Draft Environmental Impact Statement for the Proposed Butte Highlands Project, Operating Permit Application:

Butte Highlands Joint Venture

Silver Bow County, Montana

October 2013

Montana Department of
Environmental Quality

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Executive Summary

This Executive Summary provides an overview of the contents of the Draft Environmental Impact Statement (EIS) for the Proposed Butte Highlands Joint Venture (BHJV) Mine, located approximately 14 miles south of Butte, Montana. The Draft EIS describes the land, people, and resources potentially affected by the proposed mining activities. This summary does not provide all of the information contained in the Draft EIS. If more detailed information is desired, please refer to the Draft EIS, its appendices, or referenced reports.

The EIS presents descriptions of the Proposed Action and alternatives, including the No Action Alternative, Alternative Haul Routes, and the Agency-Mitigated Alternative (Chapter 2); descriptions of the affected environment for all potentially affected resources (Chapter 3); and an analysis of the impacts of the alternatives (Chapter 4).

ES-1. Introduction

BHJV holds Exploration License No.00680 which covers exploration activities within its patented mining claims. BHJV submitted an amendment to its exploration license to Montana Department of Environmental Quality (DEQ) to obtain permission to construct a decline from which to conduct underground exploration. DEQ approved the exploration license amendment for this underground work in 2009 and development of the underground exploration activities commenced.

BHJV submitted an application for an operating permit to DEQ in May 2010. The operating permit application underwent deficiency reviews and was revised prior to BHJV receiving a Letter of Completeness and Compliance in December 2012. A Draft Operating Permit was issued at that time. A final operating permit application was prepared in January 2013. The 2013 Operating Permit Application is the subject of this Draft EIS and is referred to as the Proposed Action.

BHJV submitted an application for a Montana Pollutant Discharge Elimination System (MPDES) permit from DEQ. This application seeks permission to discharge treated mine dewatering water to Basin, Fish, and Moose creeks located in the vicinity of the mine. DEQ issued a Letter of Completeness on the MPDES application in July 2012 and the draft permit was issued in April 2013. The final MPDES permit MT0031755 was issued August 1, 2013. The MPDES permit will not be analyzed as part of the EIS.

An application to discharge mine dewatering water using an underground infiltration system under a Class V Underground Injection (UIC) Permit from the United States Environmental Protection Agency (EPA) Region 8 was submitted in January 2013. EPA deemed the application complete later that month and is currently reviewing the application to determine whether to issue a draft permit. The UIC permit will not be analyzed as part of this EIS.

BHJV has held a Road Use Permit with the United States Forest Service (Forest Service) since 2009 to use portions of the existing Forest Service Road 84 (Highlands Road) west of the mine site to haul ore between the mine and an ore-transfer facility to be constructed adjacent to

Interstate-15. The Road Use Permit also covers BHJV's use of portions of Forest Service Road 84 (Highlands Road/Roosevelt Drive) to the north of the mine for employee transportation and mine support traffic. This permit expired in December 2012. Subsequent to a change in permitting regulations, the Forest Service later directed BHJV to submit a Plan of Operations for hauling ore along the proposed route. This Plan of Operations was submitted to the Forest Service in February 2013 and is currently under environmental review. The Forest Service's review of the Plan of Operations will not be analyzed as part of this EIS.

ES-2. Project Area Description

The geographic scope of this Draft EIS includes areas near the Continental Divide south of Butte, Montana in Silver Bow County. The areas potentially affected by the Proposed Action include existing infrastructure related to the proposed BHJV Mine, and the areas within the proposed mine permit boundaries, as well as a permit area encompassing a haul route road for transporting the ore to a transfer facility near Interstate-15 (Figure ES-1). The BHJV Mine is accessible from Montana Highway 2 (MT 2), Roosevelt Drive, and National Forest Service Road 84 (Highlands Road). The mine permit area covers approximately 310 acres of patented mining claims within the Beaverhead-Deerlodge National Forest. The proposed private haul route permit area covers approximately 347 acres south of Highland Road near the Feely interchange on Interstate-15 south of Butte.

There are approximately 20 acres of disturbed land at the portal pad and facilities area within the proposed mine site. Associated roads, pipelines and other small disturbed areas exist throughout the project area. The proposed mine project is surrounded by United States Forest Service (Forest Service) lands.

ES-3. Purpose and Benefits of the Proposed Action

DEQ has received an application from BHJV for a Hard Rock Operating Permit. The purpose of the proposed operating permit is to allow BHJV to pursue extraction and transport of mineral resources from its mining claims. BHJV holds Exploration License No. 00680 that covers a decline, stockpiles, and associated buildings and mine infrastructure at the proposed BHJV Mine site, located approximately fifteen miles south of Butte, Montana. The proposed permit boundaries for the project are shown in Figure ES-1.

ES-4. Scope of the Decision to be Made

DEQ's required action is to respond to BHJV's request to approve the Hard Rock Operating Permit Application for the Butte Highlands Project. To satisfy this request, DEQ must determine whether the operating permit application satisfies the requirements of the Metals Mine Reclamation Act (MMRA), Title 82, Chapter 4, Part 3, Montana Code Annotated (MCA).

The DEQ Director will use the EIS process to develop the information necessary to determine whether the Proposed Action meets the performance standards of the MMRA, including but not limited to:

- Treatment of water discharged from mine dