resulting in permanent adverse effects. The unnamed intermittent tributary (2b) is located in the north of the Mine and Process Area (Figure 3.4-11). This area is outside of the areas proposed to be disturbed by mining facilities but would be crossed by a proposed haul road. In the event that any of these waters of the state would be disturbed or filled to accommodate Project operations, a permit from DSL would be required, and mitigation required to address effects to wetlands would be stipulated within the permit.

The NWI wetland mapping database and NHD show a number of wetlands within the Permit Area that were not encountered during the 2017 field visit. A new wetland delineation should be conducted during the growing season (March through August) in order to capture herbaceous plants and observe an accurate representation of the water table. This new wetland delineation should attempt to identify the NWI-mapped and non-NWI-mapped wetlands and waterbodies, the NHD, and the Oregon DSL Statewide Wetlands Inventory-mapped wetlands and waterways in the study area because the extent, condition, and function of these wetland resources can change over time. The delineation should be submitted to DSL for review and to develop appropriate mitigation as needed for any identified wetlands that are located within Project disturbance areas.

### 3.4.4.3 Alternative A

Alternative A includes the same underground mine and surface facility layout as the Applicant's proposed Project, with the same approximately 488 acres of proposed surface disturbance and the same reclamation and closure practices. Therefore, effects to vegetation and wetlands from Alternative A are the same as for the Applicant's proposed Project described above.




Legend

- Study Area
- Monitoring Well
- Production Well
- Tributary
- Russell Road (2.75 Mi.)
- Cow Hollow Road (4.05 Mi.)
- Twin Spring Road (13.46 Mi.)
- Fence_Line
- Mine Access Road (2.48 Mi.)
- Roads
- Growth Media Stockpiles
- Infrastructure & Ancillary Facilities
- Power Supply
- Process Plant
- Quarry
- Reclamation Borrow Areas
- Stormwater Diversion Channel
- Tailings Storage Facility
- Temporary Waste Rock Storage Facility
- Underground Mine
- Water Supply
- Yards, Laydown Areas, and Stockpiles

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Stantec

*Project Location*
Malheur County, OR

Prepared by LL on 2024-01-03
TR by AU on 2024-01-03

*Client/Project*
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

2378001753

*Figure No.*
**3.4-11**

*Title*
**Project Facilities and Tributary 2b**

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# 3.5 WILDLIFE AND SPECIAL-STATUS SPECIES

Wildlife and special-status species include birds, reptiles, and mammals. The wildlife and special-status species study area consists of the Mine and Process Area and the Access Road Area plus a 2-mile buffer (Figure 3.5-1). In some instances, the discussion includes observations within 0.5-mile of the Permit Area, including survey records for wildlife habitats, birds, bats, pygmy rabbits, and white-tailed jackrabbits. The discussion also includes survey records within 2 miles of the Permit Area for raptor nests, greater sage-grouse use, and observations of terrestrial vertebrate species of concern, uncommon species, big game, and reptiles encountered during surveys, incidentally, and in transit.

## 3.5.1 Regulatory Context

### 3.5.1.1 State Regulations

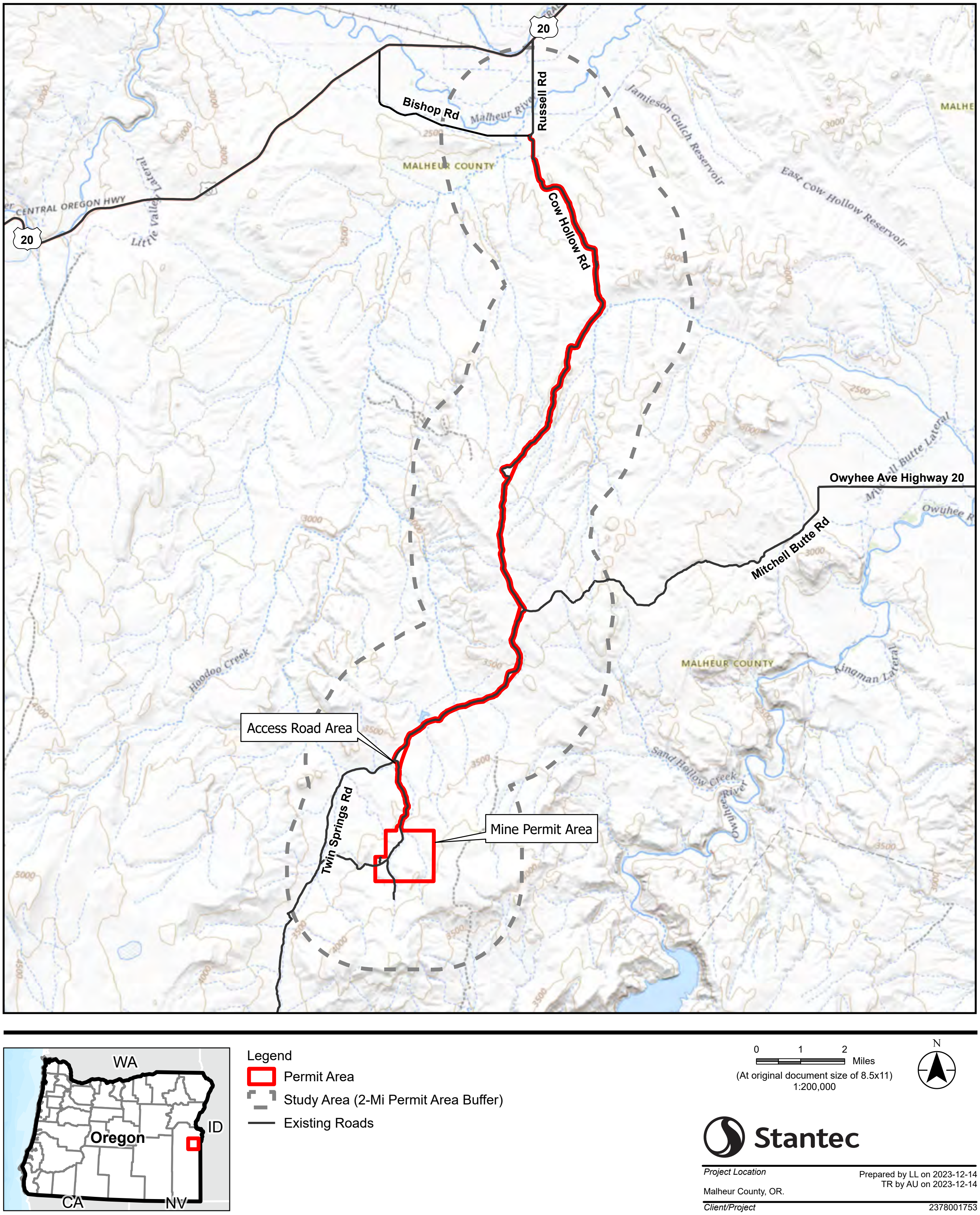
The mission of the ODFW is protect and enhance Oregon's fish and wildlife and habitat for use and enjoyment by present and future generations. The ODFW implements this mission through various statutory directives, administrative rules, and policies. This includes the Oregon Wildlife Policy (ORS 496.012), Food Fish Management Policy (ORS 506.109), Native Fish Conservation Policy (OAR 635-007-0502), Wildlife Diversity Plan (OAR 635-100), Fish and Wildlife Habitat Mitigation Policy (OAR 635-415), and Greater Sage-Grouse Conservation Strategy for Oregon (OAR 635-140).

Oregon developed the Wildlife Diversity Plan (OAR 635-100) with the goal of maintaining Oregon's wildlife diversity by protecting and enhancing populations and habitats of native wildlife at self-sustaining levels throughout natural geographic ranges. To meet this goal, Oregon developed the state Endangered Species Act (OAR 496.171-496.182), under which the ODFW maintains a list of threatened and endangered native terrestrial wildlife species in Oregon whose status is such that they are at some degree of risk of becoming extinct. The long-term goal for these state-listed species is to manage the species and their habitats so that the status of the species improves to a point where listing is no longer necessary. The ODFW also maintains a sensitive species list under Oregon's Sensitive Species Rule (OAR 635-100-0040), which focuses on fish and wildlife conservation, management, research, and monitoring of the activities of species that need conservation attention. In addition, the ODFW has management authority for fish and wildlife protection and utilizes the Oregon Conservation Strategy and other voluntary tools to protect and restore habitat on which fish and wildlife depend. The ODFW does not have jurisdiction over invertebrates in the Permit Area; these are the responsibility of the ODA. The DSL has jurisdiction over waters of the state, including wetlands, springs, seeps, perennial streams, and intermittent streams that flow during a portion of every year and that provide spawning, rearing, or food-producing areas for food and game fish. The ODFW has management authority regarding the fish and wildlife that depend on wetlands and other aquatic habitat.

Under the Oregon Wildlife Policy (ORS 496.012), "wildlife shall be managed to prevent serious depletion of any indigenous species and to provide the optimum recreational and aesthetic benefits for present and future generations of the citizens of this state" (ORS 496.012). The goal of the Oregon Wildlife Policy is to implement the provisions of Oregon Laws 1991, Chapter 735. These rules prescribe the standards for ODFW review of proposed chemical process mining operations for the purpose of developing conditions for protection of wildlife and their habitat, to further the Oregon Wildlife Policy (ORS 496.012 [Wildlife Policy]) and Food Fish Management Policy (506.109 [Food Fish Management Policy]) of the State of

Oregon. To further implement this statute, the ODFW Fish and Wildlife Habitat Mitigation Policy applies consistent goals and standards to mitigate adverse impacts to Oregon's fish and wildlife. The ODFW Fish and Wildlife Habitat Mitigation Policy (OAR 635-415) includes six habitat categories, which establish mitigation goals and implementation standards, as summarized in Table 3.5-1. The Greater Sage-Grouse Conservation Strategy for Oregon (OAR 635-140) is a sub-policy of the ODFW Fish and Wildlife Mitigation Policy. It sets population and habitat management objectives and defines and governs the ODFW's core area approach to conservation of sage-grouse in Oregon. These rules also advance sage-grouse population and habitat protection through a mitigation hierarchy and the establishment of a mitigation standard for impacts from certain types of development actions in sage-grouse habitat. Both of these policies apply to habitats affected by the proposed Project.

The ODFW also has managing authority over fish and aquatic habitats through the Food Fish Management Policy (ORS 506.109) and the Native Fish Conservation Policy (OAR 635-007-0502). The goal of the Food Fish Management Policy is to develop and manage the lands and waters of the state in a manner that will optimize the production, utilization, and public enjoyment of food fish. The Native Fish Conservation Policy's goal is to ensure the conservation and recovery of native fish in Oregon.

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*Notes*
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI
3. Background: USGS Topo Maps

Stantec

*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-14
TR by AU on 2023-12-14

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.5-1**

*Title*
**Wildlife and Special Status Species Study Area**

### Table 3.5-1 ODFW Mitigation Goals and Implementation Standards by Habitat Category

<table>
<tr><th>Habitat Category</th><th>Description</th><th>Mitigation Goal</th><th>Method</th></tr>
<tr><td>1</td><td>Irreplaceable, essential habitat for a fish or wildlife species, population, or unique assemblage of species and limited on either a physiographic province or site-specific basis, depending on the individual species, population, or unique assemblage.</td><td>No loss of either habitat quantity or quality.</td><td>Avoidance of impacts.</td></tr>
<tr><td>2</td><td>Essential habitat for a fish or wildlife species, population, or unique assemblage of species and limited either on a physiographic province or site-specific basis depending on the individual species, population, or unique assemblage.</td><td>No net loss of either habitat quantity or quality and provision of a net benefit of habitat quantity or quality.</td><td rowspan="3">A. Avoidance of impacts; or<br>B. Mitigation of impacts, if unavoidable, through reliable in-kind, in-proximity habitat mitigation.<br>If neither (A) or (B) can be achieved, the ODFW shall recommend against or shall not authorize the proposed development action.</td></tr>
<tr><td>3</td><td>Essential habitat for fish and wildlife or important habitat for fish and wildlife that is limited either on a physiographic province or site-specific basis, depending on the individual species or population.</td><td>No net loss of either habitat quantity or quality.</td></tr>
<tr><td>4</td><td>Important habitat for fish and wildlife species.</td><td>No net loss in either existing habitat quantity or quality.</td></tr>
<tr><td>5</td><td>Habitat for fish and wildlife having high potential to become either essential or important habitat.</td><td>A net benefit in habitat quantity or quality.</td><td>A. Avoidance of impacts; or<br>B. Mitigation of impacts, if unavoidable, through actions that contribute to essential or important habitat.<br>C. If neither (A) or (B) can be achieved, the ODFW shall recommend against or shall not authorize the proposed development action.</td></tr>
<tr><td>6</td><td>Habitat that has low potential to become essential or important habitat for fish and wildlife.</td><td>Minimization of impacts.</td><td>The ODFW shall act to achieve the mitigation goal for Habitat Category 6 by recommending or requiring actions that minimize direct habitat loss and avoid impacts to offsite habitat.</td></tr>
</table>

Source: OAR 635-415-0025

The Oregon chemical process mining regulations, including ORS 517.956, OAR 632-037-0120, OAR 632-037-0125, OAR 635-420-0060 and OAR 635-420-0170, have provisions pertaining to threatened, endangered, and sensitive species that protect native vertebrates and plants on lands within the permit boundary (and impacted areas outside the permit boundary) and require consideration of the impacts of chemical mining on these species. Protection measures for wildlife and special-status species must be consistent with ODFW policies, including:

1. Protective measures to maintain an objective of zero wildlife mortality;
2. Onsite and offsite mitigation ensuring that there is no overall net loss of habitat value;
3. No loss of existing critical habitat of any state or federally listed threatened or endangered species;
4. Fish and wildlife mortality reporting in accordance with a monitoring and reporting plan approved by the ODFW;
5. Surface reclamation of a chemical process mine site to ensure environmental protection and that a self-sustaining ecosystem, comparable to undamaged ecosystems in the area, has been established in satisfaction of the operator's habitat restoration obligations.

The Greater Sage-Grouse Conservation Strategy for Oregon (OAR 635-140-000 through 635-140-0025) seeks to conserve sage-grouse habitat through a mitigation hierarchy that consists of avoidance, minimization, and mitigation for direct and indirect development impacts to sage-grouse habitats.

The ODFW manages fish and wildlife species populations through management objectives specified in their respective management plans, and the BLM manages adequate habitat to support these numbers. The BLM and ODFW work cooperatively to benefit the management of wildlife and wildlife habitat.

#### 3.5.1.2 Federal Regulations

A number of federal fish and wildlife regulations apply to the Project through federal NEPA review being conducted by the BLM for the Project. These include the Endangered Species Act (ESA), the Bald and Golden Eagle Protection Act, the Migratory Bird Treaty Act, and Fish and Wildlife Coordination Act. These federal fish and wildlife regulations are administered by the USFWS and/or National Oceanic and Atmospheric Administration.

In addition, the BLM maintains a BLM Sensitive Species list, which includes native species found on BLM-administered lands whose conservation status the BLM has the capability to significantly affect through management (BLM 2008). Once a species has been designated, the BLM works cooperatively with other federal and state agencies and nongovernmental organizations to proactively conserve these species and ensure that activities on public lands do not contribute to the need for their listing under the ESA. The BLM is conducting an independent analysis of Project effects to federally listed ESA species.

### 3.5.2 Method of Analysis

The type and severity of impacts on wildlife and special-status species depends on the species present and their sensitivity, habituation, and resilience to disturbance as well as the characteristics of the disturbance, including its type, timing, location, and duration.

The analysis of effects to wildlife and special-status species and their habitats relies on data and reports provided by the Applicant, who conducted surveys to assess the presence of various wildlife species and habitats in the study area, including:

- Raptor surveys (birds and nests)
- Large-plot avian surveys (raptors and waterbirds)
- Small-plot avian surveys (birds)
- Greater sage-grouse surveys (birds, leks, and habitat)
- Pygmy rabbit and white-tailed jackrabbit surveys (rabbits, burrows, and habitat)
- Bat surveys (bats, habitat, and acoustic detection)

Baseline studies were completed using this survey data, combined with desktop analyses, to characterize existing wildlife resources in the Project area, including the Wildlife Resources Baseline Report (EM Strategies 2020) and the Aquatic Resources Baseline Report (EM Strategies 2018). Habitat categories within the study area were defined by the Applicant using information from terrestrial vegetation surveys (EM Strategies 2018) and desktop analysis using information on land cover from USGS and on sage-grouse core areas from the ODFW (EM Strategies 2020). In addition, the USFWS Information for Planning and Consultation (IPaC) database and the ORBIC database were reviewed in 2023 to provide updated species lists for the study area.

Wildlife resources in the study area under each alternative were identified and assessed quantitatively for resources for which quantitative data were available. For wildlife resources where no quantitative data were available, impacts are described qualitatively.

## 3.5.3 Affected Environment

### 3.5.3.1 Wildlife Habitat

Wildlife habitats occurring within and adjacent to the 0.5-mile buffer around the Permit Area are consistent with desert areas of the Great Basin and consist of desert-rangeland type habitat where sagebrush and grasses such as cheatgrass are the dominant species. EM Strategies identified the following United States National Vegetation Classification vegetation community types during field surveys: Intermountain Semi-Desert Steppe and Shrubland, Intermountain Semi-Desert Grassland, Great Basin-Intermountain Ruderal Dry Shrubland and Grassland, and Intermountain Mesic Tall Sagebrush Steppe and Shrubland (EM Strategies 2020).

There are no Habitat Category 1 habitats found within the study area. A portion of the study area has been classified as Habitat Category 2 (essential and limited) by the Applicant since it is mapped by the ODFW as a low-density sage-grouse use area or mule deer winter-range area (Figure 3.5-2).

Approximately 0.3 mile of the main access road passes through irrigated agriculture, and the northernmost 5 miles of the main access route passes through ODFW-designated mule deer winter range (Figure 3.5-2). During the winter months, mule deer are expected to use this winter range, and deer are likely to access irrigated agriculture throughout the growing season.

#### 3.5.3.2 Terrestrial Species

ORBIC reported evidence of only one species, the golden eagle (*Aquila chrysaetos*), in proximity to the study area within the last 5 years. This observation was a possible golden eagle nesting area (Portland State University 2023).

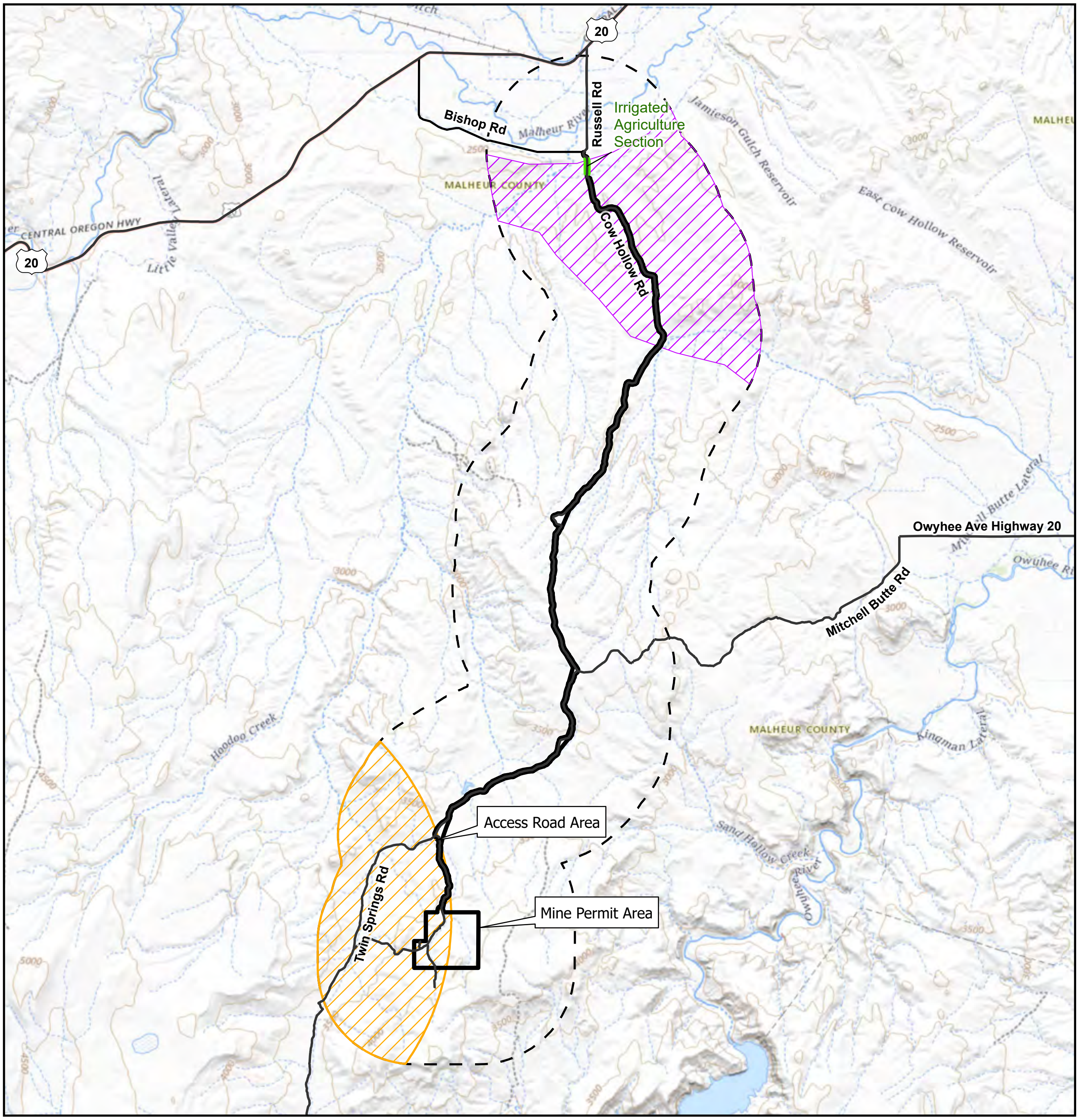
Surveys conducted observed a total of 98 species within the study area—61 birds, 10 bats, 9 small mammals, 6 large mammals, 1 amphibian, and 11 reptiles—as shown in Appendix B in the Wildlife Resources Baseline Report (EM Strategies 2020).

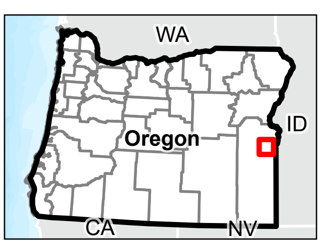
A raptor nest survey was conducted in 2014 to obtain information about raptor breeding within the 2-mile buffer of the Permit Area. Three active raptor nests were found for ferruginous hawk (*Buteo regalis*), golden eagle, and prairie falcon (*Falco mexicanus*), in addition to alternate nest sites for these species that were not being actively used (EM Strategies 2020). A burrowing owl nest and a long-eared owl nest were also identified.

Large-plot avian surveys were designed to detect large birds—raptors and waterbirds—within 0.5 mile of the Permit Area between June 2013 and May 2014. Seventeen species were detected, three of which accounted for 80 percent of all bird sightings—horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), and common raven (*Corvus corax*). Golden eagles were detected during all seasons, indicating two golden eagle territories occupied year-round (EM Strategies 2020).

Small-plot avian surveys identified 22 species within the Permit Area (EM Strategies 2020) including California quail (*Callipepla californica*), loggerhead shrike (*Lanius ludovicianus*), horned lark (*Eremophila alpestris*), barn swallow (*Hirundo rustica*), rock wren (*Salpinctes obsoletus*), mountain bluebird (*Sialia currucoides*), Brewer's sparrow (*Spizella breweri*), and western meadowlark (*Sturnella neglecta*). The proposed Project is within the Pacific Flyway, which is a western Americas migration route that spans from Mexico to Alaska (Audubon 2023). Migrating birds traveling along the Pacific Flyway migratory route are likely to pass over the Project area. State-designated special-status species that are known to use the Pacific Flyway and have been seen during Permit Area surveys are the tricolored blackbird (*Agelaius tricolor*) and the northern harrier (*Circus hudsonius*). The closest large open-water habitat is Owyhee Lake, approximately 6 miles to the east.

Multiple bat surveys were conducted to assess the presence of potential bat habitat within a 0.5-mile buffer of the Permit Area. No caves or mine adits were found during these surveys, and no areas with potential to concentrate roosting or maternal colonies were identified within the Permit Area. Potential day-roosting habitat consists of sparse rock outcrops and deciduous trees near DM Spring, which has a very limited number of cliffs and rock outcrops. These areas were surveyed numerous times, and no bats were observed. Bat acoustic surveys were conducted at landscape features most likely to attract bats (e.g., rock outcrops, water) between June 24 and October 25, 2013, and between April 8 and May 30, 2014, to aid in identifying bat use of the area. Ten species of bat were detected during these acoustic surveys, as shown in Table 3.5-2.




Legend

- Permit Area
- Study Area (2-Mi Permit Area Buffer)
- Irrigated Agriculture Section
- ODFW Mule Deer Winter Range / Category 2 Habitat
- Low Density Sage-grouse Use Area / Category 2 Habitat
- Existing Roads

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Stantec

*Project Location* Prepared by LL on 2023-12-14
TR by AU on 2023-12-14

Malheur County, OR.

*Client/Project* 2378001753

DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.5-2**

*Title*
**Wildlife Habitats in the Study Area**

***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI, ODFW
3. Background: Esri USGS Topo

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### Table 3.5-2 Bat Species Recorded within 0.5 mile of the Permit Area

| Common Name | Scientific Name | Listing Status | Months Observed |
|---|---|---|---|
| California myotis | *Myotis californicus* | ODFW Sensitive | May–August |
| Small-footed myotis | *Myotis ciliolabrum* | None | April–September |
| Long-eared myotis | *Myotis evotis* | None | July |
| Yuma myotis | *Myotis yumanensis* | None | June–July/<br>September–October |
| Hoary bat | *Lasiurus cinereus* | ODFW Sensitive | September |
| Silver-haired bat | *Lasionycteris noctivagans* | ODFW Sensitive | April–May/July/<br>September–October |
| Canyon bat | *Parastrellus hesperus* | None | April–May/July–<br>September |
| Big brown bat | *Eptesicus fuscus* | None | August |
| Spotted bat | *Euderma maculatum* | BLM Sensitive<br>ODFW Sensitive | October |
| Pallid bat | *Antrozous pallidus* | BLM Sensitive<br>ODFW Sensitive | July–August |

Source: EM Strategies 2020

Several other wildlife species were observed incidentally during the wildlife surveys. All incidental and in-transit observations of terrestrial vertebrate species of concern, uncommon species, big game, and reptiles within the Permit Area and within 2 miles of the Permit Area were recorded. Animals observed within the Permit Area include many species of birds, bats, lizards, snakes, small mammals, American badger (*Taxidea taxus*), and pronghorn (*Antilocapra americana*). Appendix B in EM Strategies' report (2020) provides the full list of species observed.

#### 3.5.3.3 Aquatic Species

Two wetlands, two springs, one pond, one artificial waterway, and ten tributary drainages occur within the study area. Aquatic surveys were conducted for fish, amphibians, and aquatic macroinvertebrates in these potentially affected waters. Visual assessments of streams and electrofishing surveys for fish occurred between May 13 and May 15, 2014. No fish were captured during electrofishing efforts. Visual assessments of streams conducted in October 2014 showed that no stream habitat was available, so no fish surveys were possible in October. Fish distribution appeared limited by the lack of streams with connectivity to the study area, and most waterbodies in the study area are ephemeral (i.e., contain water for short periods of time), which do not provide sufficient habitat for fish.

Amphibian surveys were conducted at all wetland and spring sites between May 13 and May 15, 2014, and at sites with potential suitable habitat on October 22 and October 24, 2014. No special-status amphibians were observed. Although some special-status amphibians do occur in Malheur County, their range does not extend north into the study area, which does not provide suitable year-round habitat for multi-year larval stages. One amphibian species, the Pacific tree frog (*Pseudacris regilla*), was observed at six sites in the study area in May 2014. Pacific tree frogs are able to use almost any type of still or slow-flowing water for breeding including wetlands, ponds, lakes, slow-flowing springs, irrigation ditches, road ditches, seasonally flooded pools and puddles, and deep tire ruts. However, survival in seasonal waterbodies is not assured since such water may dry up before tadpoles can complete metamorphosis (WDFW 2023). During the non-breeding season, the Pacific tree frog uses various habitats that can be quite distant from water, including wet meadows, riparian areas, woodlands, pastures, and disturbed areas (ODFW 2023a).

Surveys for aquatic macroinvertebrates were scheduled to coincide with amphibian surveys between October 22 and October 24, 2014, in flowing water. No flowing water was observed at this time, so surveys were not conducted for aquatic macroinvertebrates. While some special-status aquatic macroinvertebrates occur in the Northern Basin and Range region, which includes Malheur County, these species, including mussels, peaclams, pebblesnails, and springsnails (Portland State University 2019), generally require permanent and flowing water with a constant flow of food and oxygen to breed. The springs and streams in the study area are therefore likely unsuitable for listed aquatic macroinvertebrates.

#### 3.5.3.4 Special-Status Species

The USFWS IPaC output reported no federally listed species within the study area, although the monarch butterfly (*Danaus plexippus*), a candidate for federal listing, may be present at certain times of the year. No federal proposed or final designated critical habitat occurs within the study area (USFWS 2023).

Of the 98 species observed within the study area, seven are state listed in Oregon as sensitive (Table 3.5-3), which refers to fish and wildlife that are facing one or more threats to their populations and/or habitats. Sensitive species are defined as having small or declining populations, are at-risk, and/or are of management concern. Implementation of appropriate conservation measures to address existing or potential threats may prevent them from declining to the point of qualifying for threatened or endangered status (ODFW 2023b).

**Table 3.5-3 State-Designated Sensitive Species Observed in the Study Area**

| Common Name | Scientific Name | Oregon Listing Status | Threats to the Species |
|---|---|---|---|
| Ferruginous hawk[1] | *Buteo regalis* | Sensitive | Threats include loss of nesting and foraging habitat due to agricultural development and invasion of cheatgrass and Russian thistle. |
| Golden eagle[1] | *Aquila chrysaetos* | N/A | Threats include lead shot poisoning and collisions with vehicles and wind turbines. Species is regulated under the Bald and Golden Eagle Protection Act. |
| Burrowing owl[1] | *Athene cunicularia hypugaea* | Sensitive | Primary threats include habitat loss and fragmentation due to agricultural development and suburbanization. Eradication of prairie dogs and other burrowing mammals has led to habitat degradation. |

| Common Name | Scientific Name | Oregon Listing Status | Threats to the Species |
|---|---|---|---|
| Loggerhead shrike | *Lanius ludovicianus* | Sensitive | Threats include bioaccumulation of pesticides, limited food availability, habitat loss/degradation, and vehicle collisions. |
| Hoary bat | *Lasiurus cinereus* | Sensitive | Threats include declines in insect abundance, loss of forested roosting and foraging habitat, and pollution. |
| Silver-haired bat | *Lasionycteris noctivagans* | Sensitive | Threats include deforestation and forest management practices, which presumably have reduced habitat quality and the number of available roost sites. |
| Spotted bat | *Euderma maculatum* | Sensitive | Threats include habitat loss, predation by pets, and white-nose syndrome. |
| Pallid bat | *Antrozous pallidus* | Sensitive | Habitat has been reduced and degraded by agricultural expansion, cheatgrass invasion, fire, urban development, excessive livestock grazing, and pesticide use. |

Sources: NatureServe 2023; ORBIC 2023; Portland State University 2019

[1] Active raptor nests observed within the study area.

Surveys for pygmy rabbit and white-tailed jackrabbit were conducted within the 0.5-mile buffer of the Permit Area in 2013 and 2014 to look for evidence of rabbits and burrows. No pygmy rabbits, habitat, or evidence of pygmy rabbits were identified during the surveys. No white-tailed jackrabbits or high-quality white-tailed jackrabbit habitat was identified, although black-tailed jackrabbits were observed on multiple occasions. In addition, no potentially suitable white-tailed jackrabbit or pygmy rabbit habitat was identified within the 0.5-mile buffer of the Permit Area (EM Strategies 2020).

Greater sage-grouse (*Centrocercus urophasianus*) is a ground-nesting bird species of importance in Oregon and is in decline due to habitat loss from fire, drought, and invasive species (ORBIC 2019). The greater sage-grouse is listed in Oregon by ODFW as sensitive in the Northern Basin and Range Oregon Conservation Strategy ecoregion and sensitive-critical in the Blue Mountains Strategy ecoregion (BLM 2015a). The study area is in the northeast corner of the Northern Basin and Range ecoregion. Portions of the Permit Area are designated by the ODFW as low-density greater sage-grouse habitat (Figure 3.5-2). Greater sage-grouse use surveys were conducted in suitable habitat within 2 miles of the Permit Area in summer 2013 and winter 2014. These surveys included observations of evidence of birds, leks (male display areas), and behavior to assess breeding pairs and habitat use through brood-rearing surveys and winter-use surveys. Mating display leks are bare, grassy swales, typically surrounded by sagebrush cover, and habitats are dependent upon sagebrush steppe. No greater sage-grouse, leks, or evidence of sage-grouse use of the area were encountered during the surveys (EM Strategies 2020).

## 3.5.4 Impact Analysis

### 3.5.4.1 No Action Alternative

Under the No Action Alternative, the study area would not be developed for mining purposes, with no associated changes in wildlife habitat or disturbance of terrestrial, aquatic, or special-status species that may be present. Existing uses of the study area would likely continue, including grazing of cattle on BLM-managed rangeland allotments. The general area may be continually explored for new mining opportunities, which would have minor disturbance effects to wildlife from vehicles and equipment being used periodically at the site, similar to existing conditions.

In summary, there would be no impacts to wildlife habitats, wildlife species, and special-status species from the No Action Alternative.

### 3.5.4.2 Applicant's Proposed Project

#### Wildlife Habitat

The Project would affect wildlife habitats classified as ODFW Habitat Categories 2 through 6. Table 3.5-1 identifies the specific mitigation goals and strategies for each habitat category. Impacts to Habitat Categories 2 through 5 habitats would require (1) avoidance of impacts; 2) minimization of impacts; and (3) compensatory mitigation of impacts for unavoidable impacts. For example, a portion of the study area is classified as Habitat Category 2 (essential and limited), where the mitigation goal, if impacts are unavoidable, is no net loss of either habitat quantity or quality and provision of a net benefit of habitat quantity or quality through reliable in-kind, in-proximity habitat mitigation (OAR 635-415-0025). The Applicant has developed a Wildlife Mitigation Plan pursuant to OAR 635-420-0060 (EM Strategies and Mason, Bruce & Girard 2023) that addresses steps to achieve no overall net loss of habitat value and the mitigation goals and standards in OAR 635-415 and OAR 635-140.

Direct and indirect impacts, including habitat fragmentation and loss, would result from removal of vegetation and development of mine facilities, including installation of the perimeter fence. A fence constructed to meet the specifications outlined in the Applicant's Wildlife Protection Plan (Mason, Bruce & Girard 2023) would enclose an area of approximately 739 acres, which would be unavailable to wildlife use for the life of the mine, resulting in long-term adverse effects to wildlife habitat. In addition, the northernmost 5 miles of the main access route would pass through ODFW-designated mule deer winter range, so road-widening activities would affect this wildlife habitat. However, in mule deer winter-range habitat, noise-producing ground-disturbing activities (e.g., road construction or widening) would be avoided from December 1 to March 31, which would reduce effects to this species. With increased traffic on the access road, it is likely that mule deer may avoid the area. Studies have shown that mule deer and other ungulates avoid roads due to noise produced by traffic (Kleist et al. 2021). Using methodology developed by the ODFW to estimate indirect impacts to designated mule deer winter-range habitat, the Applicant calculated that approximately 113 acres of mule deer habitat would be indirectly impacted (EM Strategies and Mason, Bruce & Girard 2023).

To mitigate the unavoidable impacts to mule deer winter-range habitat, the Applicant would provide 2 acres of compensatory mitigation for each acre of degraded winter range (EM Strategies and Mason, Bruce & Girard 2023). An HMA would be identified during consultation with the ODFW that is adequate to offset the Project's impacts and comply with the Fish and Wildlife Habitat Mitigation Policy. Habitat enhancement actions for mule deer winter-range habitat include juniper control, weed control, seeding and shrub planting, and protection and targeted restoration. Any mitigation not satisfied by the HMA is proposed to be offset by purchasing credits from a mitigation bank (EM Strategies and Mason, Bruce & Girard 2023).

Post-closure, the Mine and Process Area would be reclaimed and converted back into rangeland, which would provide habitat for re-establishment of wildlife species that occurred prior to mining. However, it would take years for new vegetation communities to establish and become suitable habitat for terrestrial wildlife species, resulting in long-term adverse effects to wildlife habitat. The Applicant is required to comply with OAR 635-420-0110, which is the Certification of a Self-Sustaining Ecosystem.

The Applicant has developed a Reclamation Plan (Calico Resources USA Corp. 2023a) that describes the stages of reclamation planned for the closing of the Project. The goal of reclamation is to establish a sustainable ecosystem similar to pre-mining conditions. Actions in the Reclamation Plan (Calico Resources USA Corp. 2023a) include:

- Coordinating with agencies to implement and monitor reclamation using quantitative measures for evaluating habitat diversity, wildlife species diversity, and plant community composition, structure, and utilization by wildlife;
- Establish post-closure surface soil conditions conducive to the regeneration of a stable plant community; and
- Revegetating disturbed areas with appropriate plant species in order to establish self-sustaining, stable plant communities compatible with existing land uses.

Depending on the seed mix used and re-establishment success of new vegetation, some existing non-native plant communities may be replaced with more desirable native vegetation, resulting in minor improvements to wildlife habitats over the long term.

### Terrestrial Species

#### *Noise, Dust, and Human Disturbance Impacts*

Noise and dust from equipment and vehicles and human presence in the study area would disturb wildlife, which would likely move out of the area. Injury or mortality of mammals, birds, and other small animals could occur through direct contact with construction equipment and vehicles during the construction phase of the Project. Once the Project area is fenced, many wildlife species would be prevented from entering the Project area, which would reduce these effects somewhat. After construction, blasting and drilling activities would occur underground, which would minimize noise associated with the Project. Ongoing noise would be associated with trucks and vehicles using the haul road and mechanical sounds associated with the process plant.

Dust control measures and water spraying in high-traffic areas would prevent dust from blowing offsite while fencing would reduce risk of dust impacts to wildlife onsite. Traffic controls including road design speed, carpooling, and environmental training are proposed by the Applicant to reduce the impacts of noise, dust, and human presence.

In addition to these measures, ongoing noise monitoring could be conducted to ensure that noise is kept to expected levels. Seasonal restrictions, which will be imposed in permits, could reduce disturbance from episodic activities such as vegetation clearing, road improvements, and construction. Human disturbance may also result in increased predation as well as increased presence of invasive plant species.

#### *Traffic Impacts*

Terrestrial animals on or near the access road may be injured or killed by Project vehicles. This may include mule deer crossing the access road within their designated winter-range habitat. The access road is designed with a 35-mile-per-hour (mph) speed limit. To reduce wildlife–vehicle collisions, a combination of minimization measures have been identified by the Applicant, including reduced design speeds, requiring bussing of employees to reduce traffic, and environmental training.

Employees would be required to travel no faster than 25 mph on roads within the perimeter fence. In addition, employees would undergo an environmental training course with topics such as adherence to speed limits, practicing heightened caution and awareness when operating vehicles during daily periods of increased wildlife activity (e.g., dawn and dusk), reporting injured or dead wildlife, trash control, and other subjects that would aid in reducing effects of the Project to wildlife in the area.

Signs installed along the road to restrict vehicular speed would aid in ensuring that proper speed limits are adhered to, and a deer crossing sign within the mule deer winter-range habitat could alert drivers of the potential for deer to cross the road. However, deer crossing signs have been shown to be relatively ineffective at reducing wildlife–vehicle collisions (Meyer 2006). Pojar found that lighted deer crossing signs resulted in reduced driver speeds but were ineffective at reducing wildlife mortality (Pojar 1975). In a 2008 wildlife–vehicle collision reduction study, the Federal Highway Administration identified and evaluated 34 techniques for reducing wildlife–vehicle collisions including mitigation measures to influence driver behavior and measures to influence wildlife behavior (Federal Highway Administration 2008). The study found that no single measure is effective everywhere and successful reduction of wildlife–vehicle collisions most often requires a combination of multiple measures. Fences, animal detection systems, and tunnels or bridges were determined to be the most effective at reducing wildlife–vehicle collisions on highways (Federal Highway Administration 2008). For this Project, the roads that would be used to access the site would have a 35-mph design speed, which would reduce the potential for wildlife–vehicle collisions as compared to highways.

#### *Water Supply Impacts*

Mine dewatering would lower the groundwater in the immediate vicinity of the mine due to the compartmentalization evident in the field data. The Deposit Stock Tank is the only water supply source within the Project area that would be removed to accommodate development of Project facilities. Most springs in the study area are not predicted to experience noticeable declines in water level because of mine dewatering. Regarding drawdown of water in the wellfield areas, of the 24 springs studied, approximately 4 or 5 regional springs are predicted to experience substantial drawdown (greater than 0.5 foot) (Lorax 2022). Thus, the availability of water for wildlife from springs in these areas would be reduced.

The Applicant proposes to conduct monitoring of springs and seeps as described in the Spring and Seep Monitoring and Mitigation Plan (SLR 2024). In the event that water levels in springs or seeps are affected by mine operations, mitigation measures would be followed as described in Section 3.3.4.2.

### *Tailings Storage Facility and Chemical Impacts*

Geochemical characterization of tailings material produced by the Project indicates the materials would be acid generating, with the potential to leach constituents including arsenic, selenium, and other constituents associated with acidic drainage. Metals in mine tailings are often associated with sulfide materials, which are mostly immobile and have little impact on biota in a chemically reducing environment (John and Leventhal 1995). Wildlife may be exposed to several toxic metals present in the supernatant pond if they leach from compounds and solids in the TSF, which usually occurs in acidic conditions. The Project tailings material has the potential to generate acid due to its low neutralization potential. To increase the neutralization potential of the Project tailings, lime would be added to the tailings before TSF deposition, which would keep the supernatant pond slightly alkaline and reduce the potential for metal leaching. Metal assimilation may occur if wildlife are able to get through the fence to ingest free metal ions or metal compounds present in the TSF. Toxic metals are not readily metabolized and instead stored in tissues, which causes them to accumulate in individuals and bioaccumulate at higher trophic levels. At low levels these elements are nontoxic, but as they accumulate, or if a large amount is ingested, they can affect physiology and reproduction or even cause death (Currie et al. 2000; Durkalec et al. 2022). Analysis of metals on the liquid samples from the Reclaim Pond and TSF supernatant pond would occur on a quarterly basis to ensure that metal concentrations do not result in a hazard quotient exceeding 1.0 for representative wildlife species (Calico Resources USA Corp. 2023b).

Cyanide destruction would be employed to limit cyanide concentrations in the tailings and in the process water to low levels, but metal content would remain. Wildlife could be exposed to these contaminants in the supernatant pond at the TSF during mine operations if they were able to penetrate the fence to access the TSF pond. Animals that use supernatant water in the TSF as a source of drinking water could have chronic (long-term) exposure to chemicals in the water through ingestion, dermal contact, or inhalation. Of these exposures, ingestion would have the greatest effects, and waterfowl and wading birds are particularly susceptible to these risks.

The Project-specific ecological risk assessment (SLR 2023) was reviewed along with guidelines from the ICMC, EPA, and state regulations regarding cyanide concentrations that would be protective of wildlife. The ICMC requires a concentration of less than 50 mg/L weak acid dissociable (WAD) cyanide in TSFs to protect wildlife that use the water to drink and forage. OAR 340-043-0130 provides a more conservative limit on WAD cyanide at 30 mg/L. The Applicant has proposed discharging WAD cyanide levels initially to less than 15 mg/L (and not to exceed the 30 mg/L maximum). Tailings slurry from the CIL processing plant would be treated for cyanide destruction prior to being pumped to the TSF (SLR 2023). The concentration of 15 mg/L would be further reduced via natural processes such as photodegradation by UV light and biodegradation. The target level of 1 mg/L WAD cyanide is proposed for supernatant water in the TSF, which is well below the EPA and Oregon state cyanide limits and is considered to be protective of wildlife.

Cyanide toxicity is related to the types of cyanide complexes that are present (Donato et al. 2007). Cyanide may be present at the Project site in the following forms: free cyanide, WAD cyanide, and strong cyanide complexes. WAD cyanide refers to metal cyanide compounds that dissociate in acidic conditions (e.g., stomach acid), making them bioavailable and toxic when ingested. WAD cyanide is used to measure toxicity instead of total cyanide, which includes the strong cyanide complexes that are not bioavailable and, thus, do not contribute to toxicity. WAD cyanide measurements also include free cyanide, which is bioavailable and toxic to wildlife but rapidly degrades when exposed to air and natural light in tailings environments (Botz et al. 2016). Intake of cyanide via ingestion, dermal contact, or inhalation results in rapid absorption into the bloodstream. Cyanides can react with iron in blood and/or inhibit critical oxidative enzymes, which may lead to cardiac or respiratory arrest (Towill et al. 1978). If a lethal dose is not absorbed, cyanide is metabolized and excreted from the body without lasting toxicity, and since cyanide is quickly metabolized, it is unlikely to bioaccumulate in the food chain (Eisler 1991). Non-lethal effects of cyanide ingestion include bill shaking, lethargy, wing flapping, stupefaction, and gasping. Since cyanide is metabolized at non-lethal doses, these effects are temporary (Henny et al. 1994).

Migrating birds traveling along the Pacific Flyway are likely to pass over the Project area, and the TSF pond may appear as an attractive surface waterbody. A number of habitats within TSFs, particularly supernatant and tailings beaches, resemble natural habitats and attract some bird species despite a complete lack of food. Regular disturbance of the TSF would prevent establishment of aquatic plants and invertebrates, so there would not be substantial plants and insects to forage upon in this location, which is beneficial for wildlife. The Applicant’s proposed use of bird deterrent balls (i.e., plastic balls designed to partially fill with water and rest on the surface of the pool to create a flexible, blanket-like cover) could make the pond less attractive and deter birds from landing on the pond surface. However, the effectiveness of bird deterrent balls on the TSF reclaim pond is not known, so monitoring is required to assess the actual number of birds that land at the TSF.

Studies conducted after reports of significant wildlife mortality from gold mining activity in Nevada and Australia were reviewed. In Nevada, 17 tailings ponds at gold mines were surveyed in 1990, and dead birds were observed at ponds with concentrations of 81 and 62 mg/L WAD cyanide. No wildlife deaths were observed at ponds with concentrations less than 59 mg/L WAD cyanide except for one deer mouse found dead in a pond with 26 mg/L WAD cyanide. A safe threshold concentration of cyanide to eliminate wildlife loss could not be determined from the field data and initial laboratory studies (Henny et al. 1994).

Studies in Australia found significant wildlife deaths at tailings ponds with concentrations above 50 mg/L but no deaths at tailings ponds with discharge tailings concentrations consistently below 50 mg/L (Donato et al. 2007); field data generally indicate that incidents of mortality are very few at WAD cyanide concentrations lower than ~50 mg/L (Commonwealth of Australia 2010). Other case studies have indicated no evidence of wildlife mortality associated with tailings ponds when concentrations are below 50 mg/L WAD cyanide. Adoption of a level of 50 mg/L of WAD cyanide as a general maximum target at non-hypersaline sites is consistent with the standard used by the ICMC, as field observations indicate that few wildlife mortalities are likely to occur at WAD cyanide concentrations below this level. At concentrations lower than 10 mg/L WAD cyanide, no acute mortalities and minimal sublethal effects are expected (Commonwealth of Australia 2010).

An ICMC external audit at the Mponeng mine of AngloGold Ashanti in South Africa found no evidence of wildlife deaths at a TSF with WAD cyanide concentrations below 50 mg/L. Twenty-five bird species were observed in or around the TSF and were likely feeding on insects from the pond surface and did not show any signs of cyanide toxicosis. The surrounding areas were investigated, and no wildlife mortalities were observed (Hudson and Bouwman 2008).

The Barrick Cowal Gold Mine in Australia is an ICMC-compliant operation where tailings systems are monitored by trained staff on a daily basis. Tailings discharge is maintained with WAD cyanide below 30 mg/L and the supernatant pond typically has WAD cyanide concentrations of 10 mg/L. No wildlife deaths attributed to cyanosis have been documented after 7 years of observations at the Cowal Gold Mine (Donato Environmental Services 2014).

Anecdotal evidence from other TSF operations indicates that animals that penetrate the TSF fence and walk across the TSF can become trapped in the boggy sediments before they can access the pond, resulting in mortality from being unable to escape (rather than through ingestion of TSF waters). Large mammals would be prevented from entering the TSF through the use of fencing 8 feet in height, and armoring extending 30 inches above and 18 inches below the ground surface would exclude burrowing mammals including porcupines. The Applicant-proposed fencing adheres to the minimum standards for fencing at OAR 635-420-0050. However, small mammals and amphibians or reptiles could climb the fence to enter the TSF.

The TSF and pond, as well as enclosed contact water tanks, would be monitored daily to detect any wildlife mortalities, and employees would be required to report any wildlife fatalities (EM Strategies and Mason, Bruce & Girard 2023). Employees would be trained to accurately conduct wildlife monitoring and reporting.

In the event that the cyanide concentration in the TSF pond exceeded 1 mg/L and/or metals concentrations exceeded regulatory limits, the Applicant would implement a number of contingency actions (Calico Resources USA Corp. 2023b), including:

- Lowering the target WAD cyanide concentration for the cyanide detoxification circuit to a level less than 15 mg/L to reduce the WAD cyanide level in the supernatant pond;
- Using bird deterrents to prevent birds from drinking from the supernatant pond;
- Treating the supernatant pond (e.g., with hydrogen peroxide) to destroy WAD cyanide within the TSF pond;
- Treating the supernatant pond with lime to reduce concentrations of metals;
- Evaluating water management systems to reduce the load of WAD cyanide and/or metals in the pond water or to reduce the volume of water in the supernatant pond; and
- Further evaluating WAD cyanide toxicity to avian species/additional ecological risk assessment to establish if the supernatant pond is affecting birds.

Monitoring of chemicals in the TSF pond would be carried out regularly and reported to the ODFW quarterly by the Project’s environmental and safety superintendent (EM Strategies and Mason, Bruce & Girard 2023). This would ensure that cyanide and metal concentrations are closely monitored so that actions can be taken quickly to address exceedances in established thresholds. Reductions of cyanide concentrations to nontoxic levels and exclusion from cyanide solutions are the only certain methods of protecting terrestrial vertebrate wildlife from cyanide poisoning (Eisler and Wiemeyer 2004).

To reduce the attractiveness of the study area in general and the open water of the TSF specifically, birds and bats would be excluded from potential nesting structures such as open pipes or vents by installing covers, mesh, or netting.

#### *Wildlife Exclusion Measures*

Potential additional measures to prevent waterbirds from landing on the TSF pond and wildlife from entering the TSF area include the use of visual deterrents, motion-activated devices, laser deterrents, emergency hazing techniques, bio-exclusion zones, decoy ponds, use of hypersalinity, and netting and wires. Many visual and acoustic deterrents are deployed indiscriminately and not in response to specific bird activity, which leads to birds becoming habituated to these deterrents (Atzeni et al. 2016), so use of motion-activated devices is preferred.

- **Visual deterrents and effigies.** Falcon kites and predatory decoys that simulate an active predator presence in the area can scare birds away. The efficacy of effigies can vary depending on the type of effigy used and avian species. Some studies of predator effigies found they were effective initially but then birds habituated to them (Andelt et al. 1997; Cummings et al. 1986). Gilsdorf et al. (2002) found more realistic human effigies are more likely to be effective. Vulture effigies were found to be effective over a longer term (Avery et al. 2002; Tillman et al. 2002). Alternative visual deterrents such as reflecting tape, flags, and mirrors have varying effectiveness or inconclusive results depending on the distribution of deterrents (Belant and Ickes 1996; Gilsdorf et al. 2002; National Academies of Sciences, Engineering and Medicine 2011). Boag and Lewin (1980) compared the effectiveness of a model falcon, reflectors, and human effigy at both natural and tailings ponds and found the human effigy to be the most effective, although some habituation was observed with human effigies as well.

- **Radar-activated on-demand systems.** On-demand activation (e.g., BirdAvert™ by Peregrine Systems or Accipiter® A-HSPS Radar-Activated Deterrent) of sounds, human effigies, and propane cannons when birds are detected are more effective than static or timed deterrents that birds habituate to. These were found to be highly effective when tested on oil sand mine tailings in Canada (Ronconi and St. Clair 2006). Stevens et al. (2000) also found a radar-activated on-demand system using acoustic alarm calls, pyrotechnics, and chemical repellents was effective in reducing avian mortality at large contaminated ponds at a power plant.

- **Laser bird deterrents.** A silent portable device (e.g., Agrilaer® by Bird-B-Gone) can be used to repel birds using a laser beam that is optimized for repelling birds over a long distance. Birds perceive the green laser beam as a physical danger that is coming toward them and fly away (Bird-B-Gone 2023). Blackwell et al. (2002) found lasers to be effective in dispersing mallards and geese in field scenarios whereas they were less effective in captive scenarios. Effectiveness varies across species and wavelengths of transmitted light (Gilsdorf et al. 2002; Gorenzel and Salmon 2002; National Academies of Sciences, Engineering and Medicine 2011).

- **Emergency hazing.** Such measures may include the use of air cannons, explosives, or bird tear gas to deter the animals from entering the area and should only be used in emergency situations, such as if the cyanide in the TSF pond exceeded permitted levels.

- **Bio-exclusion zones.** After construction, growth of *all* vegetation, including noxious weeds, can be prevented around facilities that are fenced to prevent wildlife from entering. This would avoid establishing potential wildlife food sources, such as grasses and insects, which would further deter wildlife from entering these areas and may be particularly important for bird species. Vegetation removal from levees around agricultural evaporation ponds is effective in deterring waterfowl by reducing nesting sites and productivity (Bradford et al. 1991).

- **Decoy ponds**. Ponds may be created to attract birds to an alternate habitat nearby rather than the TSF pond and typically target waterfowl. Disadvantages of decoy ponds include difficulty accessing fresh water, avian botulism outbreaks, high cost of development (Bradford et al. 1991), and attracting more birds to the area (Chilvers 2024).
- **Hypersalinity**. Hypersalinity involves increasing the salt concentration in the TSF water to levels that are unpalatable by adding salts directly to the water or by manipulating natural salt deposits in the surrounding geology. Salinity levels need to be carefully monitored and maintained to ensure they are high enough to deter wildlife but not so high that they create other issues such as equipment erosion, soil degradation, or harm to other wildlife.
- **Netting and wires.** Netting and wires are effective at excluding birds from ponds but are less feasible at large scales. The TSF would encompass 108 acres, so the cost of enclosing the area with netting and wires can be prohibitively expensive due to the need for more costly support systems. Netting may interfere with routine daily maintenance and can be damaged by wind or buildup of snow and ice. Netting if not maintained correctly may also present a hazard to wildlife, for instance by loose netting resulting in entanglement of bird species (Bishop et al. 2003; Lowney 1993; National Academies of Sciences, Engineering, and Medicine 2011).

During reclamation, the TSF would be dewatered, covered, and vegetated, so there would be no risk of cyanide exposure to wildlife after reclamation is complete.

#### Aquatic Species

There is limited suitable habitat for fish, amphibians, and aquatic macroinvertebrates due to the ephemeral nature of most waterbodies and lack of streams with connectivity to the study area.

Fish are unlikely to occur within the aquatic resources study area, partially due to a fish barrier downstream at Rye Field Reservoir and the ephemeral nature of the drainages in the study area, resulting in no effects. In addition, since the springs and streams in the study area are likely unsuitable for many aquatic macroinvertebrates, there would be no effects to these species.

No special-status amphibians occur in the study area, so there would be no effects to these species. One common amphibian species, the Pacific tree frog, is present in the study area that is adapted to use a variety of wet habitats, including ephemeral wetlands and springs, riparian areas, and pastures. These amphibians could be affected by Project construction and operations including being trampled by vehicles and equipment, mortality of tadpoles from reduced water in ephemeral wetlands and springs that dry up before metamorphosis can be achieved, and possible injury from toxins in the TSF. Fencing of the process area and the TSF would not likely prevent amphibians from entering these areas, although a general reduction in wet areas within the fenced Permit Area may cause these species to move to other areas in search of water. In addition, the frequent disturbance of the TSF supernatant pond during discharges of tailings and pumping of process water would prevent organisms from establishing in the pond.

#### Special-Status Species

Impacts to special-status raptors including ferruginous hawk, golden eagle, and burrowing owl may result from potential exposure to cyanide and other contaminants at the supernatant pond if the pond is used as a water source. Raptors are at the top of the food chain, making them particularly vulnerable to bioaccumulation of metals. Raptors and their prey may be exposed to several toxic metals (i.e., arsenic, chromium, copper, lead, manganese, mercury, and nickel) (Durkalec et al. 2022) at the TSF. However, fencing and the use of bird deterrent balls would reduce this effect. Raptors may also be affected by noise disturbance during mating and nesting, light pollution, and vehicle strikes on access roads. Due to the presence of raptor nests in proximity to the proposed Project, nests should be surveyed during the nesting season to determine if they are active. The USFWS could then impose avoidance buffers once nesting surveys are completed and determine if protection measures are required, such as timing restrictions during the breeding and rearing season.

Impacts to special-status bird species, such as loggerhead shrike, include noise disturbance during mating and nesting, light pollution, and vehicle strikes on access roads. It is anticipated that once construction begins, the noise, heavy machinery, and human activity within the Permit Area would cause such bird species to avoid the area generally. Construction and removal of shrubs and grasses used for nesting should occur outside of the nesting season to prevent birds from nesting in these shrubs and grasses, thus reducing this effect.

To reduce night lighting effects to wildlife, the Applicant would follow practices presented in the BLM Technical Note 457, Night Sky and Dark Environments: Best Management Practices for Artificial Light at Night on BLM-Managed Lands (Sullivan et al. 2023) and would undertake the following measures to minimize lighting impacts:

- Skyward lighting would be avoided except in cases where it is needed to maintain safe conditions (e.g., signal lights on moving equipment);
- Stationary external lights would be shielded and use motion detectors, timers, or dimmers where appropriate; and
- Lighting would be directed only onto the work area and away from adjacent areas not in use, with safety and proper lighting of the active work areas being the primary goal.

Since most Project lighting is related to the underground mine workings, lighting would be underground or within enclosed buildings during the time of use, thus reducing impacts of night-time lighting and glare to special-status species.

Special-status bird species may be affected by exposure to cyanide at the TSF pond, although maintaining WAD cyanide levels at 1 mg/L and using deterrents at the TSF would prevent birds from injury in this area.

Four bat species listed as sensitive in Oregon (hoary bat, silver-haired bat, spotted bat, and pallid bat) were located during acoustic surveys within the 0.5-mile buffer of the Permit Area. Therefore, there is concern that these listed bats could use the TSF pond as a drinking and foraging source, thus being exposed to cyanide. However, the use of wildlife deterrents at the TSF and maintaining WAD cyanide levels at 1 mg/L would likely prevent bat mortality.

Bats may also be susceptible to ingestion of metals that may be present in the TSF pond (i.e., arsenic, chromium, copper, lead, mercury, and nickel) or from bioaccumulation of metals if the insects they feed on have been contaminated (Currie et al. 2000). To prevent bats from being attracted to the TSF pond, bright lights may be installed since bats have been shown to avoid brightly lit areas and to reduce drinking activity in the presence of light (Bates 2019). However, the use of lights at night would attract insects, which may draw bat species to forage on them. Thus, this measure would conflict with suggested night-lighting minimization strategies and is therefore not recommended. Hanging light-reflecting strips around the TSF perimeter on poles above the fence line may assist in deterring flying bats and birds from entering the area as they are generally repelled by reflective objects.

In other operational areas within the Permit Area, bats would be affected by lighting effects from skyward-facing lights. Impacts of light pollution on bats can include negative effects on foraging, movement, roosting, breeding, and hibernation (Cravens and Boyles 2018). Suggested measures to reduce effects of night lighting to bats are to install lighting only where necessary for safety and operational reasons, to use dynamic lighting that turns on via motion sensors where practical, and to install light shields to direct light away from the sky and toward the area of focus (Voigt et al. 2018).

No special-status aquatic species occur in streams and springs in the study area; therefore, there would be no effects to special-status aquatic species from any alternative.

Though no signs of greater sage-grouse were observed during the surveys, portions of the Permit Area and a large portion of the 2-mile buffer are designated by the ODFW as low-density greater sage-grouse habitat based on the presence of a known greater-sage grouse lek west of the general area (ODFW 2013). Due to the lack of suitable greater sage-grouse habitat, direct impacts to this species may be minimal. However, greater sage-grouse are sensitive to the effects of human development and infrastructure (e.g., fences, roads, and electrical lines) and associated noise and predation. Fences can cause direct mortality due to collisions as well as provide perches for avian predators. Adding markers to fences can make them more visible to greater sage-grouse in flight, and studies have shown that fence markers reduce collisions (Van Lenen et al. 2017). The ODFW notes that not all fences need to be marked, but marking those within 2 km of known leks can reduce collisions (Sage-Grouse Conservation Partnership 2015). There were no leks observed within the 2-mile buffer of the Permit Area boundary where fencing would be installed. However, it may be worthwhile to mark any fencing within low-density greater sage-grouse habitat, especially portions closest to the known lek west of the Permit Area as a cautionary measure. To reduce the risk of corvid predation on greater sage-grouse, new power poles located within 6 miles of sage-grouse low-density habitat would be fitted with deterrent structures (e.g., triangular avian perch and nest diverters), as recommended by the ODFW. Additionally, power poles would be monitored by trained personnel during nesting season for evidence of any nesting by potential avian predators (Mason, Bruce & Girard 2023).

Anthropogenic noise disturbance can have several negative impacts on greater sage-grouse including declines in lek attendance (Blickley et al. 2012) and interference with bird vocalizations important for mating and parent–offspring communication (Blickley and Patricelli 2012). Anthropogenic noise can cause chronic physiological stress, which can affect reproductive success, survival, and disease resistance (Blickley et al. 2012), and greater sage-grouse may avoid areas with noise from vehicular traffic. The BLM recommends that noise at the perimeter of leks is limited to 10 decibels (dB) above ambient sound levels (BLM 2015b). Noise created by the Project during both construction and operations, except blasting, is expected to attenuate to a level below 30 dBA (A-weighted decibel) and close to or below 25 dBA within approximately 3 miles from the Project’s perimeter fence (Creative Acoustics Northwest 2019).

Noise produced by blasting is instantaneous and episodic and would occur over a 29-day period during construction followed by approximately two blast events per week during operations. During operations, blasting would occur only during daylight hours and would not occur for 2 hours after sunrise and 2 hours before sunset. To minimize noise impacts on greater sage-grouse and other wildlife, blasting for construction would be avoided from March 1 through June 30. If it is determined that blasting must occur during this period, the Applicant would coordinate with the ODFW in advance to determine appropriate measures to reduce or avoid impacts (EM Strategies and Mason, Bruce & Girard 2023). If ongoing noise monitoring detects levels exceeding those indicated in the Noise Baseline Report (Creative Acoustics Northwest 2019), the Applicant would coordinate with the ODFW to determine an adaptive management approach, propose and incorporate reduction components for machinery, and halt construction activities if necessary. While there were no observations of greater sage-grouse activity in the Permit Area or the 2-mile buffer, impacts to greater sage-grouse in the Permit Area would occur through habitat loss and noise disturbance. Impacts on greater sage-grouse from road upgrades may include exposure to dust, increased trash from vehicles, the spread of invasive weeds in sage-grouse habitat, and direct impacts from collisions with moving vehicles. Posted speed limit signs would help minimize dust and direct impacts to grouse.

Mine dewatering operations may lower the groundwater in the immediate vicinity of the mine so the availability of water for wildlife from springs in this area would be reduced. However, the noise and human disturbance in this area would likely cause wildlife to avoid these areas.

Greater sage-grouse may be exposed to contaminants in the TSF pond if they are able to access and consume it. However, the site would be fenced and exclusion measures installed to prevent birds from entering the area.

While there were no signs of greater sage-grouse within the Permit Area, the proposed Project would impact greater sage-grouse habitat. Greater sage-grouse populations are most at risk from habitat loss due to juniper encroachment, invasive plant species, large-scale wildfire, and anthropogenic development (Davies et al. 2011). The ODFW developed the Greater Sage-Grouse Conservation Strategy for Oregon (OAR 635-140-000 through 635-140-0025), a comprehensive approach to sage-grouse conservation including mitigation framework to ensure that any habitat losses are offset to achieve a net conservation benefit. The standard requires the proposed mitigation to achieve a net conservation benefit for greater sage-grouse “by replacing the lost functionality of the impacted habitat to a level capable of supporting greater sage-grouse numbers than that of the habitat which was impacted. Where mitigation actions occur in existing sage-grouse habitat, the increased functionality must be in addition to any existing functionality of the habitat to support sage-grouse.”

The Oregon Sage-Grouse Habitat Quantification Tool (HQT) is used to determine the quantified compensatory mitigation required for associated impacts to greater sage-grouse habitats. Compensatory mitigation for greater sage-grouse habitat must lead to a net benefit for the species. The Applicant proposes to obtain and manage one or more offsite HMAs for the life of the Project or the duration of the Project’s impacts. Working with the ODFW, the Applicant is reviewing two properties for offsetting the Project’s impacts to greater sage-grouse habitat. Specific mitigation actions at the greater sage-grouse HMAs may include weed treatments, native shrubland/grassland restoration, wildfire planning, infrastructure removal, livestock management, and seep/spring management. Any mitigation not satisfied by the HMAs may be offset by purchasing credits from a mitigation bank (EM Strategies and Mason, Bruce & Girard 2023).

#### 3.5.4.3 Alternative A

Under Alternative A, use of thiosulfate in place of cyanide would modify the chemistry and leaching potential of the tailings material. However, while cyanide would no longer be present in the tailings and process solution, use of thiosulfate as a leaching reagent would still mobilize other constituents from the tailings material, including arsenic and selenium. Leached concentrations of these constituents in process solutions would most likely be above reference values and would have similar risks to wildlife exposed to the TSF supernatant pond as under the Applicant’s proposed Project.

The remaining aspects of the proposed Project, including development of facilities, fencing, road widening, and so on would be the same as under the Applicant’s proposed Project and would therefore have the same effects.

In summary, impacts to wildlife habitats and species would be approximately the same under Alternative A as under the Applicant’s proposed Project.

# 3.6 NON-NATIVE AND INVASIVE PLANTS

For the purposes of this evaluation, invasive plants are defined as non-native organisms that cause economic or environmental harm and are capable of spreading to new areas of the state. Non-native plants can include noxious weeds, which are defined as “a plant designated by a governmental agency to be injurious to public health, agriculture, recreation, wildlife, or property” (ODA 2023a). Specifically, in Oregon “noxious weeds” are terrestrial, aquatic or marine plants designated by the Oregon State Weed Board that represent “the greatest public menace” and are “a top priority for action by weed control programs” (ORS 569-350). Non-native and invasive plants are managed through multiple agencies including the ODA, Malheur County, and the BLM.

The non-native and invasive plants study area includes the entire Permit Area (i.e., the Mine and Process Area and the Access Road Area) (Figure 3.6-1).

## 3.6.1 Regulatory Context

### 3.6.1.1 State Regulations

The ODA has responsibility for jurisdiction, management, and enforcement of the State of Oregon’s noxious weed law. State noxious weed laws pertain to both private and public land. The ODA maintains and updates the list of Oregon noxious weeds, which are divided into classifications A, B, and T as follows (ODA 2022):

- **A-Listed Weed**. A weed of known economic importance that occurs in the state in small enough infestations to make eradication or containment possible or is not known to occur, but whose presence in neighboring states makes future occurrence in Oregon seem imminent. Recommended action: Infestations are subject to eradication or intensive control when and where found.
- **B-Listed Weed**. A weed of economic importance that is regionally abundant but may have limited distribution in some counties. Recommended action: Limited to intensive control at the state, county, or regional level as determined on a site-specific, case-by-case basis. Where implementation of a fully integrated statewide management plan is not feasible, biological control (when available) shall be the primary control method.
- **T-Designated Weed**. A designated group of weed species that are selected and will be the focus for prevention and control by the Noxious Weed Control Program. Action against these weeds will receive priority. T-designated noxious weeds are determined by the Oregon State Weed Board, and the ODA is directed to develop and implement a statewide management plan. T-designated noxious weeds are species selected from either the A or B list.

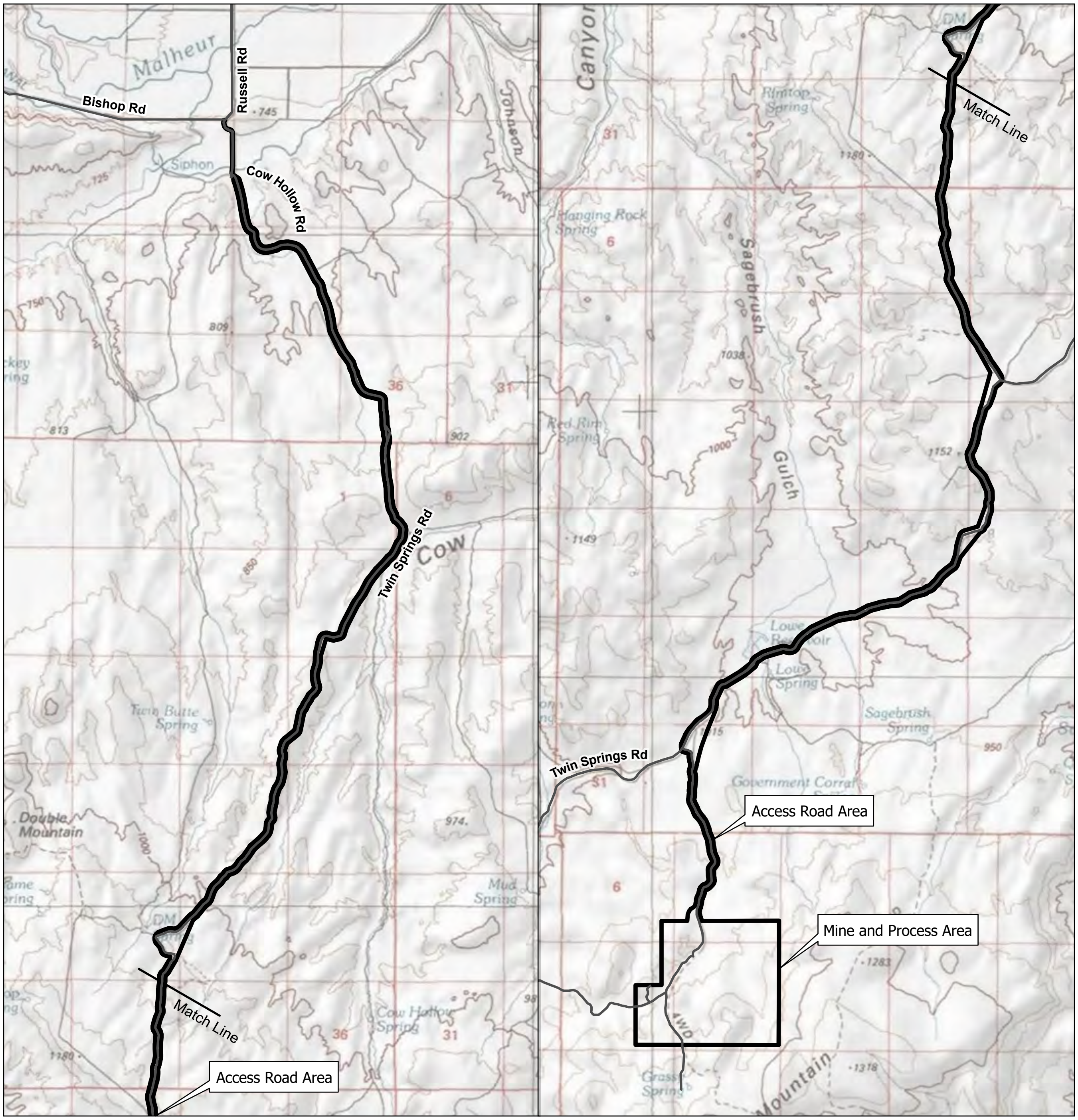
### 3.6.1.2 County Regulations

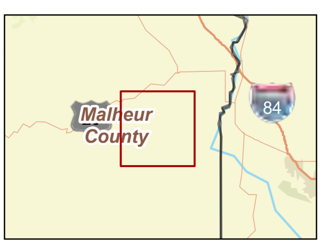
All of Malheur County is within the Malheur County Weed District, which is governed by the Malheur County Court based on recommendations from the Malheur County Weed Advisory Board. Malheur County has prioritized control and/or eradication of noxious weeds by A, B, and C classes, which are defined by the county as follows (Malheur County 2023a):

- **Class A Weed**. A weed of economic/environmental importance known to occur in the county in very small numbers that make eradication practicable or that is not known to occur but whose status in surrounding counties makes future occurrence seem imminent. Action: Infestations are subject to eradication or intensive control when and where found.
- **Class B Weed**. A weed of known economic/environmental importance and of moderate to wide distribution and highly invasive, subject to intensive control or eradication where feasible at the county level. Action: Infestations are subject to control where found, with possible county assistance when funds are available. All Class B weeds are required to be controlled within 50 feet of all property lines, easements, and rights-of-way.
- **Class C Weed**. A weed of known economic/environmental importance and of general distribution that is subject to control or eradication as local conditions warrant. Action: Infestations are treated at the landowner's discretion.

#### 3.6.1.3 Federal Regulations

The Federal Noxious Weed Act of 1974 established a federal program to control the spread of noxious weeds. It requires that each federal agency (e.g., BLM, USFWS, USFS) conducts the following: (1) designate a lead office and person trained in the management of undesirable plants; (2) establish and fund a management program for undesirable plants; (3) complete and implement cooperative agreements with state agencies; and (4) establish integrated management systems to control undesirable plant species. The BLM has identified noxious weed management as a priority problem affecting ecosystem health on public lands and, as such, has developed a policy relating to the management and coordination of noxious weed activities. This policy further requires that all ground-disturbing projects and any projects that alter plant communities be assessed to determine the risk of introducing or spreading noxious weeds.




Legend

Study Area

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(At original document size of 8.5x11)

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*Project Location*

Malheur County, OR.

Prepared by LL on 2023-09-21
TR by KB on 2023-09-21

*Client/Project* 2378001753

DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*

**3.6-1**

*Title*

**Non-Native and Invasive Plants Study Area**

***Notes***

**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: BLM, iMapInvasives
**3.** Background: Esri USA Topo Maps

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### 3.6.2 Method of Analysis

Existing occurrences of non-native and invasive plants were described using baseline vegetation surveys and a review of available information from county databases. The Applicant conducted baseline vegetation surveys in 2012, 2013, 2015, 2017, and 2019 (EM Strategies 2018; HDR Engineering 2014, 2015; Siskiyou BioSurvey LLC 2019; Table 3.6-1). This information was supplemented with spatial information on invasive plant observations obtained from Oregon iMapInvasives (ORBIC 2023). Current lists of noxious weeds were also acquired from the ODA and the Malheur County Weed Advisory Board to update the statuses of the species observed and reported in the previous baseline reports. Project-related impacts for non-native and invasive plants were assessed qualitatively by considering the effects caused by construction activities, mining operations, maintenance activities, and post-reclamation land use on these invasive plant communities.

### 3.6.3 Affected Environment

Thirteen noxious species were observed throughout the study area during baseline vegetation surveys conducted between 2012 and 2019 (Table 3.6-1). Dominant noxious plant species present throughout the study area include medusahead rye (*Taeniatherum caput-medusae*), Scotch thistle (*Onopordum acanthium*), and cheatgrass (*Bromus tectorum*). Mapping of noxious plant species during the 2019 survey showed a large portion of the Mine and Process Area occupied by medusahead rye, while scotch thistle was observed along large portions of the Access Road Area. The spatial distribution of these species and others can be found in the Applicant's Noxious Weed Monitoring and Control Plan (Calico Resources USA Corp. 2024).

One invasive plant species, rush skeletonweed (*Chondrilla juncea*), was found within the study area from the spatial analysis using data from iMapInvasives (ORBIC 2023). There were eight observations of this species in the northern portion of the Access Road Area. No invasive plant species in this specific dataset were observed within the Mine and Process Area (ORBIC 2023).

Table 3.6-1 shows the non-native and invasive plants in the study area. Descriptions of each species are provided after the table.

**Table 3.6-1 Noxious Weed Species Observed in the Non-Native and Invasive Plants Study Area**

| Common Name | Scientific Name | Distribution | Malheur County Status | Oregon Status |
|---|---|---|---|---|
| Swainsonpea/Austrian peaweed | *Sphaerophysa salsula* | Along access roads | B | B |
| Bull thistle | *Cirsium vulgare* | At Mine and Process Area | B | B |
| Canada thistle | *Cirsium arvense* | Along access roads and northern boundary of Mine and Process Area | B | B |
| Cheatgrass | *Bromus tectorum* | Dominant throughout | C | n/a |
| Common reed | *Phragmites australis* | One spot at small spring | B | B |

| Common Name | Scientific Name | Distribution | Malheur County Status | Oregon Status |
|---|---|---|---|---|
| Field bindweed | *Convolvulus arvensis* | Along access roads | C | B |
| Kochia | *Kochia scoparia* | Along access roads | C | B |
| Medusahead rye | *Taeniatherum caput-medusae* | Dominant throughout | B | B |
| Nodding/musk thistle | *Carduus nutans* | Along access roads | B | B |
| Ribbon grass/reed canarygrass | *Phalaris arundinacea* | One spot at irrigation canal | A | B, T |
| Rush skeletonweed[1] | *Chondrilla juncea* | Along access roads | A | B, T |
| Scotch thistle | *Onopordum acanthium* | Common throughout | B | B |
| Whitetop (hoary cress) | *Cardaria draba (Lepidium draba)* | Along access roads | B | B |

[1] The only species from Oregon iMapInvasives that was mapped within the non-native and invasive plants study area.

### 3.6.3.1 Swainsonpea/Austrian Peaweed

Introduced from Asia, swainsonpea (*Sphaerophysa salsula*) is common within Western states in irrigated fields and moist non-crop areas such as along fences and roadsides. It poses a threat to clover and alfalfa as the seeds of these species are similar in weight and shape, making it difficult to separate them when crop seed is imported. Swainsonpea may also be unpalatable and/or poisonous to livestock and wildlife due to alkaloids in the plant (ODA 2023b).

### 3.6.3.2 Bull Thistle

Bull thistle (*Cirsium vulgare*) is a Eurasian native plant that occurs in every county in Oregon. It is considered a nuisance weed in pastures and rangeland as it forms dense thickets, which displace and outcompete more desirable forbs and grasses (ODA 2023b). Thistles tend to establish along roadsides, railways, ditches, and other highly disturbed sites and can be distributed seed via wind, water, birds, and other animals. It is also spiny, which makes it unpalatable to wildlife and livestock (USDA 2014). Bull thistle can easily be controlled in pastures by using herbicides or by mowing to prevent seed production. Biocontrol insects (e.g., gall fly) are also effective at targeting seed dispersal, thereby reducing populations (ODA 2023b).

### 3.6.3.3 Canada Thistle

Introduced from southeastern Eurasia and Europe, Canada thistle (*Cirsium arvense*) occurs in every county in Oregon and is the most common thistle species in the US. It can be found in cultivated fields, riparian areas, pastures, forests, lawns, roadsides, and waste areas (ODA 2023b). This species prevents the coexistence of other species through shading, outcompeting for resources, and possibly through the release of chemical toxins poisonous to other plants (USDA 2006a). Manual removal can be difficult due to its prickly leaves and easy fragmentation of the extensive root system. Four approved biocontrol agents (i.e., a stem weevil, a seed head weevil, a crown weevil, and a stem gall fly) are established in Oregon (ODA 2023b).

#### 3.6.3.4 Cheatgrass

Cheatgrass (*Bromus tectorum*) is a dominate weed located east of the Cascade Mountains within rangelands, croplands, and disturbed areas. It spreads quickly through seed dispersal and forms thick, dense stands, outcompeting native grasses. Cheatgrass is also highly flammable, making it a wildfire hazard. For smaller patches, hand pulling or hoeing before seed production can be used to reduce infestation (Oregon State University 2023).

#### 3.6.3.5 Common Reed

Native to Africa and temperate parts of Asia and Europe, common reed (*Phragmites australis*) spreads by dispersing seeds by wind, water, and animals. These transport methods can allow seed dispersal over long distances (ODA 2023b). The tall nature of this plant also shades out other plants, allowing it to create a monoculture of this species (USDA 2005a). In Oregon, this species typically inhabits wetlands, estuaries, and areas with adequate moisture (ODA 2023b). Physical manual control of this species is difficult as all the rhizomes must be dug up as it can easily re-establish from any fragments left in the soil (USDA 2005a).

#### 3.6.3.6 Field Bindweed

Field bindweed (*Convolvulus arvensis*) is widely distributed in Oregon, inhabiting roadsides, grasslands, and urban environments and is known for reducing crop fields by outcompeting crops for moisture and nutrients. This species is also mildly toxic to grazing animals (USDA 2006b). Manual removal of this species is difficult as fragmentation of the deep root system and dispersal of seeds can increase densities (ODA 2023b). Complete eradication of field bindweed is difficult as seeds remain viable in the soil for up to 20 years (USDA 2006b). Two biocontrol agents have been approved in Oregon, the defoliating moth and the gall mite (ODA 2023b).

#### 3.6.3.7 Kochia

Introduced from Eurasia, kochia (*Kochia scoparia*) is extensively established in the eastern, drier portion of Oregon. It is a highly adaptable plant that can be found in pastures, roadsides, ditches, wastelands, and cultivated fields. Once kochia matures, it breaks off at the base of the plant and becomes a tumbleweed, which is how it spreads its seeds (USDA 2010). This species can be toxic to livestock if consumed in large quantities (USDA 2010). It can become rapidly resistant to many herbicides and reduces crop yields through competition for resources (ODA 2023b).

#### 3.6.3.8 Medusahead Rye

Medusahead rye was introduced from the Mediterranean region of Eurasia and is distributed within all counties of Oregon, specifically expanding rapidly in fire-scarred areas and low-moisture rangeland. Medusahead rye changes the natural moisture dynamics of the soil by extracting most of the moisture, preventing perennial grasses from even beginning to grow. Once it dominates an area, the land becomes unable to support wildlife and livestock as the plant is stiff and hard, with tiny barbs that can injure grazing animals (ODA 2023b).

#### 3.6.3.9 Nodding/Musk Thistle

Musk thistle (*Carduus nutans*) is native to southern Europe and western Asia and is distributed mostly throughout the eastern portion of Oregon. It spreads through seed dispersal and thrives with any human disturbance activity. Musk thistle is commonly found in moist areas such as ditch banks, roadsides, and cereal fields. It is unpalatable to wildlife and livestock due to spines that can be harmful to animals. Hand pulling can be effective on small populations if done prior to seed set. Three biocontrol agents have been established in Oregon (i.e., a crown weevil, a seed head weevil, and a flower fly; ODA 2023b).

#### 3.6.3.10 Ribbon Grass/Reed Canarygrass

Ribbon grass (*Phalaris arundinacea*) is often found in older gardens and abandoned farms. It tends to grow well in moist conditions such as next to water features and even thrives in shallow water, where it is highly competitive and extremely difficult to eradicate once established due to the plant's huge seed banks. Ribbon grass is also tolerant of poor, dry soils and has virtually no disease or pest problems (ODA 2023b). Some manual and chemical methods can be used to control and manage ribbon grass, but no single method works everywhere (USDA 2005b).

#### 3.6.3.11 Rush Skeletonweed

Introduced from Eurasia, rush skeletonweed (*Chondrilla juncea*) is common in southwest counties in Oregon. This species is very drought resistant as it has deep roots that can draw water up from the soil. Rush skeletonweed is an aggressive plant in both rangeland and cropland, where it produces lower crop yields. It has tough, latex-filled stems that can cause difficulties with harvesting efforts, and it also outcompetes other crops, both of which cause lower crop yields. Manual removal through pulling of the plant is not recommended as small root segments can establish new plants. Control of rush skeletonweed can be accomplished using high rates of the herbicide picloram (Malheur County 2023b). There are three biological agents that have been established in Oregon (i.e., a gall midge, a gall mite, and a rust fungus), all of which are able to reduce seed production (ODA 2023b).

#### 3.6.3.12 Scotch Thistle

Scotch thistle (*Onopordum acanthium*) was introduced from Asia and Europe and is now common in all eastern Oregon counties. It invades rangeland by forming large, dense patches that are impenetrable due to the large size and spiny nature of the plant. This plant spreads easily by producing over 20,000 lightweight seeds that can be dispersed by wind, water, or animals (USDA 2005c). Treatments to reduce Scotch thistle (including mechanical and chemical methods) are costly and must be repeated for years (ODA 2023b).

#### 3.6.3.13 Whitetop (Hoary Cress)

Native to southwest Asia, whitetop (*Cardaria draba*) is continually invading much of eastern Oregon, east of the Cascade Mountains. Whitetop establishes in disturbed soils, including excessively grazed areas as well as along roadsides, waste areas, and ditches, and along watercourses (USDA 2006c). This species has an extensive root system and can form dense patches rapidly that outcompete other native species (ODA 2023b). Mechanical removal methods such as pulling and grubbing should be implemented within 10 days of plant emergence and before flowering and seed set. Flooding can also be used to control whitetop as the seeds lose viability after being in wet soil for 1 month. Herbicidal application can effectively control the spread of this species with repeated application (USDA 2006c).

## 3.6.4 Impact Analysis

### 3.6.4.1 No Action Alternative

Under the No Action Alternative, current conditions would continue, with non-native and invasive plant species spreading across the landscape over time. The roads in the study area would still be used to support current uses such as livestock grazing and recreational activities. The existing roads would also allow the area to be continually explored for new mining opportunities. Vehicles using these roads would spread seeds and plant fragments as they are driven from areas infested with invasive species to areas without. Seeds of invasive species would also continue to spread through other natural pathways including by wind, water, and attachment onto wildlife and livestock.

In summary, the No Action Alternative would result in long-term, minor impacts to vegetation from the continued spread of non-native and invasive species throughout the non-native and invasive plants study area, particularly along the existing roadways where these species persist and spread.

### 3.6.4.2 Applicant's Proposed Project

Under the Applicant’s proposed Project, areas where vegetation has been removed due to construction, operation, or reclamation activities would be susceptible to invasion by invasive or non-native plants. Due to the presence of 13 non-native and invasive species within the non-native and invasive plants study area (Table 3.6-1) and the large amount of ground disturbance associated with the Project, there is a high risk of spreading these invasive plants throughout the site. Similarly, the access road improvements, including road widening and culvert placement, have the potential to spread existing invasive plant species during construction. Vehicle traffic along the access roads would also increase after completion of the road upgrades as Project vehicle traffic including pick-up trucks, service vehicles, mine staff personal vehicles, and a daily shuttle bus would travel along Twin Springs Road for the life of the mine, increasing the risk of spreading these species over the entirety of the Project area.

To substantially reduce the spread, introduction, and establishment of invasive, non-native species and noxious weeds, the Applicant has developed a Noxious Weed Monitoring and Control Plan (Calico Resources USA Corp. 2024). This plan outlines the approaches used for prevention, protective management practices, and treatment methods including regular monitoring of the Project area to promote early detection of non-native and invasive plants followed by rapid response of treatments, interim seeding of long-term disturbed areas, use of certified weed-free materials, bi-annual road inspections, and herbicide application (roadside spraying) or mechanical methods to remove unwanted vegetation. In addition, annual surveys of specific areas susceptible to weed establishment would be undertaken with results used to update the direct weed management efforts and the Noxious Weed Monitoring and Control Plan. Any new noxious weed infestations identified during weed monitoring efforts would be reported to the ODA BLM, and the Malheur County Weed Supervisor, and a treatment plan would be developed. The Applicant would monitor the effectiveness of previous years’ treatment applications to determine if alternate measures should be taken to reduce or eliminate existing infestations, reduce seed production, and prevent future infestations.

Based on monitoring results, treatment methods may be varied during the Project or during decommissioning and post-Project reclamation phases.

Noxious weed monitoring and control would be implemented for a minimum period of 5 years following the cessation of mine operations. A post-closure monitoring plan would be developed for reclaimed areas, including monitoring methodology, parameters, and frequencies. Plan development and post-closure monitoring would be coordinated with and approved by the BLM and DOGAMI, and post-closure monitoring would conclude at acceptance of mine closure. The costs for vegetation monitoring would be part of the reclamation bond (see Section 5.6 of the EE for further information on reclamation bonding and financial assurances). Introduction of new non-native and invasive plant species could occur through the use of equipment contaminated with soil containing seeds of these invasive plants from outside the Project area. Likewise, the spread of existing non-native and invasive plant species outside the Project area could also occur as vehicles and equipment move to and from the site. This is of particular concern along existing roadways where invasive species are currently present. Mitigation for this effect would be to wash the underside and wheels of all vehicles that enter and exit the site to prevent the spread of undesirable plant species.

Overall, with the implementation of the Noxious Weed Monitoring and Control Plan, impacts from the Applicant's proposed Project on the spread and establishment of invasive and non-native species would be long term and minor.

#### 3.6.4.3 Alternative A

Alternative A includes the same underground mine and surface facility layout as the Applicant's proposed Project, with the same approximately 488 acres of proposed surface disturbance and the same reclamation and closure practices. Therefore, effects to invasive plants from Alternative A are the same as for the Applicant's proposed Project described above.

# 3.7 CULTURAL RESOURCES

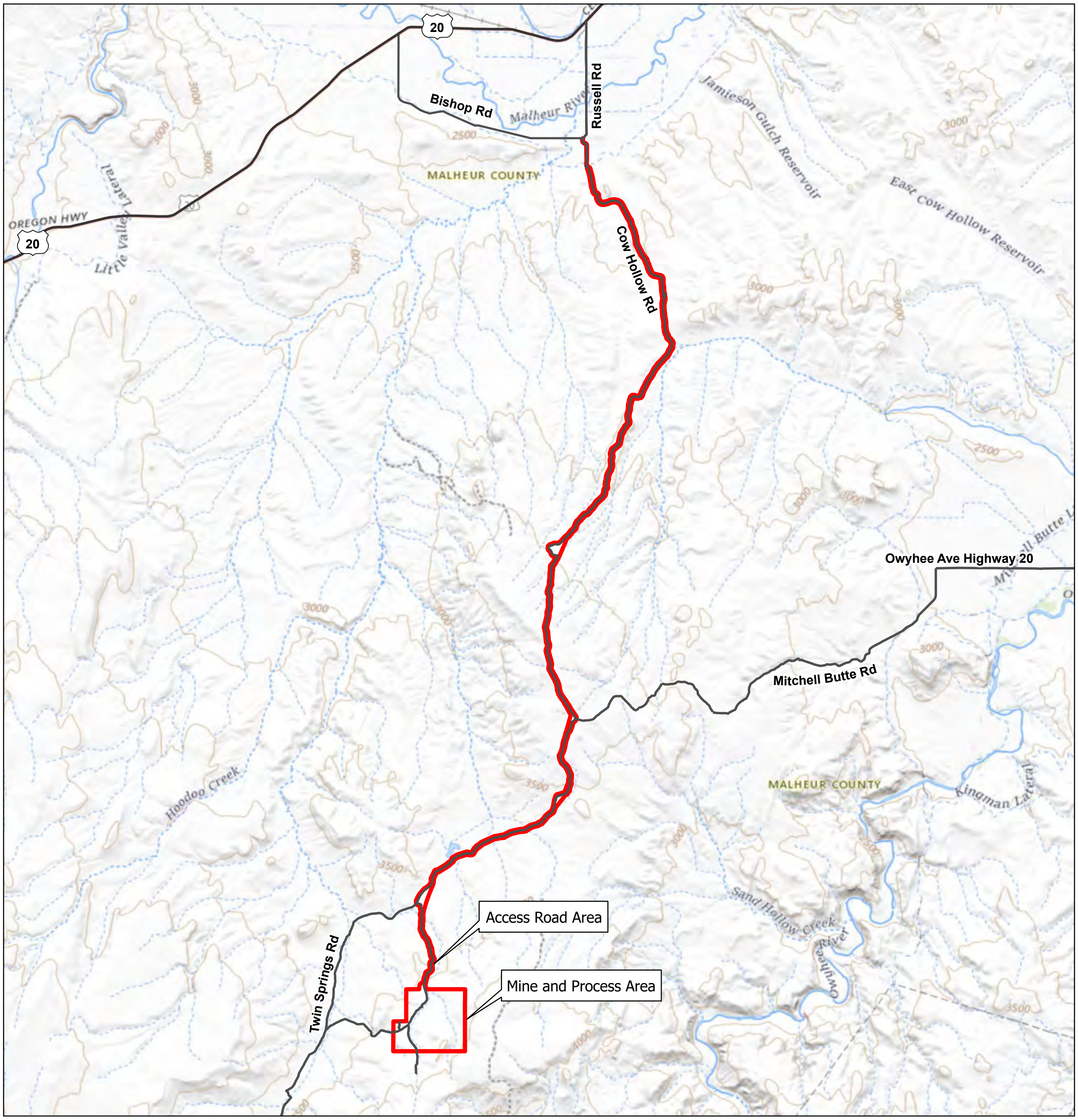
For the purposes of this evaluation, cultural resources are defined as archaeological, historical, or architectural sites, structures, or places and may include locations of traditional cultural or religious importance.

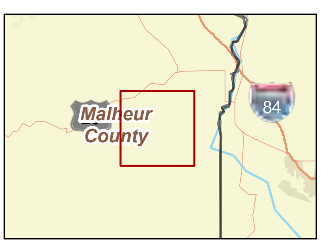
The cultural resources study area, also known as the Area of Potential Effect (APE), consists of the entire Permit Area (the Mine and Process Area and the Access Road Area) (Figure 3.7-1).

## 3.7.1 Regulatory Context

Environmental review of the proposed Project is being carried out by state agencies, federal agencies, and local governments pursuant to the Oregon chemical process mining permit process. DOGAMI is the lead facilitating entity and is responsible for complying with ORS 358.653, Protection of Publicly Owned Historic Properties. Archaeological resources are protected on non-federal, public, and private land under ORS 358.905. ORS 97.740 protects Native American graves, burial items, and items of cultural patrimony. Excavation of archaeological sites requires an Oregon archaeological permit per ORS 390.235, OAR 736-051-0080, and OAR 736-051-0090. The location of cultural resources will be maintained as confidential and exempt from the Oregon public records law, ORS 192.311, under ORS 192.501(11).

Federal environmental review is being conducted by the BLM as the lead federal agency. As such, the BLM is responsible for complying with the National Historic Preservation Act (NHPA), Public Law 89-665, as amended, and its implementing regulation, 36 Code of Federal Regulations (CFR) Part 800.




Legend
Study Area
Existing Roads

0 1 2 Miles
(At original document size of 8.5x11)
1:180,000

N

Stantec

*Notes*
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: BLM, iMapInvasives
3. Background: Esri USA Topo Maps

*Project Location*
Malheur County, OR.
Prepared by LL on 2023-09-21
TR by KB on 2023-09-21

*Client/Project*
2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.7-1**

*Title*
**Cultural Resources Study Area**

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### 3.7.2 Method of Analysis

Cultural resources are evaluated for their eligibility for listing in the National Register of Historic Places (NRHP) using the criteria defined by the NHPA to evaluate the significance of a resource. The analysis of potential impacts to cultural resources is limited to historic properties, as defined by Section 106 of the NHPA and its implementing regulation, 36 CFR Part 800. The criteria for determining whether cultural resources are eligible for listing in the NRHP and therefore considered historic properties are provided in 36 CFR Part 60.4. The NRHP criteria are as follows:

> *The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, or association, and:*
>
> *a) That are associated with events that have made a significant contribution to the broad patterns of our history; or*
>
> *b) That are associated with the lives of persons significant in our past; or*
>
> *c) That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or*
>
> *d) That have yielded, or may be likely to yield, information important in prehistory or history.*

Impact analysis requires consideration of the character-defining features of a historic property and protection of the characteristics that give that property its significance. Direct effects are “caused by the action and occur at the same time and place” (40 CFR Part 1508.8) and may include demolition of structures and any ground-disturbing activities within an archaeological site. Indirect effects are “caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable” (40 CFR Part 1508.8) and may include addition of visual or audible elements to the landscape, erosion within an archaeological site, or structural damage from blasting-related vibrations.

Appendix C of 33 CFR Part 325 states that an undertaking would affect a historic property when the undertaking may alter the characteristics of the property that qualified the property for inclusion in the NRHP. “No effect” means that an undertaking would have no effect at all on a particular historic property. An “adverse effect” means that an undertaking would alter the character-defining features of a particular historic property in such a way that would diminish the eligibility of the property for listing in the NRHP. “No adverse effect” means that an undertaking would have an effect but not such that it would alter the characteristics that make a particular historic property eligible for listing in the NRHP.

Appendix C of 33 CFR Part 325 also states that effects that would otherwise be found to be adverse may be considered not adverse when the historic property is of value only for its potential contribution to archaeological, historical, or architectural research; when such value can be substantially preserved through conducting appropriate research; and when such research is conducted in accordance with applicable professional standards and guidelines.

In January 2023, the Applicant submitted a memorandum (Calico Resources USA Corp. 2023) to the TRT requesting modifications to Section 3.13 of the Calico Environmental Baseline Work Plans. The purpose was to move the evaluation of historic significance, effects analysis, and detailed developed effects treatment (avoidance, minimization, and mitigation of effects) from the Cultural Resources Baseline Data Report and defer it to the EE. Doing so would allow the NEPA EIS to proceed and would accommodate ongoing NHPA Section 106 consultation between the BLM and the Oregon SHPO, appropriate Native American tribes, and interested parties. On February 2, 2023, the TRT approved the requested changes to the Work Plan. On recommendation from the SHPO, the TRT agreed that the December 2019 revised Cultural Resources Baseline Data Report is complete and accurate and conforms to the 2017 Work Plan, as amended and approved by the TRT on February 2, 2023. DOGAMI communicated this approval in a February 13, 2023, letter to the Applicant (DOGAMI 2023).

### 3.7.1 Affected Environment

Parts of the study area were surveyed in 2014 and 2015 (Holschuh 2015; Smith et al. 2016). In the mine area, these surveys identified five sites and one isolated resource that are unevaluated for listing in the NRHP: 35ML542, 35ML544, 35ML546, 35ML2178, 35ML2179, and TS-9. Two additional sites were identified in the haul road: 35ML543 (unevaluated) and 35ML1036 (not eligible).

EM Strategies completed a cultural resource inventory for the Permit Area in 2017 (Felling 2019). A total of 48 cultural resources were identified, consisting of 5 of the previously recorded archaeological resources, 9 new archaeological resources, 14 new built environment historic resources, and 20 new isolated finds.

Of the five previously recorded archaeological sites in the Permit Area, two are precontact simple flaked stone sites, two are precontact basic habitation sites, and one is a multicomponent site including precontact complex flaked stone and historic prospecting components. Of the nine newly identified archaeological resources in the Permit Area, five are precontact simple flaked stone sites, three are precontact complex flaked stone sites, and one is a historic berm and ditch site associated with the historic Lowe Reservoir. Of the 14 newly recorded built environment resources, 12 are historic road segments, one is a segment of a historic canal, and one is the historic Grassy Mountain Reservoir. The isolated finds consist of 7 precontact isolates, 12 historic isolates, and 1 multicomponent find.

The SHPO concurred with the eligibility recommendations for 44 of the 47 cultural resources discussed in the report (Felling 2019):

- Six newly recorded precontact sites (35ML2223, 35ML2224, 35ML2225, 35ML2226, 35ML2227, and 35ML2228) were recommended to be considered *unevaluated* for listing in the NRHP.
- All 14 built resources (G-JS-06, G-DF-04, G-DF-05, G-DF-07, G-DF-08, G-DF-10, G-DF-11, G-DF-12, G-DF-13, G-DF-14, G-DF-16, G-DF-17, G-JS-01, and G-JS-08) were recommended as *not eligible* for listing in the NRHP under any evaluation criteria.
- Four of the previously recorded sites and the previously recorded isolated resource (35ML543, 35ML544, 35ML546, 35ML2179, and TS-9) remain *unevaluated*, as previously determined.
- One of the previously recorded precontact sites (35ML542) was recommended as *eligible* for listing in the NRHP under Criterion D.

- The historic component of the previously recorded multicomponent site (35ML1986) was recommended as *not eligible* for the NRHP under any evaluation criteria, and the precontact component of this multicomponent site was recommended to be considered *unevaluated* for listing in the NRHP until further subsurface investigations are completed.

- The remaining four previously recorded precontact sites (35ML933, 35ML940, 35ML1987, and 35ML2178) were recommended to be considered *unevaluated* for the listing in the NRHP until further subsurface investigations are completed.

- Nineteen of the 20 isolated artifacts identified were recommended as *not eligible* for listing in the NRHP under any evaluation criteria.

The SHPO did not concur with the eligibility recommendations for three of the cultural resources discussed in the report (Felling 2019):

- The historic berm and ditch site (35ML2229) was recommended as *not eligible* for listing in the NRHP under any evaluation criteria; however, the SHPO did not concur with this recommendation, stating that too little information was presented in the report to support that finding. The SHPO noted that the site, as a segment of a larger linear resource, needed to be evaluated with respect to the entire resource.

- One of the newly recorded prehistoric sites (35ML2222) was recommended as *eligible* for listing in the NRHP under Criterion D. The SHPO stated that data were inadequate to support the eligibility recommendation. The SHPO considers sites such as 35ML2222 as “unevaluated and treated as eligible” and stated that if the Project cannot avoid this site, testing of the portion of the site that would be impacted would be necessary.

- The SHPO did not concur with the interpretation of JS-ISO-09, one of the 20 isolated finds presented in the report. At this locale, five prehistoric flakes from four different source materials were collected and interpreted as an isolated find of simple core reduction activities in an area of limited soil depth. The SHPO found the report provided insufficient information supporting the finding that the area had little chance of soil depth and that subsurface testing was needed to determine whether this is an isolated find or a buried archaeological site. As such, this resource should be treated as *unevaluated* for the purposes of this undertaking.

In summary, there are 20 eligible or unevaluated cultural resources that could potentially be impacted by the Project (Table 3.7-1).

**Table 3.7-1 Cultural Resources Eligible or Unevaluated for Listing in the NRHP in the Study Area**

| Trinomial or Field Code | Period | Site Type | NRHP Eligibility |
|---|---|---|---|
| 35ML542 | Precontact | Basic habitation | Eligible |
| 35ML543 | Precontact | Simple flaked stone | Unevaluated |
| 35ML544 | Precontact | Simple flaked stone | Unevaluated |
| 35ML546 | Precontact | Simple flaked stone | Unevaluated |
| 35ML933 | Precontact | Simple flaked stone | Unevaluated |
| 35ML940 | Precontact | Basic habitation | Unevaluated |
| 35ML1036 | Precontact | Simple flaked stone | Not Eligible |
| 35ML1986 | Multicomponent | Flaked stone/prospecting | Precontact unevaluated, historic not eligible |
| 35ML1987 | Precontact | Complex flaked stone | Unevaluated |
| 35ML2178 | Precontact | Complex flaked stone | Unevaluated |
| 35ML2179 | Historic | Rock alignment | Unevaluated |
| 35ML2222 | Precontact | Complex flaked stone | Unevaluated |
| 35ML2223 | Precontact | Simple flaked stone | Unevaluated |
| 35ML2224 | Precontact | Complex flaked stone | Unevaluated |
| 35ML2225 | Precontact | Simple flaked stone | Unevaluated |
| 35ML2226 | Precontact | Simple flaked stone | Unevaluated |
| 35ML2227 | Precontact | Simple flaked stone | Unevaluated |
| 35ML2228 | Precontact | Simple flaked stone | Unevaluated |
| 35ML2229 | Historic | Berm and ditch | Unevaluated |
| TS-9 | Precontact | Simple flaked stone | Unevaluated |
| JS-ISO-09 | Precontact | Simple flaked stone | Unevaluated |
| G-DF-07 | Historic | J-H canal segment | Not eligible |

Through NHPA Section 106 consultation, the BLM is working with the Burns Paiute Tribe to develop a tribal study. The study would help address the SHPO’s eligibility concerns for precontact cultural resources and assist in assessing effects and associated mitigation measures for these resources. While the SHPO has advocated for further testing of the precontact sites in the study area, the tribe has advocated through consultation for no testing and no artifact collection, as they consider these actions to be adverse effects.

## 3.7.2 Impact Analysis

### *3.7.2.1* No Action Alternative

Under the No Action Alternative, the Permit Area would remain in its current state, and the existing historic properties would not be affected or altered. Any future mine development at this location would require acquisition of permits and environmental approval and review, including coordination with the SHPO. In summary, there would be *No Effect* on historic properties under the No Action Alternative.

### *3.7.2.2* Applicant's Proposed Project

Based on the proposed facility layout, the Project would directly adversely affect 10 historic properties (35ML542, 35ML544, 35ML933, 35ML940, 35ML1986, 35ML1987, 35ML2178, 35ML2179, 35ML2222, and 35ML2223) within the APE that are currently recommended as *eligible* or *unevaluated* for listing on the NRHP under Criterion D. Additionally, one site (35ML2228) that is recommended as *unevaluated* for listing on the NRHP may be directly impacted by a proposed powerline associated with the Project, although the exact alignment of this utility line has not yet been finalized. Thus, the Project as proposed would result in *Adverse Effects* to historic properties.

Consultation is ongoing between the BLM and affected tribes to outline the process and procedures for mitigation for adverse effects to cultural resources. Such mitigation could include a buffer zone around an identified resource as avoidance or conducting mining underneath these sites without impact, if possible. The outcome of this consultation will be discussed with the SHPO to determine the ultimate path forward.

### *3.7.2.3* Alternative A

Since Alternative A includes the same underground mine and surface facility layout as the Applicant's proposed Project, with the same approximately 488 acres of proposed surface disturbance and the same reclamation and closure practices, the effects on cultural resources from Alternative A are the same as those from the Applicant's proposed Project described above.

# 3.8 RANGELAND MANAGEMENT

For the purposes of this evaluation, rangeland is defined as areas of public and unfenced private land used by permittees for livestock grazing allotments, which is permitted and administered by the BLM or the DSL.

The rangeland management study area includes the entire Permit Area (the Mine and Process Area and the Access Road Area) (Figure 3.8-1).

## 3.8.1 Regulatory Context

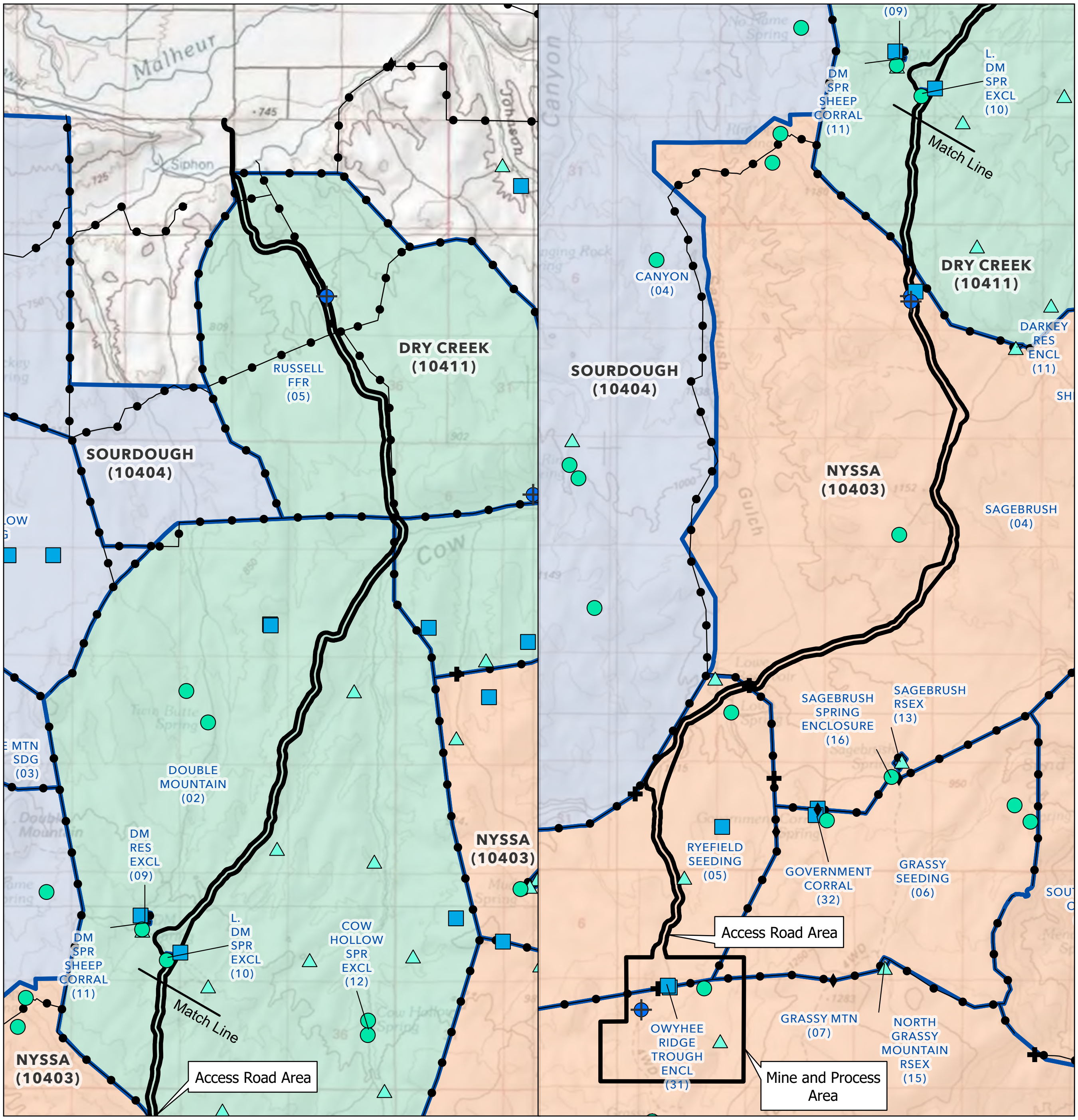
The DSL manages approximately 630,000 acres of rangeland in southeast Oregon, primarily in Lake, Harney and Malheur Counties (DSL 2023). DSL staff in Bend administer and manage rangeland leases under administrative rules (OAR 141-110) adopted by the State Land Board. Forage leases are contractual agreements with lessees for grazing livestock on state lands and are valid for a 20-year term with typically a 20-year renewal. However, there are no DSL-managed lands in the study area (DSL 2023).

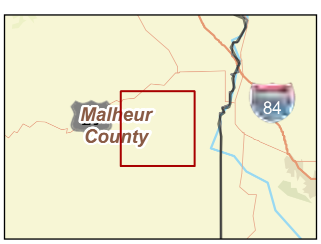
On federal land in Oregon, the BLM administers 10-year permits and leases held by ranchers who graze their livestock (mostly cattle and sheep) on allotments for a fee. Each allotment may contain multiple pastures, and each allotment has a defined authorized livestock grazing level and management objective specific to the individual pasture. The BLM uses *Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands* (BLM 1997) to ensure that its grazing management helps preserve or restore rangeland function and health. The BLM works closely with rancher permittees to ensure public rangelands remain healthy, productive working landscapes.

## 3.8.2 Method of Analysis

Project-related impacts on rangeland management were assessed qualitatively by considering the impacts caused by construction activities, mining operations, maintenance activities, and post-reclamation land use. This includes an estimation of the amount of rangeland that would be removed from service by the proposed Project and potential effects to this land after reclamation, over the long term. The analysis was conducted using the Grazing Management Baseline Report (EM Strategies 2018) and geographic information system (GIS) mapping information obtained from the BLM (BLM 2023).

Compatibility with applicable rangeland management plans also was assessed.




Legend
- Study Area
- BLM Pasture

Rangeland Improvements
- Cattleguard
- Fence (Gate)
- Reservoir
- Spring Development
- Trough
- Well (Water)
- Fence

BLM Grazing Allotments
- DRY CREEK
- NYSSA
- SOURDOUGH

***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: BLM
3. Background: Esri USA Topo Maps

0 0.5 1 Miles
(At original document size of 8.5x11)
1:90,000

N

Stantec

*Project Location* Malheur County, OR.
Prepared by LL on 2023-08-16
TR by KB on 22023-08-16

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.8-1**

*Title*
**Rangeland Management Study Area and Grazing Allotments**

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### 3.8.3 Affected Environment

There are no acres of DSL-managed land within the rangeland management study area (DSL 2023).

There are two BLM grazing allotments in the rangeland management study area: Nyssa (10403) and Dry Creek (10411; Figure 3.8-1, Table 3.8-1). The Mine and Process Area is located wholly within the Nyssa allotment, and the Access Road Area runs through both allotments. The 1.8-acre Nyssa Owyhee Ridge Trough Enclosure, containing a water source for grazing animals, is located entirely within the study area, and approximately 42 percent of the 3.1-acre Dry Creek Little DM Spring Exclosure (which does not have a water source), is located within the study area (Table 3.8-1). Approximately 1 to 8 percent of the remaining pastures within the Nyssa and Dry Creek allotments are located within the rangeland management study area. A total of 1,652.9 acres of grazing pastures are located with the study area.

**Table 3.8-1 Grazing Allotments and Pastures in the Rangeland Management Study Area**

| Allotment No. | Allotment Name | Pasture Name | Total Pasture Acres | Pasture Acres within Study Area | % Pasture Areas within Study Area | BLM Management Strategy |
|---|---|---|---|---|---|---|
| 10403 | Nyssa | Sagebrush | 11,877.2 | 215.7 | 1.82 | Improve |
| 10403 | Nyssa | Ryefield Seeding | 3,720.3 | 285.8 | 7.68 | Improve |
| 10403 | Nyssa | Grassy Mountain Seeding | 3,034.5 | 30.2 | 0.99 | Improve |
| 10403 | Nyssa | Grassy Mountain | 29,764.2 | 710.4 | 2.39 | Improve |
| 10403 | Nyssa | Owyhee Ridge Trough Enclosure[1] | 1.8 | 1.8 | 100 | Improve |
| | | **Nyssa Allotment Totals** | **48,398.00** | **1,243.9** | **2.57** | |
| 10411 | Dry Creek | Cow Hollow Seeding | 1,598.5 | 12.9 | 0.81 | Maintain |
| 10411 | Dry Creek | Double Mountain | 12,639.6 | 253.1 | 2.00 | Maintain |
| 10411 | Dry Creek | Russell Fenced Federal Range | 5,386.0 | 141.9 | 2.63 | Maintain |
| 10411 | Dry Creek | Little DM Spring Exclosure[2] | 3.1 | 1.3 | 41.19 | Maintain |
| | | **Dry Creek Allotment Totals** | **19,627.20** | **409.20** | **2.08** | |
| | | **Total** | **68, 025.3** | **1,652.9** | **2.43** | |

Source: EM Strategies 2018

1 Reservoir enclosure: grazed reservoir enclosure, fenced to allow livestock access from more than one pasture.

2 Riparian exclosure: area adjacent to water that is fenced to exclude livestock grazing.

Water supplies for grazing animals, including reservoirs (stock tanks), springs, and troughs are shown on Figure 3.8-1. The figure shows a number of options for water supplies to the various grazing allotments.

## 3.8.4 Impact Analysis

### 3.8.4.1 No Action Alternative

Under the No Action Alternative, grazing allotments managed by the BLM would continue to be permitted and administered to permittees according to existing 20-year leases, and livestock grazing would likely continue. The “improve” management strategy for some pastures would continue to be managed to enhance current unsatisfactory resource conditions and would result in minor beneficial effects to rangeland within these areas.

The area surrounding the proposed mine may be continually explored for new mining opportunities, which would have minimal effects to rangeland management from vehicles and equipment being used periodically at the site, similar to existing conditions. In summary, there would be minor impacts to rangeland management from the No Action Alternative.

### 3.8.4.2 Applicant’s Proposed Project

Under the Applicant’s proposed Project, there would be no effects to DSL-managed lands as there are none within the study area. For BLM-managed rangeland, while approximately 1,653 acres are within the rangeland management study area (permit boundary), only 739 acres would be fenced. Rangeland within the Nyssa allotment and Dry Creek allotment would be removed from grazing during construction, operation, and closure of the Project, resulting in long-term negative effects to these allotments. However, this is a small amount of the total allotments affected, and the area is proposed to be reclaimed as rangeland post-reclamation, resulting in minor, long-term negative effects to overall rangeland management in the rangeland management study area.

One pasture would be completely removed from grazing, the 1.8-acre Nyssa Owyhee Ridge Trough Enclosure, which would negatively affect the permittee of this site. However, the management strategy for this pasture is “improve,” meaning that this allotment is managed to improve current unsatisfactory resource conditions and would receive the highest priority for funding and management actions (BLM 1997). In addition, it is assumed that other pastures within the Nyssa allotment could be used for grazing the animals that currently use this pasture, since the acreage is small and would not support a large number of animals.

A portion of the Dry Creek Little DM Spring Exclosure would also be removed from grazing. However, this area is listed as an exclosure, which restricts animals from grazing to protect and maintain riparian areas, and as such, there would be no effects to rangeland management from removal of this pasture.

A small portion (1–<8 percent) of the remaining pastures located within the rangeland management study area would be unavailable for grazing, resulting in minor effects to permittees since the remaining acreage may be adequate for the number of animals allowed to graze each pasture.

Under the Applicant’s proposed Project, there are three troughs, two springs, and two water wells that are located within the study area that would be unavailable for use by grazing animals. However, this area would be fenced to prevent animals from entering, so there would be no requirement for water supply.

The drawdown of water due to the underground mine is predicted to be relatively limited to the area in the immediate vicinity of the mine due to the compartmentalization evident in the field data (Lorax 2022).

However, the consumption of groundwater pumped from production wells has the potential to lower groundwater levels in areas farther afield, which could affect livestock watering areas. As described in Section 3.3, localized groundwater drawdown between 0.5 and 11 feet is predicted to extend toward springs and stock tanks located approximately 1 mile northeast of the mine, springs and a stock tank located approximately Depending on the depth of the groundwater and the nature of hydraulic connections sourcing these areas, the predicted drawdown may affect flows in some of these springs. Springs that are not fed by groundwater but rather by stormwater runoff and accumulated storage of stormwater in soils would not be affected by groundwater drawdown. The uncertainty in the drawdown effect can be resolved through monitoring and potential mitigation of reduced spring flows if a reduction in flow is observed. If there is an observed reduction in flow at a livestock watering location, effects could be mitigated by supplementing flow with groundwater pumped from a new groundwater well installed near the water source or piping groundwater from a nearby existing well. Reducing the extraction of groundwater from production wells would also reduce these effects.

In the event that springs used by livestock experience reductions in flow, they could be fenced using exclosures to prevent overuse by livestock and degradation. Alternative sources of water should be provided in these areas for livestock use.

There are two water rights held by the BLM for livestock and wildlife within the predicted area of groundwater drawdown, both of which involve reservoirs constructed to retain surface water runoff. Since these reservoirs are not related to groundwater, dewatering drawdown in their vicinity would have a negligible effect on their water supply and function.

Injury or mortality of grazing livestock could occur through direct contact with construction equipment or vehicles. The Mine and Process Area would be completely fenced to exclude livestock and the public from entering the site, which would avoid this affect. However, the Access Road Area is not proposed to be fenced, and livestock grazing on or near the roads may be injured or killed by Project vehicles. Potential mitigation to reduce or avoid this impact includes installing signs along the road to restrict vehicular speed and reduce the potential for vehicular–livestock collisions and installing fencing along the road to prevent livestock from crossing the road. However, installing such fencing would impact wildlife movement through the Access Road Area and segment the pastures, and it may restrict livestock from accessing water supplies. It is therefore not recommended to fence the entire Access Road Area, but rather to assess fencing needs in collaboration with the BLM.

Post-closure, the Mine and Process Area would be reclaimed and converted back into rangeland. It would take months to years for new vegetation communities to establish and become suitable for livestock grazing. However, the pastures in this area are all currently categorized as “improve,” so the reclamation and subsequent re-establishment of vegetation may have an overall beneficial effect on grazing in this area over the long term.

### 3.8.4.3 Alternative A

Alternative A includes the same underground mine and surface facility layout as the Applicant’s proposed Project, with the same approximately 488 acres of proposed surface disturbance and the same reclamation and closure practices. Therefore, effects to rangeland management from Alternative A are the same as for the Applicant’s proposed Project described above.

# 3.9 LANDS, LAND USE, AND REALTY

For the purposes of this evaluation, lands and realty resources are defined as land ownership, land uses, zoning, and land management plans. The lands and realty study area includes a 1,000-foot buffer surrounding the entire Permit Area (the Mine and Process Area, and Access Road Area) to include all land uses that could be affected both directly and indirectly by Project construction activities, mining operations, and maintenance (Figure 3.9-1).

## 3.9.1 Regulatory Context

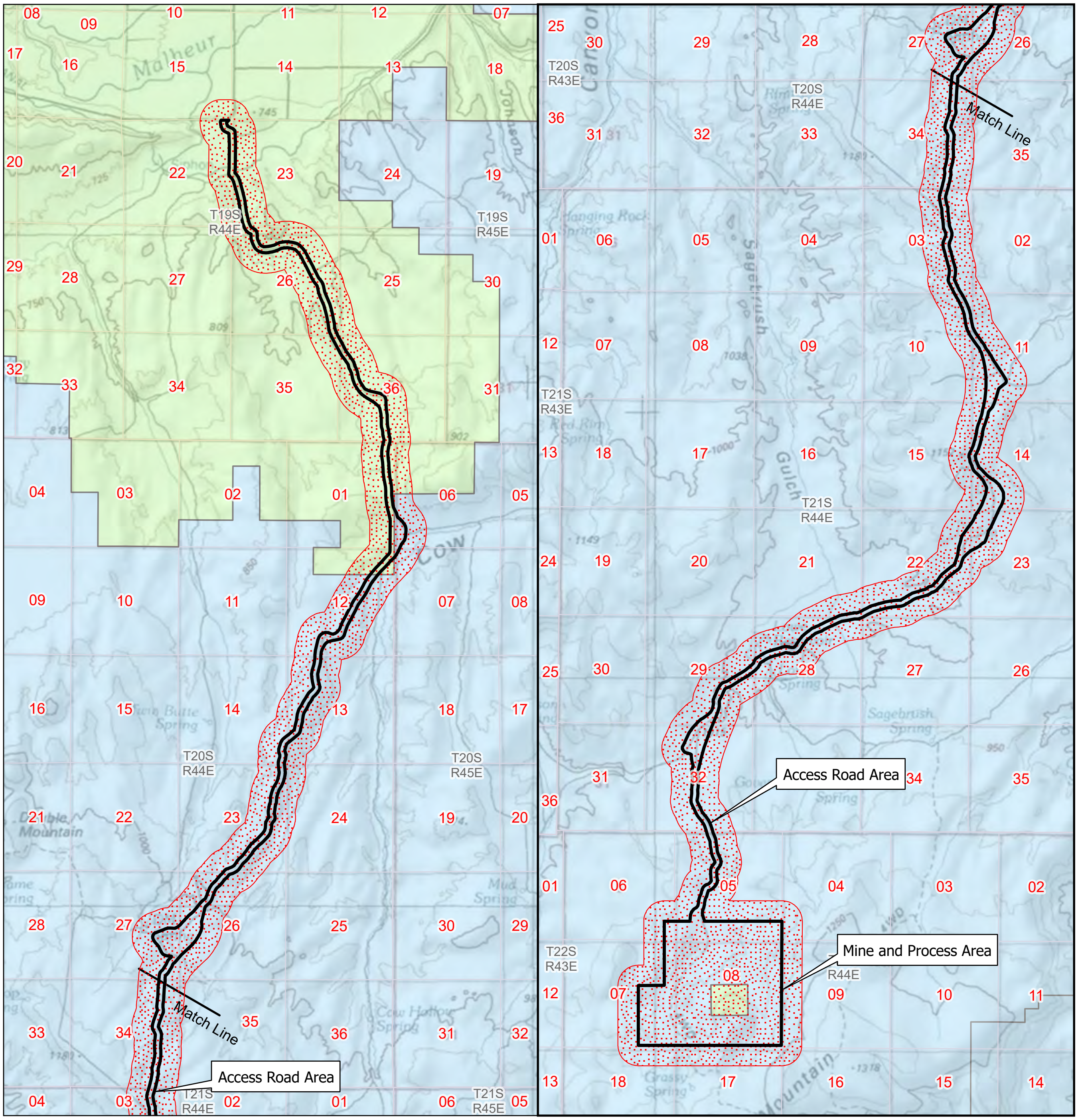
The proposed Project is located within the approximately 3,321-acre Malheur Resource Area, which is managed by the BLM through the SEORMP and Record of Decision. The SEORMP pertains to land in Malheur, Grant, and Harney Counties in a 6.5-million-acre planning area. It establishes guidance for managing land uses and allocations including livestock grazing management, wild horse management, land tenure adjustments, off-highway vehicle (OHV) use, wild, scenic and recreation river designations, mineral management, vegetation management, and areas of critical environmental concern. The SEORMP contains objectives and opportunities to provide for exploration and development of energy and mineral resources while protecting other sensitive resources.

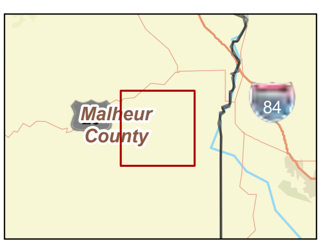
Oregon’s statewide land-use planning program is governed by statute, administrative rules administered by the DLCD, and city and county codes, including the Malheur County Comprehensive Plan and land-use zone maps. The purpose of the comprehensive plan is to identify the present and future needs of Malheur County to guide its future growth and development in compliance with state law.

A DOGAMI Consolidated Permit is required for mining and processing of metal-bearing ores and to provide for reclamation. DOGAMI is collaborating with other state agencies to ensure that proposed Project uses are compatible with surrounding land uses and develop and implement mitigation for potential conflicts as necessary.

Malheur County declined to evaluate land-use compliance on federally owned land within the site boundary. As a result, DOGAMI must conduct its own evaluation of compliance with land-use requirements on federal lands. DOGAMI’s evaluation of compliance with land-use requirements is therefore divided into two parts based on land ownership: (1) private lands and (2) federal lands (Figure 3.9-1).

Malheur County evaluated the privately owned lands (the patented lode mining claim parcels) within the site boundary and issued its Conditional Use Permit on May 23, 2019, and Land Use Compatibility Statement on July 30, 2019. DOGAMI will use the Malheur County 2019 Land Use Compatibility Statement to assess compliance with land-use requirements for the privately owned lands and will use information provided by the Applicant to assess compliance with land-use requirements for federal lands, in collaboration with the BLM.




Legend
- Permit Area
- Land Use Study Area (1,000-ft Permit Area buffer)
- Privately Owned Land
- Federally Owned Land

0 0.5 1 Miles
(At original document size of 8.5x11)
1:90,000

N

Stantec

*Project Location* Prepared by JC on 2023-10-27
TR by RB on 2023-10-27
Malheur County, OR.

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.9-1**

*Title*
**Lands, Land Use and Realty Study Area**

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI, ORBIC
**3.** Background: Esri USA Topo Maps

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### 3.9.2 Method of Analysis

All land-use categories were identified within the lands, land use, and realty study area (Figure 3.9-1). Existing land uses were inventoried by reviewing and interpreting aerial photography and verifying the data locally through the Malheur County Comprehensive Plan and zoning ordinance mapping data (Malheur County 1985). The BLM SEORMP (2002) was used to assess compatibility with land-use planning. The Applicant's Land Use Baseline Report (EM Strategies 2018) was used in the assessment of land ownership and the affected environment for lands, land use, and realty.

Project-related impacts on land use and realty resources were assessed qualitatively by considering the impacts caused by construction activities, mining operations, and post-reclamation land uses. Impacts to land ownership, land use, and compatibility with land-use management plans and zoning were assessed.

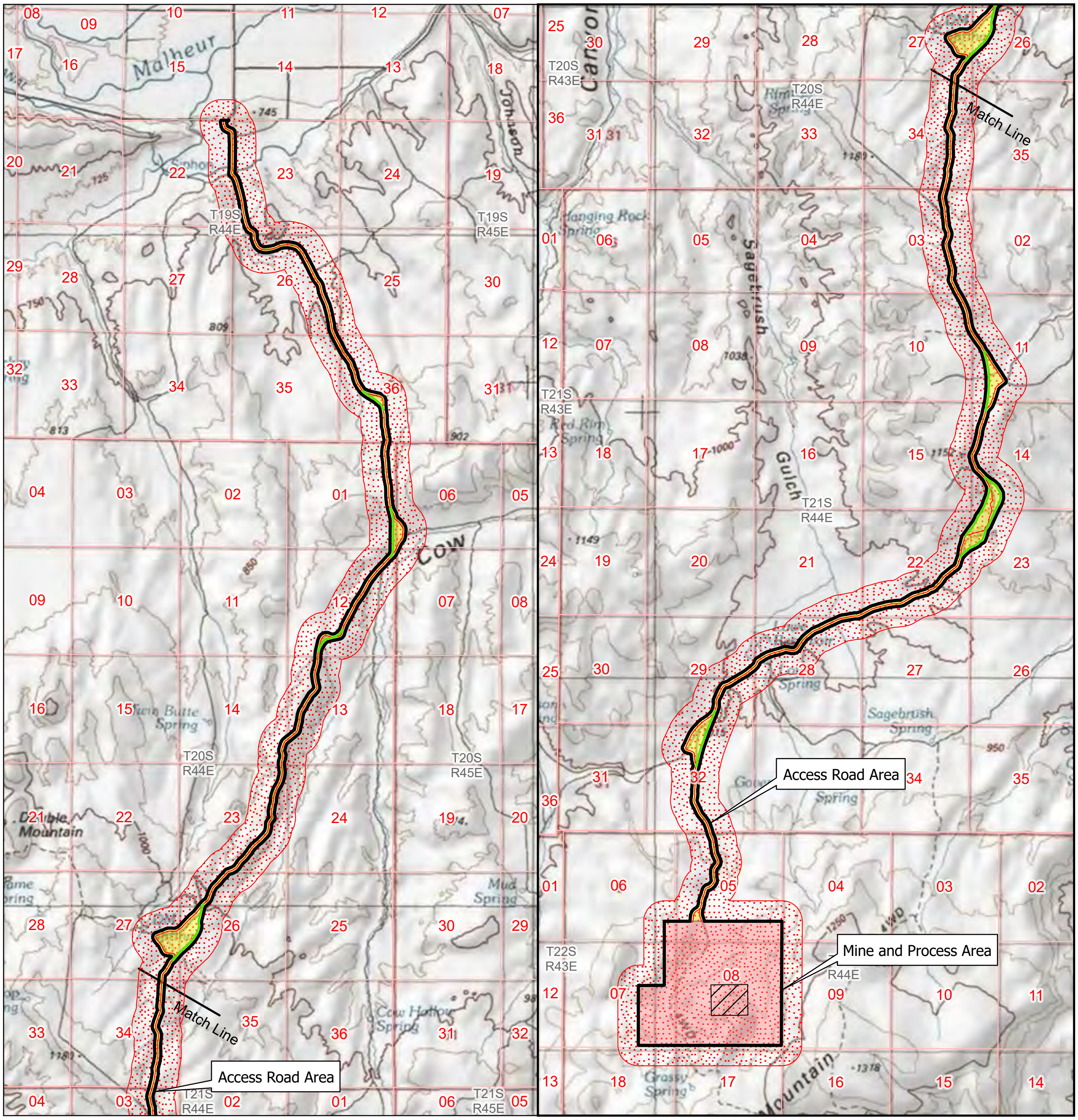
### 3.9.3 Affected Environment

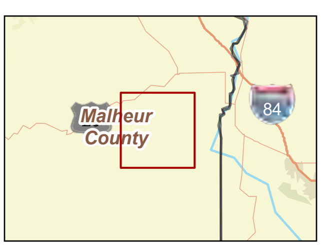
The Mine and Process Area is in all, or portions of, Sections 5 through 8, Township 22 South, Range 44 East (T22S, R44E) (Willamette Meridian). The Mine and Process Area is located on three patented lode mining claims (Figure 3.9-2) and unpatented lode mining claims that are part of a larger land position that consists of unpatented lode mining claims and mill site claims on lands administered by the BLM. All proposed mining would occur on the patented claims, with some mine facilities being located on unpatented claims. The mineral deposit is located within three patented mining claims that are owned by the Applicant (Figure 3.9-2). The Applicant owns and controls 100 percent of the mineral tenure of the patented mining claims, unpatented mining claims, and mining leases that constitute the Project. The surrounding surface rights associated with the locations of the planned Project surface facilities belong to the federal government and are managed by the Vale District office of the BLM.

Access roads to be used for Project access include Russell Road, Cow Hollow Road, and Twin Springs Road (Figure 3.9-2), which are located on both public lands administered by the BLM and private lands controlled by other entities. Russell Road is maintained by the county, and Cow Hollow Road and Twin Springs Road are maintained by the BLM.

Land in the study area is currently used for grazing and dispersed recreation and supports an existing road network that provides local access.

The State of Oregon identifies the lands, land use, and realty study area as “Grazing and Farm Use.” The Malheur County Comprehensive Plan (1985) identifies the proposed Project area as “Exclusive Farm Use (EFU)” and “Exclusive Range Use (ERU).” The county's land-use zone maps reflect designations C-A1: EFU, and C-A2: ERU, as shown in Figure 3.9-3. EFU property is designated to implement statewide Planning Goal 3 to preserve and maintain the agricultural land in the county for agricultural purposes (Malheur County 1985). Mining operations are allowable uses in these designated areas through a conditional use authorization from the county.




Legend

- Permit Area
- Land Use Study Area (1,000-ft Permit Area buffer)
- Mine Process Area
- Access Road Area
- Patented Lode Claim
- Proposed Access Road
- Possible Road Realignment

0 0.5 1 Miles
(At original document size of 8.5x11)
1:90,000

N

**Notes**
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI, ORBIC
3. Background: Esri USA Topo Maps

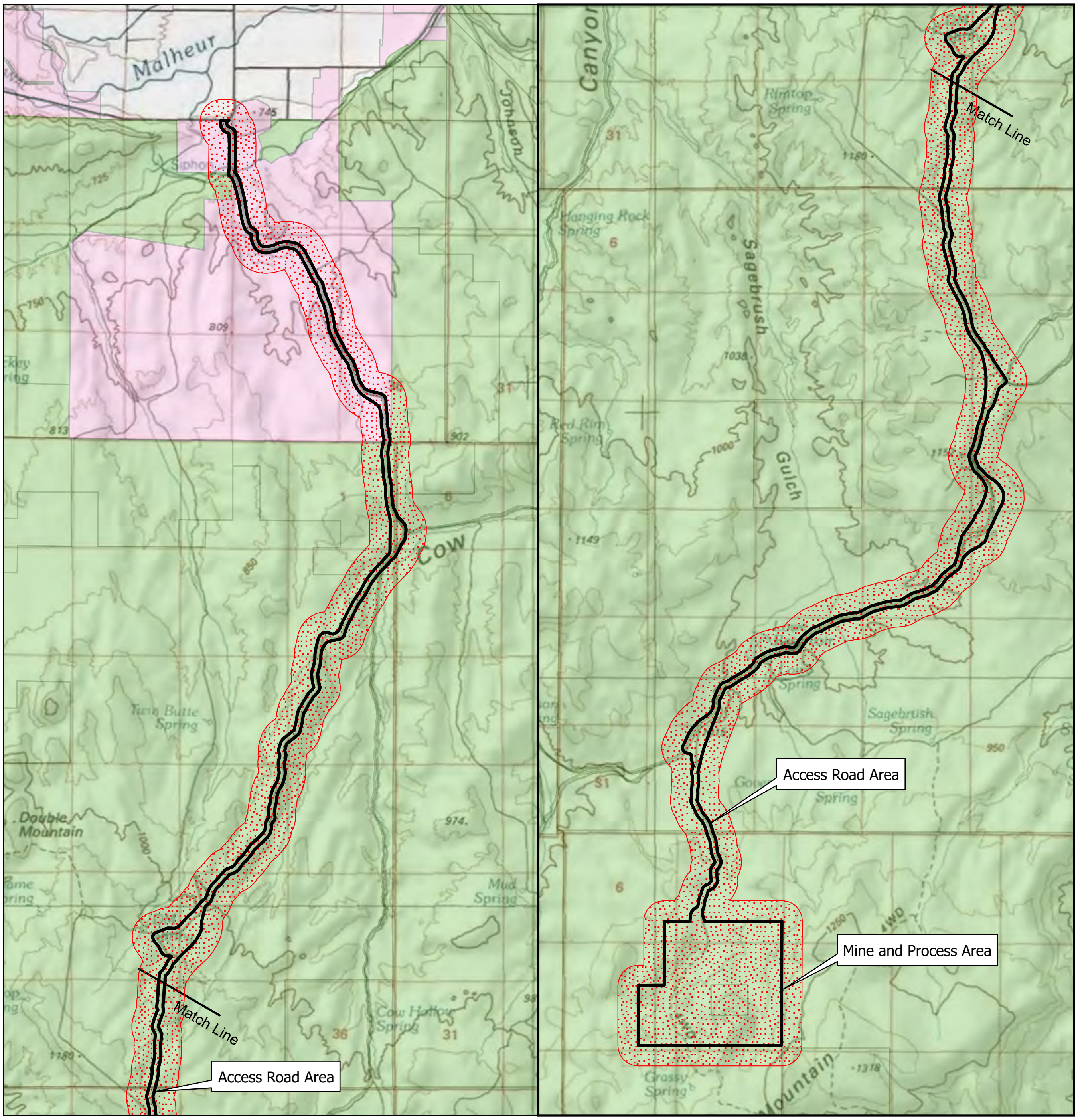
Stantec

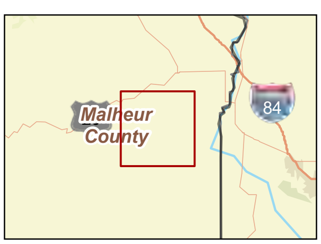
Project Location: Malheur County, OR.
Prepared by JC on 2023-10-27
TR by RB on 2023-10-27

Client/Project: 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

Figure No.
**3.9-2**

Title
**Patented Lode Claims in the Study Area**




Legend

- Permit Area
- Land Use Study Area (1,000-ft Permit Area buffer)

Land Use Zone

- C-A1 Exclusive Farm Use
- C-A2 Exclusive Range Use

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(At original document size of 8.5x11)
1:90,000

N

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI, ORBIC
**3.** Background: Esri USA Topo Maps

Stantec

*Project Location* Prepared by JC on 2023-10-27
TR by RB on 2023-10-27
Malheur County, OR.

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.9-3**

*Title*
**Land Use Zones in the Study Area**

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### 3.9.4 Impact Analysis

#### 3.9.4.1 No Action Alternative

Under the No Action Alternative, lands owned by the BLM and Malheur County would continue to be managed according to their respective land management plans. Patented lode mining claims may be sold or transferred to another entity or may remain with the Applicant.

Exploration of the mineral resource may continue at the site, similar to existing conditions, although since the No Action Alternative would result from denial of the Consolidated Permit, mineral exploration may not continue. Other existing land uses, including grazing and dispersed recreation, would likely continue within the study area. Overall, impacts to land use and realty resources would remain the same as under current conditions.

#### 3.9.4.2 Applicant's Proposed Project

Under the Applicant's proposed Project, no change in land ownership is anticipated, including for land owned by the BLM and Malheur County and under private ownership (along the access road).

Under the Applicant's proposed Project, land uses within the permit boundary would change from livestock grazing and dispersed recreation to mining use for approximately 14 years, after which time reclamation would return the land back to grazing and dispersed recreation use, resulting in substantial long-term impacts to land use.

After access road upgrades, Russell Road would continue to be maintained by the county, and Cow Hollow Road and Twin Springs Road would continue to be maintained by the BLM. Uses of these roads would not change, although post-reclamation, there would likely be less traffic using these roads.

With regard to BLM-managed lands, development within the Malheur Resource Area requires BLM review and approval through the NEPA process, which will take into account the requirements of the SEORMP. Mining is an allowed use of BLM-administered land in and near the study area, subject to operational timing limitations arising from the need to protect special-status plants, pronghorn winter range, mule deer winter range, and bighorn sheep habitat. The Applicant will work with the BLM to identify and mitigate potential land-use conflicts on BLM-administered land as part of its environmental review process.

#### 3.9.4.3 Alternative A

Alternative A includes the same underground mine and surface facility layout as the Applicant's proposed Project, with the same approximately 488 acres of proposed surface disturbance and the same reclamation and closure practices. Therefore, effects to land ownership and use from Alternative A are the same as for the Applicant's proposed Project described above. Compatibility with applicable land-use plans and zoning would also be the same as for the Applicant's proposed Project.

# 3.10 AIR QUALITY AND GREENHOUSE GAS EMISSIONS

The air quality and GHG emissions study area consists of the entire Permit Area (the Mine and Process Area and the Access Road Area) plus a 50-km buffer consisting of the surrounding air basin (Figure 3.10-1). The 50-km buffer was used to assess ground-level impacts from the proposed Project facility air emissions as described in the Grassy Mountain Mine New Source Review Analysis Modeling Report (Air Sciences, Inc. [ASI] 2022a). The American Meteorological Society/Environmental Protection Agency Regulatory modeling system (AERMOD) used for the analysis is the recommended model for short-range analyses (up to 50 km) in the Guideline on Air Quality Models, maintained by the EPA.

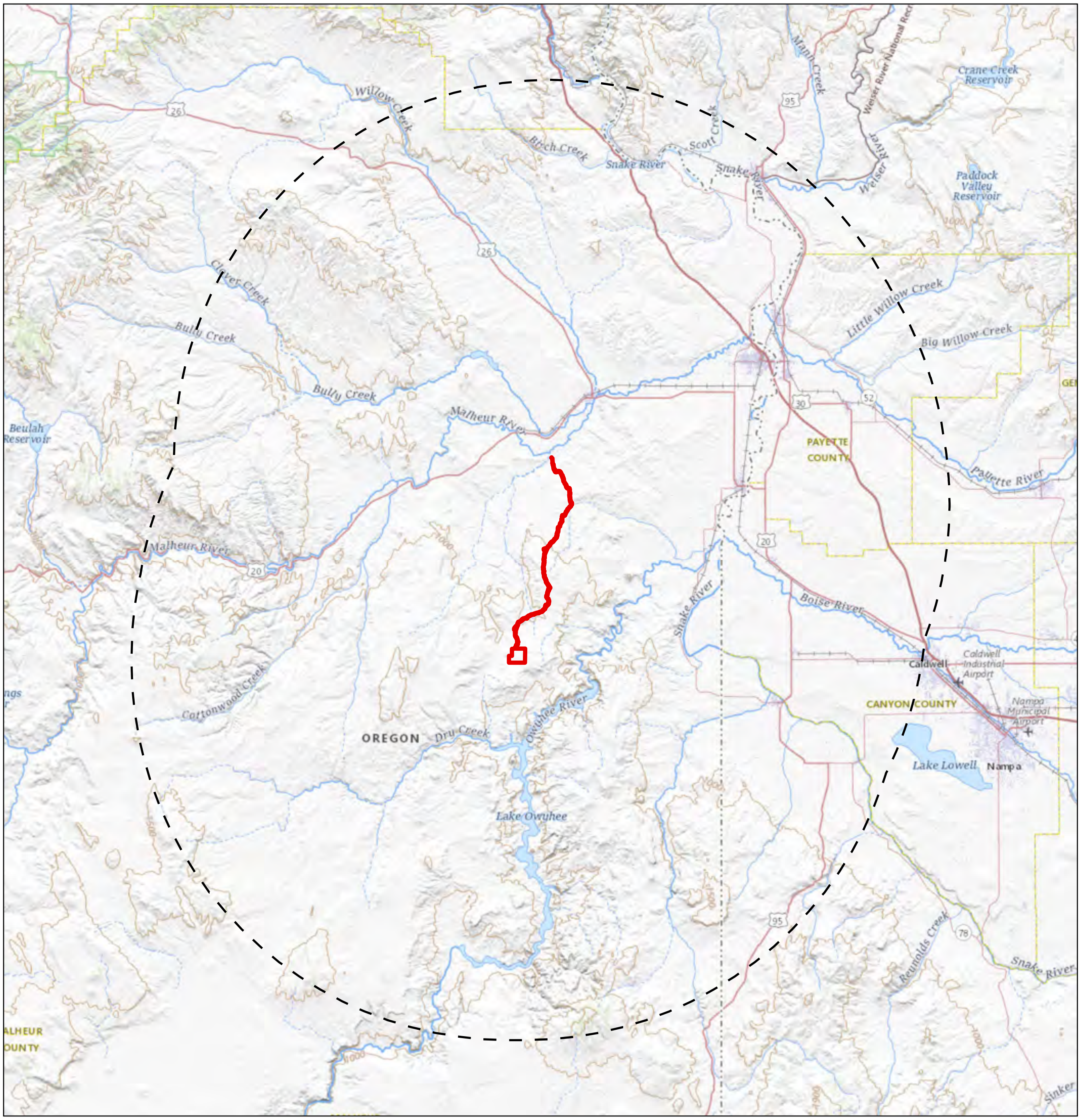
## 3.10.1 Regulatory Framework

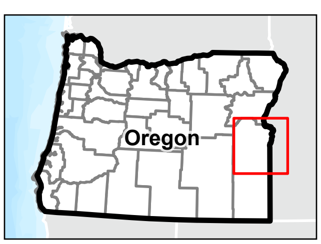
### 3.10.1.1 National Ambient Air Quality Standards

The regulatory framework for air quality includes both federal and state rules, regulations, and standards promulgated by the EPA and implemented by the Oregon DEQ. The Clean Air Act (CAA) established the National Ambient Air Quality Standards (NAAQS) for seven criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide ($NO_2$), ozone ($O_3$), particulate matter 10 microns ($PM_{10}$) or less in diameter, particulate matter 2.5 microns ($PM_{2.5}$) or less in diameter, and sulfur dioxide ($SO_2$) (Table 3.10-1).

Pursuant to the CAA, the EPA has developed classifications known as air basins. Each air basin or portion of a basin is designated as being in “attainment” if the basin is compliant with an applicable NAAQS; “nonattainment” if the levels exceed a particular NAAQS for a given pollutant; or “maintenance” if monitored pollutants have improved under an approved EPA plan. There may also be areas that do not contain sufficient levels of monitoring data and are designated as “unclassified.” The Project is within an unclassified region and is assumed to be in attainment.

DEQ is the state agency for the State of Oregon that has been delegated the authority to implement a State Implementation Plan (SIP). Adherence to NAAQS is part of the SIP. Along with overseeing NAAQS compliance, DEQ is the permitting and enforcement authority for air quality regulations throughout the state. Prior to construction of any potential air emission source, an evaluation of toxic pollutant impacts, or an exemption, is necessary via acquisition of a standard Air Contaminant Discharge Permit (ACDP) from DEQ.




Legend
- Permit Area
- Study Area (50-km Permit Area Buffer)

0 4 8 Miles
(At original document size of 8.5x11)
1:800,000

N

Stantec

*Project Location*
Malheur County, OR

Prepared by LL on 2023-10-13
TR by EC on 2023-10-13

*Client/Project*
2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.10-1**

*Title*
**Air Quality and Greenhouse Gas Study Area**

***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources:
3. Background: USGS Topo

\\xdchi1-xenprd-cifs\shared_projects\2378\237800175\03_data\gis_cad\gis\ArcPro\DOGAMI_GrassyMountain_Env_Eval\DOGAMI_GrassyMountain.aprx Revised: 2024-04-12 By: gmontague

**Table 3.10-1 National Ambient Air Quality Standards**

| Pollutant | | Primary/ Secondary | Averaging Time | National Standard | Form |
|---|---|---|---|---|---|
| Carbon monoxide | | Primary | 8-hour | 9 ppm | Not to be exceeded more than once a year |
| | | | 1-hour | 35 ppm | |
| Lead | | Primary and secondary | Rolling 3-month average | 0.15 µg/m³ | Not to be exceeded |
| Nitrogen dioxide | | Primary | 1-hour | 100 ppb | 98th percentile of 1-hour daily maximum concentration, averaged over 3 years |
| | | Primary and secondary | Annual | 53 ppb | Annual mean |
| Ozone | | Primary and secondary | 8-hour | 0.070 ppm | Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years |
| Particle pollution | $PM_{2.5}$ | Primary | Annual | 12 µg/m³ | Annual mean, averaged over 3 years |
| | | Secondary | Annual | 15 µg/m³ | Annual mean, averaged over 3 years |
| | | Primary and Secondary | 24-hour | 35 µg/m³ | 98th percentile, averaged over 3 years |
| | $PM_{10}$ | Primary and secondary | 24-hour | 150 µg/m³ | Not to be exceeded more than once per year on average over 3 years |
| Sulfur dioxide | | Primary | 1-hour | 75 ppb | 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years |
| | | Secondary | 3-hour | 0.5 ppm | Not to be exceeded more than once per year |

Source: EPA 2023a

µg/m³ = micrograms per cubic meter; ppb = parts per billion, ppm = parts per million

### 3.10.1.2 Clean Air Oregon Risk Analysis

DEQ also operates a toxics program called Clean Air Oregon (CAO), which is a partnership between DEQ and Oregon Health Authority to manage air toxics emissions from industrial stationary sources. The Oregon air quality permitting rules require the assessment of potential Hazardous Air Pollutants (HAPs[1]) and other state-regulated toxic emissions for permitting purposes for determining whether a facility is a major or area source of HAPs and to ensure compliance with the CAO program.

### 3.10.1.3 Prevention of Significant Deterioration

The CAA divides areas where air quality is already cleaner than required by federal standards into three classes (I, II, and III) and specifies the increments of $SO_2$, $NO_2$ and particulate pollution allowed in each class as regulated by the Prevention of Significant Deterioration (PSD) regulations (Table 3.10-2). The

[1] Hazardous air pollutants (HAPs) are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects.

PSD regulations are applicable to a source pollutant if the source has the potential to exceed the major source thresholds.

Class I areas include national parks, wilderness, monuments, and other pristine areas; allowable increments of new pollution in these areas are very small. Class II areas include all attainment and not classifiable areas that are not designated as Class I; allowable increments of new pollution in these areas are modest. Class III represents selected areas that states may designate for development; allowable increments of new pollution are large (but may not exceed the NAAQS). Federal PSD regulations limit the maximum allowable increase in ambient pollutant concentration in Class I, Class II, and Class III areas.

### Table 3.10-2 Federal Prevention of Significant Deterioration Limits

| Pollutant | Averaging Time | Maximum Allowable Increase ($\mu g/m^3$) | | |
|---|---|---|---|---|
| | | Class I Area | Class II Area | Class III Area |
| $PM_{2.5}$ | Annual | 1 | 4 | 8 |
| | 24-hour | 2 | 9 | 18 |
| $PM_{10}$ | Annual | 4 | 17 | 34 |
| | 24-hour | 8 | 30 | 60 |
| $SO_2$ | Annual | 2 | 20 | 40 |
| | 24-hour | 5 | 91 | 182 |
| | 3-hour | 25 | 512 | 700 |
| $NO_2$ | Annual | 2.5 | 25 | 50 |

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

#### 3.10.1.4 New Source Performance Standards and National Emissions Standards for Hazardous Air Pollutants

The CAA enacted the New Source Performance Standards (NSPS) and National Emissions Standards for Hazardous Air Pollutants (NESHAP) for specific types of equipment located at new or modified stationary pollutant sources. NSPS regulations limit emissions from source categories to minimize the deterioration of air quality. Stationary sources are required to meet these limits by installing newer equipment or adding pollution controls to older equipment to reduce emissions below the specified limit.

The EPA also instituted a NESHAP to regulate potential mercury emissions specifically related to gold mine ore processing and production. This applies to any industrial facility engaged in the processing of gold mine ore that uses any of the following processes: roasting operations; autoclaves; carbon kilns; pregnant tanks; electrowinning; mercury retorts; or melt furnaces. The proposed Project is a gold mine ore processing and production facility under this definition.

Title V permitting is a CAA program geared toward larger or “major” emission sources. For facilities to be classified as a “major source,” a facility must emit more than 100 tons per year (tpy) of any regulated pollutant, 10 tpy of any single HAP, or 25 tpy or more of any combination of HAPs from applicable sources. The facility-wide Project emissions are expected to be less than the major source threshold. However, NESHAP requires that a minor source obtain a Title V permit.

#### 3.10.1.5 Greenhouse Gases

The primary natural and synthetic GHGs in the Earth's atmosphere are water vapor, carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), and fluorinated gases. The EPA tracks GHG emissions in the United States by source sector (e.g., industrial, land use, electricity generation), fuel source (e.g., coal, natural gas, geothermal, petroleum), and economic sector (e.g., residential, transportation, commercial, agriculture). With so many GHG emission sources nationally, from cattle to vehicles to electric power generators, no single source is likely to represent a significant percentage of national emissions. For the proposed Project, GHG emissions estimates are required for informational purposes and to determine whether mandatory reporting is required. The EPA implemented the Mandatory Reporting of Greenhouse Gases Rule in March 2010. If a project emits more than 25,000 metric tpy of carbon dioxide equivalent ($CO_2e$), GHG reporting is required.

### 3.10.2 Method of Analysis

#### 3.10.2.1 National Ambient Air Quality Standards

The primary indicator of air quality impacts for criteria pollutants is the NAAQS. A particulate matter ($PM_{2.5}$ and $PM_{10}$) monitoring site was installed near the Project area in 2014 by Bison Engineering, Inc. (Bison Engineering, Inc. 2015). Regional background concentrations were established using a combination of onsite data and data from nearby EPA monitoring networks.

Project emissions were estimated using calculations (e.g., emission factors, material balance, or source test data) as appropriate to determine expected levels from mining, processing, and nonroad activities. Emission rates for $PM_{10}$, $PM_{2.5}$, CO, $SO_2$, nitric oxide ($NO_x$), Pb, $O_3$, and volatile organic compounds (VOCs) generated from mining, processing, and support operations were estimated for each identified emission unit. Emission estimates of GHGs, expressed as $CO_2e$, were also made. The emissions were calculated using EPA's AP-42, Compilation of Air Pollutant Emissions Factors, database and operational throughputs for each emission unit provided by the Applicant. The resultant emissions were compared with applicable federal, state, and local standards for protection of human health and the environment and for potential nuisance. These emissions include criteria pollutants, HAPs, state-regulated toxic pollutants, and GHGs.

The Applicant conducted dispersion modeling using AERMOD for all applicable criteria pollutants under New Source Review as part of the Project's DEQ ACDP permit application. The technical specification of this modeling effort is documented in the *Grassy Mountain Mine New Source Review Analysis Modeling Report* (ASI 2022a). AERMOD is one of the most frequently used regulatory dispersion models in the United States and represents the EPA's preferred model for the assessment of near-field (up to 50 km [approximately 31 miles]) pollutant dispersion impacts. A series of nested receptor grids spacing located primarily along the Project permit boundary, which delineates where public access may be restricted, were used to assess ground-level impacts from air emissions.

Modeled sources associated with the Applicant's proposed Project are topsoil storage, the TSF, TWRSF, reclaim pond, borrow areas, blasting, cement batch plant, mine exhaust ventilation, ore and aggregate stockpiles, crushers, and haul roads. Within the Process Area, several leach tanks, kilns, mercury retorts and furnaces, material transfer, and heating, ventilation, and air conditioning (HVAC) systems are included in the modeling. Modeled short-term emission rates for the non-fugitive emissions were derived from the maximum design hourly rates, and long-term emission rates were derived using the maximum hourly rates and annual utilization factors. The modeled emission rates for fugitive sources were based on annual activity rates. All emission sources were modeled as point, volume, or area sources for analysis. The effects of building-induced downwash were incorporated into the modeling analysis using the most recent version of the Building Profile Input Program with the Plume Rise Model Enhancements algorithm (BPIP-PRIME version 04274) (ASI 2022b). Additionally, tailpipe emissions from nonroad vehicles were included in the analysis at the request of DEQ.

$PM_{2.5}$ can be formed indirectly in the atmosphere via chemical interaction of $NO_x$ and $SO_2$ emissions. First, direct $PM_{2.5}$ concentrations from the proposed Project were estimated via the EPA-preferred AERMOD. To evaluate the secondary $PM_{2.5}$ impacts from the $PM_{2.5}$ precursor emissions, a Tier 1 assessment was performed using the following equations, where RHS is the representative hypothetical source:

$$PM_{2.5} 24hr\ Impact = \frac{RHS\ 24hr\ Impact\ (from\ NOx) \times Grassy\ Mountain\ NOx\ Emissions}{RHS\ NOx\ Emissions} + \frac{RHS\ 24hr\ Impact\ (from\ SO_2) \times Grassy\ Mountain\ SO_2\ Emissions}{RHS\ SO_2\ Emissions}$$

$$PM_{2.5} Ann\ Impact = \frac{RHS\ Ann\ Impact\ (from\ NOx) \times Grassy\ Mountain\ NOx\ Emissions}{RHS\ NOx\ Emissions} + \frac{RHS\ Ann\ Impact\ (from\ SO_2) \times Grassy\ Mountain\ SO_2\ Emissions}{RHS\ SO_2\ Emissions}$$

The applicable existing $PM_{2.5}$ ambient background concentrations and the primary $PM_{2.5}$ concentrations were added to the estimated Project secondary $PM_{2.5}$ maximum impacts to calculate the total $PM_{2.5}$ concentrations for comparison with the NAAQS.

Unlike other criteria pollutants, $O_3$ is not directly emitted from industrial sources and instead is formed on a regional scale through a series of complex photochemical reactions involving VOCs, $NO_x$, and other gases in the atmosphere. Although source-specific $O_3$ impacts were not modeled using AERMOD, ambient conditions pertaining to potential $O_3$ formation due to the Project were evaluated. $O_3$ impacts from the Project emissions were evaluated using the EPA Tier 1 Modeled Emission Rates for Precursors (MERPs) approach for single-source $O_3$ and secondary $PM_{2.5}$. Note that the Project emission rates are the short-term values converted to tpy. The $O_3$ 8-hour maximum impacts are calculated as follows:

$$O_3 8hr\ Impact = \frac{RHS\ 8hr\ Impact\ (from\ NOx) \times Grassy\ Mountain\ NOx\ Emissions}{RHS\ NOx\ Emissions} + \frac{RHS\ 8hr\ Impact\ (from\ VOC) \times Grassy\ Mountain\ VOC\ Emissions}{RHS\ VOC\ Emissions}$$

The final EPA MERPs Guidance and the DEQ modeling guidance were evaluated to establish the most conservative RHS MERP value (DEQ 2022; EPA 2019).

#### 3.10.2.2 Clean Air Oregon Risk Analysis

CAO is a state program that regulates emissions of toxic air contaminants from industrial and commercial facilities. Health risk impacts of those pollutants are evaluated for individuals living or working nearby and for schools in the vicinity. Assessments of both cancer and non-cancer risks are required. The Applicant conducted a Level 3 Risk Analysis, which incorporates detailed site-specific information and representative meteorological data (DEQ 2022). The analysis is essentially a full AERMOD assessment for all applicable toxic pollutants. Daily and annual Project emissions for a variety of sources were modeled based on a June 28, 2022, DEQ-approved CAO inventory. CAO analysis includes point, volume, area, and line sources.

A series of nested receptor grids were used to represent specific exposed population types. Acute open space was used to establish the nearest acute population receptors. Similarly, residential area receptors were evaluated to establish the closest resident receptors. Other areas included commercial locations (non-resident workers) and schools (non-resident children). Chronic cancer and non-cancer risks were determined for workers, schools, and residences.

Ambient concentrations of all toxic pollutants were determined using AERMOD and Method C Risk Equivalent Emission Rate (REER) as defined by the 2022 DEQ modeling guidance (DEQ 2022). The REER was calculated for each toxic emission unit by summing the ratios of emission rate to the corresponding expected toxic emissions (i.e., risk-based concentration [RBC]) by the Chemical Abstract Service number and receptor type. For more details, please refer to Appendices D and E of the CAO Risk Assessment Report developed by ASI (ASI 2023).

#### 3.10.2.3 Prevention of Significant Deterioration

Federal PSD regulations limit the maximum allowable increase in ambient pollutant concentration in Class I, Class II, and Class III areas. DEQ modeling guidelines require all sources within Class II areas to conduct air quality PSD increment assessment and all sources with 200 km of a Class I area to provide an analysis for Class I PSD increments (DEQ 2022). AERMOD modeling was conducted to ensure compliance with applicable increment standards.

#### 3.10.2.4 Greenhouse Gases

GHGs allow heat from the sun to pass though the upper atmosphere and warm the Earth by blocking some of the heat that is radiated from the Earth back into space. As GHG concentrations increase in our atmosphere, they impact the global climate by further decreasing the amount of heat that is allowed to escape back into space. Many GHGs occur naturally in the environment; however, human activity has contributed to increased concentrations of these gases in the atmosphere. $CO_2$ is emitted from the combustion of fossil fuels (i.e., oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). Methane results from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills. Methane is also emitted during the production and transport of coal, natural gas, and oil. $N_2O$ is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste. Fluorinated gases, while not abundant in the atmosphere, are powerful GHGs that are emitted from a variety of industrial processes and are often used as substitutes for $O_3$-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons).

All the different GHGs have various capacities to trap heat in the atmosphere, which are known as global warming potentials (GWPs). For the purposes of this analysis, a GHG's GWP is generally standardized to $CO_2e$, the equivalent amount of $CO_2$ mass the GHG would represent. Methane has a current GWP estimated to be between 28 (gas alone) and 36 (with climate feedbacks), and $N_2O$ has a GWP of 298.

The EPA Greenhouse Gas Equivalence Calculator was used to estimate GHG emissions from the Applicant's proposed Project, including mining direct emissions and indirect process facility emissions.

## 3.10.3 Affected Environment

### 3.10.3.1 National Ambient Air Quality Standards

Table 3.10-3 provides the regional background concentrations for the proposed Project.

**Table 3.10-3 Ambient Pollutant Concentration Summary**

| Pollutant | Averaging Time | Concentration | Source | Method |
|---|---|---|---|---|
| $PM_{2.5}$ | Annual | 4.6 µg/m$^3$ | Site data collection | October 2014–September 2015: adjusted annual average (fewer dates affected by wildfire smoke) |
| | 24-hour | 21 µg/m$^3$ | | October 2014–September 2015: second high (fewer dates affected by wildfire smoke) |
| $PM_{10}$ | 24-hour | 23 µg/m$^3$ | | |
| $SO_2$ | 1-hour | 4.17 ppb | AQS (16-001-0010) Meridian, Idaho | 2014–2016 (99th percentile) |
| | 3-hour | 0.623 ppb | | 2014–2016 (annual mean) |
| $NO_2$ | 1-hour | 43.63 ppb | AQS (16-001-0010) Meridian, Idaho | 2014–2016 (98th percentile) |
| | Annual | 10.72 ppb | | 2014–2016 (annual mean) |
| CO | 1-hour | 0.244 ppm | AQS (16-001-0010) Meridian, Idaho | 2014–2016 (annual mean) |
| | 8-hour | 0.244 ppm | | |
| $O_3$ | 8-hour | 0.063 ppm | AQS (16-001-0010) Meridian, Idaho | 2014–2016 (4th high average) |
| Pb | 3-month | 1.99E-04 µg/m$^3$ | AQS (16-001-0010) Meridian, Idaho | 2014–2016 (annual mean divided by 4) |

Sources: Bison Engineering, Inc. 2015; EPA 2017

All gaseous concentrations are in parts per million/billion (ppm/ppb); particulate matter is in micrograms per cubic meter (µg/m$^3$).

AQS = Air Quality System

The National Emissions Inventory (NEI) is a comprehensive and detailed estimate of air emissions of criteria pollutants, criteria precursors, and HAPs from air emissions sources. The NEI is released every 3 years based primarily upon data provided by state, local, and tribal air agencies for sources in their jurisdictions and supplemented by data collected by the EPA (EPA 2023b). When NEI data are combined with the available monitoring data shown above, readers can get a sense of the localized atmospheric response to emissions loading occurring near the ambient air quality monitors. The most recent NEI data from 2020 by default includes the Project area and indirect source emissions occurring there, as these sources and contributing emissions-generating activities have been in existence for several NEI reporting periods. Despite this fact, the area remains in attainment for all the NAAQS. Table 3.10-4 illustrates the total county emissions from Malheur County and two surrounding counties (Harney County to the east and Owyhee County to the west in Idaho).

**Table 3.10-4 2020 National Emissions Inventory Data**

| County | $PM_{10}$ | $PM_{2.5}$ | VOC | $NO_x$ | CO | $SO_2$ | $CO_2$ | Methane | $N_2O$ | HAPs |
|---|---|---|---|---|---|---|---|---|---|---|
| Malheur | 12,673 | 3,966 | 20,028 | 3,627 | 33,192 | 257.6 | 711,331 | 1,098 | 6.08 | 5,681 |
| Harney | 10,139 | 2,345 | 21,383 | 2,119 | 17,751 | 91.8 | 239,738 | 571.2 | 1.25 | 4,992 |
| Owyhee | 6,633 | 1,429 | 12,348 | 1,849 | 9,347 | 55.8 | 210,752 | 249.5 | 1.86 | 3,273 |

Source: EPA 2023b

The Project is within an unclassified region and is assumed to be in attainment, meaning that it is compliant with applicable NAAQS.

With regard to $O_3$, the Project area is located in a rural setting, away from the influence of urban/metropolitan area $O_3$ precursor emissions. The area surrounding the Project is sparsely populated and used primarily for ranching and farming.

### 3.10.3.2 Prevention of Significant Deterioration

The Project area is located in a Class II area, which includes all attainment and non-classifiable areas; allowable increments of new pollution in these areas are modest. There are four Class I areas within 200 km of the air quality and GHG study area (Figure 3.10-2): Strawberry Mountain Wilderness, Eagle Cap Wilderness, Hells Canyon Wilderness, and Sawtooth Wilderness. The closest Class I area is 120 km to the northwest at the Strawberry Mountain Wilderness.

### 3.10.3.3 New Source Performance Standards and National Emissions Standards for Hazardous Air Pollutants

The Project would include equipment for metallic mineral processing plants that is subject to various NSPS and NESHAP regulations to limit emissions from source categories and minimize the deterioration of air quality, so installation of newer equipment or addition of pollution controls is required. The proposed Project is also required to obtain a standard ACDP (submitted by the Applicant to DEQ on September 28, 2023).

In addition, while facility-wide Project emissions are expected to be less than the major source threshold under the CAA, NESHAP requires that a minor source obtain a Title V permit. Thus, the Project will be required to obtain a Title V permit following acquisition of an DEQ standard ACDP.

### 3.10.3.4 Greenhouse Gases

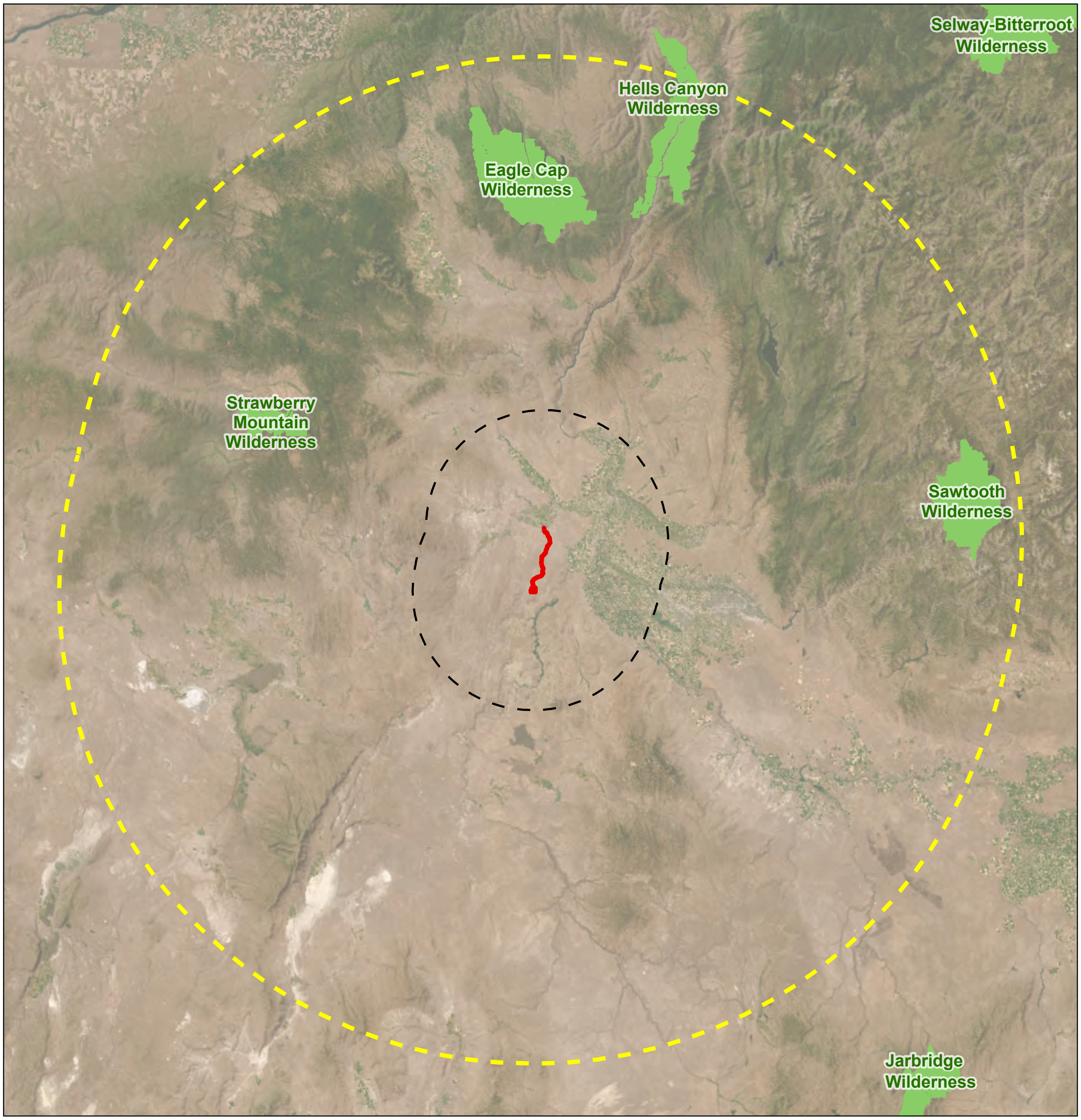
Table 3.10-5 shows GHG emissions and sinks in the US by source sector as tracked by the EPA.

### Table 3.10-5 US Greenhouse Gas Fossil Fuel Combustion Emissions Allocated to Economic Sectors (million metric tons)

| Implied Sectors | 2005 (MMT $CO_2$e) | 2017 (MMT $CO_2$e) | 2021 (MMT $CO_2$e) |
|---|---|---|---|
| Electric power industry | 2,456.9 | 1,779.2 | 1,584.1 |
| Transportation | 1,966.0 | 1,841.6 | 1,804.3 |
| Industry | 1,574.4 | 1,494.5 | 1,487.3 |
| Agriculture | 630.2 | 654.2 | 635.8 |
| Commercial | 418.9 | 437.6 | 439.2 |
| Residential | 371.2 | 328.4 | 365.6 |
| US territories | 59.7 | 26.3 | 24.1 |
| Total emissions | **7,477.4** | **6,561.8** | **6,340.2** |
| Land use, land-use change, and forestry (sinks) | (781.1) | (774.2) | (754.2) |
| Net emissions (sources and sinks) | **6,696.3** | **5,787.6** | **5,586.0** |

Source: EPA 2023c

MMT $CO_2$e = million metric tons carbon dioxide equivalent




Legend
- Permit Area
- Class I Area
- 50-km Buffer
- 200-km Buffer

0 10 20 Miles
(At original document size of 8.5x11)
1:2,561,623

N

Stantec

Project Location: Malheur County, OR
Prepared by LL on 2023-10-13
TR by EC on 2023-10-13

Client/Project: 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

Figure No.
3.10-2

Title
**Class I Areas and Grassy Mountain Gold Project**

***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources:
3. Background: USGS Topo

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## 3.10.4 Impact Analysis

### 3.10.4.1 No Action Alternative

Under the No Action Alternative, proposed mine construction, operations, and reclamation activities would not occur. The Project area would be preserved in its current state, and air quality would not be affected or meaningfully altered. Activity at the site may include continued exploration of mineral resources. Any future mine development at the site would require new permits and environmental approval and review. Therefore, air quality under the No Action Alternative would be similar to that described for existing conditions.

### 3.10.4.2 Applicant's Proposed Project

#### National Ambient Air Quality Standards

Emission rates for $PM_{10}$, $PM_{2.5}$, CO, $SO_2$, $NO_x$, Pb, $O_3$, VOCs, and GHGs, expressed as $CO_2e$, generated from mining, processing, and support operations were estimated for each identified emission unit. Table 3.10-6 shows the calculated air pollutant emissions for the Applicant's proposed Project.

**Table 3.10-6 Grassy Mountain Estimated Emissions (tons/year)**

| Activity | PM | $PM_{10}$ | $PM_{2.5}$ | CO | $NO_x$ | $SO_2$ | VOCs | HAPs[1] | GHG[2] |
|---|---|---|---|---|---|---|---|---|---|
| Process | 10.47 | 4.68 | 1.47 | 7.97 | 5.89 | 0.66 | 1.57 | 4.31 | 4,474 |
| Mining and fugitive | 38.48 | 10.78 | 1.08 | 10.89 | 1.69 | 0.001 | -- | 2.77 | -- |
| Nonroad | 0.53 | 0.53 | 0.53 | 10.53 | 9.69 | 0.02 | 9.62 | 3.34 | 1,840 |
| **Facility total** | **49.48** | **15.99** | **3.08** | **29.39** | **17.27** | **0.67** | **11.19** | **10.42** | **6,313** |

Source: ASI 2022b

1 Fugitive HAPs also includes emissions from tank leaks and hydrogen cyanide.

2 Measured in $CO_2e$ = carbon dioxide equivalent.

Since the Project is located within an area designated as unclassified, it is subject to attainment rules using the applicable significant emission rate (SER) in tpy for each pollutant. Estimates of Project emissions show that the total PM and $PM_{10}$ exceed the SER of 25 and 15 tpy, respectively. The Project is therefore subject to a Type B New Source Review permit for $PM_{10}$, which is one of three ACDP options. The DEQ modeling guidance (DEQ 2022) requires that all new facilities subject to a simple or standard ACDP compare short-term trial significant emission thresholds (SETs). The SETs are compared to the short-term NAAQS averaging periods:

- $NO_2$ – 1 hour
- $PM_{2.5}$ – 24 hour
- $SO_2$ – 1 hour

If the short-term emission rate exceeds the applicable SET, dispersion modeling is required. Table 3.10-7 illustrates the Project emissions compared to the SETs.

### Table 3.10-7 Potential Project Emissions (tons/year)

| Activity | 24-hour $PM_{2.5}$ (lb/day) | $NO_x$ 1-hour (lb/hour) | $SO_2$ 1-hr (lb/hour) |
|---|---|---|---|
| Process | 18.5 | 31.06 | 0.46 |
| Mining and fugitive | 10.0 | 5.38 | 0.01 |
| Nonroad | 5.1 | 3.88 | 0.01 |
| **Facility total** | **33.6** | **40.32** | **0.48** |
| **SET** | **5** | **3** | **3** |

Source: ASI 2022a

Table 3.10-7 shows that the Project's short-term emissions of $PM_{2.5}$ and $NO_2$ would exceed the SET. Therefore, modeling is required for the two averaging periods, in addition to modeling for $PM_{10}$ because emissions of PM and $PM_{10}$ exceed the SER.

Dispersion modeling conducted to quantify and evaluate impacts from onsite mining operations and processing for $PM_{10}$, $PM_{2.5}$, and $NO_2$. Model impacts were assessed for each averaging period for all applicable NAAQS. Table 3.10-8 shows the modeled concentrations for the Project emissions shown in Table 3.10-6. All three short-term averaging periods modeled the maximum impact.

### Table 3.10-8 Model-Predicted Maximum Impacts of the Applicant's Proposed Project

| Pollutant | Averaging Period | Modeled Impact (μg/m$^3$) | Background (μg/m$^3$) | Total Impact (μg/m$^3$) | NAAQS (μg/m$^3$) | In Compliance? |
|---|---|---|---|---|---|---|
| $PM_{10}$ | 24-hour | 24.6 | 23 | 47.6 | 150 | Yes |
| $PM_{2.5}$ | 24-hour | 3.7 | 21 | 24.7 | 35 | Yes |
| $NO_2$ | 1-hour | 140.0 | 5.1 | 145.1 | 188 | Yes |

Source: ASI 2022a

As demonstrated in Table 3.10-8, the modeled ambient air pollutant concentrations for $PM_{10}$, $PM_{2.5}$, and $NO_2$ together with the applicable background concentrations do not exceed the applicable NAAQS standards. Based on the dispersion modeling results, the Applicant's proposed Project would result in short-term, minor to moderate, localized air resource impacts.

The applicable existing $PM_{2.5}$ ambient background concentrations and the primary $PM_{2.5}$ concentrations were added to the estimated Project secondary $PM_{2.5}$ maximum impacts to calculate the total $PM_{2.5}$ concentrations for comparison with the NAAQS. Results of the MERPs calculations are presented in Table 3.10-9. Note that Project emission rates for the precursors in the analysis represent the Project's short-term emission rates converted to tpy. To demonstrate compliance with the $PM_{2.5}$ NAAQS, primary, secondary, and background concentrations were summed and compared to the NAAQS as shown in Table 3.10-10. The table shows that the maximum secondary $PM_{2.5}$ emissions from the proposed Project are in compliance with the NAAQs.

### Table 3.10-9 Maximum Secondary $PM_{2.5}$ Impacts

| Source | $SO_2$ Emissions (tpy) | $PM_{2.5}$ from $NO_x$ Precursors (µg/m$^3$) | $SO_2$ Emissions (tpy) | $PM_{2.5}$ from $SO_2$ Precursors (µg/m$^3$) |
|---|---|---|---|---|
| RHS – 24-hour | 500 | 0.2 | 500 | 0.25 |
| Project | 21.3 | 0.0085 | 12.2 | 0.0005 |
| **Project 24-hour $PM_{2.5}$ secondary impact (µg/m$^3$)** | | | | 0.0009 |

Source: ASI 2022a

### Table 3.10-10 Maximum Secondary $PM_{2.5}$ Compliance Demonstration

| Pollutant | Averaging Period | Primary Impact (µg/m$^3$) | Secondary Impact (µg/m$^3$) | Background (µg/m$^3$) | Total Impact (µg/m$^3$) | NAAQS (µg/m$^3$) | In Compliance? |
|---|---|---|---|---|---|---|---|
| $PM_{2.5}$ | 24-hour | 3.7 | 0.009 | 21 | 24.67 | 35 | Yes |

Source: ASI 2022a

$O_3$ impacts from Project emissions were evaluated for single-source $O_3$ and secondary $PM_{2.5}$. Table 3.10-11 provides the emission rates used in the MERPs assessment. As Table 3.10-11 shows, the maximum $O_3$ 8-hour concentration is less than the significant impact level and is therefore in compliance with DEQ regulations.

### Table 3.10-11 Maximum Ozone 8-hour Concentration and Compliance Demonstration

| Source | $NO_x$ Emissions (tpy) | $O_3$ from $NO_x$ Precursors (ppb) | VOC Emissions (tpy) | $O_3$ from VOC Precursors (ppb) |
|---|---|---|---|---|
| RHS | 500 | 1.94 | 500 | 0.46 |
| Project | 21.3 | 0.08 | 12.2 | 0.01 |
| Project 8-hour ozone concentration | | | | 0.09 |
| NAAQS compliance demonstration (significant impact level) | | | | 1 |
| Project impact less than significant impact level? | | | | Yes |

Source: ASI 2022a

#### Clean Air Oregon Risk Analysis

Daily and annual emissions for a variety of Project sources were estimated based on a June 28, 2022, DEQ-approved CAO inventory. Underground mining sources would all vent to the atmosphere via one singular point source and incorporate activities such as material handling, drilling, and blasting. The borrow pit would provide backfill material from the underground mine, which incorporates blasting, crushing, and a general pit area. The processing area would involve ore crushing, stockpiles, and a mill. While the mill would be a contained source with no emission release, the stockpile and crushing were modeled as volume sources. The refinery includes numerous emission units. The primary toxic emission units are the lime silo, leach tanks, CIL tanks, mercury retort, melting furnace, and electrowinning unit. Lime silo unloading was modeled as a volume source. Leach circuit tanks were modeled as area sources. The remaining refinery sources, including lime silo loading, were modeled as point sources (ASI 2023).

The other primary source evaluated for the Level 3 CAO analysis is the tailings facility. Byproducts of the CIL would be pre-treated and routed via pipeline to the tailings facility and reclaim pond. The aqueous solution would slowly dry over time and as evaporation occurs, hydrogen cyanide gas would be released to the atmosphere. Emissions are estimated based on temperature, wind speed, and surface area (ASI 2023). Other modeled miscellaneous sources include the concrete batch plant, emergency generator/fire pump, HVAC units, and storage tanks. Vehicle traffic from nonroad equipment was also evaluated due to tailpipe emissions. Table 3.10-14 provides the expected toxic emissions by the Chemical Abstract Service number and receptor type.

Ambient concentrations of all toxic pollutants were determined. The REER was calculated for each toxic emission unit by summing the ratios of emission rate to the corresponding RBC for each exposure scenario. Table 3.10-12 illustrates the toxic emission unit, modeling sources, and applicable emissions allocation. For more details, please refer to Appendices D and E of the CAO Risk Assessment Report developed by ASI (ASI 2023).

### Table 3.10-12 REER Allocation by Emission Unit and Modeled Source

| Toxic Emission Unit | Modeled Source ID | Description | Allocation % |
|---|---|---|---|
| Ore crushing | OC1 | Dump of ore to run-of-mine-hopper | 2.3 |
| | OC2 | Hopper to vibrating pan feeder | 2.3 |
| | OC3 | Primary crusher (including transfers in and out) | 20.0 |
| | OC4 | Primary crusher discharge conveyor transfer to screen feed conveyor | 2.3 |
| | OC5 | Ore screen (including transfers in and out) | 36.7 |
| | OC6 | Transfer to secondary crusher surge bin | 2.3 |
| | OC7 | Secondary crusher surge bin to secondary crusher vibrating feeder | 2.3 |
| | OC8 | Secondary crusher (including transfers in and out) | 20.0 |
| | OC9 | Secondary crusher discharge conveyor transfer to screen feed conveyor | 2.3 |
| | OC10 | Screen discharge conveyor transfer to product conveyor | 2.3 |
| | OC11 | Product conveyor transfer to fine ore bin | 2.3 |
| | OC12 | Fine ore bin discharge feeder to ball mill feed conveyor | 2.3 |
| | OC13 | Ball mill feed conveyor to ball mill transfer | 2.3 |
| Borrow crushing | BC1 | Dump of borrow to surge bin | 5.3 |
| | BC2 | Surge bin to vibrating grizzly transfer | 5.3 |
| | BC3 | Primary crusher (including transfers in and out) | 9.5 |
| | BC4 | Crusher discharge conveyor transfer point | 5.3 |
| | BC5 | Screen feed conveyor 1 transfer point | 5.3 |
| | BC6 | Screen feed conveyor 2 transfer point | 5.3 |
| | BC7 | Screen (including transfers in and out) | 44.0 |
| | BC8 | Cone crusher (including transfers in and out) | 9.5 |
| | BC9 | Screen discharge conveyor transfer to stockpile conveyor | 5.3 |
| | BC10 | Ore stockpile conveyor transfer to borrow stockpile | 5.3 |
| | BRW | Borrow pit | 46.9 |

| Toxic Emission Unit | Modeled Source ID | Description | Allocation % |
|---|---|---|---|
| Fugitive dust—material handling, drilling, blasting | BRWBLAST | Borrow blasting | 30.5 |
| | WRSF | Waste rock storage facility | 7.1 |
| | CRF | Cemented rockfill stockpile | 7.5 |
| | STK | Ore stockpile | 6.9 |
| | TS1 | Topsoil storage 1 | 0.8 |
| | TS2 | Topsoil storage 2 | 0.3 |
| BRWB | BRWBLAST | Borrow blasting – ANFO – VOCs | 100 |
| BRWBD | | Borrow blasting – ANFO – metals | 100 |
| CKD | CKD | Carbon regeneration kiln (drum) | 100 |
| CKDHG | | Carbon regeneration kiln (drum; mercury only) | 100 |
| MFP | MF | Melting furnace particulate | 100 |
| MFHG | | Melting furnace mercury only | 100 |
| MFD | | Melting furnace diesel combustion | 100 |
| UFD | UG | Underground fugitive dust—material handling, drilling, blasting | 100 |
| UDP | | Underground nonroad activity (including hauling) | 100 |
| UB | UG | Underground blasting, emulsion VOCs | 100 |
| UBD | | Underground blasting, emulsion metals | 100 |
| MR | MR | Mercury retort | 100 |
| HA | HA | Admin HVAC | 100 |
| HPO | HPO | Plant house and dry HVAC | 100 |
| HL | HL | Laboratory HVAC | 100 |
| HWW | HWW | Plant workshop and warehouse HVAC | 100 |
| HTW | HTW | Truck workshop and warehouse HVAC | 100 |
| HMO | HMO | Mine office and change house HVAC | 100 |
| EW | EW | Electrowinning | 100 |
| TSF | TSF | Tailings storage facility | 100 |
| POND | POND | Tailings reclaim pond | 100 |
| LEACH1 | LEACH1 | CN leach tank 1 | 100 |
| LEACH2 | LEACH2 | CN leach tank 2 | 100 |
| CILTANK1 | CILTANK1 | CIL tank 1 | 100 |
| CILTANK2 | CILTANK2 | CIL tank 2 | 100 |
| CILTANK3 | CILTANK3 | CIL tank 3 | 100 |
| CILTANK4 | CILTANK4 | CIL tank 4 | 100 |
| CILTANK5 | CILTANK5 | CIL tank 5 | 100 |
| CILTANK6 | CILTANK6 | CIL tank 6 | 100 |
| CILTANK7 | CILTANK7 | CIL tank 7 | 100 |
| CEM1 | CEM1 | Cement loading to silo | 100 |
| CEM2 | CEM2 | Cement unloading to batch plant | 100 |

| Toxic Emission Unit | Modeled Source ID | Description | Allocation % |
|---|---|---|---|
| CEM3 | CEM3 | Aggregate transfer | 100 |
| CEM4 | CEM4 | Weigh hopper loading | 100 |
| CEM5 | CEM5 | Mixer loading (central mix) | 100 |
| EDG1 | EDG1 | Emergency generator | 100 |
| EDFP | EDFP | Emergency diesel fire pump | 100 |
| LS1 | LS1 | Lime silo loading | 100 |
| LS2 | LS2 | Lime silo unloading to slaker | 100 |
| TG1 | TG1 | Mine gasoline tank | 100 |
| TD1 | TD1 | Mine diesel tank 1 | 100 |
| TD2 | TD2 | Mine diesel tank 2 | 100 |

Source: ASI 2023

A series of nested receptor grids were used to represent specific exposed population types. Table 3.10-13 illustrates the nearest non-acute receptors to the facility by zoning code (ASI 2023). Note the acute exposure hazard was calculated for all receptors within Oregon.

### Table 3.10-12 Nearest Exposure Receptors by Risk Class

| Easting Coordinates[1] | Northing Coordinates[1] | Risk Classification | Oregon Zoning Code | Description |
|---|---|---|---|---|
| 466000.0 | 4886000.0 | Residential | RNG | Federal range |
| 468000.0 | 4886000.0 | Residential | EFU80 | Exclusive farm use 80 |
| 504000.0 | 4874000.0 | Residential | MHDR | Medium/high-density residential |
| 467702.0 | 4839557.0 | Worker | RNG | Federal range |
| 474243.0 | 4839495.0 | Worker | RNG | Federal range |
| 466286.6 | 4829470.7 | Worker | RNG | Federal range |
| 451130.0 | 4857129.0 | Child | RC | Residential/commercial |
| 480485.0 | 4869487.0 | Child | MDR | Medium-density residential |
| 494402.0 | 4843162.0 | Child | No class | -- |

Source: ASI 2023

[1] All coordinates are in Universal Traverse Mercator Zone 11.

## Table 3.10-14 Facility-Wide Toxic Emissions and Risk-Based Concentrations

| Chemical Abstract Service No. or DEQ ID | Toxic Pollutant | Residential Chronic | | Non-Resident Chronic | | | | Acute | Facility Total Emissions | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cancer RBC | Non-Cancer RBC | Child Cancer RBC | Child Non-Cancer RBC | Worker Cancer RBC | Worker Non-Cancer RBC | Non-Cancer RBC | ton/year | lb/day |
| 7440-36-0 | Antimony and compounds | -- | 3.0E-01 | -- | 1.3E+00 | -- | 1.3E+00 | 1.0E+00 | 5.5E-04 | 4.8E-03 |
| 7440-38-2 | Arsenic and compounds | 2.4E-05 | 1.7E-04 | 1.3E-03 | 2.4E-03 | 6.2E-04 | 2.4E-03 | 2.0E-01 | 1.8E-03 | 2.2E-02 |
| 7440-41-7 | Beryllium and compounds | 4.2E-04 | 7.0E-03 | 1.1E-02 | 3.1E-02 | 5.0E-03 | 3.1E-02 | 2.0E-02 | 2.2E-05 | 1.9E-04 |
| 7440-43-9 | Cadmium and compounds | 5.6E-04 | 5.0E-03 | 1.4E-02 | 3.7E-02 | 6.7E-03 | 3.7E-02 | 3.0E-02 | 1.7E-04 | 6.9E-03 |
| 18540-29-9 | Chromium VI, chromate and dichromate particulate | 3.1E-05 | 8.3E-02 | 5.2E-04 | 8.8E-01 | 1.0E-03 | 8.8E-01 | 3.0E-01 | 3.3E-04 | 3.2E-03 |
| 7440-48-4 | Cobalt and compounds | -- | 1.0E-01 | -- | 4.4E-01 | -- | 4.4E-01 | -- | 3.2E-05 | 2.7E-04 |
| 7439-92-1 | Lead and compounds | -- | 1.5E-01 | -- | 6.6E-01 | -- | 6.6E-01 | 1.5E-01 | 8.6E-04 | 3.8E-02 |
| 7439-96-5 | Manganese and compounds | -- | 9.0E-02 | -- | 4.0E-01 | -- | 4.0E-01 | 3.0E-01 | 1.4E-03 | 2.4E-02 |
| 7439-97-6 | Mercury and compounds | -- | 7.7E-02 | -- | 6.3E-01 | -- | 6.3E-01 | 6.0E-01 | 4.4E-03 | 9.8E-02 |
| C365 | Nickel compounds, insoluble | 3.8E-03 | 1.4E-02 | | 6.2E-02 | | 6.2E-02 | 2.0E-01 | 4.8E-04 | 1.8E-02 |
| 7440-39-3 | Barium and compounds | -- | -- | -- | -- | -- | -- | -- | 8.5E-03 | 7.4E-02 |
| 7440-50-8 | Copper and compounds | -- | -- | -- | -- | -- | -- | 1.0E+02 | 5.3E-04 | 2.0E-02 |
| 7440-62-2 | Vanadium (dust and fume) | -- | 1.0E-01 | -- | 4.4E-01 | -- | 4.0E-01 | 8.0E-01 | 3.0E-04 | 2.4E-03 |
| 7440-66-6 | Zinc and compounds | -- | -- | -- | -- | -- | -- | -- | 3.1E-03 | 1.1E-01 |
| 1313-27-5 | Molybdenum trioxide | -- | -- | -- | -- | -- | -- | -- | 8.1E-05 | 7.2E-04 |
| 7440-22-4 | Silver and compounds | -- | -- | -- | -- | -- | -- | -- | 3.5E-05 | 3.4E-04 |
| 7631-86-9 | Silica, crystalline | -- | 3.0E+00 | -- | 1.3E+01 | -- | 1.3E+01 | -- | 3.2E+00 | 3.1E+01 |
| 115-07-1 | Propylene | -- | 3.0E+03 | -- | 1.3E+04 | -- | 1.3E+04 | -- | 5.7E-02 | 2.2E+00 |
| 106-99-0 | 1,3-Butadiene | 3.3E-02 | 2.0E+00 | 8.6E-01 | 8.8E+00 | 4.0E-01 | 8.8E+00 | 6.6E+02 | 2.0E-02 | 9.6E-01 |
| 75-05-8 | Acetonitrile | -- | 6.0E+01 | -- | 2.6E+02 | -- | 2.6E+02 | -- | 6.0E-03 | 5.6E-02 |
| 107-02-8 | Acrolein | -- | 3.5E-01 | -- | 1.5E+05 | -- | 1.5E+05 | 6.9E+00 | 4.4E-03 | 1.7E-01 |
| 67-64-1 | Acetone | -- | 3.1E+04 | -- | 1.4E+05 | -- | 1.4E+05 | 6.2E+04 | 4.1E-04 | 3.8E-03 |

| Chemical Abstract Service No. or DEQ ID | Toxic Pollutant | Residential Chronic | | Non-Resident Chronic | | | | Acute | Facility Total Emissions | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cancer RBC | Non-Cancer RBC | Child Cancer RBC | Child Non-Cancer RBC | Worker Cancer RBC | Worker Non-Cancer RBC | Non-Cancer RBC | ton/year | lb/day |
| 67-63-0 | Isopropyl alcohol | -- | 2.0E+02 | -- | 8.8E+02 | -- | 8.8E+02 | 3.2E+03 | 7.8E-04 | 7.3E-03 |
| 107-13-1 | Acrylonitrile | 1.5E-02 | 5.0E+00 | 3.8E-01 | 2.2E+01 | 1.8E-01 | 2.2E+01 | 2.2E+02 | 1.1E-03 | 1.1E-02 |
| 71-43-2 | Benzene | 1.3E-01 | 3.0E+00 | 3.3E+00 | 1.3E+01 | 1.5E+00 | 1.3E+01 | 2.9E+01 | 4.1E-02 | 9.8E-01 |
| 108-88-3 | Toluene | -- | 5.0E+03 | -- | 2.2E+04 | -- | 2.2E+04 | 7.5E+03 | 7.8E-02 | 8.5E-01 |
| 100-41-4 | Ethyl Benzene | 4.0E-01 | 2.6E+02 | 1.0E+01 | 1.1E+03 | 4.8E+00 | 1.1E+03 | 2.2E+04 | 1.6E-02 | 1.3E-01 |
| 100-42-5 | Styrene | -- | 1.0E+03 | -- | 4.4E+03 | -- | 4.4E+03 | 2.1E+04 | 5.4E-04 | 5.1E-03 |
| 108-67-8 | 1,3,5-Trimethylbenzene | -- | 6.0E+01 | -- | 2.6E+02 | -- | 2.6E+02 | -- | 1.7E-04 | 1.6E-03 |
| 91-20-3 | Naphthalene | 2.9E-02 | 3.70E+00 | 7.6E-01 | 1.6E+01 | 3.5E-01 | 1.6E+01 | 2.0E+02 | 7.1E-03 | 1.2E-01 |
| 7782-49-2 | Selenium and compounds | -- | -- | -- | -- | -- | -- | 2.0E+00 | 2.1E-04 | 9.9E-03 |
| 91-57-6 | 2-Methyl naphthalene | -- | -- | -- | -- | -- | -- | -- | 9.6E-07 | 8.6E-06 |
| 56-49-5 | 3-Methylcholanthrene | -- | -- | -- | -- | -- | -- | -- | 5.4E-08 | 3.0E-07 |
| 57-97-6 | 7,12-Dimethylbenz[a]anthracene | -- | -- | -- | -- | -- | -- | -- | 4.8E-07 | 2.6E-06 |
| 83-32-9 | Acenaphthene | -- | -- | -- | -- | -- | -- | -- | 3.0E-04 | 1.5E-02 |
| 208-96-8 | Acenaphthylene | -- | -- | -- | -- | -- | -- | -- | 3.6E-04 | 1.8E-02 |
| 75-07-0 | Acetaldehyde | 4.5E-01 | 1.4E+02 | 1.2E+01 | 6.2E+02 | 5.5E+00 | 6.2E+02 | 4.7E+02 | 7.1E-02 | 3.5E+00 |
| 7664-41-7 | Ammonia | -- | 5.0E+02 | -- | 2.2E+03 | -- | 2.2E+03 | 1.2E+03 | 8.1E-01 | 1.6E+01 |
| 120-12-7 | Anthracene | -- | -- | -- | -- | -- | -- | -- | 3.6E-04 | 1.8E-02 |
| 56-55-3 | Benz[a]anthracene | 2.1E-04 | -- | 7.8E-03 | -- | 1.5E-02 | -- | -- | 3.5E-04 | 1.7E-02 |
| 50-32-8 | Benzo[a]pyrene | 4.3E-05 | 2.0E-03 | 1.6E-03 | 8.8E-03 | 3.0E-03 | 8.8E-03 | 2.0E+03 | 3.2E-06 | 1.6E-04 |
| 205-99-2 | Benzo[b]fluoranthene | 5.3E-05 | -- | 2.0E-03 | -- | 3.8E-03 | -- | -- | 6.0E-04 | 3.0E-02 |
| 191-24-2 | Benzo[g,h,i]perylene | 4.7E-03 | -- | 1.7E-01 | -- | 3.4E-01 | -- | -- | 3.1E-07 | 1.3E-05 |
| 207-08-9 | Benzo[k]fluoranthene | 1.4E-03 | -- | 5.2E-02 | -- | 1.0E-01 | -- | -- | 6.0E-04 | 3.0E-02 |
| 218-01-9 | Chrysene | 4.3E-04 | -- | 1.6E-02 | -- | 3.0E-02 | -- | -- | 3.2E-04 | 1.6E-02 |
| 53-70-3 | Dibenz[a,h]anthracene | 4.3E-06 | -- | 1.6E-04 | -- | 3.0E-04 | -- | -- | 3.1E-04 | 1.5E-02 |

| Chemical Abstract Service No. or DEQ ID | Toxic Pollutant | Residential Chronic | | Non-Resident Chronic | | | | Acute | Facility Total Emissions | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Cancer RBC | Non-Cancer RBC | Child Cancer RBC | Child Non-Cancer RBC | Worker Cancer RBC | Worker Non-Cancer RBC | Non-Cancer RBC | ton/year | lb/day |
| 206-44-0 | Fluoranthene | 5.3E-04 | -- | 2.0E-02 | -- | 3.8E-02 | -- | -- | 3.6E-04 | 1.8E-02 |
| 86-73-7 | Fluorene | -- | -- | -- | -- | -- | -- | -- | 1.9E-03 | 9.3E-02 |
| 50-00-0 | Formaldehyde | 1.7E-01 | 9.0E+00 | 4.3E+00 | 4.0E+01 | 2.0E+00 | 4.0E+01 | 4.9E+01 | 1.61E-01 | 7.6E+00 |
| 110-54-3 | Hexane | -- | 7.0E+02 | -- | 3.1E+03 | -- | 3.1E+03 | -- | 1.2E-01 | 7.8E-01 |
| 193-39-5 | Indeno[1,2,3-cd]pyrene | 6.1E-04 | -- | 2.2E-02 | -- | 4.3E-02 | -- | -- | 3.1E-04 | 1.5E-02 |
| 106-46-7 | p-Dichlorobenzene (1,4-Dichlorobenzene) | 9.1E-02 | 6.0E+01 | 2.4E+00 | 2.6E+02 | 1.1E+00 | 2.6E+02 | 1.2E+04 | 3.6E-05 | 2.0E-04 |
| 85-01-8 | Phenanthrene | -- | -- | -- | -- | -- | -- | -- | 3.5E-03 | 1.7E-01 |
| 129-00-0 | Pyrene | -- | -- | -- | -- | -- | -- | -- | 7.6E-04 | 3.7E-02 |
| 1330-20-7 | Xylene (mixture) | -- | 2.2E+02 | -- | 9.7E+02 | -- | 9.7E+02 | 8.7E+03 | 1.1E-01 | 2.2E+00 |
| 74-90-8 | Hydrogen cyanide | -- | 8.0E-01 | -- | 3.5E+00 | -- | 3.5E+00 | 3.4E+02 | 1.9E+00 | 1.2E+01 |
| 12185-10-3 | Phosphorus (white) | -- | 9.0E+00 | -- | 4.0E+01 | -- | 4.0E+01 | 2.0E+01 | 2.8E-05 | 2.5E-04 |
| 108-90-7 | Chlorobenzene | -- | 5.0E+01 | -- | 2.2E+02 | -- | 2.2E+02 | -- | 1.8E-05 | 8.9E-04 |
| 7647-01-0 | Hydrochloric acid | -- | 2.0E+01 | -- | 8.8E+01 | -- | 8.8E+01 | 2.1E+03 | 1.7E-02 | 8.3E-01 |
| C200 | Diesel particulate matter | 1.0E-01 | 5.0E+00 | 2.6E+00 | 2.2E+01 | 1.2E+01 | 2.2E+01 | -- | 3.7E+00 | 2.9E+02 |
| 192-97-2 | Benzo[e]pyrene | -- | -- | -- | -- | -- | -- | -- | 2.4E-08 | 4.6E-07 |
| 198-55-0 | Perylene | -- | -- | -- | -- | -- | -- | -- | 4.6E-08 | 8.9E-07 |
| 92-52-4 | Biphenyl | -- | -- | -- | -- | -- | -- | -- | 9.7E-05 | 5.3E-04 |
| 110-82-7 | Cyclohexane | -- | 6.0E+03 | -- | 2.6E+04 | -- | 2.6E+04 | -- | 2.2E-03 | 1.2E-02 |
| 108-95-2 | Phenol | -- | 2.0E+02 | -- | 8.8E+02 | -- | 8.8E+02 | 5.8E+03 | 5.1E-04 | 2.8E-03 |
| 95-63-6 | 1,2,4-Trimethylbenzene | -- | 6.0E+01 | -- | 2.6E+02 | -- | 2.6E+02 | -- | 2.3E-02 | 1.3E-01 |
| 98-82-8 | Isopropylbenzene (cumene) | -- | 4.0E+02 | -- | 1.8E+03 | -- | 1.8E+03 | -- | 4.6E-03 | 2.5E-02 |

Source: ASI 2023

A Level 3 Risk Analysis was conducted to assess health risk impacts of air pollutants for the CAO. The maximum total modeled risk impacts are based on the RBCs (Table 3.10-14) to estimate the potential risks at the exposure locations (Table 3.10-13) for each exposure scenario. All maximum risk results were determined for each exposure scenario and compared to the associated Source Permit Risk Action Level. The results demonstrated that all scenarios were below the Risk Action Level as illustrated in Table 3.10-15. This means that the facility is in compliance with the CAO program.

### Table 3.10-13 Nearest Exposure Receptors by Risk Class

| Risk Category | Exposure Scenario | | Maximum Risk Location | | Maximum Risk | Source Permit Risk Action Level |
|---|---|---|---|---|---|---|
| | | | Easting (m) | Northing (m) | | |
| Cancer | Chronic | Residential | 472000.0 | 4820000.0 | 0.2 | 0.5 |
| | | Child | 480485.0 | 4869487.0 | <0.002 | |
| | | Worker | 474243.0 | 4839495.0 | <0.05 | |
| Non-Cancer | Chronic | Residential | 479000.0 | 4834500.0 | <0.02 | |
| | | Child | 480485.0 | 4869487.0 | <0.0004 | |
| | | Worker | 474243.0 | 4839495.0 | <0.02 | |
| | Acute | | 471268.3 | 4835965.9 | 0.3 | |

Source: ASI 2023

### Prevention of Significant Deterioration

Federal PSD regulations limit the maximum allowable increase in ambient pollutant concentration in Class I, Class II, and Class III areas. The Project is classified under the CAA as a PSD minor source of air quality emissions and would not exceed these thresholds under the PSD regulations because the majority of the Project emissions sources are fugitive[2] in nature and as such are not included in the determination of PSD applicability for a non-listed source category such as gold mining. However, DEQ modeling guidelines require all sources within Class II areas to conduct air quality PSD increment assessment and all sources within 200 km of a Class I area to provide an analysis for Class I PSD increments. With regard to effects on Class II areas, the results of the air quality PSD increment assessment are provided in Table 3.10-16, which shows that the Project would be in compliance with applicable increment standards in Class II areas.

### Table 3.10-14 Maximum Secondary $PM_{2.5}$ Compliance Demonstration

| Pollutant | Averaging Period | Primary Impact (µg/m³)[1] | Secondary Impact (µg/m³) | Total Impact (µg/m³) | Class II PSD Increment (µg/m³) | In Compliance? |
|---|---|---|---|---|---|---|
| $PM_{2.5}$ | 24-hour | 4.4 | 0.009 | 4.409 | 9 | Yes |
| $PM_{10}$ | Annual | 2.21 | N/A | 2.21 | 17 | Yes |
| $PM_{10}$ | 24-hour | 24.6 | N/A | 24.6 | 30 | Yes |

Source: ASI 2022a

1 High second high design values (ASI 2022a, 2022b)

2 Fugitive emissions are defined as emissions that could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.

The closest Class I area is 120 km to the northwest, at the Strawberry Mountain Wilderness. The *Federal Land Managers' Air Quality Related Values Work Group Phase I Report—Revised* provides a Class I screening analysis (Q/D; emissions over distance) (USFS 2010). The "air quality related value" per this guidance includes a combined total of the $NO_x$, $SO_2$, $PM_{2.5}$, and $PM_{10}$. The Q/D significance threshold is 10. The screening results for Strawberry Mountain Wilderness are provided in Table 3.10-17, which shows that the combined $NO_x$, $SO_2$, $PM_{2.5}$, and $PM_{10}$ emissions are less than the Q/D significance threshold, resulting in minimal effects to Class I areas.

**Table 3.10-15 Q/D Analysis for Strawberry Mountain**

| Air Quality Related Value Pollutant (lb/day) | Emissions (Q) (ton/year) | Distance (D) (km) | Q/D ton/year-km | Q/D<10? |
|---|---|---|---|---|
| 228 | 42 | 120 | 0.3 | Yes |

### New Source Performance Standards and National Emissions Standards for Hazardous Air Pollutants

The NSPSs and NESHAPs apply for specific types of equipment located at new or modified stationary pollutant sources. The facility-wide Project emissions are expected to be less than the major source threshold under the NESHAP. However, NESHAP requires that a minor source such as the Project obtain a Title V permit.

### Greenhouse Gases

Per the EPA Greenhouse Gas Equivalence Calculator, the Applicant's proposed Project would produce approximately the same amount of GHG emissions annually (6,313 tpy of $CO_2e$) as that produced by 722 households annually due to energy consumption and 1,274 gasoline passenger cars driven for a year (EPA 2023d). This includes the mining direct emissions and the indirect process facility emissions.

Minimization measures identified to reduce effects to air quality and GHG include the use of biodiesel in underground mining equipment to reduce overall fuel emissions, implementing SIC mine operations and scheduling (or similar technology) to reduce transportation of materials and traffic wait times, and recycling rubber and plastic materials, which saves energy and reduces GHG emissions.

The GHG emissions resulting from the Applicant's proposed Project would represent approximately 0.0.029 percent of the gross GHG emissions for the State of Oregon permitted sources (21.5 MST for 2021) (DEQ 2023). It is anticipated the Project would result in short-term, minor, localized impacts from GHG emissions. Therefore, mandatory reporting is not required.

## 3.10.4.3 Alternative A

Under Alternative A, there would be potential hydrogen sulfide emissions that would need to be managed via air quality controls on the process. Operational monitoring would need to include hydrogen sulfide and ammonia for worker protection. If a natural gas or propane boiler were used for thiosulfate manufacture in lieu of electrical power, there would be minor differences in combustion emissions associated with the Project. However, the amount of natural gas or propane use would be very small compared to the diesel and gasoline usage by the Project.

# 3.11 NOISE

Noise emissions from the Project have the potential to generate noise impacts on the local acoustic environment. This assessment provides an overview of the existing conditions in the Project area and identifies changes in noise levels from Project actions at key noise receptor locations to determine potential noise impacts. The key noise receptor locations are noise-sensitive properties and a quiet area located near the proposed permit boundary. Within the Permit Area, the noise-sensitive properties are located near the beginning of the Project access road at the intersection of Russell Road and Bishop Road; the quiet area is Lake Owyhee State Park, about 6 miles southeast of the Project. The noise study area consists of two sections:

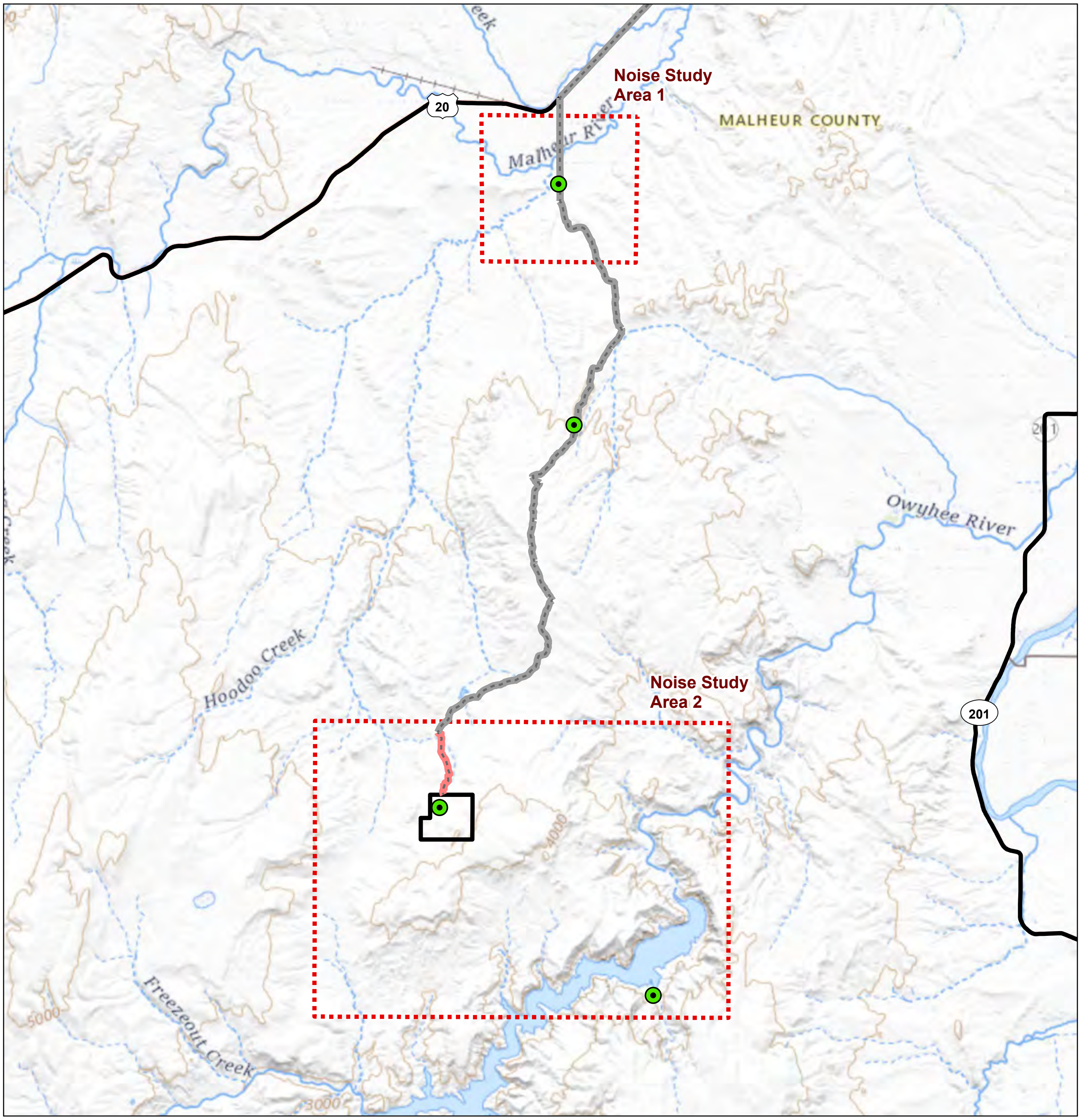
- Noise Study Area 1 (Site D): From the beginning of the Project access road, a 4-mile by 4-mile study area covering the area from US Route 20 along Russell Road to Cow Hollow Road. There are three residential dwellings identified as noise-sensitive properties or noise receptors.
- Noise Study Area 2 (Site B): From the Project mine site, a 6-mile by 8-mile study area encompassing the mine site and Lake Owyhee State Park. There is one noise receptor selected as representative of Lake Owyhee State Park.

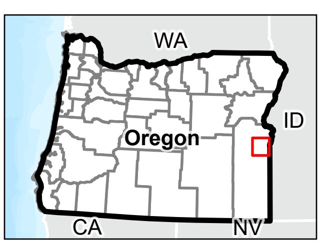
Figures 3.11-1 through 3.11-3 illustrate the noise study areas and the selected noise receptors. Table 3.11-1 summarizes the noise receptors with Universal Transverse Mercator coordinates and distances to the Project site.

### Table 3.11-1 Noise Receptor Summary

| Study Area and Receptor Site ID | Noise Receptor Category | Noise Receptor ID | Universal Transverse Mercator | | | Description | Distance to Site (miles) |
|---|---|---|---|---|---|---|---|
| | | | Easting | Northing | Zone No. | | |
| Study Area 1 Site D | Noise-sensitive properties | R1 | 475314 | 4861869 | 11 | Residential dwelling | 16 |
| | | R2 | 475439 | 4862296 | 11 | Residential dwelling | 16.2 |
| | | R3 | 475484 | 4862562 | 11 | Residential dwelling | 16.4 |
| Study Area 2 Site B | Quiet area | R4 | 479073 | 4828619 | 11 | Lake Owyhee State Park | 6 |

Source: Creative Acoustics Northwest, Inc. 2019




Legend

- Mine and Process Area
- Ambient Noise Measurement Site Location
- Main Access Road
- Project Access Road
- Noise Study Areas

0 1 2 Miles
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N

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*Project Location*
Malheur County, OR

Prepared by LL on 2023-11-07
TR by YM on 2023-11-09

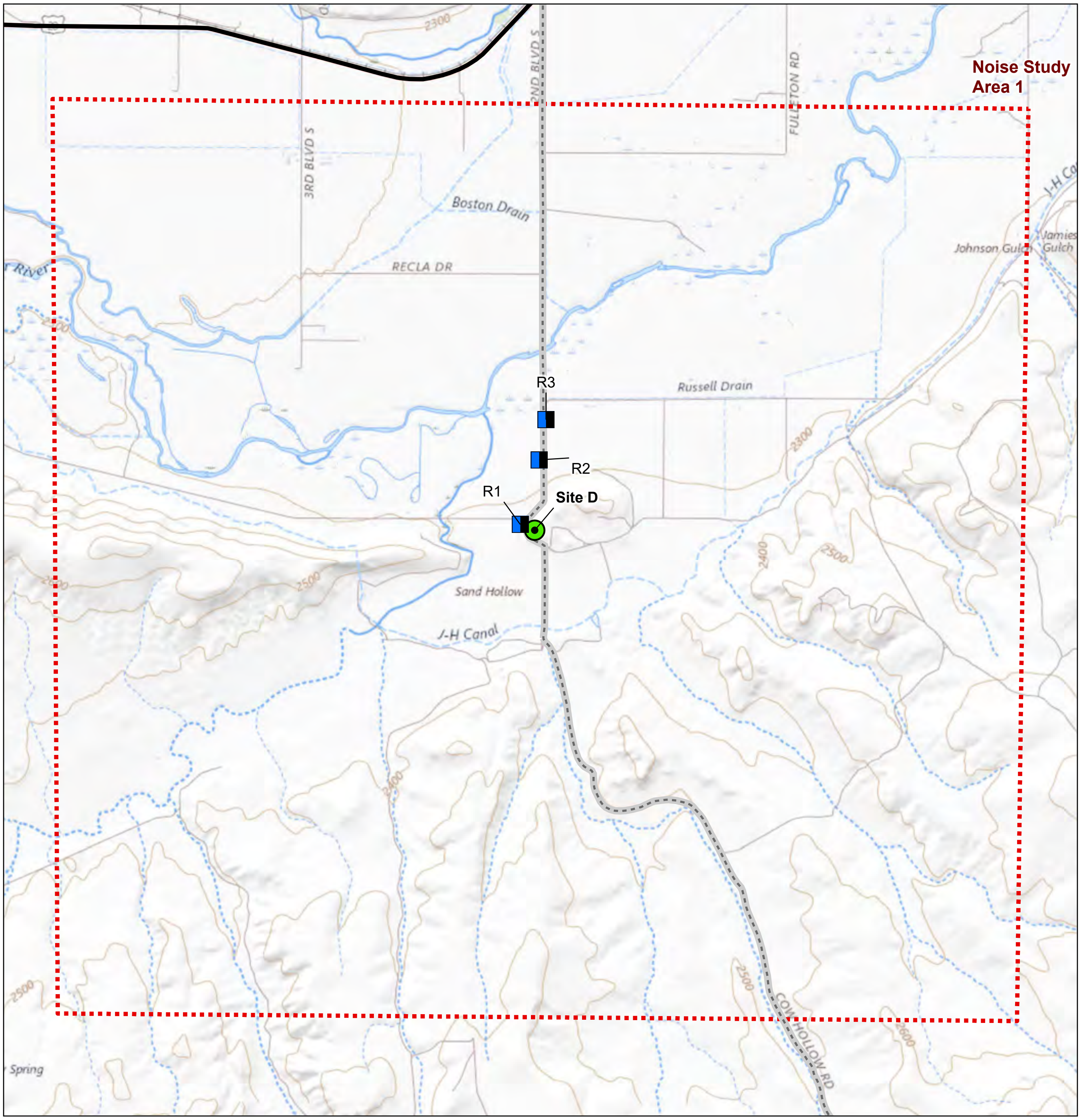
*Client/Project*
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

2378001753

*Figure No.*
**3.11-1**

*Title*
**Noise Study Areas**

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI
**3.** Background: USGS Topo





Legend

- Ambient Noise Measurement Site Location
- Receptor
- Main Access Road
- Noise Study Area

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*Notes*
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI
3. Background: USGS Topo

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Environmental Evaluation Report

*Figure No.*
**3.11-2**

*Title*
**Noise Study Area 1 and Noise Receptors (R1, R2, and R3)**

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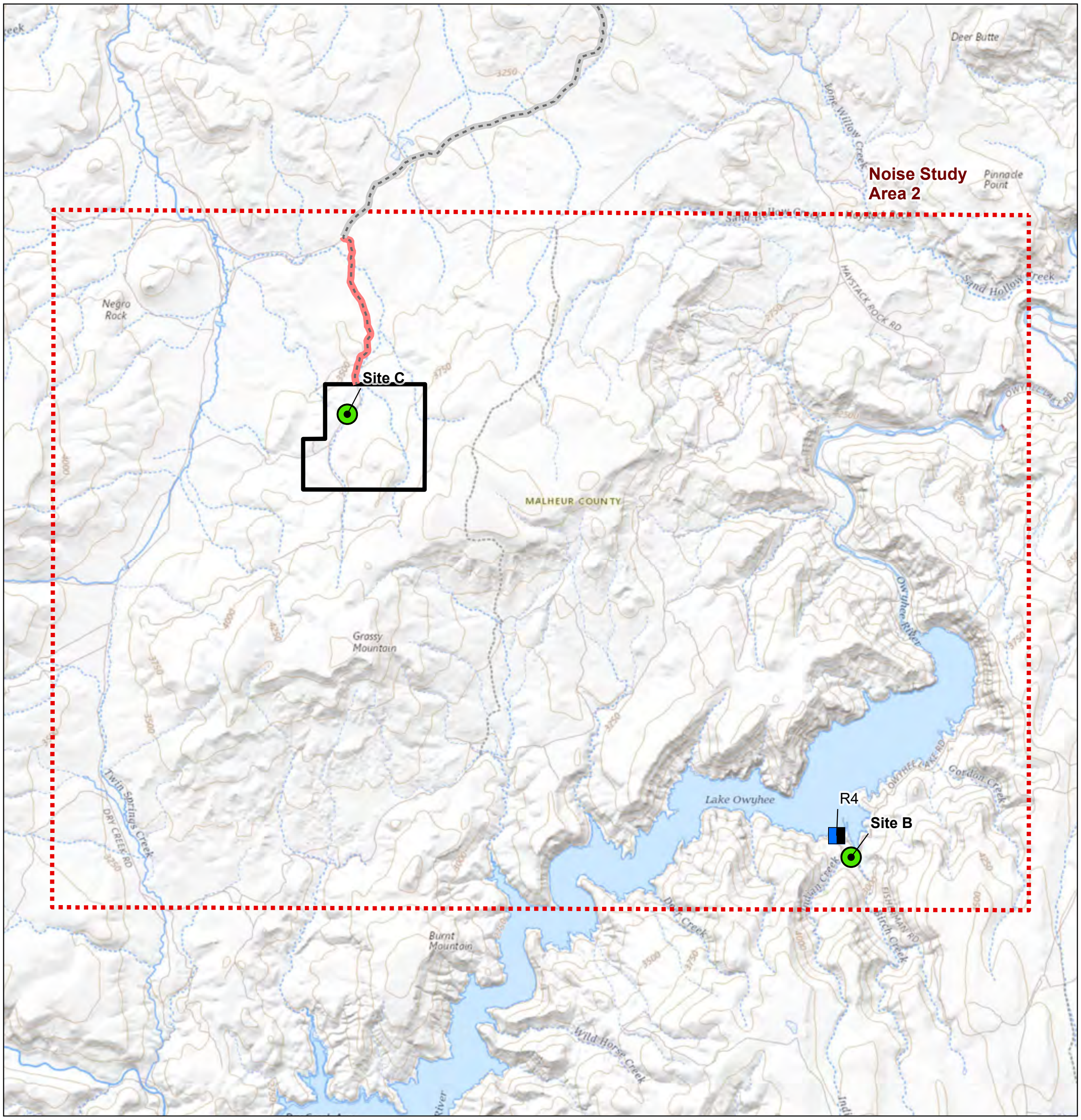


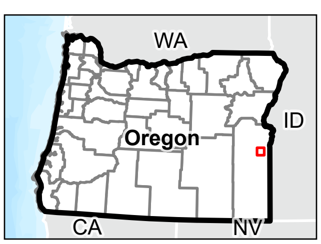


Legend

- Mine and Process Area
- Ambient Noise Measurement Site Location
- Receptor
- Main Access Road
- Project Access Road
- Noise Study Area

0 0.55 1.1 Miles

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1:106,000

N

Stantec

*Notes*
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI
3. Background: USGS Topo

*Project Location*
Malheur County, OR

Prepared by LL on 2023-11-07
TR by YM on 2023-11-09

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*Figure No.*
**3.11-3**

*Title*
**Noise Study Area 2 and Noise Receptor (R4)**

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The noise analysis focuses on two Project phases: construction and operations. Noise levels during the closure and reclamation phases are expected to be lower than those during the construction and operations phases because some of the equipment and activities required would be similar in nature but lower in quantity. The noise analysis considers noise emissions from mobile and stationary equipment during construction (years 1 and 2, including the pre-production phase) and operations (years 3 through 11) activities at the mine site and access road.

Environmental noise typically varies over time. To account for this variation, a single number descriptor known as the equivalent continuous sound level ($L_{eq}$) and statistical percentile sound levels ($L_n$) are used. $L_{eq}$ is defined as the steady, continuous sound level over that specified time that has the same acoustic energy as the actual measured sound level. $L_n$ is the sound level exceeded "n" percent of the measurement time—in other words, for n percent of the time, the fluctuating sound levels are higher than the $L_n$ level. Widely used $L_n$ sound levels include $L_1$, $L_{10}$, and $L_{50}$. $L_1$ is the sound level exceeded for 1 percent of the measurement time; it is commonly called the "intrusive sound level" and is near the maximum level in that time period. $L_{10}$ is the sound level exceeded for 10 percent of the measurement time; it is often used to indicate the upper limit of fluctuating noise, such as traffic noise. $L_{50}$ is the sound level exceeded for 50 percent of the measurement time; it represents the median of the fluctuating noise and is sometimes incorporated into the community noise assessment.

Since human hearing is not equally sensitive to all frequencies of sound, certain frequencies are typically given more and certain frequencies are given less "weight" when assessing environmental noise impacts. The dBA scale corresponds to the sensitivity range for human hearing and is used for $L_{eq}$, $L_1$, $L_{10}$, and $L_{50}$ sound levels in this assessment, except where specifically indicated. The unweighted or linear sound level measurement unit without the A-weighted filter is denoted by dB, and the C-weighted sound level filter is denoted by dBC.

### 3.11.1 Regulatory Context

Oregon DEQ has established statewide maximum permissible environmental noise levels for new industrial uses at the nearest noise-sensitive property (such as a residence, school, church, hospital, or public library). The maximum permissible statistical noise levels at noise-sensitive properties from the Project's operations are shown in Table 3.11-2.

**Table 3.11-2 Maximum Permissible Project Noise Levels at Noise-Sensitive Properties**

| Noise Level Statistic | Day (7 A.M. to 10 P.M.) | Night (10 P.M. to 7 A.M.) |
|---|---|---|
| $L_{50}$ | 55 dBA | 50 dBA |
| $L_{10}$ | 60 dBA | 55 dBA |
| $L_1$ | 75 dBA | 60 dBA |

Source: DEQ 2022

$L_{50}$ = noise levels exceeded 50 percent of each hour

$L_{10}$ = noise levels exceeded 10 percent of each hour

$L_1$ = noise levels exceeded 1 percent of each hour

Maximum permissible environmental noise levels for new industrial facilities are measured at nearby quiet areas (such as wilderness areas, state parks, game reserves, wildlife breeding areas, and outdoor amphitheaters) and are more restrictive (lower) than for noise-sensitive properties. For this Project, Lake

Owyhee State Park (located approximately 6 miles from the Project) is the only quiet area within the surrounding area. The maximum permissible noise levels from the proposed Project operation in a quiet area is shown in Table 3.11-3.

### Table 3.11-3 Maximum Permissible Project Noise Levels in Quiet Areas

| Noise Level Statistic | Day (7 A.M. to 10 P.M.) | Night (10 P.M. to 7 A.M.) |
|---|---|---|
| $L_{50}$ | 50 dBA | 45 dBA |
| $L_{10}$ | 55 dBA | 50 dBA |
| $L_{1}$ | 60 dBA | 55 dBA |

Source: DEQ 2022

$L_{50}$ = noise levels exceeded 50 percent of each hour

$L_{10}$ = noise levels exceeded 10 percent of each hour

$L_{1}$ = noise levels exceeded 1 percent of each hour

According to the DEQ noise regulations, the noise limits that are specified in Tables 3.11-2 and 3.11-3 must not be exceeded in any 1-hour period of the day, and the noise generated by the Project cannot cause the statistical ambient noise levels ($L_{50}$ and $L_{10}$) to increase by more than 10 dBA in any 1 hour.

DEQ has also established noise limits on impulse noise. The same limits apply to noise-sensitive properties and quiet areas. Table 3.11-4 presents the maximum permissible Project impulse noise levels at nearby noise-sensitive properties and quiet areas. Note that the level, frequency weighting, and time weighting are different for blasting noise when compared to other impulsive sounds. For blasting noise, the C-weighting is used with the microphone time weighting set to slow. For other impulsive sounds, there is not a frequency weighting.

### Table 3.11-4 Maximum Permissible Project Impulse Noise Levels

| Source | Noise Level Statistic | Day (7 A.M. to 10 P.M.) | Night (10 P.M. to 7 A.M.) |
|---|---|---|---|
| Blasting | $L_{max, slow}$ | 98 dBC | 93 dBC |
| Other impulsive | $L_{peak}$ | 100 dB | 80 dB |

Source: DEQ 2022

$L_{max, slow}$ = maximum sound level during the measurement with the microphone time weighting set to slow with 1 second time constant

$L_{peak}$ = maximum instantaneous sound pressure level during the measurement

dB = linear decibel

dBC = C-weighted decibel

The maximum permissible sound levels summarized in Table 3.11-2 through Table 3.11-4 are set forth for the Project operational noise. The DEQ noise limits do not pertain to construction noise from the Project. There are no state or federal noise guidelines, bylaws, or ordinances that prescribe quantitative limits for construction noise of a project. Construction noise criteria should account for the existing noise environment, absolute noise levels during construction activities, the duration of construction, and adjacent land uses. The US Federal Transit Administration (FTA) Transit Noise and Vibration Impact Assessment Manual (FTA 2018) provides guidance on noise effects during construction and may be used to define the noise thresholds for Project construction activities.

The FTA (2018) recommends using the combined $L_{eq.equip\ (8hr)}$ and the combined $L_{dn.equip\ (30days)}$ to assess impacts of all equipment in the construction phase. $L_{dn}$ is the average day-night sound level over a 24-hour period.

Table 3.11-5 summarizes the noise criteria for the Project construction noise based on FTA guidance (2018).

**Table 3.11-5 Federal Transit Administration Construction Noise Criteria**

| Land Use | $L_{eq.equip\ (8hr)}$[1] (dBA) | | $L_{dn.equip\ (30days)}$[2] (dBA) 30-day Average |
|---|---|---|---|
| | Daytime | Nighttime | |
| Residential | 80 | 70 | 75 |
| Commercial | 85 | 85 | 80[3] |
| Industrial | 90 | 90 | 85[3] |

Source: FTA 2018

1 $L_{eq.equip\ (8\ hr)}$ = combined 8-hour $L_{eq}$ sound level

2 $L_{dn.equip\ (30\ days)}$ = combined average 30-day day-night sound level $L_{dn}$

3 Use a 24-hour $L_{eq(24hr)}$ instead of $L_{dn.equip\ (30day)}$

For the Project, $L_{eq.equip\ (8hr)}$ is used as noise limits for the construction noise assessment.

## 3.11.2 Method of Analysis

The Project has the potential to affect the local environment, particularly noise receptors at noise-sensitive properties and quiet areas; therefore, the noise assessment focuses on these key noise receptor locations to assess compliance with DEQ noise criteria. It is anticipated that the primary sources of Project noise would be construction and operations activities from the mine site.

At the end of the mining period, mine components would be closed and reclaimed in stages over approximately 4 years, with 29 years of post-closure monitoring and inspections. The quantity of noise-emitting equipment required for the closure and reclamation phase is expected to be lower than that used during the construction and operation phases. Accordingly, a quantitative noise assessment of the closure and reclamation phase is not included.

The noise effects model focuses on activities during the construction and operations phases. Potential Project noise impacts on identified noise receptors are determined by comparing existing baseline noise levels with predicted Project noise levels. As such, the noise impact analysis is conducted using baseline noise measurements and noise modeling methods as described herein.

### 3.11.2.1 Baseline Noise Measurements

To quantify the existing acoustic environment and identify current baseline noise conditions, a baseline noise monitoring survey was conducted for the Permit Area and at Lake Owyhee State Park in April and May 2018 at four locations (Creative Acoustics Northwest, Inc. 2019). A summary of the baseline noise conditions is included in Section 3.11.4.

### 3.11.2.2 Noise Modeling

Noise emissions generated from Project construction and operation phases were assessed with noise modeling to predict noise levels at the identified noise receptors. The modeling results were then compared to the DEQ noise criteria and FTA noise limits to determine compliance.

Noise modeling in this assessment was completed using the Cadna/A software (DataKustik 2021), which incorporates International Organization for Standardization (ISO) Standard 9613 (ISO 1993, 1996) algorithms, which specify methods of calculating the attenuation of sound propagating outdoors. These ISO standards are commonly used by noise practitioners and are widely accepted by regulatory bodies and government agencies. The Cadna/A software model accounts for the following factors:

- Geometric spreading
- Screening effects
- Atmospheric absorption
- Ground condition
- Source size, location, and elevation
- Mild downwind conditions from the Project to the dwelling(s) and/or temperature inversion condition
- Source directivity

The values of 50°F (10 degrees Celsius [°C]) temperature and 70 percent relative humidity were used in the model settings to represent summer nighttime conditions that enhance noise propagation. A wind speed of 1 to 5 meters per second (2–11 miles per hour) downwind condition from the source to the receptor is built into the propagation algorithms. The ground absorption factor (G) is an index whose value ranges from zero to one, where zero represents a reflective surface and one represents an absorptive surface. Waterbodies were assigned a G value of zero. The mine site and developed areas, as well as all remaining surrounding areas, were assigned G values of 0.5. Ground terrain information was based on data from the Natural Resources Conservation Service (NRCS; NRCS 2023).

Table 3.11-6 lists the parameters used in the acoustic modeling.

**Table 3.11-6 Acoustic Modeling Parameters**

| Model Parameters | Model Setting |
|---|---|
| Temperature[1] | 50°F (10°C) |
| Relative humidity[1] | 70% |
| Wind speed | Downwind condition, wind speed of 1 meter per second to 5 meter per second (based on ISO 9613-2 standard) |
| Noise source | Refer to Sections 3.11.5.2.1 and 3.11.5.2.2 |
| Acoustic modeling software | Cadna/A (DataKustik 2021 MR2) |
| Noise propagation standard | ISO 9613 (ISO 1996) |

| Model Parameters | Model Setting |
|---|---|
| Ground conditions and attenuation factor [2] | Ground absorption (G):<br>• Lake area G = 0<br>• Entire Project area and surrounding areas G = 0.5 with predominantly soil and short grass<br>(G varies between zero and one, where zero represents reflective ground surface and one represents absorptive ground surface condition) |
| Terrain parameters (terrain resolution) | 30-meter by 30-meter ground terrain data incorporated in model |
| Reflection parameters [3] | Two orders of reflection |

Source: Creative Acoustics Northwest, Inc. 2019

1 The values of 50°F (10°C) temperature and 70% relative humidity are used in the model settings to represent summer nighttime conditions that enhance noise propagation.

2 Ground terrain information is based on NRCS geospatial data (2023).

3 The reflection parameter of two represents the numbers of reflection when the sound emission incident ray hits a structure.

Noise contour maps to illustrate the extent of noise effects from Project construction and operations were also created through the noise modeling exercise. The noise contour maps show noise propagation levels in different colors from the noise sources to the surrounding areas.

#### 3.11.2.3 Blast and Vibration Assessment

During the Project construction phase, blasting activities would be used to initiate the underground mine and at the quarry. During the operations phase, excavation of the underground material would involve drilling and blasting activities underground.

Blast energy generates air overpressure and causes ground-borne vibration. Air overpressure is the additional pressure above normal atmospheric pressure that is generated from a blast and is measured in decibels (dB). The intensity of ground vibration is measured in units of peak particle velocity in inches per second or millimeters per second. The magnitude of blast air overpressure and ground-borne vibration depends on the explosive type, loading densities, weight, blast pattern, spacing of blasting holes, detonator delays, and other factors. Without detailed data of the blasting design, blasting effects on noise and vibration cannot be quantitively assessed for the Project. Therefore, blasting and vibration effects are assessed qualitatively in this noise analysis in consideration of proposed Project actions and distance to sensitive noise receptors.

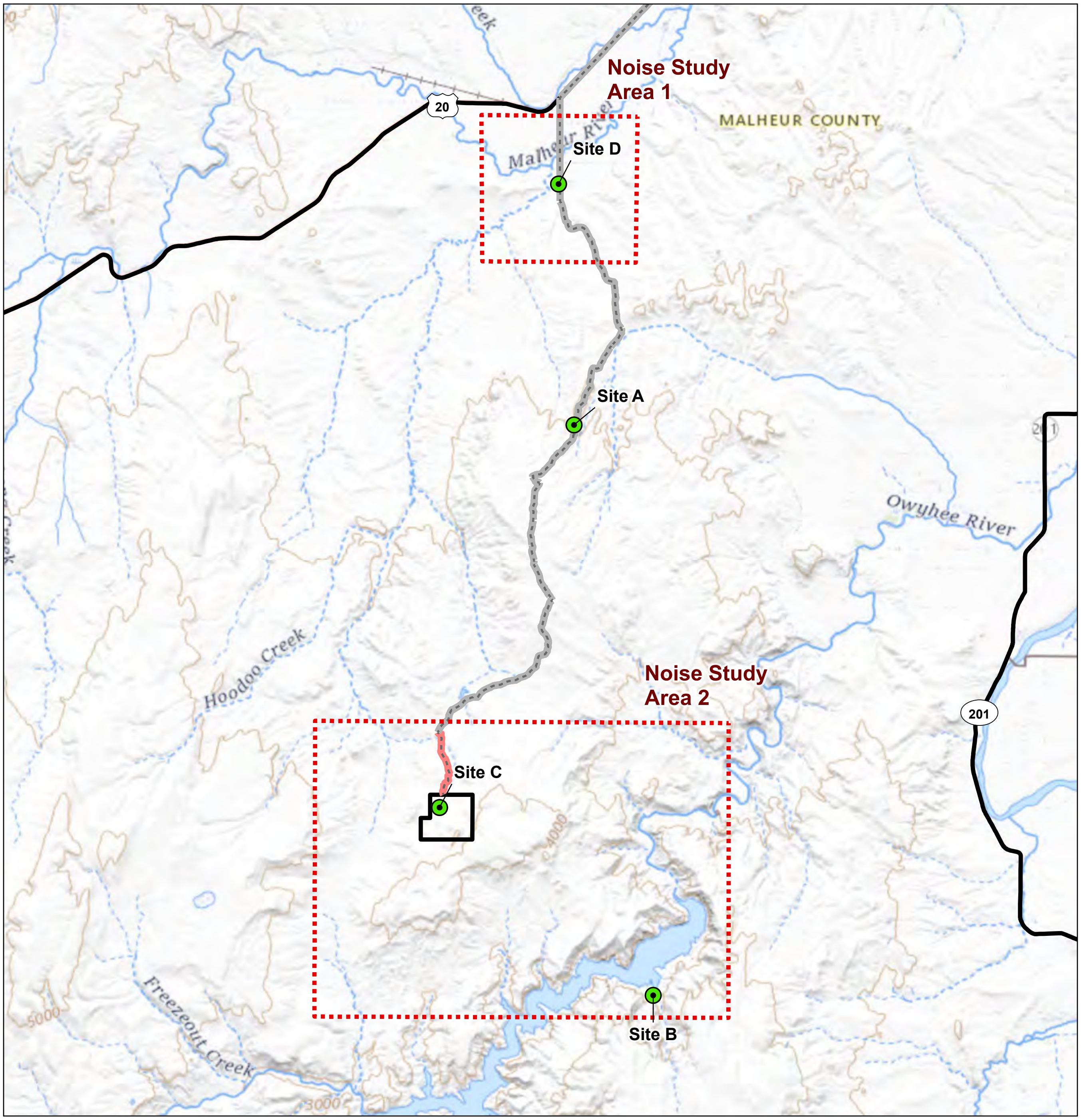
### 3.11.3 Affected Environment

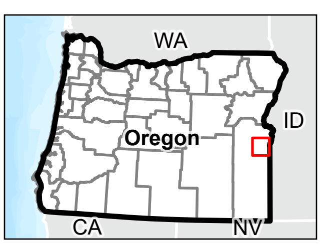
Existing ambient noise levels were measured at four noise measurement sites as shown in Figure 3.11-4:

- **Site A:** An undeveloped location on BLM land approximately 170 feet west of Twin Springs Road and approximately three miles south of the intersection of Twin Springs Road and Cow Hollow Road. This measurement site, although not technically a noise-sensitive property, is intended to represent a location that could experience an environmental noise impact due to a change in road traffic accessing the Project site along Twin Springs Road.
- **Site B:** Located in the Lake Owyhee State Park, 1298 Lake Owyhee Dam Road, Adrian, Oregon, approximately 250 feet west of Fisherman Road (the access road into Indian Creek Campground)

and approximately 600 feet south of the gate entrance into Indian Creek Campground. This measurement site was chosen to represent the closest quiet area to the Project site.

- **Site C**: A site within the Mine and Process Area, approximately 375 feet southwest of the entrance gate and 150 feet west of an unnamed access road. This measurement site, although not technically a noise-sensitive property, is intended to represent an undeveloped rural area.
- **Site D**: Residences located along Bishop Road, approximately 250 feet east of Russell Road. This measurement site was selected to characterize a residential noise-sensitive property and to characterize a location that could experience a change in road traffic along Russell Road. Three receptors were also identified nearby as residences.




Legend
- Mine and Process Area
- Ambient Noise Measurement Site Location
- Main Access Road
- Project Access Road
- Noise Study Areas

0 1 2 Miles
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*Project Location*
Malheur County, OR

Prepared by LL on 2023-11-07
TR by YM on 2023-11-09

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2378001753
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Grassy Mountain Gold Project
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*Figure No.*
**3.11-4**

*Title*
**Baseline Noise Monitoring Locations**

***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI
3. Background: USGS Topo

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The DEQ noise regulations only apply to noise-sensitive properties and quiet areas, Sites D and B. The results of the ambient noise measurements from Sites A through D are presented in Table 3.11-7.

### Table 3.11-7 Ambient Noise Summary (dBA)

| Metric | $L_{eq}$ | $L_{max}$ | $L_{min}$ | $L_1$ | $L_{10}$ | $L_{50}$ |
|---|---|---|---|---|---|---|
| **Site A: Undeveloped location along Twin Springs Road** | | | | | | |
| Daytime minimum | 27.2 | 49.4 | 17.4 | 35.8 | 26.6 | 19.2 |
| Daytime average | 35.9 | 58.3 | 19.0 | 45.7 | 39.1 | 30.3 |
| Daytime maximum | 49.0 | 73.8 | 24.8 | 59.8 | 53.2 | 40.0 |
| Nighttime minimum | 20.6 | 40.2 | 17.1 | 27.7 | 19.7 | 17.8 |
| Nighttime average | 29.1 | 51.4 | 19.0 | 38.2 | 31.0 | 24.8 |
| Nighttime maximum | 39.8 | 65.4 | 22.3 | 50.1 | 43.5 | 37.5 |
| **Site B: Lake Owyhee State Park** | | | | | | |
| Daytime minimum | 22.4 | 37.9 | 17.3 | 29.4 | 25.0 | 20.3 |
| Daytime average | 28.1 | 49.7 | 20.2 | 37.9 | 28.5 | 24.0 |
| Daytime maximum | 41.6 | 71.9 | 26.3 | 54.7 | 37.3 | 35.2 |
| Nighttime minimum | 19.3 | 32.1 | 17.2 | 23.4 | 20.3 | 18.1 |
| Nighttime average | 29.9 | 45.4 | 23.6 | 34.9 | 32.1 | 28.3 |
| Nighttime maximum | 38.1 | 55.8 | 31.4 | 48.6 | 43.7 | 37.0 |
| **Site C: Grassy Mountain Mine and Process Area** | | | | | | |
| Daytime minimum | 32.5 | 55.5 | 17.1 | 44.2 | 28.8 | 20.7 |
| Daytime average | 40.4 | 67.3 | 20.6 | 51.7 | 40.7 | 31.2 |
| Daytime maximum | 56.7 | 94.4 | 31.9 | 64.7 | 56.0 | 46.8 |
| Nighttime minimum | 19.3 | 40.8 | 16.9 | 23.8 | 20.2 | 17.9 |
| Nighttime average | 26.6 | 50.7 | 18.4 | 34.2 | 27.4 | 22.5 |
| Nighttime maximum | 48.8 | 81.3 | 21.9 | 53.4 | 41.7 | 30.2 |
| **Site D: Residences at Bishop Road, Vale, Oregon** | | | | | | |
| Daytime minimum | 30.8 | 52.1 | 20.2 | 40.5 | 32.0 | 26.2 |
| Daytime average | 37.8 | 60.0 | 24.5 | 47.1 | 39.8 | 33.2 |
| Daytime maximum | 50.7 | 77.7 | 36.4 | 58.9 | 54.2 | 48.2 |
| Nighttime minimum | 28.6 | 48.6 | 23.3 | 33.1 | 30.1 | 27.3 |
| Nighttime average | 40.8 | 58.9 | 30.3 | 48.4 | 41.8 | 37.4 |
| Nighttime maximum | 69.8 | 92.5 | 36.0 | 86.2 | 50.6 | 45.1 |

Source: Creative Acoustics Northwest, Inc. 2019
Daytime = 7:00 A.M. to 10:00 P.M.
Nighttime = 10:00 P.M. to 7:00 A.M.

The baseline noise levels measured at the identified noise-sensitive properties at Site D within Noise Study Area 1, and at the quiet area at Site B within Noise Study Area 2 (Figure 3.11-3) are summarized in Table 3.11-8.

### Table 3.11-8 Representative Baseline Ambient Noise Levels at Receptors

| Study Area and Site ID | Noise Receptor Category | Receptor ID | Daytime | | Nighttime | |
|---|---|---|---|---|---|---|
| | | | $L_{10}$ (dBA) | $L_{50}$ (dBA) | $L_{10}$ (dBA) | $L_{50}$ (dBA) |
| Study Area 1<br>Site D | Noise-sensitive properties | R1, R2, and R3 | 25.6 | 22.4 | 21.3 | 19.1 |
| Study Area 2<br>Site B | Quiet area | R4 | 34.0 | 26.7 | 30.2 | 28.1 |

Source: Creative Acoustics Northwest, Inc. 2019

According to DEQ regulations, noise generated by the Project cannot cause the ambient noise levels ($L_{50}$ and $L_{10}$) to increase by more than 10 dBA in any 1 hour. The maximum proposed noise limits for Project operations at the two noise measurement sites are presented in Table 3.11-9.

### Table 3.11-9 Proposed Noise Limits for the Project

| Study Area and Site ID | Noise Receptor Category | Site and Receptor ID | Daytime | | Nighttime | |
|---|---|---|---|---|---|---|
| | | | $L_{10}$ (dBA) | $L_{50}$ (dBA) | $L_{10}$ (dBA) | $L_{50}$ (dBA) |
| Study Area 1<br>Site D | Noise-sensitive Properties | R1, R2, and R3 | 35.6 | 32.4 | 31.3 | 29.1 |
| Study Area 2<br>Site B | Quiet area | R4 | 44.0 | 36.7 | 40.2 | 38.1 |

Source: Creative Acoustics Northwest, Inc. 2019

More details on the baseline noise monitoring survey can be found in the Noise Baseline Report (Creative Acoustics Northwest, Inc. 2019).

## 3.11.4 Impact Analysis

### 3.11.4.1 Construction Noise Sources

The first 2 years of the Project would include construction of facilities and the pre-production phase of the Project. This period was selected for modeling of construction impacts because it represents the worst-case scenario of equipment usage during activities such as bulk earthwork, site facility construction, and pre-production mining activities. It is noted that construction activities would occur at other stages in the Project, such as creating the stages of TSF embankments.

Project construction-phase noise emissions were established using the following information sources:

- Equipment lists, design data, and equipment noise ratings based on the data from similar equipment from the Stantec acoustic database;
- Equipment specifications and referenced formula from acoustic literature (Bies and Hansen 2003; Crocker 2007); and
- A publication that provides reference sound power levels and sound pressure levels for common construction equipment (Department for Environment, Food, and Rural Affairs 2005).

The construction noise emission focused on the following areas:

1. Process plant area
2. Mine pre-production
3. TSF
4. TWRSF
5. Stockpiles
6. Mine quarry
7. Access and haul roads

The access road for the mine would be an existing road that begins at the intersection of US Route 20 and Russell Road and continues south along Cow Hollow Road and Twin Springs Road until reaching the mine. Some areas of road improvements would be required, including some roadway realignments, road widening, and installation of cross-drain culverts. As the access road at Site D (Figure 3.11-2) is in proximity to noise-sensitive properties, noise assessment for the access road construction focused on the area along Russell Road to Cow Hollow Road within a 4-mile stretch.

Construction-phase noise emissions for the process plant are based on the following assumptions:

- Worst-case scenario is based on a period of the first 2 years for the mine site and the first year for the access road.
- Construction equipment operates an average of 8 hours during the daytime between 7:00 A.M. and 10 P.M. during a 24-hour period.
- Equipment operates at 100 percent capacity.
- Access road traffic includes heavy trucks and passenger vehicles, including pickup trucks.
- Speed limit along the access road is 40 mph.
- Construction of internal access and mine haul roads is included in the construction within the mine site permit boundary.

Construction noise-emitting equipment at the mine site and access road and associated sound power levels are summarized in Tables 3.11-10 and 3.11-11, respectively.

### Table 3.11-10 Mine Site Construction Equipment Summary

| Description | Quantity | Sound Power Level (dBA) Per Unit |
|---|---|---|
| Excavator backhoe 65 ton | 2 | 113 |
| Excavator 400G John Deere | 1 | 106 |
| Rubber tire loader CAT993 | 1 | 116 |
| Rubber tire loader wheel loader 206 kW | 1 | 109 |
| Articulated trucks 38 ton | 2 | 120 |
| Articulated trucks primary trucks 144 ton | 1 | 121 |
| Grader 215 kW | 2 | 113 |
| Grader 178 kW | 2 | 112 |
| Crawler dozer CATD6T | 1 | 109 |
| Crawler dozer CATD7T | 1 | 109 |
| Crawler DOZER CATD8T | 2 | 113 |
| Diesel water truck 15 kW | 2 | 112 |
| Pipe fusing machine | 1 | 91 |
| 40-ton rock truck | 1 | 117 |
| 65-ton rock truck | 1 | 119 |
| Diesel dump truck | 1 | 108 |
| Concrete mixer | 2 | 111 |
| Rubber wheel loader 260 kW | 1 | 109 |
| Diesel rough terrain cranes 110 Ton | 2 | 97 |
| Diesel rough terrain forklift 12 Ton | 1 | 92 |
| Service truck 1 ton | 2 | 109 |
| Service truck 2 ton | 2 | 109 |
| Rock drills | 1 | 114 |
| Grout mixer | 2 | 93 |
| Plate packer | 1 | 104 |
| Compressor | 2 | 107 |
| 3-inch minus pump | 3 | 100 |
| 6-inch pump | 3 | 103 |
| Heavy duty light tower | 4 | 95 |
| Diesel bore/drill rigs blasthole stemmer | 1 | 95 |
| Power generation set | 1 | 109 |
| Crew vans | 2 | 109 |
| Back alarm | 5 | 115 |

**Table 3.11-11 Access Road Construction Equipment Summary**

| Description | Quantity | Sound Power Level (dBA) per unit |
|---|---|---|
| Excavator 55 kW | 1 | 106 |
| Rubber tire loader | 1 | 116 |
| Rubber tire loader wheel loader 206 kW | 1 | 109 |
| Grader 178 kW | 2 | 108 |
| Crawler dozer CATD6T | 1 | 109 |
| Articulated trucks 38 Ton | 2 | 117 |
| Diesel water truck 15 kW | 1 | 109 |
| Asphalt pavers and screeds CATAP400 | 1 | 108 |
| Service truck 1 ton | 2 | 106 |
| Service truck 2 ton | 2 | 106 |
| Plate packer | 1 | 104 |
| Paving drum roller CB7 | 1 | 104 |

Construction-phase access road traffic noise emissions are based on the following assumptions:

- Equipment operates in the daytime only;
- Equipment operates at 100 percent capacity;
- Highest access road traffic volumes are assumed at four vehicles per hour; and
- Construction traffic includes heavy trucks, pickup trucks, crew buses, and other light vehicles.

Construction would also include upgrading an existing powerline and installing a new powerline and 525 poles along the mine access road from the intersection of Cow Hollow Road and Twin Springs Road to the mine site for approximately 25.2 miles to provide power to the mine. This construction would not occur near the noise-sensitive properties (Site D) or quiet area (Site B), and noise is expected to be negligible in these areas. During construction of the powerline, one emergency diesel generator capable of producing 2,000 kW would be located at the process plant to be used during construction and initial mining of the underground mine decline. This diesel generator is included in the construction noise sources listed in Table 3.11-10.

### 3.11.4.2 Operation Noise Sources

Mill operations would include over 9 years of mining and processing. The operations-phase scenario is considered representative of the worst-case for noise emissions used in noise modeling. The Project operations-phase noise emissions were established using the following information sources:

- Equipment lists, design data, and equipment noise ratings based on the data for similar equipment from the Stantec acoustic database;

- Equipment specifications and referenced formula from acoustic literature (Bies and Hansen 2003; Crocker 2007); and
- Measurement data of the sound power levels and sound pressure levels for common operational equipment.

The mine site activities would include mobile equipment traveling between different areas onsite and stationary equipment in the process areas, mine areas, and other operating areas. The operations noise assessment focused on the worst-case years that represent the highest overall intensity of noise-emitting equipment distribution in different mine areas. Noise models included a combination of stationary and mobile noise sources that are described in the following sections.

No mine haul trucks or other heavy vehicles would travel along the access road during the operation phase of the Project; therefore, noise effects of traffic on the access road near Site D would be minimal. As such, operational vehicle noise is not included in the noise assessment for the mine operation phase.

#### 3.11.4.3 Stationary Sources

The noise model assumed all equipment operates continuously during both daytime and nighttime periods during a 24-hour period. The mine site sound power levels are based on a combination of theoretical calculations and past project experience for similar facilities. The major components of the mine site are:

- Process plant building
- Mill building including primary crusher, secondary crusher, and grinder
- Reagent storage building
- Gold room
- Ore stockpile
- Conveyors
- Dust collectors
- HVAC units
- Water supply pumps
- Power supply substations

A detailed listing of equipment type, quantity, and sound power level inside each building and outdoors for the operation phase is presented in Tables 3.11-12 and 3.11-13, respectively.

Transformers would be placed at the mine site to supply power for electrical equipment during the operations phase of the Project. These transformers are included in the operation noise sources listed in Table 3.11-13.

### Table 3.11-12 Operation Stationary Equipment inside Buildings

| Equipment Description | Quantity | Sound Power Level (dBA) Per Unit[1] |
|---|---|---|
| **Process Building** | | |
| Carbon regeneration kiln exhaust fan | 1 | 76 |
| Electrowinning cells extraction fan | 1 | 82 |
| Room vent fan | 1 | 64 |
| Pre-leach thickener underflow pump | 1 | 108 |
| Secondary CRUSHER WET SCRUBBER FAN | 1 | 91 |
| Pebble conveyor 2 motor | 1 | 85 |
| High angle pebble conveyor motor | 1 | 87 |
| Reclaim tunnel vent fan | 1 | 94 |
| Fine ore stockpile cover ventilation fan | 1 | 82 |
| Primary crusher transfer conveyor | 1 | 94 |
| Fine ore stockpile feed conveyor | 1 | 93 |
| Sag mill feed conveyor | 1 | 94 |
| Pebble conveyor | 1 | 92 |
| Primary crusher transfer conveyor | 2 | 88 |
| **Reagent Building** | | |
| Lime distribution pump | 1 | 95 |
| Fresh water pump | 1 | 97 |
| Gland water pump | 1 | 88 |
| Electrowinning cell rectifier | 1 | 84 |
| Potable water pump | 1 | 84 |
| Process plant air compressor | 1 | 93 |
| **Gold Room** | | |
| Induction furnace extraction fan | 1 | 88 |
| Drying oven extraction fan | 1 | 89 |
| Oxygen plant rotary & reciprocating compressor | 1 | 115 |
| **Mill Building** | | |
| Wet scrubber recirculating pump | 1 | 90 |
| Cyclone feed pump | 1 | 107 |
| Process water pump | 1 | 109 |
| CIP tailings pump | 1 | 106 |
| Carbon advance pump 1 & 2 | 2 | 90 |
| Elution area potable water pump | 1 | 98 |
| Barren solution pump | 1 | 95 |
| Tailings pump | 1 | 107 |
| Mill area overhead crane | 1 | 95 |
| CIP area overhead crane | 1 | 88 |

| Equipment Description | Quantity | Sound Power Level (dBA) Per Unit[1] |
|---|---|---|
| Elution area jib crane | 1 | 85 |
| Carbon regeneration area jib crane | 1 | 85 |
| Sulfur dioxide package | 1 | 108 |
| Sag mill feed conveyor | 1 | 101 |
| High angle pebble conveyor | 1 | 87 |
| Pebble conveyor | 1 | 85 |
| Sag mill | 1 | 113 |
| Ball mill | 2 | 115 |
| Sag mill trommel screen | 1 | 107 |
| Trash screen | 2 | 99 |
| Ball mill trommel screen | 2 | 107 |
| Inter-tank screen | 2 | 104 |
| Primary crushing air compressor | 2 | 107 |
| Secondary crusher overhead crane | 1 | 88 |
| Primary jaw crusher | 1 | 112 |
| Primary crusher transfer conveyor | 1 | 103 |
| Apron feeder | 1 | 113 |
| Vibrating grizzly screen | 2 | 107 |
| Rock breaker | 1 | 118 |
| Primary crusher bag house dust collector fan | 1 | 101 |
| Secondary crusher overhead crane | 1 | 88 |
| Secondary cone crusher | 1 | 115 |
| Primary crusher transfer conveyor | 1 | 103 |
| Secondary crusher vibrating feeder | 1 | 118 |
| Secondary crusher retractable feeder | 1 | 107 |
| Wet scrubber recirculating pump | 1 | 90 |

1 Sound power level represents each unit of equipment.

### Table 3.11-13 Operation Outdoor Stationary Equipment Summary

| Equipment Description | Quantity | Sound Power Level (dBA) Per Unit[1] |
|---|---|---|
| Sag mill feed conveyor | 2 | 101 |
| Reclaim fine ore apron feeder 1 & 2 | 2 | 112 |
| Cartridge dust collector | 6 | 101 |
| Water pump | 5 | 100 |
| Booster pump | 3 | 100 |
| Stockpile feed conveyor | 3 | 101 |
| Conveyor motor | 5 | 97 |

| Equipment Description | Quantity | Sound Power Level (dBA) Per Unit[1] |
|---|---|---|
| Vehicle wash machine | 2 | 92 |
| HVAC vent fans | 12 | 97 |
| Substation transformer 120 MVA | 2 | 103 |
| Substation transformer 300 MVA | 1 | 106 |

1 Sound power level represents each unit of equipment.

MVA = mega volt amp

#### 3.11.4.4 Mobile Sources

Mobile mining equipment that remains underground would have no noise effects on aboveground noise levels. Therefore, the noise assessment only includes mobile equipment that would be located aboveground (including haul trucks that transport the mined material to surface facilities). Mobile equipment would operate across the entire site. The noise emissions from the mobile equipment would be distributed throughout the site—for instance, hydraulic loaders would load the ore and waste into haul trucks, which, in turn, would transport the waste rock to the TWRSF and the ore to the ore stockpile adjacent to the crushing circuit. The crushed ore would then be transported to the mill to be ground in a ball mill in a closed-circuit system.

Mobile sources would operate for two 12-hour shifts per day. The mine would operate 24 hours per day, 4 days per week, and processing would occur 24 hours per day, 7 days per week. Table 3.11-14 summarizes the different aboveground mobile equipment with equipment type, quantity, and sound power level per unit.

### Table 3.11-14 Mobile Equipment Summary

| Equipment Description | Quantity | Sound Power Level (dBA) per unit[1] |
|---|---|---|
| Four-wheel drive twin cab truck | 1 | 106 |
| Four-wheel drive twin cab utility | 1 | 106 |
| All-terrain crane | 1 | 94 |
| Articulated haul trucks | 1 | 117 |
| Blast hole drill | 1 | 95 |
| Crushing area Bobcat | 1 | 107 |
| Diamond drilling | 1 | 114 |
| Dozer | 1 | 109 |
| Dual (drill + bolter) | 3 | 114 |
| Elevated work platform | 1 | 86 |
| Emulsion loader | 1 | 106 |
| Forklift | 1 | 92 |
| Front-end loader | 2 | 109 |
| Hiab truck | 1 | 108 |
| Load Haul Dump loader | 1 | 116 |
| Lube truck | 1 | 108 |

| Equipment Description | Quantity | Sound Power Level (dBA) per unit[1] |
|---|---|---|
| Mine rescue truck | 2 | 106 |
| Motor grader | 2 | 108 |
| Pipe fusing machine | 1 | 91 |
| Shotcrete sprayer | 1 | 104 |
| Shotcrete truck | 1 | 104 |
| Telehandler | 2 | 92 |
| Truck with ejector bed | 3 | 117 |
| Mini van—transport | 3 | 106 |

[1] Sound power level represents each unit of equipment.

The noise modeling results predict Project noise emissions in terms of $L_{eq}$ noise levels. Based on noise source assumptions that the mine would operate continuously, the noise emissions from construction equipment are averaged over 8 hours during the daytime period. It is expected that noise emissions from construction and operations equipment would not fluctuate significantly; as such, the $L_{eq}$ noise level approximates the $L_{50}$ noise level. The $L_{10}$ noise level is commonly approximated as $L_{eq}$ + 3 dB per the methods in the Federal Highway Administration's Highway Construction Noise Handbook (2019).

### 3.11.4.5 No Action Alternative

Under the No Action Alternative, the noise study areas would not be developed for mining purposes, there would be no heavy machinery or blasting occurring at the site, and therefore there would be no noise generated above ambient levels. Existing uses of the noise study areas would likely continue, including grazing of cattle and the potential for continued exploration of new mining opportunities, which would have minor noise and vibration effects from the exploration equipment, similar to the existing conditions.

### 3.11.4.6 Applicant's Proposed Project

#### Construction

Table 3.11-15 summarizes the predicted $L_{eq}$ noise levels at the noise receptors for the Project construction phase and compares them with FTA construction noise criteria for residential uses.

**Table 3.11-15 Predicted Noise Levels for Project Construction Phase**

| Study Area and Site ID | Receptor Category | Receptor ID | Predicted Noise Level, $L_{eq\ (8hr)}$ (dBA) | FTA Noise Criteria $L_{eq.equip\ (8hr)}$ (dBA) | |
|---|---|---|---|---|---|
| | | | | Daytime | Nighttime |
| Study Area 1 Site D | Noise-sensitive Properties | R1 | 55.7 | 80 | 70 |
| | | R2 | 47.5 | 80 | 70 |
| | | R3 | 45.9 | 80 | 70 |
| Study Area 2 Site B | Quiet area | R4 | 16.6 | 80 | 70 |

Results in Table 3.11-15 indicate that the predicted noise levels at the noise receptors during the Project construction phase are well below the FTA noise criteria during the daytime period at the noise-sensitive properties (R1, R2, and R3) and minimal at the quiet area (R4). Therefore, Project construction would have negligible to minor noise effects at local noise receptors. Figures 3.11-5 and 3.11-6 illustrate the construction noise contour maps at Noise Study Area 1 and Noise Study Area 2, respectively. They show the extent of noise generated from the construction equipment, including construction traffic to the noise study areas.

### Operations

Noise receptors at the noise-sensitive properties (R1, R2, and R3) are located more than 16 miles from the Project mine site. Considering that only minimal light vehicle traffic would use the access roads during operations, noise contributions from Project operations would be negligible at these noise receptors.

Table 3.11-16 summarizes the predicted $L_{eq}$ noise levels and converted $L_{50}$ and $L_{10}$ noise levels at the quiet area noise receptor (R4) during the Project operations phase. Table 3.11-17 shows the cumulative noise levels (which are combined with the Project noise levels and baseline noise levels) and the associated noise level change at the quiet area, Site B, noise receptor (R4).

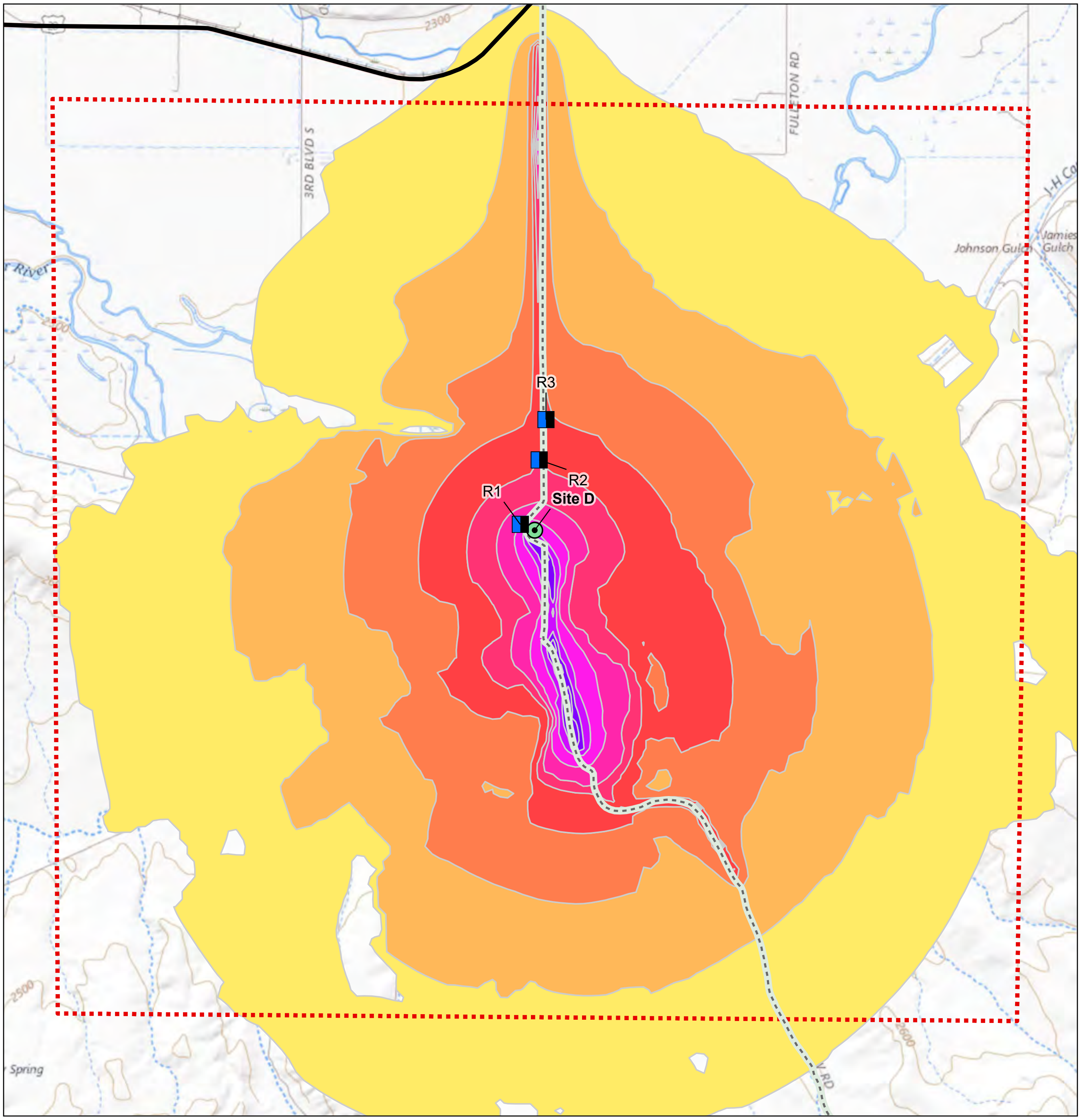
**Table 3.11-16 Predicted Noise Levels for Project Operations Phase**

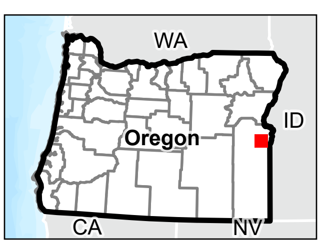
| Study Area and Site ID | Receptor Category | Receptor ID | Predicted Noise Level, $L_{eq}$ (dBA) | Predicted Noise Level, $L_{10}$ (dBA) | Predicted Noise Level, $L_{50}$ (dBA) |
|---|---|---|---|---|---|
| Study Area 2<br>Site B | Quiet area | R4 | 13.2 | 16.2 | 13.2 |

**Table 3.11-17 Project Operations-Phase Cumulative Noise Levels and Associated Noise Level Changes at the Quiet Area, Site B, Receptor (R4)**

| Baseline Noise Level (dBA) | | | | Cumulative Noise Level (dBA) | | | | Changes of Noise Level (dBA) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Daytime | | Nighttime | | Daytime | | Nighttime | | Daytime | | Nighttime | |
| $L_{10}$ | $L_{50}$ | $L_{10}$ | $L_{50}$ | $L_{10}$ | $L_{50}$ | $L_{10}$ | $L_{50}$ | $L_{10}$ | $L_{50}$ | $L_{10}$ | $L_{50}$ |
| 34.0 | 26.7 | 30.2 | 28.1 | 34.1 | 26.9 | 30.4 | 28.2 | +0.1 | +0.2 | +0.2 | +0.1 |

DEQ noise regulations stipulate that noise generated by the Project may not increase by more than 10 dBA above baseline noise levels ($L_{50}$ and $L_{10}$) in any 1 hour. Results in Table 3.11-17 indicate that the increase in noise levels from the Project would be between 0.1 and 0.2 dBA at Site B, the quiet area, which is well below the 10-dBA limit. Therefore, the Project would comply with DEQ noise regulations during the operation phase. Figure 3.11-7 illustrates the operation noise contour map at Noise Study Area 2. It shows the extent of noise generated from the operational equipment to Noise Study Area 2.




Legend

- Receptor
- Ambient Noise Measurement Site Location
- Main Access Road
- Noise Study Area

**Noise Level (dBA)**

- 30-35
- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- >70

0 0.2 0.4 Miles

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Stantec

*Project Location*
Malheur County, OR

Prepared by LL on 2023-11-07
TR by YM on 2023-11-09

*Client/Project*
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

2378001753

*Figure No.*
**3.11-5**

*Title*
**Construction Noise Contour Map - Noise Study Area 1**

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI
**3.** Background: USGS Topo

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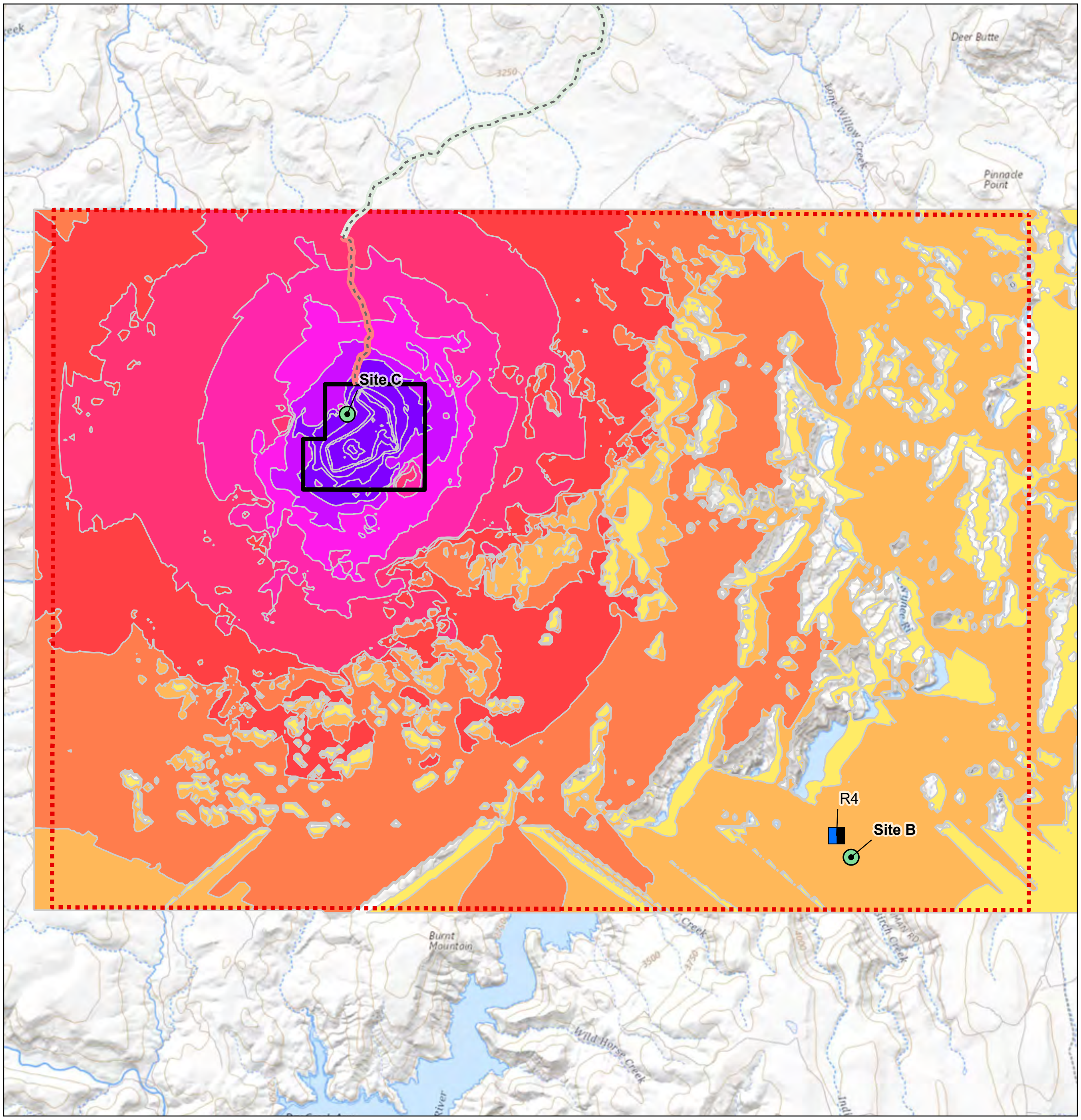


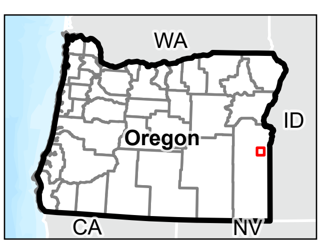


Legend
- Mine and Process Area
- Receptor
- Ambient Noise Measurement Site Location
- Main Access Road
- Project Access Road
- Noise Study Area

**Noise Level (dBA)**
- 10-15
- 15-20
- 20-25
- 25-0
- 30-35
- 35-40
- 40-45
- 45-50
- >50

0 0.55 1.1 Miles
(At original document size of 8.5x11)
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N

Stantec

*Project Location*
Malheur County, OR

Prepared by LL on 2023-11-07
TR by YM on 2023-11-09

*Client/Project*
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

2378001753

*Figure No.*
**3.11-6**

*Title*
**Construction Noise Contour Map - Noise Study Area 2**

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI
**3.** Background: USGS Topo

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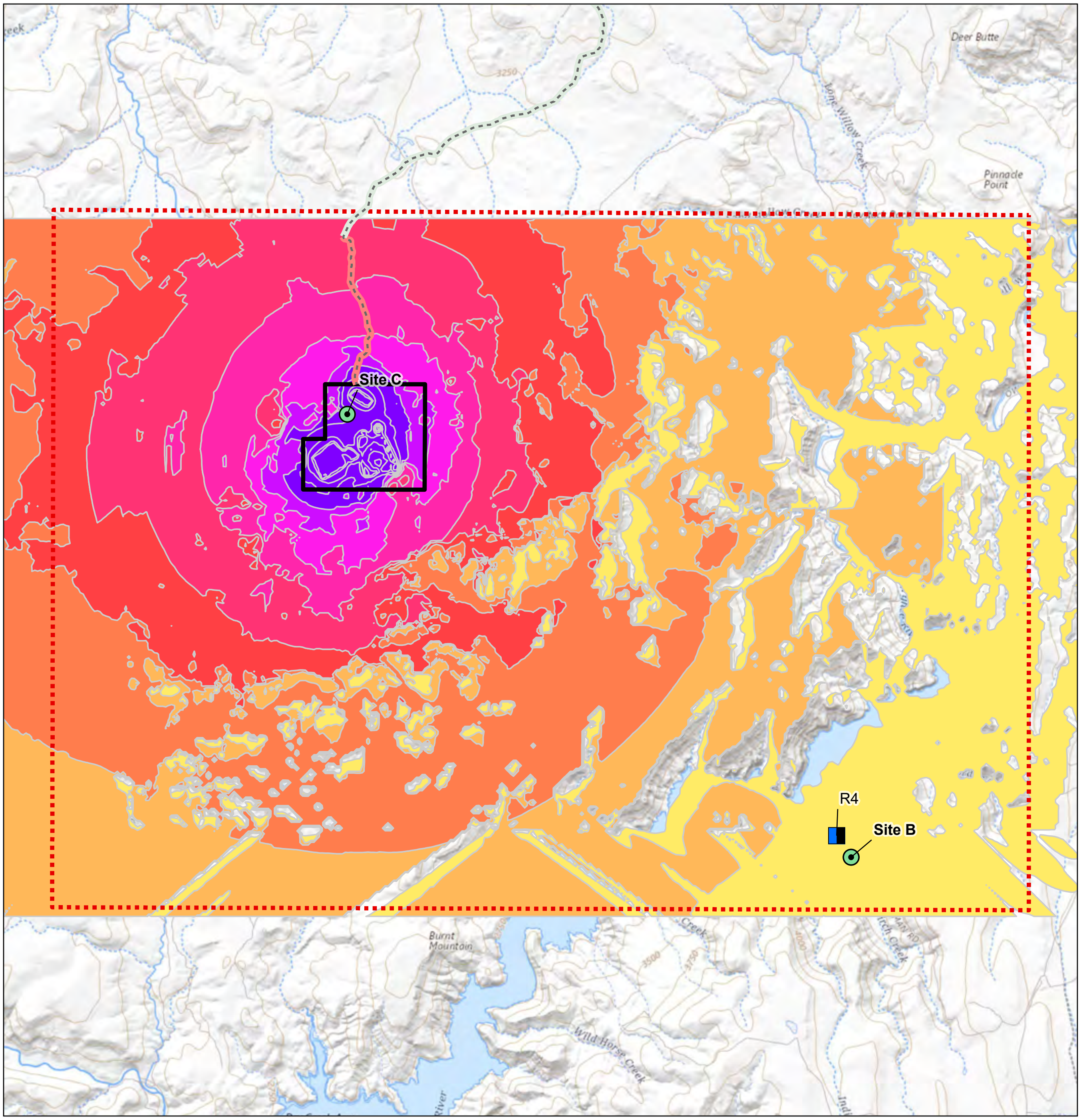


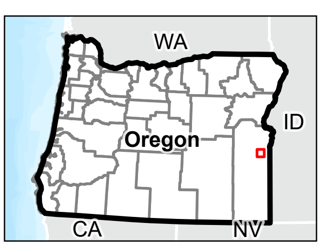


Legend
- Mine and Process Area
- Receptor
- Ambient Noise Measurement Site Location
- Main Access Road
- Project Access Road
- Noise Study Area

**Noise Level (dBA)**
- 10-15
- 15-20
- 20-25
- 25-0
- 30-35
- 35-40
- 40-45
- 45-50
- >50

0 0.55 1.1 Miles
(At original document size of 8.5x11)
1:106,000

N

Stantec

*Project Location*
Malheur County, OR

Prepared by LL on 2023-11-07
TR by YM on 2023-11-09

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.11-7**

*Title*
**Operation Noise Contour Map - Noise Study Area 2**

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI
**3.** Background: USGS Topo

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#### Blast and Vibration

Blast noise is a predominantly low-frequency sound, with most of the audible sound energy below 50 hertz. At a distance, it is usually heard as a low rumble or “popping” sound that lasts 1 or 2 seconds. If the wind is blowing away from the listener, there may be no audible sound. Under some atmospheric conditions, such as low cloud cover, the sound waves are propagated over a great distance, which results in a more noticeable “bang,” referred to as an “air blast.” For ground-borne vibrations, under typical conditions, blasting vibration intensity diminishes with distance at a rate of about one-third of its previous value each time the distance from the vibration source is doubled.

The selected quiet area receptor at Lake Owyhee State Park is located about 6 miles (10 km) away from the Project mine site. Due to this distance, blasting effects are expected to be negligible at this quiet area receptor and would not act cumulatively with other noise and vibration effects from the Project, irrespective of their activity type.

The selected noise-sensitive properties located near the beginning of the Project access road at the intersection of Russell Road and Bishop Road are approximately 16 miles from the mine site. Due to this distance, blasting effects are also expected to be negligible at these noise-sensitive properties.

After construction, blasting and drilling activities would occur underground, which would minimize noise associated with the mine. Ongoing noise would be associated with trucks and vehicles using the haul road and mechanical sounds associated with the process plant.

Vibrations caused by site equipment hitting a pothole or other obstruction would be localized, dropping off rapidly with distance. Road upgrades would improve the roadway near the residences, which would remove potholes and other obstructions that may cause vibration effects. Vibration caused by Project construction and operation equipment would be negligible at Lake Owyhee State Park and at the noise-sensitive properties.

### 3.11.4.7 Alternative A

Alternative A includes the same underground mine and surface facility layout as the Applicant’s proposed Project, with the same proposed surface disturbance (approximately 488 acres) and the same reclamation and closure practices.

Site preparation, construction, and operation of most surface facilities would be the same as in the Applicant’s proposed Project. The use of thiosulfate instead of cyanide would occur within the enclosed process plant with similar noise emissions. Therefore, noise effects from Alternative A are expected to be the same as those for the Applicant’s proposed Project described above.

# 3.12 VISUAL RESOURCES

For the purposes of this analysis, visual resources are defined as the visible physical features on a landscape including topographical and geologic features, water features, vegetation, and built structures.

The visual resources study area consists of the entire Permit Area (the Mine and Process Area and the Access Road Area), adjacent parcels (using a 10-mile buffer) and viewing areas from where Project-related features and construction, operation, and maintenance activities have the potential to be visible (Figure 3.12-1).

## 3.12.1 Regulatory Context

The Oregon chemical process mining rules do not include specific baseline information requirements for visual resources. Visual resources are addressed by Oregon under Statewide Planning Goal 5, which requires all cities and counties to conserve open space and protect natural and scenic resources including wetlands, riparian corridors, and wildlife habitat.

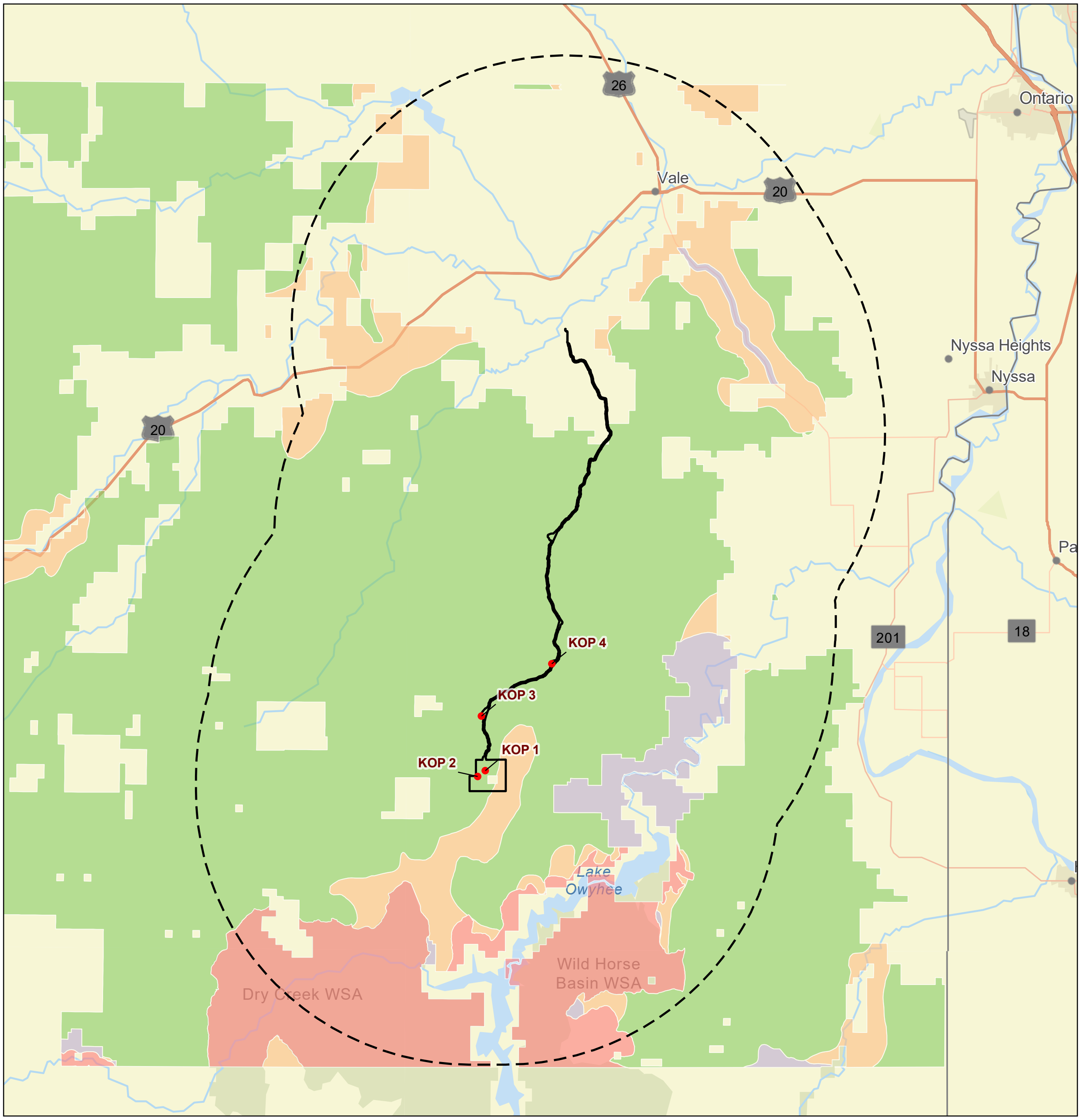
Federal review of the proposed Project for visual resources is being conducted by the BLM and includes use of the BLM Visual Resources Management (VRM) system (BLM 2012). This system provides a method to identify visual resource values, establishes objectives for managing these values, and provides information to evaluate the visual effects of proposed projects on public lands. Since parts of the proposed Project would be located on BLM lands, the VRM system was used to describe existing conditions and assess Project effects in this EE.

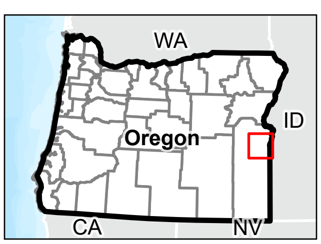
## 3.12.2 Method of Analysis

Existing visual resources, such as landscape features, buildings, and vegetation were identified by the Applicant in the visual resources study area (EM Strategies 2017) as part of a description of the current landscape. The development of Project elements was considered to assess changes in the landscape. Changes in visual resources considered:

- **Landscape Character.** Consideration of past changes to the landscape character such as topography and landforms, vegetation, landscape features (water and exposed rock), and cultural modification or development.
- **Scenic Integrity.** Consideration of the extent to which the existing landscape was previously altered, and, therefore, the extent to which changes to the landscape would not be as readily apparent compared to changes to an unaltered, more natural appearing landscape.

Potential viewing locations of the proposed Project were identified in the Visual Resources Baseline Report (EM Strategies 2017). These are locations from which the Project could be seen by the public, such as roadways, public facilities, public recreation areas, or residences.




Legend

- Permit Area
- Study Area (10-Mi Permit Area Buffer)
- Key Observation Point

**Visual Resources Management (VRM) Classes**

- VRM 1 - Preserve existing character of landscape
- VRM 2 - Largely retain the existing character of the landscape
- VRM 3 - Partially retain the existing character of the landscape
- VRM 4 - Modification of the character of the landscape is allowed

0 1.5 3 Miles
(At original document size of 8.5x11)
1:355,396

N

***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI
3. Background: Esri Streets Basemap

Stantec

*Project Location*
Malheur County, OR

Prepared by LL on 2023-11-15
TR by AU on 2023-11-15

*Client/Project*
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report
2378001753

*Figure No.*
**3.12-1**

*Title*
**Visual Resources Study Area Showing VRM Classes**

\\xdchl-xenprd-cifs\shared_projects\2378\2378001753\03_data\gis_cad\gis\ArcPro\DOGAMI_GrassyMountain_VisualResource\GrassyMountain_VisualResource.aprx Revised: 2024-04-16 By: gmontague

Changes in the existing visual landscape were assessed with regard to viewer sensitivity and viewing distance by considering the visual appearance of Project facilities that would be developed in the study area from these areas. Consideration was given to the potential number of viewers, the duration of views, the context of the viewing setting, viewing distances, and viewer expectations. For example, viewers would be more sensitive to landscape changes to foreground and middleground views than those at a distance.

Lighting impacts from the proposed Project were also considered.

BLM VRM classes are typically assigned to public land units through the use of the visual resource inventory classes in the BLM's land use planning process. One of four visual resource management classes is assigned to each unit of public lands. The specific objectives of each visual resource management class are presented in Table 3.12-1.

**Table 3.12-1 BLM Visual Resource Management Classes**

| VRM Class | Class Description |
|---|---|
| I | To preserve the existing character of the landscape.<br>Allowed Level of Change: This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention. |
| II | To retain the existing character of the landscape.<br>Allowed Level of Change: The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape. |
| III | To partially retain the existing character of the landscape.<br>Allowed Level of Change: The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. |
| IV | To provide for management activities that require major modification of the existing character of the landscape.<br>Allowed Level of Change: The level of change to the characteristic landscape can be high. Management activities may dominate the view and may be the major focus of viewer attention. However, the impact of these activities should be minimized through careful siting, minimal disturbance, and repeating the basic elements of form, line, color, and texture within the existing setting. |

### 3.12.3 Affected Environment

The landscape within the visual resources study area is characterized by gently rolling hills with small, dark-brown rock outcroppings along ridgelines and tan colored soils. Vegetation is desert-rangeland with dominant sagebrush and grasses, and invasive cheatgrass. Built structures include fence lines, stock-watering troughs, and transmission lines. Overall, the landscape has vegetation common to the region, relatively homogenous color composition, and large amounts of open space with few unique topographic features.

BLM VRM Classes III and Class IV occur within the visual resources study area. The majority of the Mine and Process Area and the entirety of the Access Road Area are located within a Class IV landscape, which allows for management activities requiring major modification of the existing character of the landscape. The eastern part of the Process Area is located within a Class III landscape (Figure 3.12-1), in which a moderate level of change to the landscape character is allowed.

Considering the rural setting of the proposed Project and its location within surrounding rolling hills and valleys, public viewing locations are limited. Viewing locations for the proposed Project include those from existing roadways within the study area, from surrounding pastures where cattle ranchers would be present, and from the surrounding hills and valleys that hunters may access. The existing visual resources within the study area for these viewpoints are described as follows:

- **Views from existing access roads**. The roadway itself is gravel/dirt and tan in color, some dark-brown rock outcroppings are visible in the middleground and background, and gently rolling hills are visible in the background along the horizon line. A transmission line runs along a portion of the existing access road, and some fences are visible from locations along the road.
- **Views from surrounding pastures**. The visible landscape from this location is characterized by gently rolling hills, viewed in the middleground and background, with light tan to brown soils in some disturbed areas. Vegetation comprises sagebrush, bunchgrasses, and cheatgrass with sagebrush and rabbitbrush shrubs scattered through the landscape. Some fences and stock-watering troughs are built within the landscape and can be seen from some surrounding pastures.
- **Views from surrounding hills and valleys**. The landscape consists of rolling hills and valleys of varying hues of green grasses and shrubs, with some dark-brown rock outcroppings in the background. Some fences and a transmission line are visible in the distance from some locations in surrounding areas.

The extent of existing artificial lights in the study area is not known. However, since the area is rural, it is assumed that there are few to no light sources located within the area, including a lack of lights along the existing rural roads.

## 3.12.4 Impact Analysis

### 3.12.4.1 No Action Alternative

Under the No Action Alternative, the Project area would remain in its current state, and existing visual resources would not be changed. The landscape character, scenic integrity, and views from surrounding areas would be unchanged. No Project facilities that would use lighting would be constructed so there would be no lighting impacts. Consequently, visual resources under the No Action Alternative would be similar to those described for existing conditions.

### 3.12.4.2 Applicant's Proposed Project

The underground mine would not be visible to viewers from the access road, surrounding rangeland, or the surrounding areas since the majority of the facility would be underground and only the portal would be visible at the surface. After active mining ceases, the mine portal would be closed, plugged, and revegetated post-closure, which would return the area to pre-mining visual conditions, resulting in minor, short-term visual impacts.

The TSF would be developed in stages as embankments are created and tailings are deposited, which would be a large change in the landscape. However, its location within a valley would reduce visual effects from surrounding areas. The TSF would remain at the site permanently, which would alter the landscape and result in a permanent visual impact. However, the TSF would be covered and vegetated as part of the reclamation plan, which would reduce its visual effects and it would ultimately appear as a hill on the landscape.

The roads used for access to the Project would be upgraded, including installing culverts and widening, resulting in temporary visual impacts from such road construction. After construction is completed, these upgraded roads would be visible to travelers using them, including recreationists using Twin Springs Road. Since the road upgrades would look similar to the existing roads within the area, impacts to visual resources would be negligible.

As the majority of the Process Area and the entirety of the Access Road Area are located within a Class IV landscape, allowing major modification of the existing character of the landscape, there would be no conflicts with the BLM Class IV land classification. The eastern part of the Process Area is located within a Class III landscape, allowing a moderate level of change to the landscape character. The perimeter fencing, presence of construction vehicles and equipment, and potential dust emissions would constitute moderate changes. Development of the TSF and installation of the process plant and other buildings could be considered a major landscape change while in operation. However, after reclamation is complete, the TSF would appear as a vegetated hill on the landscape, and the buildings would be removed, resulting in short-term visual impacts.

With regard to viewpoints, changes in views were considered from the existing access road, surrounding pastures, and surrounding hills and valleys, as follows:

- **Changes in views from the existing access road.** During construction, there would be short-term visual contrasts between the landscape and new perimeter fencing, presence of construction vehicles and equipment, and potential dust emissions from existing access roads. During operation, some facilities within the Project area itself may be visible to travelers along Twin Springs Road for short periods of time as they travel through the area. Post-reclamation, buildings and fencing would be removed and disturbed areas regraded and vegetated, which would result in changes to topography but would not strongly contrast with vegetation in the landscape in general, resulting in minor, short-term visual impacts.
- **Changes in views from surrounding pastures.** During construction, there would be short-term visual contrasts between the landscape and new perimeter fencing, presence of construction vehicles and equipment, potential dust emissions, and new mining structures. During operation, some facilities within the Project area itself would be visible to viewers in surrounding pastures, including aboveground buildings, TWRSF, and the TSF. Post-reclamation, buildings and fencing would be removed and disturbed areas regraded and vegetated, which would result in changes to topography but would not strongly contrast with vegetation in the landscape in general, resulting in moderate, short-term visual impacts.
- **Changes in views from surrounding hills and valleys.** The Project area is located in a rural area consisting of gently sloping hills. Consequently, the proposed Project and associated building and structures would not be visible from many locations in surrounding hills and valleys. Post-reclamation,

the revegetated site would not contrast with vegetation in the landscape in general, resulting in minor, short-term visual impacts.

Since the mine is proposed to operate 24 hours per day, 4 days per week and the process plant would operate two shifts per day, 365 days per year, it is assumed that the Project would install lights to accommodate night workers. However, most lighting would be underground or within enclosed buildings during the time of use, reducing the impacts of night-time lighting and glare. Since it is assumed there are few to no light sources in the area, installation of lights for Project operations would constitute a change from current conditions in the immediate area. There are no nearby structures, people, or fixed operations that would be affected by night-lighting. Viewed from a distance, the area may appear as a glow in the distance, resulting in short-term visual impacts—post-reclamation, all lights would be removed along with other aboveground structures. The Project would follow BMPs developed by the BLM for lighting at night (Sullivan et al. 2023), which includes minimizing the use of skyward lighting (unless needed to maintain safe conditions), installing motion detectors or timers and hoods/shields to avoid and minimize skyward lighting on exterior lights (to the extent practical), and directing all lighting only onto the active work areas (Sullivan et al. 2023). These measures would reduce the glow effect during operations.

### 3.12.4.3 Alternative A

Under Alternative A, the same underground mine and surface facilities as the Applicant's proposed Project would be required, resulting in the same visual effects on the landscape. Visual impacts under Alternative A would therefore be approximately the same as for the Applicant's Proposed Project.

# 3.13 RECREATION

For the purposes of this evaluation, recreation resources are defined as publicly accessible facilities and land areas that provide recreational opportunities for wildlife viewing, hunting, fishing, picnicking, biking, all-terrain vehicle use, hiking, rockhounding, and associated outdoor activities.

The recreation resources study area consists of the entire Permit Area (the Mine and Process Area and the Access Road Area) (Figure 3.13-1).

## 3.13.1 Regulatory Context

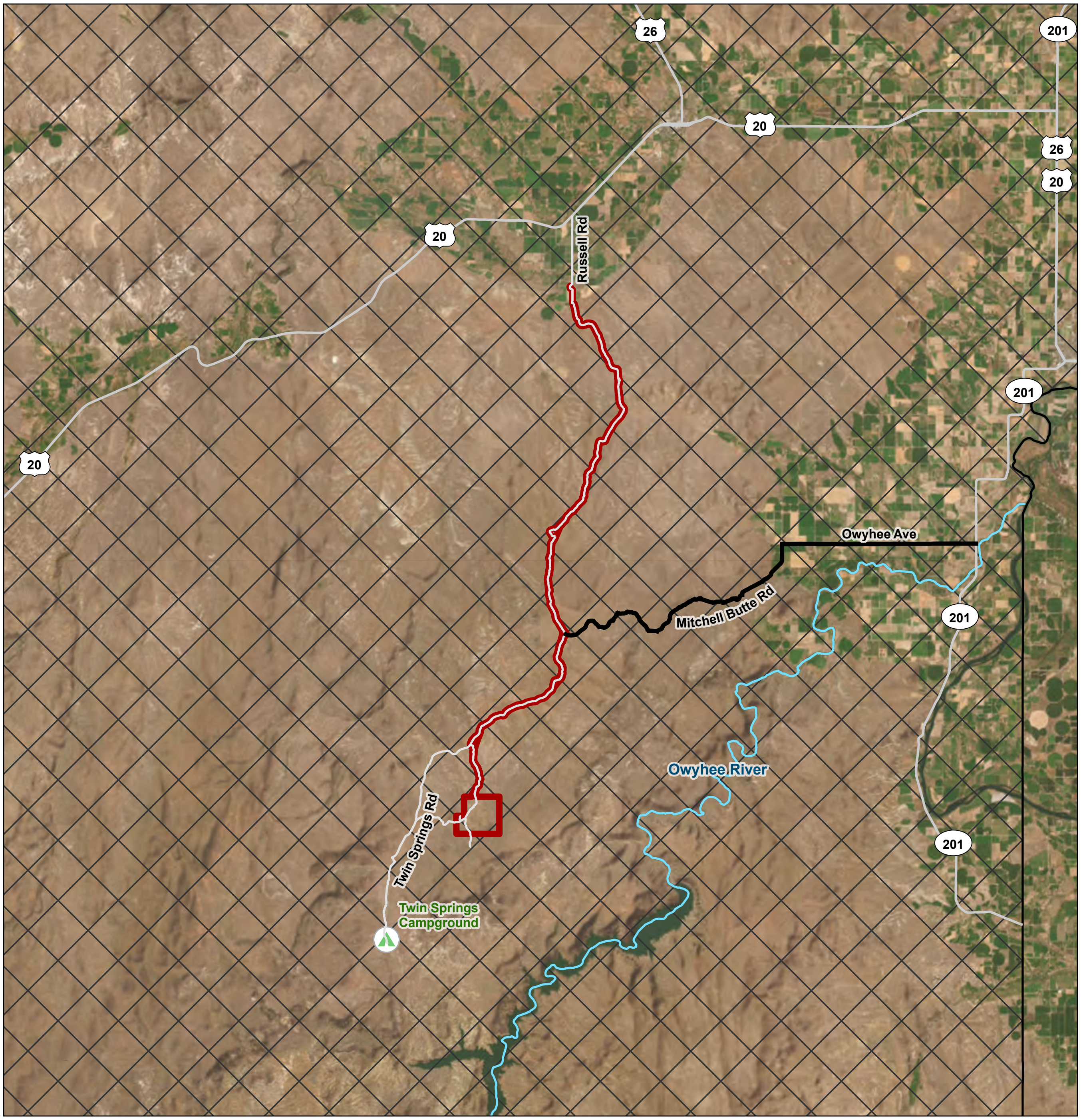
The proposed Project is located within the approximately 3,321-acre Malheur Resource Area, which is managed by the BLM through the SEORMP. The SEORMP establishes guidance for managing land uses and allocations including livestock grazing management, wild horse management, land tenure adjustments, OHV use, wild, scenic and recreation river designations, mineral management, vegetation management, and areas of critical environmental concern. Notably, this plan provides opportunities for exploration and development of energy and mineral resources while protecting other sensitive resources. Development within the Malheur Resource Area requires that "public land be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water, and archaeological values" (BLM 2002). The proposed Project requires BLM review and approval under NEPA, which will take into account whether the requirements of the SEORMP are met.

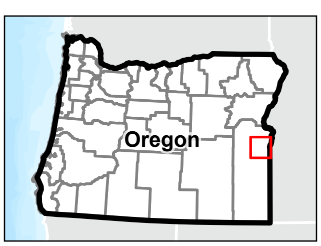
Malheur County–owned land within the recreation resources study area is not subject to recreation regulations since the county addresses only developed recreation facilities such as parks and playgrounds.

The National Wild and Scenic Rivers System was created by Congress in 1968 to preserve certain rivers with outstanding natural, cultural, and recreational values. Each designated river is administered by either a federal or state agency with the goal of protecting and enhancing the values that caused it to be designated. There are no designated wild, scenic, or recreational rivers within the recreation resources study area.

## 3.13.2 Method of Analysis

Project-related impacts on recreation resources generally were assessed qualitatively by considering the impacts caused by construction activities, mining operations, maintenance activities, and post-reclamation land use. The likely direct impacts on recreational use and access were considered, in addition to the potential indirect changes in the existing recreational setting and experience. Compatibility with applicable recreation management plans also was assessed. The Recreation Baseline Report (EM Strategies 2018) prepared by the Applicant was used in the assessment of land ownership and the affected environment for lands and realty.




Legend
- Study Area
- Emergency Access Road
- Existing Roads
- Twin Springs Campground
- BLM Resource Area

0 1.5 3 Miles
(At original document size of 8.5x11)
1:300,000

N

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources:
**3.** Background: USGS Topo

Stantec

*Project Location*
Malheur County, OR

Prepared by LL on 2023-10-19
TR by AU on 2023-10-10

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.13-1**

*Title*
**Recreation Resources Study Area**

\\xdchi1-xenprd-cifs\shared_projects$\2378\237800175303_data\gis_cad\gis\ArcPro\DOGAMI_GrassyMountain_Env_Eval\DOGAMI_GrassyMountain.aprx Revised: 2023-10-20 By: lluz

### 3.13.3 Affected Environment

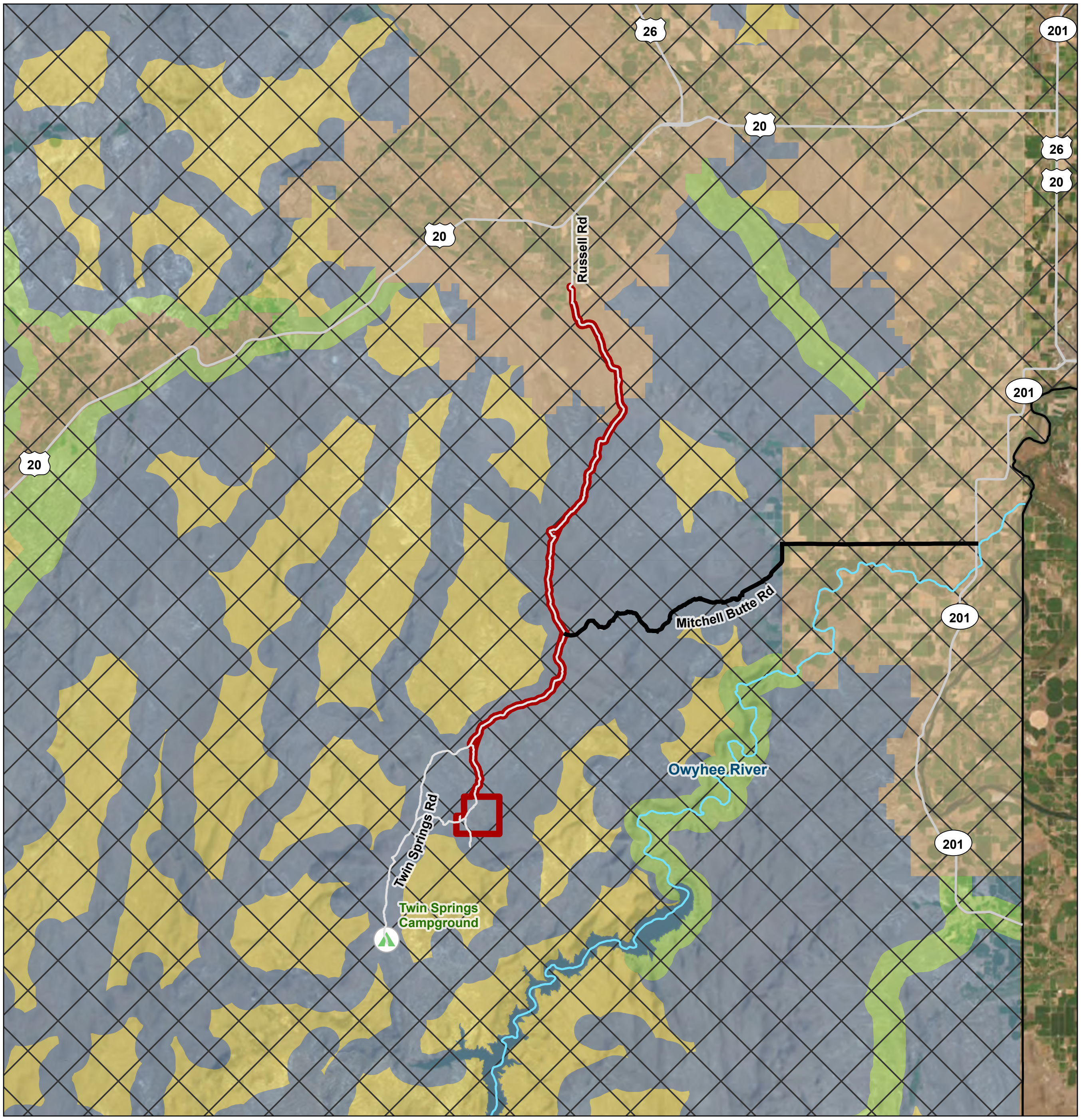
Within the BLM-managed Malheur Resource Area, there are two recreation classifications that occur within the recreation resources study area, as shown in Figure 3.13-2 and summarized below:

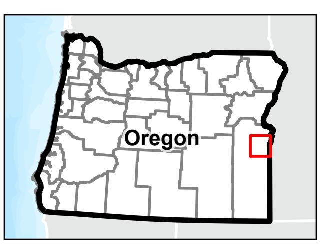
- **Rural.** This is a substantially modified environment. Resource modifications and utilization practices should enhance specific recreation activities. Facilities are designed for use by a large number of people. Motorized use and parking opportunities are available. The probability of user interaction is moderate to high, as is the convenience of sites and opportunities. These factors are generally more important than the physical setting. Wildland challenges and testing of outdoor skills are generally important. Activities may include interpretive services, swimming, bicycling, recreation cabin use, and skiing.
- **Semi-primitive Motorized**. This is a predominately natural or natural-appearing environment of moderate to large size. User interaction is low, but there is evidence of other users. Minimum onsite controls and restrictions may be present. Use of motorized vehicles is permitted. There is a moderate probability of experiencing isolation, closeness to nature, and self-reliance in outdoor skills. Activities may include boating, motor biking, specialized OHV use, mountain climbing, camping, hunting, wildlife viewing, hiking, and picnicking.

The recreation resources study area supports dispersed recreation and an existing road network that provides local access. Recreational opportunities include OHV use, camping, picnicking, hiking, hunting, wildlife viewing, and rockhounding. There are no designated recreational sites within the recreation resources study area. However, there is one designated recreation site located approximately 3 miles from the study area boundary, the Twin Springs Campground, which is a primitive campsite with few amenities. Access to the campground is via Twin Springs Road within the Permit Area (Figure 3.13-1). Twin Springs Road is unpaved (gravel) and passes through undeveloped land that is administered by the BLM, which manages and maintains Twin Springs Road. Twin Springs Road is most popular in the summer for access to the Twin Springs Campground and is also used by hunters during hunting seasons. Winter use by farm and recreational traffic is low on Twin Springs Road. Road reconstruction, widening, and culvert placement are all proposed for the portion of Twin Springs Road within the Permit Area.

There are no designated wild, scenic, or recreational rivers within the recreation resources study area. The closest nationally designated wild, scenic, or recreational river is the Owyhee River, located approximately 31 miles from the proposed Permit Area (Figure 3.13-1).

An emergency access route for the Project has been identified as a portion of Oregon State Route 201, and Malheur County–owned Mitchell Butte Road and Owyhee Avenue. Owyhee Avenue is part of the main access to Owyhee Reservoir, which is a popular destination for recreationists to undertake waterborne activities including fishing, kayaking, and boating. Approximately 4 miles of Owyhee Avenue, a mostly paved county-owned and -maintained road, would be needed for emergency access.




Legend
- Study Area
- Emergency Access Road
- Existing Roads
- Twin Springs Campground
- BLM Resource Area

**Recreation Opportunity Spectrum**
- Rural Natural
- Rural
- Semi-Private Motorized
- Semi-Private Non-Motorized

0 1.5 3 Miles
(At original document size of 8.5x11)
1:300,000

N

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources:
**3.** Background: USGS Topo

Stantec

*Project Location* Prepared by LL on 2023-10-19
TR by AU on 2023-10-10
Malheur County, OR

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**3.13-2**

*Title*
**BLM Recreation Opportunity Spectrum Classifications in the Study Area**



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## 3.13.4 Impact Analysis

### 3.13.4.1 No Action Alternative

Under the No Action Alternative, lands owned by the BLM and Malheur County would continue to be managed according to their respective land management plans, and dispersed recreation, including OHV use, hiking, hunting, wildlife viewing, and rockhounding, would likely continue. Twin Springs Road, which provides access to the Twin Springs Campground, would not be subject to closure for upgrades, widening, or culvert installation, and existing road conditions would continue.

There would be no effects to wild, scenic, or recreational rivers since there are no designated wild, scenic, or recreational rivers within the recreation resources study area.

Overall, impacts to recreation resources would remain the same as under current conditions.

### 3.13.4.2 Applicant's Proposed Project

Under the Applicant's proposed Project, 488 acres of land within the Permit Area would be fenced off and closed to dispersed recreation until the area is reclaimed. In the event that dispersed recreation occurs in the surrounding area, the presence of mine facilities, including the TSF and process plant, may negatively impact the recreation experience due to associated visual and noise effects. However, there are plentiful opportunities for dispersed recreation in the vicinity and beyond that can continue to be used for recreation purposes. After mine closure, the fencing and aboveground facilities would be removed, reclamation of the site would occur, and the site itself would be available again for dispersed recreation. Mine closure is estimated to be a period of approximately 30 years, during which time access restrictions may continue to limit dispersed recreation in some areas such as the covered TSF.

Under the Applicant's proposed Project, the portion of Twin Springs Road within the Permit Area would be reconstructed, widened, and have culverts installed, which would likely require traffic restrictions. It is anticipated that reconstruction of the access road would take approximately 1 year to complete. During this time, intermittent road restrictions during installation of 11 culverts and areas of road realignment could result in access delays for users of the Twin Springs Campground and Owyhee Reservoir, which would have greater effects in the summer season for recreational traffic. Since winter use of Twin Springs Road is low by farm and recreational traffic, these effects would be smaller in the winter. Construction traffic including oversize vehicles and trucks would travel along Twin Springs Road during the 1- to 2-year construction and pre-production period, which could obstruct and/or delay other users of the road. Signage would be installed along the roadways alerting drivers to the presence of heavy construction vehicles to help prevent roadway conflicts.

After completion of the road upgrades and culvert installations, Project vehicle traffic including pick-up trucks, service vehicles, mine staff personal vehicles, and a daily shuttle bus would travel along Twin Springs Road for the life of the mine. The additional traffic on roads used by recreationists is not likely to delay recreation traffic since Project vehicle traffic would not be oversize or move slower than a standard car. Road upgrades on Twin Springs Road would improve the road condition for recreationists accessing the Twin Springs Campground as well as other dispersed recreational opportunities nearby. The Twin Springs Campground consists of five primitive camping sites with restrooms and a dump site (ParkAdvisor.com 2024). Currently, high-clearance vehicles are recommended for visitors to the area and the roads are considered impassible when wet (Oregon Discovery 2024). Improved road conditions may result in higher recreational use of the area with increased traffic along Twin Springs Road as people are able to access the Twin Springs Campground and recreational opportunities more easily. This increased traffic may result in additional vehicle noise, collisions with wildlife, spread of noxious and invasive weeds, and increased litter or dumping.

Approximately 4 miles of Owyhee Avenue would be used for emergency egress from the mine site. In the event of an emergency, Owyhee Avenue may be blocked by a large volume of traffic as personnel and vehicles exit the site, which could block or delay access to Owyhee Reservoir. However, this road would be used on an emergency basis only.

There would be no effects to wild, scenic, or recreational rivers since there are no designated wild, scenic, or recreational rivers within the recreation resources study area.

#### 3.13.4.3 Alternative A

Alternative A includes the same underground mine and surface facility layout as the Applicant’s proposed Project with the same approximately 488 acres of proposed surface disturbance and the same reclamation and closure practices. Therefore, effects to recreation from Alternative A are approximately the same as for the Applicant’s proposed Project described above.

# 4.0 CHAPTER 4: CUMULATIVE IMPACT ANALYSIS

## 4.1 INTRODUCTION

Cumulative impacts are effects from a proposed development that could potentially combine with the impacts of other actions to produce a greater, or cumulative, impact. Per regulations at OAR 632-037-0085, the cumulative impact analysis should include:

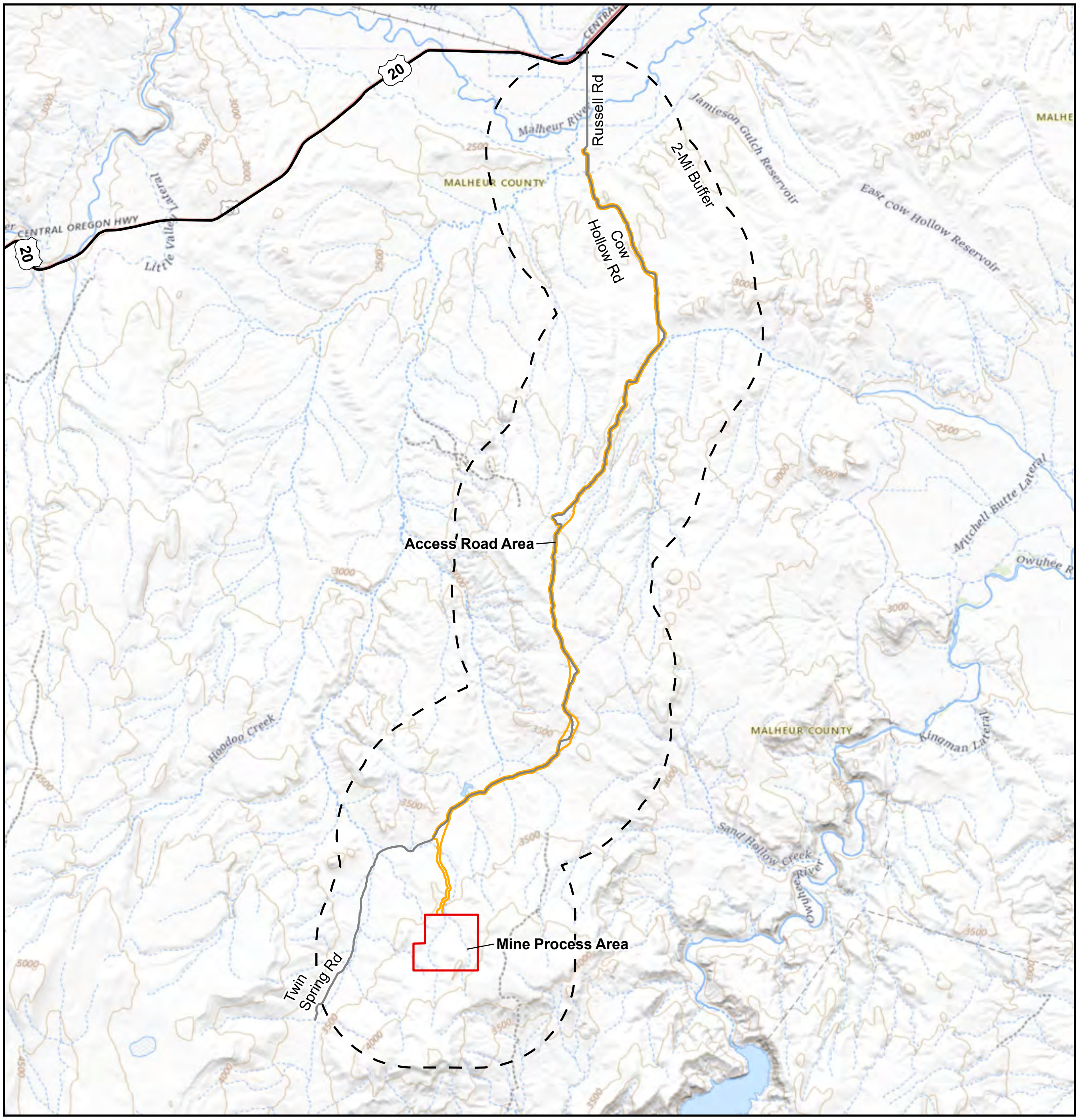
> An identification of past, present and reasonably foreseeable future actions that may occur in the study area, including each of the following types of actions:
>
> - **Similar actions.** Actions that, when viewed with other reasonably foreseeable or proposed actions, have similarities that provide a basis for evaluating their environmental consequences together, such as common timing or geography;
> - **Connected actions**. Actions that cannot or will not proceed unless other actions are taken previously or simultaneously, or that are interdependent parts of a larger action and rely on the larger action for their justification;
> - **Separate actions**. Actions that affect the same environmental resources, including air, vegetation, wildlife and wildlife habitat, soil, and water resources. (OAR 632-037-0085)

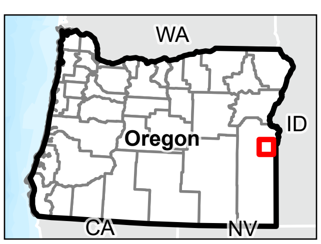
The identification of future projects and actions involves some uncertainty, as does the assessment of the magnitude of impacts now and in the future. The cumulative impacts analysis is designed to explore the range of potential cumulative impacts while recognizing these uncertainties. However, by statute, this analysis will include an assessment of the total cumulative impact on the environment that results from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of the agency or persons that undertake the other action or whether the actions are on private, state, or federal land (ORS 517.979(3)(b)). This cumulative impact analysis provides a broad assessment of potential impacts associated with implementing the proposed Project by considering a wide array of other activities, new and ongoing projects, and programs in the Project area and its vicinity. Cumulative effects are identified to allow decision-makers to be informed if changes may be necessary in existing programs or if future regulatory initiatives may be required.

## 4.2 SCOPE OF CUMULATIVE IMPACT ANALYSIS

The cumulative impact study area is the area in which effects from the proposed Project could combine with effects from other projects and actions to create cumulative impacts. In this case, the area of potential effects includes land within and surrounding the entire Permit Area (the Mine and Process Area and the Access Road Area) plus the roads that would be used to access the Project—US Route 20, Russell Road, and Twin Springs Road. Figure 4-1 shows the cumulative impacts study area.

It is noted that while the Applicant holds gold mining claims nearby, the potential future development of these claims was considered to be outside the scope of this analysis.




Legend

- Cumulative Impact Study Area
- Access Road Area
- Mine Process Area

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Stantec

*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-19
TR by AU on 2023-12-22

*Client/Project* 2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**4-1**

*Title*
**Cumulative Impacts Study Area**

***Notes***
**1.** Coordinate System: NAD 1983 UTM Zone 11N
**2.** Data Sources: DOGAMI
**3.** Background: USGS Topo Maps

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Since the majority of this area is rural with little development, other projects and actions that could occur in this area would likely be limited to mineral exploration, road upgrades, utility projects (e.g., transmission lines, culvert replacements), solar or wind energy installations, residential development, agriculture, livestock grazing, and mining. Since mineral exploration and livestock grazing presently occur in this area, these are included in the affected environment descriptions as part of the existing conditions discussed in Chapter 3. For the remaining actions, applicable information sources were reviewed to identify future projects and actions. This process includes the identification of federal, non-federal, and private actions with possible effects that could be coincident with those of the proposed Project on environmental resources. Similar, connected, and separate actions were all considered in the identification of other projects and actions. Cumulative effects would be possible if the geographic and time boundaries for effects of the proposed Project and other projects and actions overlap.

## 4.3 METHODS

This cumulative impact analysis identifies the environmental resources and proposed actions for which cumulative impacts may occur. Cumulative impacts cannot occur to a resource where there are no impacts identified from the proposed Project, since there would be no impacts to cumulatively add to. So, first impacts from the proposed Grassy Mountain Gold Project were identified and summarized. Next, projects in the cumulative impact study area were identified from review of state and county data sources and websites where notices of proposed projects and actions are posted. Research on potential projects for the cumulative impacts analysis included the following sources:

- Review of other proposed mining or exploration permits from the DOGAMI Mining and Exploration Permit Database (DOGAMI 2023);
- Review of ODOT projects that are ongoing or proposed (ODOT 2023a);
- Review of the Malheur County Planning Department database (Malheur County 2023);
- Conversation with Eric Evans, Malheur County Planning Director (Evans, pers. comm., 2023);
- BLM National NEPA Register (BLM 2023a);
- BLM Oregon and Washington GIS database for mining and exploration (BLM 2016);
- BLM SEORMP (BLM 2002) and its amendment (BLM 2023b);
- Portland General Electric website (PGE 2023);
- Idaho Power website (Idaho Power 2023a);
- DarkSky Oregon and DarkSky International websites (DarkSky Oregon 2024; DarkSky International 2024); and
- Residential development websites including those of Intermountain Realty Inc. (2023), Realtor.com (2023), and Redfin (2023).

Finally, the environmental resources that could potentially be affected by such future projects and actions in the cumulative impact study area were identified. The environmental resources that have potential impacts from both the proposed Project and future projects and actions were assessed to determine the combined, or cumulative, effects. This is typically a qualitative analysis since the level of information on planned projects can oftentimes be rather limited. Nevertheless, the results of the assessment are useful in understanding the potential cumulative impacts from a proposed project in combination with other actions in the area.

## 4.4 IDENTIFICATION OF CUMULATIVE ACTIONS AND PROJECTS

This cumulative impact analysis focuses on the actions from which cumulative impacts may occur and the resources that may be affected. In order to assess such effects, it is first necessary to identify the impacts from the proposed Project and determine if cumulative impacts could occur to each resource. These impacts are shown in Table 4-1.

**Table 4-1 Impacts from the Proposed Grassy Mountain Gold Project**

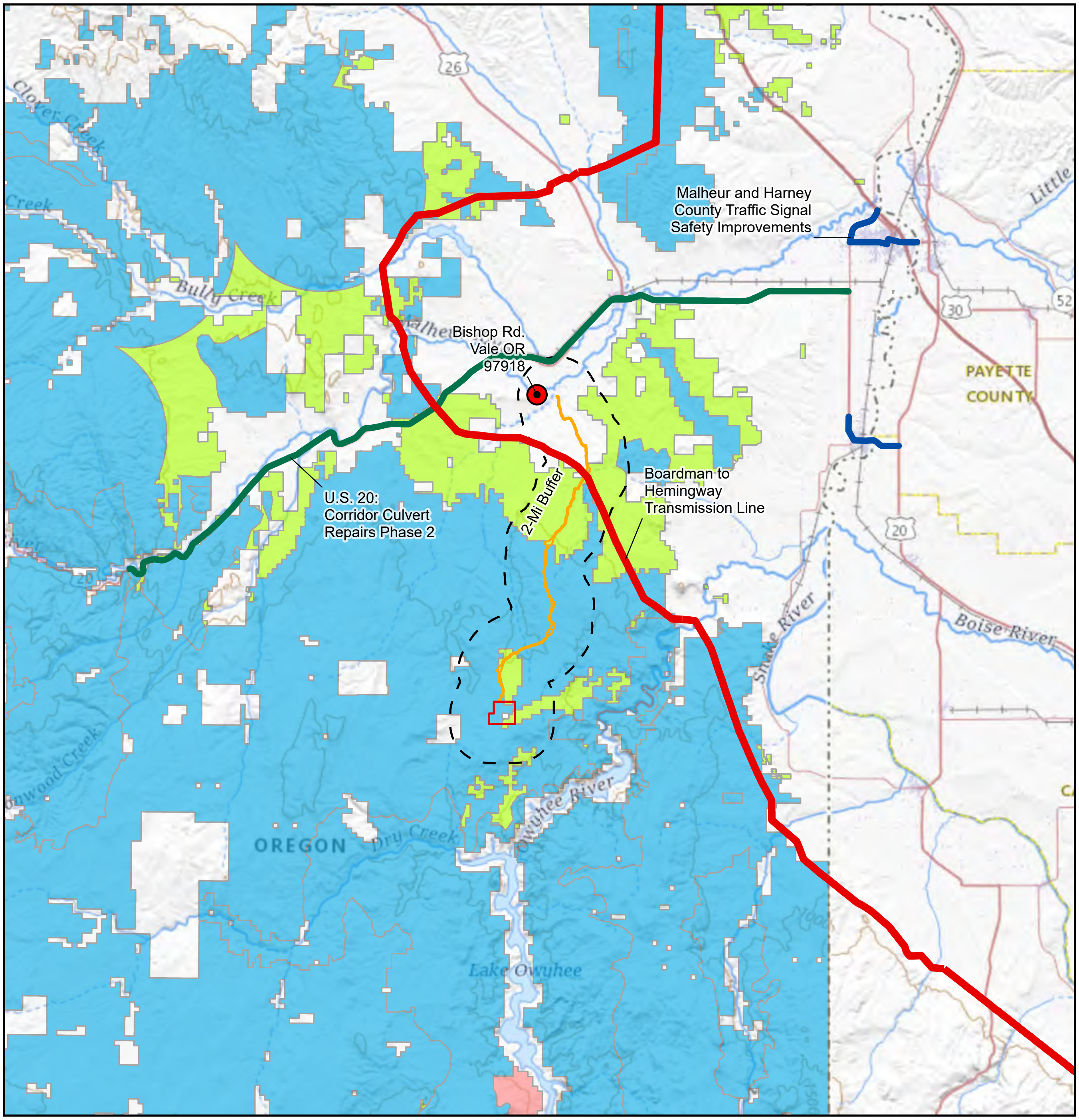
| Resource | Impacts from the Proposed Grassy Mountain Gold Project | Cumulative Impact Potential |
|---|---|---|
| Geology and Minerals | Permanent extraction and consumption or temporary relocation of approximately 3.4 million tons of ore and waste rock, including approximately 362,000 ounces of gold and 517,000 ounces of silver. Permanent and temporary relocation/mobilization of metals contained in extracted ore and waste rock. | Gold and silver formations extend outside the Project area boundary, so potential reduction of these resources by other new mining operations could occur if they exist. |
| Soils | Changes in the physical and chemical properties of soils, decrease in the quality of stockpiled topsoil, movement of soils onsite through erosion, and potential contamination from spills or leaks of chemicals. | Localized effects would be within the Permit Area, so other actions occurring outside of this area would not be cumulative. |
| Water Resources | Water drawdown greater than 10 feet within 0.5 mile of pumping areas; localized groundwater drawdown extending toward springs and stock tanks approximately 1 to 1.5 miles from the underground mine; changes in surface water drainage patterns by construction of the TSF; and waste rock and ore that generate acid and leach metals including arsenic, selenium, and other constituents under long-term weathering conditions contained within lined facilities or mixed with cement in underground mine. | Other projects and actions that draw down water could cumulatively affect groundwater resources within 1.5 miles of the Permit Area. |
| Vegetation and Wetlands | Moderate long-term negative effects to native vegetation habitats including big sagebrush. | Other projects that affect sagebrush habitats, state-listed Mulford’s milkvetch, or wetlands in the area could have cumulative impacts. |

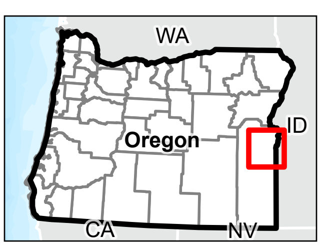
| Resource | Impacts from the Proposed Grassy Mountain Gold Project | Cumulative Impact Potential |
|---|---|---|
| | One state-listed endangered plant species, Mulford's milkvetch, occurs at two sites near the access road proposed to be widened, requiring a permit or a consultation with staff at the ODA.<br>Two wetlands within the Access Road Area, totaling 0.29 acre, may be avoided or filled with a permit from the DSL. | |
| Wildlife and Special-Status Species | Effects to ODFW Habitat Categories 2 through 6 and low-density greater sage-grouse habitat requiring avoidance or mitigation. Wildlife Mitigation Plan and compensatory mitigation required to offset effects.<br>Indirect and direct effects to sage-grouse and mule deer habitat offset by compensatory mitigation.<br>Injury or mortality of animals through direct contact with construction equipment and vehicles during construction.<br>Potential exposure of wildlife and special-status raptors to toxic metals and low levels of cyanide in the TSF supernatant pond. Fencing and deterrents aimed at preventing access to the TSF.<br>Anthropogenic disturbance, noise, and light pollution impacts to bats and some bird species including greater sage-grouse. | Other projects that affect wildlife habitat, greater sage-grouse habitat, mule deer habitat, and/or state-listed species could have cumulative impacts. |
| Non-Native and Invasive Plants | Spread of existing non-native and invasive plant species could occur as soils are disturbed and as vehicles and equipment move within and outside of the Permit Area. The Noxious Weed Monitoring and Control Plan would minimize these effects. | Other projects and actions that use the same roadways as the proposed Project may cumulatively spread invasive species. Airborne non-native and invasive seed transport may cumulatively occur across geographically overlapping projects. |
| Cultural Resources | Potential direct adverse effects to 10 cultural sites that are currently recommended as eligible or unevaluated for listing on the NRHP under Criterion D. However, consultation is ongoing to avoid or mitigate effects. | Other projects and actions in the general area that affect cultural resources could result in cumulative impacts. However, typically avoidance or mitigation for resources is required to prevent or reduce such effects. |

| Resource | Impacts from the Proposed Grassy Mountain Gold Project | Cumulative Impact Potential |
|---|---|---|
| Rangeland Management | Rangeland removed from grazing; injury or mortality of grazing livestock through direct contact with vehicles on roadways; and possible reduction in flow at livestock watering locations near production wells. | Other projects and actions in the general area that remove rangeland from use or that draw down water could result in cumulative impacts. |
| Lands and Realty | Approximately 488 acres of land inside the Permit Area would change from livestock grazing and dispersed recreation to mining use for approximately 14 years. | Other projects and actions in the general area that propose a change in land use or zoning could result in cumulative impacts. However, proposed changes in land use or zoning outside of the Permit Area would require independent review and decision by land managers. |
| Air Quality and GHG | Emissions from the proposed Project would be in compliance with state air quality regulations and would produce approximately the same amount of GHG emissions (6,313 tpy of $CO_2e$) as the energy used by 722 households and 1,274 gasoline passenger cars driven for a year. | Other projects and actions using vehicles and equipment with emissions could result in cumulative impacts. However, such projects would be required to assess emissions and comply with applicable regulations. |
| Noise | Project construction and operations would have negligible to minor noise effects at local noise receptors and comply with DEQ noise regulations. Blasting and vibration effects are also expected to be negligible at local noise receptors and noise-sensitive properties. | Other projects and actions that occur along access roads could be cumulative, depending on the type of activity proposed with regard to noise. |
| Visual Resources | During construction and operations, visual effects from facility development (e.g., the TSF and aboveground buildings), new perimeter fencing, presence of construction vehicles and equipment, and potential dust emission from existing access roads would occur to travelers along Twin Springs Road from surrounding pastures. Post-reclamation, the vegetated TSF would appear as a hill on the landscape. Project lighting may be seen as a glow in the distance. | Other projects and actions that occur along access roads could result in cumulative impacts, depending on the type of activity proposed with regard to visual effects. Other projects and actions that install lighting in the general area may cause cumulative effects from additional light in the night sky. |
| Recreation | Approximately 488 acres of land within the Permit Area would be fenced off and closed to dispersed recreation for the 14-year expected life of the mine. Traffic restrictions during road upgrades would impact users of | Other projects and actions along the access roads and emergency egress road that involve large volumes of traffic, slow or heavy construction vehicles, or road |

| Resource | Impacts from the Proposed Grassy Mountain Gold Project | Cumulative Impact Potential |
|---|---|---|
| | these roads when accessing recreation areas (e.g., the Twin Springs Campground). During an emergency, access via the emergency egress road may be delayed due to a large volume of traffic as personnel and vehicles exit the site. After mine closure and reclamation, the majority of the site would be available for dispersed recreation. Improved road conditions may result in higher recreational use of the area, with increased traffic along Twin Springs Road as people are able to access the Twin Springs Campground and other nearby recreational opportunities more easily. | closures could result in cumulative impacts. |

Next, potential future projects and actions in the cumulative impact study area were identified, focusing on the potential for cumulative effects, so projects and actions were investigated primarily for roadways and developments close to the site (Figure 4-2). The data sources listed in Section 4.3 were reviewed and the results presented in Table 4-2, along with an evaluation of the potential cumulative effects from such projects.




**Legend**

- Cumulative Impact Study Area
- Access Road Area
- Mine Process Area

**Identified Project**

- Malheur and Harney County Traffic Signal Safety Improvements
- U.S. 20: Corridor Culvert Repairs Phase 2
- Boardman to Hemingway Transmission Line
- Property for Sale

**BLM SEORMP Amendment-OHV Area Designations**

- Closed
- Limited to Existing
- Open

0 2.5 5 Miles
(At original document size of 8.5x11)
1:500,000

N

***Notes***
1. Coordinate System: NAD 1983 UTM Zone 11N
2. Data Sources: DOGAMI, BLM
3. Background: USGS Topo Maps

Stantec

*Project Location*
Malheur County, OR.

Prepared by LL on 2023-12-19
TR by AU on 2023-12-22

*Client/Project*
2378001753
DOGAMI
Grassy Mountain Gold Project
Environmental Evaluation Report

*Figure No.*
**4-2**

*Title*
**Projects and Actions Identified within the Study Area**

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### Table 4-2 Projects and Actions Identified in Close Proximity to the Proposed Action

| Information Source | Identified Projects and Actions | Potential Cumulative Effects |
|---|---|---|
| DOGAMI | No permits for exploration or extraction in Malheur County. The closest mineral exploration actions are approximately 30 miles north in Baker County. | None. There are no exploration or mining projects in proximity to the Grassy Mountain Gold Project. |
| ODOT | Installation of traffic signals at the intersection of US Route 26/US Route 20 in Nyssa and Oregon State Route 201, Southwest Fourth Avenue, and Idaho Avenue in Ontario. Scheduled for construction in 2024 (Figure 4-2). | None likely. These traffic signal safety improvements would not occur on the same roads and would be complete prior to construction of the Grassy Mountain Gold Project. |
| ODOT | US Route 20 Corridor Culvert Repairs (Phase 2): Repair of culverts along the 150-mile corridor from Vale to Riley that are in critical or poor condition to extend the life of the structures (ODOT 2023b). Scheduled for construction in 2024 (Figure 4-2). | None likely. Culvert repairs would occur in select areas along US Route 20 beginning in 2024. This project may be complete prior to the start of construction of the Grassy Mountain Gold Project. However, if delays occur, there may be some minor traffic interruptions to vehicles using the highway to access Grassy Mountain. There would be no cumulative impacts to travelers along US Route 20 from both projects. |
| Malheur County Planning Department | No projects identified. | None. |
| BLM National NEPA Register | NW Malheur Mineral Material Sites Project: Development of up to 7 mineral material sites to support restoration, fuel break construction and maintenance, fire suppression, and public safety and to conduct associated road restoration (BLM 2023c). | None likely. This project is approximately 21 miles away and roads to be upgraded are different than those for the proposed Project. Some habitat loss may occur, but Project design features for greater sage-grouse habitat would benefit many wildlife species.<br>Project activities would not combine to create adverse cumulative impacts. |
| BLM National NEPA Register | Denton Gold Danser Plan and Occupancy Project: Expansion of exploration beyond 5 acres and 1,000-ton limits, increasing impacts to surface disturbance. Project is currently under NEPA review by the BLM (BLM 2023d). | None. This project is approximately 45 miles north with existing mining and exploration occurring. Expansion would affect approximately 100 acres of land within paleo riverbeds and would not disturb the same habitats as the Grassy Mountain Gold Project. |

| Information Source | Identified Projects and Actions | Potential Cumulative Effects |
|---|---|---|
| BLM GIS Database (Oregon and Washington) | No projects listed within Malheur County. | None. |
| BLM SEORMP Amendment | Protection of lands with wilderness characteristics: The approved SEORMP Amendment prioritizes the protection of 33 land units identified by the BLM as having wilderness characteristics. Management of these areas would emphasize the maintenance and/or enhancement of the wilderness resource (BLM 2023b). | None likely. The closest units prioritized for protection of wilderness are approximately 10 miles southwest of the proposed Project.<br>The addition of wilderness protection outside the Project area combined with the proposed Project would not create adverse cumulative impacts. |
| BLM SEORMP Amendment | OHV Area Designations: The approved SEORMP Amendment designates two areas totaling 40,368 acres near the city of Vale, Oregon, to be managed as “open” to OHV use; 319,501 acres currently classified as “open” to be designated as “limited to existing routes”; and 15,829 acres “closed” to OHV use that will remain closed (BLM 2023b). | Potential to affect. The combination of improved road conditions due to the proposed Project and reduced open OHV use areas may result in increased recreation and OHV use in and around the Permit Area. Potential minor cumulative impacts to resources in this area including soils, vegetation, wetlands, wildlife, invasive plants, air quality, noise, visual resources, and recreation could occur. |
| Portland General Electric | No projects identified in Malheur County | None. |
| Idaho Power (Malheur County) | Proposed Boardman to Hemingway Transmission Line (Idaho Power 2023b): A 300-mile, 500-kV transmission line that would travel through Malheur County (Figure 4-2). | Potential to affect. The proposed transmission line would cross the Project’s Access Road Area at the intersection of Twin Springs Road and Cow Hollow Road. Potential minor cumulative impacts to resources in this area including soils, vegetation, wetlands, wildlife, invasive plants, air quality, noise, and visual resources would occur. |
| DarkSky Oregon and DarkSky International | Oregon Outback International Dark Sky Sanctuary: The first phase of the sanctuary has been certified by DarkSky International and includes 2.5 million acres in Lake County. Future phases include expanding certification eastward into Harney and Malheur Counties for a total dark sky area of 11.4 million acres (DarkSky Oregon 2024). | Potential to affect. If the future expansion into Malheur County includes Grassy Mountain and the Project area, outdoor night-time lighting at the Project will need to meet International Dark Sky Sanctuary Program Guidelines set forth by DarkSky International. Cumulative effects of dark skies and reduced light pollution include increased human and wildlife well-being, |

| Information Source | Identified Projects and Actions | Potential Cumulative Effects |
|---|---|---|
| | | reduced energy use, and preservation of natural night sky heritage (DarkSky International 2024). |
| Intermountain Realty Inc. | Intermountain Realty lists 10 properties for sale within Malheur County; only 1 is residential. The nearest property listed is approximately 60 miles north, near Baker City. | None. No development proposed at this property for sale. |
| Realtor.com | 1 property for sale: an approximately 37-acre vacant lot located on Bishop Road, approximately 1 mile west of the Permit Area (Figure 4-2). | None likely. This is a small acreage on land zoned for development of a residence about a mile from the proposed access road improvements. Localized, small volume of vehicles/equipment would be used to construct a home for a short period of time. |
| Redfin | 2 homes for sale, both more than 15 miles east from the Permit Area. | None. No development proposed at these home sites. |

## 4.5 CUMULATIVE IMPACTS ASSESSMENT

Projects identified in the cumulative impact study area include ongoing dispersed recreation, grazing, and mineral exploration. These are similar to past and ongoing actions in the cumulative impact study area. These past and ongoing actions are included in the baseline, or existing conditions, described in Chapter 3.

As shown in Table 4-2, there are three identified projects/actions that would impact some of the same resources as the proposed Grassy Mountain Gold Project within the Access Road Area: Idaho Power's proposed Boardman to Hemingway Transmission Line, the BLM's SEORMP Amendment OHV Area Designations, and the future expansion of the Oregon Outback International Dark Sky Sanctuary.

The proposed Boardman to Hemingway Transmission Line would overlap with the Grassy Mountain Gold Project at the intersection of Twin Springs Road and Cow Hollow Road. In the event that construction of the proposed Boardman to Hemingway Transmission Line were to occur at the same time as road widening and reconstruction of access roads for the Grassy Mountain Gold Project, there would be cumulative impacts to resources in this area including combined effects of both projects to soils, vegetation, wildlife, invasive plants, air quality, noise, and visual resources. However, construction of the Boardman to Hemingway Transmission Line is expected to begin in 2024 and be complete by 2026, which is prior to the estimated start of construction of the Grassy Mountain Gold Project. If the transmission line is completed on schedule, there may be minor cumulative impacts from both projects in the Access Road Area including minor temporary effects to soils, vegetation, and invasive species from earth-moving and general construction activity and permanent effects to visual resources from the presence of a new transmission line and wider road.

The BLM approved an amendment to the 2002 SEORMP, which went into effect on February 26, 2024. The amendment includes travel management objectives for OHV area designations (open, limited, and closed) and would designate approximately 319,501 acres that are currently open to motorized use as limited to existing roads and primitive routes. A significant amount of land previously open to OHV use will be limited to existing routes, which may increase OHV activity in areas with open access for recreationists seeking open access over limited access. Most of the remaining area open to OHV use is in proximity to the proposed Project, east of the access road. The combination of improved access roads due to the proposed Project and reduced open OHV use areas may result in increased recreation and OHV use in and around the Permit Area. This may lead to minor cumulative impacts to soils, vegetation, wildlife, invasive plants, air quality, noise, visual resources, and recreation if there is increased OHV activity in the Access Road Area.

The Oregon Outback International Dark Sky Sanctuary is an area located in southeastern Oregon that is aimed at preserving Oregon’s dark skies and diminishing light pollution for both human and wildlife well-being (DarkSky Oregon 2024). A Lighting Management Plan that conforms with all local, regional, and national laws is required to become a Dark Sky Sanctuary (DarkSky International 2023). The area must show commitment to the dark skies and quality outdoor lighting with at least two-thirds of the outdoor lighting fixtures in the area conforming to the Lighting Management Plan (DarkSky International 2023). Outdoor lighting requirements outlined in the Lighting Management Plan include:

- Using outdoor lighting at night only when needed and appropriate for the task of ensuring public safety;
- Fully shielding all lighting fixtures to target light direction and restrict the amount of upward-directed light;
- Using controls like timers and motion detectors to avoid over-lighting;
- Choosing lighting color that minimizes the amount of short-wavelength light at night; and
- Not using illuminated signs except for navigational purposes (DarkSky International 2023).

The first phase of the Oregon Outback International Dark Sky Sanctuary has been certified by DarkSky International. It includes 2.5 million acres in Lake County and currently has some of the darkest skies in the world (Reagan 2024). Future phases of the Oregon Outback Dark Sky Sanctuary include expanding certification eastward into Harney and Malheur Counties to create a total dark sky area of 11.4 million acres (DarkSky Oregon 2024). The proposed expansion of the Oregon Outback International Dark Sky Sanctuary into Malheur County may include Grassy Mountain and the Project area. The Applicant already proposes to minimize impacts of night-time lighting by following BMPs developed by the BLM (Sullivan et al. 2023). This includes avoiding skyward lighting except when needed for safety, using shields on outdoor lights, utilizing motion detectors, timers, and dimmers, and directing light only onto the active work areas (EM Strategies and Mason, Bruce & Girard 2023). Additional measures the Applicant should incorporate include using lighting that emits narrow-spectrum, long-wavelength light with colors of amber, orange, or red whenever feasible and avoiding the use of illuminated signs when possible (Sullivan et al. 2023). With these measures in place, there would not likely be a conflict between the proposed Project and potential future phases of the Oregon Outback International Dark Sky Sanctuary within the Project area. Overall, cumulative impacts from the Grassy Mountain Gold Project in combination with the identified projects and actions in the study area would be minor.

# 5.0 CHAPTER 5: MITIGATION

## 5.1 INTRODUCTION

Mitigation measures are actions that can be taken to avoid, minimize, rectify, reduce, eliminate, or compensate for adverse effects on the environment. There are different types of mitigation measures that can be implemented to address Project effects. Under NEPA, mitigation is defined in 40 CFR 1508.20 as:

1. Avoiding the impact altogether by eliminating the action or parts of the action;
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
3. Rectifying the impact by repairing, rehabilitating, or restoring the adverse effect on the environment;
4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and
5. Compensating for the impact by replacing or providing substitute resources or environments.

In Oregon, mining operations are required to implement protection measures for fish and wildlife species that are consistent with policies of the ODFW. Per ORS 517.956, onsite and offsite mitigation must ensure that there is no overall net loss of habitat value, and the mitigation must be consistent with the goals and standards of the ODFW Chemical Process Mining Consolidated Application and Permit Review Standards (OAR 635-420) and ODFW's Fish and Wildlife Habitat Mitigation Policy (OAR 635-415). Mitigation must also be consistent with the population and habitat management objectives of the Greater Sage Grouse Conservation Assessment and Strategy for Oregon (Hagen 2011), which implements habitat protection through a mitigation hierarchy and the establishment of a mitigation standard for impacts in sage-grouse habitat through the Greater Sage-Grouse Conservation Strategy for Oregon (OAR 635-140).

This EE considers numerous measures to avoid, minimize, rectify, reduce, eliminate, or compensate for impacts on environmental resources from the proposed Project including:

- Environmental performance standards required under the Oregon chemical process mining permitting process;
- Mitigation measures described in the avoidance and minimization plans proposed by the Applicant;
- Measures identified to further reduce effects to environmental resources, summarized from the measures described in the Chapter 3 impact analyses discussions;
- Compensatory mitigation requirements; and
- Durability and financial assurances.

Some Applicant-proposed avoidance and minimization measures and plans are required under federal, state, and local permits and others are measures that the Applicant has incorporated into the design and operation plans of the proposed Project to aid in reducing Project effects. While these Applicant-proposed avoidance and minimization actions and plans are considered to be part of the proposed Project, they are identified in this chapter to provide a complete summary of all measures that have been considered in the design and development of the Project.

In addition, compensatory mitigation is identified to offset remaining unavoidable Project effects after all other mitigation actions have been evaluated, often at a separate location. DOGAMI defines compensatory mitigation in OAR 632-037-0010 (18) as “Compensating for the impact by replacing or providing comparable substitute resources or environments.” This chapter addresses the entire mitigation sequencing, including compensatory mitigation.

The potential impacts of Project actions after accounting for all Applicant-proposed avoidance and minimization measures were reviewed and additional measures identified for consideration to further reduce effects. These are described in Chapters 2 and 3 and are summarized in this chapter.

Lastly, durability and financial assurances are identified, which are long-term protection instruments and funds set aside to be used by regulatory agencies in the event that a project is abandoned prior to complete mitigation and reclamation actions. Per ORS 517-987, DOGAMI may require security or an annuity for post-reclamation monitoring and care to be paid before the final bond release which would be sufficient to cover long-term site care and monitoring needs. Under this regulation, DOGAMI would determine the amount of the proposed security or annuity and distribute a proposal to all permitting and cooperating agencies.

## 5.2 ENVIRONMENTAL PERFORMANCE STANDARDS

Environmental performance standards are part of Oregon’s chemical process mining permitting requirements (ORS 517.956; OAR 632-037; OAR 340-043; and OAR 635-420), which guide agency reviews of a proposed project. The intent is to minimize environmental damage through use of best available, practicable, and necessary technology and by providing protection measures that are consistent with polices of the permitting agencies. There are three types of environmental performance standards—general environmental performance standards that would apply to most resources, fish and wildlife performance standards aimed to reduce effects to fish and wildlife and their habitats, and reclamation performance standards to ensure that after mining ceases, the site is restored appropriately.

Environmental performance standards include, but are not limited to:

- Use of “best available, practicable, and necessary technology” to minimize environmental damage and ensure compliance with environmental standards;
- Requiring liners, leak detection, and leak collection systems to protect groundwater;
- Ensuring air emissions, including dust, are properly controlled;
- Ensuring there is no discharge to streams, rivers, or groundwater;
- Treatment of tailings to reduce toxins before discharge;
- Long-term environmental monitoring at mine closure for as long as 30 years;
- Proper management and storage of all chemicals, including petroleum products; and
- Routine environmental monitoring and reporting.

As described under OAR 632-037-0125, and OAR 635-420-0030 fish and wildlife protection standards include, but are not limited to:

- Maintaining an objective of zero wildlife mortality;
- Covering or containing all chemical processing solutions;
- Covering and fencing associated wastewaters or maintaining them in a condition that is not harmful to wildlife;
- Ensuring no overall net loss of habitat value;
- Ensuring no loss of existing critical habitat for state or federal listed threatened or endangered species; and
- Wildlife monitoring and mortality reporting.

Reclamation performance standards include, but are not limited to (OAR 632-037-0130):

- Ensuring protection of human health and safety (and also livestock, fish, and wildlife);
- Ensuring environmental protection;
- Requiring certification to the ODFW and the ODA of a self-sustaining ecosystem comparable to undamaged ecosystems in the area;
- Including backfilling or partial backfilling on a case-by-case basis;
- Ensuring adequate, long-term environmental monitoring; and
- Providing adequate financial security.

These standards are addressed in the Applicant's CPA and associated reports and management plans (Calico Resources USA Corp. 2023a) and were considered in the evaluation of effects and in the development of additional minimization measures as described in Chapter 3 and summarized herein.

## 5.3 APPLICANT-PROPOSED AVOIDANCE AND MINIMIZATION PLANS

The Applicant provided a number of plans in its permit application to DOGAMI that contain avoidance and minimization measures. These plans[1] include the following:

- Cyanide Management Plan (Ausenco 2023);
- Emergency Response Plan (Calico Resources USA Corp. 2023b);
- Inadvertent Discovery Plan (Calico Resources USA Corp. 2022a);

[1] These draft plans are available to view at the DOGAMI website: Oregon Department of Geology and Mineral Industries: MLRR Grassy Mountain - Consolidated Permit Application Documents: Mineral Land Regulation and Reclamation: State of Oregon.

- Interim Management Plan (Calico Resources USA Corp. 2021a);
- Monitoring Proposal for Groundwater and Facilities (SPF 2022);
- Noise Monitoring Plan (Calico Resources USA Corp. 2023c);
- Noxious Weed Monitoring and Control Plan (Calico Resources USA Corp. 2024);
- Petroleum-Contaminated Soil Management Plan (Calico Resources USA Corp. 2022b);
- Project Quality Plan (Ausenco 2019);
- Reclamation Plan (Calico Resources USA Corp. 2023d);
- Safety Training Plan (Calico Resources USA Corp. 2021b);
- Spring and Seep Monitoring and Mitigation Plan (SLR International Corporation 2024);
- Stormwater Pollution Control Plan (WSP USA Inc. 2023);
- Tailings Chemical Monitoring Plan (Calico Resources USA Corp. 2023e);
- Toxic and Hazardous Substances Transportation and Storage Plan (Calico Resources USA Corp. 2021c);
- Waste Management Plan (Calico Resources USA Corp. 2023f);
- Wildlife Mitigation Plan (EM Strategies and Mason, Bruce & Girard, Inc. 2023); and
- Wildlife Protection Plan (Mason, Bruce & Girard, Inc. 2023).

The Applicant's measures to avoid and minimize potential impacts of the proposed Project included in the CPA and these supporting plans are summarized[2] by resource area in Table 5-1. These measures are considered part of the proposed Project for purposes of the environmental evaluation presented in Chapter 3 of the EE.

**Table 5-1 Summary of the Applicant's Proposed Avoidance and Minimization Measures[1]**

| Resource Area | Avoidance and Minimization Measures |
|---|---|
| Geology and Minerals | • Constructing explosives-storage facilities at the southwest side of the Project area, using the hill as a natural barrier between the explosives-storage facility and other infrastructure. |
| Soils | • Non-vegetative stabilization of disturbed areas within 14 days of earthwork activities stopping, and vegetative stabilization when conditions allow seed-mix to be distributed to minimize soil erosion by wind and stormwater. |

2 Table 5-1 does not include every single measure described in the plans, but rather summarizes the most important measures. The Applicant's management plans can be accessed at: https://www.oregon.gov/dogami/mlrr/Pages/Calico-GrassyMtn_applicationDocuments.aspx.

| Resource Area | Avoidance and Minimization Measures |
|---|---|
| | • Using temporary covers to minimize erosion of stockpiles from stormwater and wind.<br>• Gravel surfacing on travel ways to minimize soil movement.<br>• Installing runoff detention facilities and vegetated filter strips (e.g., bioswales) to minimize soil erosion by water. Runoff control structures include silt traps and fences constructed of certified weed-free straw bales or geotextile fabric and sediment retention basins. Soil collected in these structures will be periodically removed and placed in growth medium stockpiles for future use during reclamation.<br>• Restricting vehicle to areas where vegetative stabilization or infiltration will be practiced to minimize soil compaction.<br>• During reclamation, seeding growth media remaining in stockpiles for one or more seasons and use of erosion berms or swaddles around growth media stockpiles to reduce erosion.<br>• Storing diesel fuel and hydrocarbon products in primary (e.g., tanks, tote bins, barrels) and secondary containment to prevent release into the environment. |
| Water Resources | • No direct discharges to surface waters.<br>• Using dual liners and leak detection for the TSF and TWRSF.<br>• Collecting leachate formed from rainfall interaction with waste rock in the TWRSF in an underdrain system that drains to the reclaim pond.<br>• Using secondary containment for process equipment, pipelines, and the TSF.<br>• Installing stormwater control ditches, grading, berms, or curbing to divert stormwater away from Project facilities.<br>• Installing straw wattles, silt fences, rock check dams, or ditching around construction areas to control erosion and avoid contamination of discharged stormwater.<br>• Collecting and reusing surface water or groundwater exposed to excavated materials or mining process facilities, including collecting and diverting precipitation that falls directly onto Project facilities.<br>• Monitoring of groundwater levels using two groundwater monitoring wells screened in the same Grassy Mountain Formation as the production wells to detect changes from baseline conditions and determine if mitigation is necessary.<br>• Monitoring of spring, seep, and groundwater quality in the vicinity of select springs.<br>• Replacing natural spring discharges in the event that groundwater drawdown reduces flow, which may include installing a well, constructing a system to capture and retain stormwater, or transporting water from another location.<br>• Locating chemicals and other pollution sources away from surface water drainages, and locating construction products and wash water in zero-discharge areas.<br>• Managing all wash water in containment facilities and discharging into closed-loop septic system to prevent wash water from contacting the surface water. |

| Resource Area | Avoidance and Minimization Measures |
|---|---|
| | • Using concrete trucks to wash out in designated plastic-lined collection pits to avoid alkaline runoff.<br>• Storing chemical and hazardous substances in vessels that prevent leaks and spills within secondary containment facilities.<br>• Using drip plans or absorbents to collect any leaking fluids from equipment during equipment maintenance and fueling.<br>• Installing a centralized oil-water separator adjacent to the truck workshop to treat water from drains located at each maintenance bay and from the wash rack to prevent impacts to surface and groundwater from truck maintenance and cleaning.<br>• Storing oil that is separated in a double-lined tank or a single-wall tank in a concrete containment and collection by a licensed waste collection contractor. |
| Vegetation and Wetlands | • Minimizing disturbance to existing vegetation during construction and operation.<br>• Creating selective site sterilization (i.e., vegetation-free spaces around fire hazard areas) to prevent wildfires.<br>• Preparing any disturbed ground and sowing with an appropriate native seed mix to ensure successful growth and prevention of the spread of non-native and noxious weeds.<br>• Establishing post-closure surface soil conditions conducive to the regeneration of a stable plant community during reclamation activities.<br>• Revegetating disturbed areas with appropriate plant species to establish self-sufficient, stable plant communities compatible with existing land uses. |
| Wildlife and Special-Status Species | • Designing transmission lines to adhere to the Avian Power Line Interaction Committee suggested practices for avian protection and the Idaho Power Zone 3 standard for avian protection from electrocution.<br>• Designing transmission lines to include perching and nesting deterrence structures located within 10 km of greater sage-grouse habitat and inspecting deterrence structures at least once every 3 years to identify needed repairs. If a nest is detected, coordinate with ODFW within one business day to determine an appropriate response.<br>• Installing covers, mesh, or netting on potential nesting or roosting structures, such as open pipes or vents, to exclude birds and bats.<br>• Avoiding ground-disturbing activities (i.e., construction) within low-density habitat for greater sage-grouse from March 1 to June 30 and avoiding road construction and widening in mule deer winter range from December 1 to March 31. If an episodic activity needs to occur within the seasonal restriction, coordinate with the ODFW to determine the appropriate course of action (e.g., pre-activity nesting surveys to determine current occupancy prior to completing the activity, activity timing adjustments, a need for additional mitigation).<br>• Using existing roads to the maximum extent possible during construction and operation; when this is unavoidable, using the minimum width for safe travel to reduce impacts to wildlife habitats.<br>• Performing a nesting clearance survey 14 days prior to disturbance if vegetation clearing must occur during the migratory bird nesting period (April 15 |

| Resource Area | Avoidance and Minimization Measures |
|---|---|
| | to July 31). If an active nest is found, apply a 100-foot no-disturbance buffer until the nest has fledged or failed.<br>• Conducting episodic Project-related disturbances (e.g., vegetation clearing, road improvements, facility construction) outside of timing restrictions specific to different species such as specific nesting seasons to avoid effects to wildlife during sensitive life stages. If these activities cannot occur outside the timing restriction, coordinate with the ODFW (and USFWS if golden eagles are involved) on a new course of action (e.g., pre-activity nest surveys).<br>• Covering or filling trenches or install a wildlife ramp overnight to prevent animals from entering or being trapped in trenches.<br>• Conducting concurrent reclamation during initial construction to mitigate habitat loss.<br>• Installing fencing around the perimeter of the Project area to exclude wildlife and conducting monthly inspections of the perimeter fence to detect damage to the fence or evidence of under-burrowing by larger species and making repairs.<br>• Installing exclusion methods for birds and bats in open pipes or vents such as covers, mesh, or netting to prevent their use as nesting structures. Monitor potential nesting structures during the nesting season to detect any failure of exclusion apparatus.<br>• Avoiding the use of skyward lighting except where needed to maintain safe conditions (e.g., signal lights or lights on moving equipment) to avoid night lighting effects to bats and other nocturnal animals.<br>• Disposing of garbage appropriately in covered waste bins to prevent access by corvids and other wildlife.<br>• Conducting employee training to practice vigilance during periods of heightened wildlife activity (i.e., dawn and dusk), to report injured or dead wildlife onsite, and to perform appropriate trash control practices.<br>• Requiring a 35-mph speed limit on the upgraded Access Road Area and bussing employees to the mine to reduce the risk of wildlife–vehicle collisions.<br>• Managing WAD cyanide concentrations in the liquid fraction of the slurry going to the TSF so that it remains at the lowest concentration possible and does not exceed 30 mg/L in accordance with OAR guidelines, with a target concentration of less than 15 mg/L.<br>• Conducting regular testing and sampling of the TSF and reclaim pond to demonstrate consistent non-toxicity to wildlife.<br>• Installing physical exclusion devices, wastewater treatment methods, and regular monitoring to prevent wildlife from accessing the TSF and reclaim pond. Fence the TSF reclaim pond separately as an additional exclusion method.<br>• Deploying bird deterrent balls on the TSF reclaim pond surface to deter birds and bats from access.<br>• Monitoring the TSF and reclaim pond for presence of fish, aquatic invertebrates, algae, or aquatic vegetation daily/weekly.<br>• Following the ICMC guidelines for safe management of cyanide and cyanidation mill leach solutions and tailings. |

| Resource Area | Avoidance and Minimization Measures |
|---|---|
| | • Storing cyanide in a cyanide storage area completely fenced and secured, with a concrete slab and bund walls providing 110% containment.<br>• Implementing the Noxious Weed Plan and Reclamation and Closure Plan to prevent habitat loss through a change in vegetation structure from pre-mine conditions.<br>• Coordinating with agencies to implement and monitor reclamation using quantitative measures for evaluating habitat diversity, wildlife species diversity, and plant community composition, structure, and utilization by wildlife. |
| Non-native and Invasive Plants | • Treating weed infestations prior to and after conducting any blading or other road maintenance activities. Treatment may include herbicide application (e.g., roadside spraying) or mechanical removal.<br>• Clearing topsoil contaminated with noxious weeds first and encapsulating it in the TSF in areas that are to be cleared and where noxious weeds have been identified to prevent their spread.<br>• Disposing of noxious weeds and topsoil contaminated with noxious weeds appropriately to prevent their spread.<br>• Using certified weed-free straw bales for sediment control and seed and mulch used in reclamation.<br>• Conducting interim seeding for sites with exposed soil for more than one growing season to prevent the establishment of non-native and invasive plants.<br>• Ensuring that personnel and contractors avoid, as much as possible, travel through areas that are identified as containing noxious weeds to prevent their spread to uncontaminated areas.<br>• Power-washing vehicles and equipment used by personnel or contractors who transport equipment onsite or those who must travel through identified noxious weed areas to minimize the spread of noxious weed seeds. The main areas on vehicles to be decontaminated include the equipment tracks, tires, undercarriage, axles, wheel wells, running boards, bumpers, and brush guard assemblies.<br>• Conducting fire management and prevention programs and post-fire reclamation efforts to mitigate against the effects of fire, which can change vegetation communities, allowing non-native and invasive plants to thrive.<br>• Conducting monitoring to identify new weed infestations and to evaluate the effectiveness of noxious weed treatments.<br>• Conducting post-closure noxious weed monitoring and control for a minimum period of 5 years following the cessation of mine operations.<br>• Creating and following a post-closure monitoring plan coordinated with, and approved by, the BLM, DOGAMI and ODFW which would conclude at acceptance of mine closure.<br>• Following an approved Restoration Plan that addresses restoring the site to a self-sustaining ecosystem (per OAR 635-420-0110). |
| Cultural Resources | • Conducting a tribal study of the area to address the SHPO’s eligibility concerns for precontact cultural resources and assist in assessing effects and associated mitigation measures for these resources. |

| Resource Area | Avoidance and Minimization Measures |
|---|---|
| | • Implementing actions in the Inadvertent Discovery Plan in the event that historical or archaeological resources are found, including stopping work immediately in the vicinity of the find and notifying the SHPO and BLM archaeologist to protect cultural resources.<br>• Placing a 30-meter buffer around any inadvertent discovery of cultural resources with work being able to proceed outside of this buffered area unless additional cultural materials are encountered to prevent damage to the discovery.<br>• If human remains are encountered, securing the location, not disturb the remains in any way, not calling 911, and not taking photos. Work must not resume in the area of discovery until all parties involved agree upon a course of action. |
| Rangeland Management | • Installing a perimeter fence around the Mine and Process Area to prevent access by livestock.<br>• Installing gates or cattle guards along roadways where necessary to prevent livestock access to the site.<br>• Replacing natural spring discharges in the event that groundwater drawdown reduces flow, which may include installing a well, constructing a system to capture and retain stormwater, or transporting water from another location.<br>• Providing a stable post-closure landscape that supports defined land uses of livestock grazing or rangeland, wildlife habitat, and recreational land. |
| Lands, Land Use, and Realty | • Revegetating disturbed areas with appropriate plant species to establish self-sufficient, stable plant communities compatible with existing land uses.<br>• Providing a stable post-closure landscape that supports defined land uses of livestock grazing or rangeland, wildlife habitat, and recreational land, with opportunities to consider mineral exploration and development when feasible. |
| Air Quality and GHG | • Spraying water in high-traffic road areas to prevent fugitive dust from blowing offsite.<br>• Implementing BMPs onsite for dust control, which may include water sprays, enclosures, hoods, curtains, shrouds, and movable and telescoping chutes.<br>• Installing, operating, and maintaining emission units and associated control equipment in good working order to minimize emissions.<br>• Evaluating air emission control requirements if the Project becomes a large-quantity generator per 40 CFR 265 Subparts AA (Air Emission Standards for Process Vents), BB (control air emissions from equipment leaks), and CC (control emissions from certain tanks, containers and surface impoundments). |
| Noise | • Conducting noise disturbance activities outside of wildlife timing restrictions (e.g., avoiding noise-producing ground-disturbing activities such as road widening in mule deer winter -range habitat from December 1 to March 31). If this cannot be accomplished, coordinate with the ODFW for an exception.<br>• Avoiding blasting for construction from March 1 to June 30, or coordinating with the ODFW in advance to determine appropriate measures to reduce or avoid impacts if blasting occurs during this period. |

| Resource Area | Avoidance and Minimization Measures |
|---|---|
| | • Conducting noise monitoring per the Noise Monitoring Plan, which provides the framework to monitor noise during construction, operation, and blasting.<br>• Conducting noise monitoring and if construction-related noise exceeds expected levels from March 1 to June 30, halting activities and coordinating with the ODFW to determine an adaptive management approach.<br>• Conducting blasting for operations only during daylight hours and avoiding periods from sunrise to 2 hours after sunrise and 2 hours before sunset.<br>• Incorporating reduction components for machinery in coordination with the ODFW if noise levels are found above expected levels during operations.<br>• Conducting confirmation noise monitoring following the implementation of mitigation measures imposed by the ODFW. |
| Visual Resources | • Avoiding the use of skyward lighting except where needed to maintain safe conditions (e.g., signal lights or lights on moving equipment).<br>• Shielding stationary external lights and using motion detectors, timers, or dimmers where appropriate.<br>• Directing lighting only onto work areas and away from adjacent areas not in use, with safety and proper lighting of the active work areas being the primary goal. |
| Recreation | • Providing a stable post-closure landscape that supports defined land uses of livestock grazing or rangeland, wildlife habitat, and recreational land, and ensures a self-sustaining ecosystem. |

In the event that a permit is granted and the Project proceeds, the Applicant would develop additional plans or revise existing draft plans to comply with operational standards and regulations. Such plans may include:

- Blasting plans for the quarry with site-specific engineering controls and blasting protocols;
- Tailings Management Plan;
- SPCC Plan;
- Petroleum-contaminated Soils Management Plan;
- Security plan for reducing the risks associated with blasting agents;
- Evacuation plans for structures including the administrative/security building, truck workshop, warehouse, assay laboratory, CIL process building, and other structures that might require evacuation during an emergency;
- Operations plans for each major facility;
- Monitoring plan for inspection and monitoring activities to maintain compliance with air emission control requirements;

- Spring and Seep Monitoring and Mitigation Plan;
- Final Engineering Site Closure Plan for closure of the TSF;
- Post-Closure Monitoring Plan;
- Compensatory Mitigation Plan; and
- HMA Management Plan.

## 5.4 ADDITIONAL PROPOSED MEASURES IDENTIFIED IN THE EE

After the Applicant's minimization measures have been taken into account, additional measures and BMPs were identified to further reduce potential impacts of the Project and are listed by resource area in Table 5-2. These measures are summarized from Chapters 2 and 3 of the EE and Appendix A and presented here for convenience. Additional avoidance, minimization, and mitigation may be considered by the TRT in its decision-making and agency permit review processes.

**Table 5-2 Summary of BMPs and Additional Minimization Measures Identified in the EE**

| Resource Area | BMPs/Minimization Measures |
|---|---|
| Geology and Minerals | • No additional measures are proposed. |
| Soils | • Using seed growth media stockpiles that would be left for more than 1 month to prevent soil loss through wind erosion.<br>• Installing stormwater controls to manage stormwater run-on.<br>• Collecting soil samples from the bottom of the excavation after soil cleanup in the event of a spill, analyzing these samples for total petroleum hydrocarbons, and comparing the results to applicable standards to determine whether the excavation effectively collected all soil affected by the spill. |
| Water Resources | • Conducting monitoring of groundwater levels and quality.<br>• Supplementing spring flows with groundwater pumped from a new or existing groundwater well installed near the spring in the event of an observed reduction in flow at a spring location.<br>• Transporting water from an alternative potable water source to provide water at the location of the affected spring or seep until alternative mitigation measures are operating. |
| Vegetation and Wetlands | • Conducting a new wetland delineation to attempt to identify the NWI-mapped and non-NWI-mapped wetlands and waterbodies and the Oregon DSL Statewide Wetlands Inventory-mapped wetlands and waterways in the study area as the extent, condition, and function of these resources can change over time, so that adequate avoidance and mitigation measures can be identified for all resources.<br>• Conducting a new wetland delineation during the growing season (March through August) to capture herbaceous plants and observing an accurate representation of the water table. Submit the wetland delineation to DSL for |

| Resource Area | BMPs/Minimization Measures |
|---|---|
| | review and develop appropriate mitigation as needed for any identified wetlands that are located within Project disturbance areas.<br>• Placing soil and amendments as necessary on reclaimed areas, and planting sagebrush plugs/seedlings, perennial grasses, and perennial forbs in appropriate quantities/ratios to achieve viable sagebrush habitats post-mining.<br>• Developing a Sagebrush Habitat Monitoring Plan with ODFW oversight that incorporates adaptive management measures to address sagebrush plug failures, prevention of invasive grasses, alternate strategies for restoration, and extension of post-closure monitoring to a period of 20 to 30 years to confirm re-establishment of sagebrush communities. |
| Wildlife and Special-Status Species | • Conducting ongoing noise monitoring to ensure that noise is kept to expected levels.<br>• Installing speed limit signage along the access road to restrict vehicular speed to reduce wildlife-vehicle collisions.<br>• Installing deer crossing signage along the access road within the mule deer winter-range habitat to alert drivers of the potential for deer to cross the road.<br>• Incorporating additional measures to prevent waterbirds from landing on the TSF pond and wildlife from entering the TSF area. Examples include using visual deterrents, motion-activated devices, laser deterrents, emergency hazing techniques, bio-exclusion zones, decoy ponds, hypersalinity, and/or netting and wires. The use of motion-activated devices is preferred as many visual and acoustic deterrents are deployed indiscriminately and not in response to specific bird activity, which leads to birds becoming habituated to these deterrents.<br>• Conducting raptor nest surveys during the nesting season to determine if they are active and submitting findings to the USFWS and the ODFW, which could then impose avoidance buffers and determine if other protection measures are required, such as timing restrictions during the breeding and rearing season.<br>• Performing construction activities and removing shrubs and grasses used for nesting outside of the nesting season to prevent birds from nesting in the area.<br>• Following practices in BLM Technical Note 457, Night Sky and Dark Environments: Best Management Practices for Artificial Light at Night on BLM-Managed Lands to reduce glow effects.<br>• Installing lighting only where necessary for safety and operational reasons, using dynamic lighting that turns on via motion sensors where practical, and installing light shields to direct light away from the sky and toward the area of focus to reduce effects of light pollution to bats and birds.<br>• Installing reflective strips around the TSF perimeter on poles above the fence line to assist in deterring flying bats and birds from entering the area.<br>• Installing markers on perimeter fences to make them more visible to greater sage-grouse in flight to reduce collisions and resulting injuries. |
| Non-native and Invasive Plants | • No additional measures are proposed. |

| Resource Area | BMPs/Minimization Measures |
|---|---|
| Cultural Resources | • Consultation is ongoing between the BLM and affected tribes to outline the process and procedures for mitigation for adverse effects to cultural resources. Such mitigation could include implementing a buffer zone around an identified resource for avoidance or conducting mining underneath these sites without impact, if possible. The outcome of this consultation will be discussed with the SHPO to determine the ultimate path forward. |
| Rangeland Management | • Supplementing spring flows with groundwater pumped from a new groundwater well installed near the spring or piping groundwater from a nearby existing well in the event of an observed reduction in flow at a livestock watering location.<br>• Installing signage to restrict speed along the Access Road Area to reduce vehicular-livestock collisions.<br>• Installing fencing along the Access Road Area in collaboration with the BLM to prevent livestock access to the road in some areas. |
| Lands, Land Use, and Realty | • No additional measures are proposed. |
| Air Quality and GHG | • Using biodiesel in underground mining equipment to reduce the buildup of emissions in enclosed spaces and reducing overall fuel emissions at the site with associated reduced effects to air quality and GHG.<br>• Using SIC mine operations and scheduling, which can reduce transportation of materials, traffic waiting times, and emissions, with associated reduced effects to air quality and GHG.<br>• Recycling rubber and plastic materials to save energy and reduce GHG emissions. |
| Noise | • No additional measures are proposed. |
| Visual Resources | • Following BMPs developed by the BLM for lighting at night, which includes minimizing the use of skyward lighting (unless needed to maintain safe conditions), installing motion detectors or timers and hoods/shields to avoid and minimize skyward lighting on exterior lights (to the extent practical), and directing all lighting only onto the active work areas. |
| Recreation | • No additional measures are proposed. |

## 5.5 COMPENSATORY MITIGATION

Compensatory mitigation is the final action when implementing the mitigation hierarchy. Compensating for a project proponent's unavoidable impacts includes replacing or providing comparable substitute resources or environments. This may include a project proponent providing in-kind or out-of-kind mitigation actions through an onsite or offsite location. These may be implemented through permittee-responsible mitigation (e.g., mitigation actions for an HMA), payment to a third party (e.g., ILF), or purchasing credits from an established mitigation bank.

Compensatory mitigation for impacts to wildlife habitats is regulated through, and must be consistent with, the ODFW Fish and Wildlife Habitat Mitigation Policy (OAR 635-415-0000 through OAR 635-415-0025) and the Greater Sage-Grouse Conservation Strategy for Oregon (OAR 635-140-0000 through OAR 635-140-0025). The appropriate compensatory mitigation for impacts to wildlife habitats that are expected to remain following implementation of all avoidance and minimization measures is addressed through these administrative rules.

### 5.5.1 Compensatory Mitigation for Direct Impacts to Wildlife Habitats Other than Greater Sage-Grouse

The Project would directly impact ODFW Habitat Categories 2 through 6, as defined in the ODFW Fish and Wildlife Habitat Mitigation Policy. Mitigation for impacts to each category is as follows:

- Habitat Category 2: No net loss of habitat quantity or quality and net benefit of habitat quantity or quality; mitigation of unavoidable impacts through in-kind and in-proximity habitat mitigation.
- Habitat Category 3: No net loss of habitat quantity or quality; mitigation of unavoidable impacts through in-kind and in-proximity mitigation.
- Habitat Category 4: No net loss of habitat quantity or quality; mitigation of unavoidable impacts through in-kind or out-of-kind, in-proximity or off-proximity mitigation.
- Habitat Category 5: Net benefit in habitat quantity or quality, which can be achieved through actions that improve remaining habitat or through compensatory mitigation that contributes to essential or important habitat.
- Habitat Category 6: Mitigation goal is to minimize impacts through minimizing direct habitat loss and avoiding impacts to offsite habitat.

Mitigation to offset impacts to Habitat Categories 2, 3, and 5 would be implemented and completed either prior to or concurrent with the Project. Compensatory mitigation to offset impacts to these habitats is being coordinated with the ODFW.

### 5.5.2 Compensatory Mitigation for Indirect Impacts to Mule Deer Winter Range

There would be indirect impacts to mule deer winter range from Project development. This includes disturbance and displacement of mule deer during road improvements[3] and as a result of increased traffic flow in areas that overlap mule deer winter range. In addition to minimization measures to reduce these indirect impacts, compensatory mitigation is required, which would be determined through continued coordination with the ODFW.

### 5.5.3 Compensatory Mitigation for Greater Sage-grouse Habitat

Compensatory mitigation for sage-grouse must be consistent with the mitigation standards in OAR 635-140. The Applicant is working directly with the ODFW to identify the amount and type of compensatory mitigation that would be needed to offset Project impacts to greater sage-grouse low-density habitat. The

[3] In mule deer winter range habitat, road construction and widening would be avoided from December 1 to March 31.

amount of acreage required to offset Project effects is calculated using the Oregon sage-grouse HQT, which provides a science-based method for quantifying habitat function, assessing impacts of the proposed development on greater sage-grouse, and identifying appropriate compensatory mitigation. The standard for compensatory mitigation of direct and indirect habitat impacts in sage-grouse habitat is to achieve net conservation benefit for sage-grouse. This is achieved by replacing the lost functionality of the impacted habitat to a level capable of supporting greater sage-grouse numbers. The mitigation requirement for sage-grouse habitat would be determined through continued coordination with the ODFW.

### 5.5.4 Compensatory Mitigation Strategy/Plan

A summary of proposed compensatory mitigation for direct and indirect effects to habitat types is provided in Table 5-3. Mitigation and functional acreages have yet to be determined. In some cases, mitigation acres may be overlapped, if appropriate. For example, habitat that supports greater sage-grouse may also function as mule deer winter range.

**Table 5-3 Summary of Compensatory Mitigation for the Project**

| Type of Impact | Mitigation Acres |
|---|---|
| Direct impacts to Habitat Categories 2 through 6 wildlife habitats | To be determined |
| Indirect impacts to mule deer winter range | To be determined |
| | **Functional Acres** |
| Direct and indirect impacts to greater sage-grouse habitats | To be determined |

The Applicant proposed to use one or a combination of options to provide compensatory mitigation for impacts to wildlife and wildlife habitat:

- Option 1: Permittee-Implemented Mitigation: HMA;
- Option 2: ODFW ILF Sage-Grouse Mitigation Program for Greater Sage-Grouse; and
- Option 3: Third Party Payment-to-Provide to Mitigation Bank: Wildlife Habitat and Greater Sage-Grouse.

These compensatory mitigation options are summarized in the following subsections. For more information, refer to the Wildlife Mitigation Plan (EM Strategies and Mason, Bruce & Girard, Inc. 2023).

#### 5.5.4.1 Option 1: Permittee-Implemented Mitigation: Habitat Mitigation Area

Under this option, one or more offsite HMAs would be obtained and managed for the life of the Project or the duration of the Project's impacts, whichever is greater (per OAR 635-415-0020). HMA properties for mule deer winter range[4] would be located within the Beulah-Malheur Herd Range to meet the in-proximity component of the mitigation goal. The Applicant would work with the ODFW to select appropriate HMA

[4] This habitat is also ODFW Habitat Category 2.

sites that would fulfill the mitigation need to comply with the ODFW Fish and Wildlife Habitat Mitigation Policy (OAR 635-415) and the Greater Sage-Grouse Conservation Strategy (OAR 635-140).

The selected property/properties for the HMA would be acquired through outright purchase, a conservation easement, or other legal mechanism, and documentation of the legal arrangement would be provided to the ODFW prior to initiating construction of the Project. The Applicant would work with the ODFW to develop an HMA Management Plan that would describe the site-specific habitat management and restoration objectives for the HMA, including mitigation performance measures (per OAR 635-415-0020) containing success criteria, a timeline for formally determining that mitigation goals and standards have been met, provisions for long-term protection and management of the HMA, and a reporting schedule, to ensure the HMA can be successfully managed to fulfill the compensatory mitigation goals for the Project.

This is the Applicant’s preferred option, but if sufficient HMAs to complete mitigation are unavailable, mitigation using HMAs would be sought in combination with one or more of the other mitigation options.

#### 5.5.4.2 Option 2: ODFW In-Lieu Fee Program for Greater Sage-Grouse

This option is currently limited to mitigating Project impacts to greater sage-grouse. A funding structure for the ODFW Sage-Grouse Mitigation Program ILF option for mitigation has been created, and the Applicant can pay a Project-specific calculated fee to the program. Once paid, the mitigation responsibility for offsetting impacts to greater sage-grouse and any liability therein would be assumed by the state and the mitigation would be managed by the program.

#### 5.5.4.3 Option 3: Third Party Payment-to-Provide: Wildlife Habitat Management and Greater Sage-Grouse Mitigation Bank

Under this option, mitigation credits would be purchased from an existing conservation bank owned and operated by TerraWest Conservancy, a habitat conservation and management company based out of Jackson, Wyoming, or from a different conservation bank that must be approved by the ODFW. TerraWest Conservancy currently has an approximately 32,000-acre upland habitat conservation bank under development in Malheur County and would provide greater sage-grouse habitat credits. The same property could also be used to provide appropriate mitigation acres for offsetting direct and indirect impacts to mule deer winter range and direct impacts to other in-kind habitat types similar to those that will be impacted by the Project. Credits purchased as mitigation for this Project would be retired and maintained in perpetuity. Similar to the ILF option, the mitigation liability is transferred from the Applicant to the mitigation banker through the credit purchase.

## 5.6 DURABILITY AND FINANCIAL ASSURANCES

Durability and financial assurances refer to the provision of funds, through bonds or other means, to cover the costs that government agencies would incur to complete mitigation, reclamation, and closure in the absence of a project operator. In other words, if a mining project were abandoned without adequately addressing its environmental effects or prior to completing reclamation, these would be the budgets required for reclaiming the project site in whatever condition it was left (at any stage of the project). The costs of reclaiming a site would vary over time as a project is constructed, operated, closed, and reclaimed. Therefore, assessments of these costs should be conducted annually and additional funds provided as necessary.

### 5.6.1 Mitigation Assurances

Durability and financial assurances guarantee the long-term protection and management of a mitigation site once mitigation actions are implemented. Durability instruments can be provided through conservation easements or fee title acquisition. Financial assurances provide long-term funding for a mitigation site to ensure that the mitigation actions are successful, including long-term monitoring. Durability assurances are typically part of a permittee-responsible mitigation project to ensure mitigation actions are durable and can be sought through a mitigation bank, whereby the bank is responsible for the durability and financial assurances of performing the mitigation (i.e., liability is transferred through a credit purchase).

### 5.6.2 Reclamation Assurances

Financial assurance instruments are guarantees issued by a bonding company (e.g., a reclamation bond), an insurance company, a bank, or another financial institution that agrees to hold itself liable for the acts or failures of a third party. Since this Project requires various permits and approvals from Oregon state regulatory agencies led by DOGAMI and federal agencies led by the BLM, a reclamation bond or alternative security is required per ORS 517.810, OAR 632-037-0135, and 43 CFR 3809 to ensure that both DOGAMI and the BLM would have sufficient funds to reclaim the Project site in the event of abandonment prior to fully reclaiming the site (BLM 2023; DOGAMI 2023). To allow for effective coordination between the two agencies, a memorandum of understanding is being developed to establish and maintain coordination between the two agencies for their respective joint responsibilities regarding the administration and reclamation of lands disturbed by the Project and to hold a joint reclamation bond for any approved mining operations.

The financial assurance calculation would be based on a complete and adequate reclamation cost estimate and would constitute the actual reclamation cost that DOGAMI and the BLM would have to pay to contract for reclamation of disturbed areas to the standards outlined in the Project Reclamation Plan (Calico Resources USA Corp. 2023d). This amount would be determined at the time permits are issued prior to any surface disturbance and assessed annually. An initial reclamation cost estimate was developed using the Nevada Standardized Reclamation Cost Estimator and was submitted as part of the CPA. A total reclamation cost of approximately $12,416,573 has been calculated at the cessation of planned mining, including indirect costs such as contingency and contractor profit. This cost is based on the completion of the Phase II TSF. If Phase III of the TSF is realized, the bond would be updated accordingly. A phased-bonding approach would be used with suitable milestone events agreed upon in coordination with DOGAMI and the BLM with respect to Project development. The bond amount would be updated to reflect the actual disturbance and whatever additional disturbance is planned for the subsequent period including any changes to equipment, and consumable and labor costs. The Project Reclamation Plan contains more details regarding development of the reclamation cost estimate and financial assurances (Calico Resources USA Corp. 2023d).

# 6.0 CHAPTER 6: REFERENCES

This chapter provides a list of all documents used in the development of the EE. References are organized by the EE chapter and section in which they are cited. References used in appendices are provided within the individual appendices.

## CHAPTER 1: INTRODUCTION

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# CHAPTER 3: IMPACT ANALYSIS

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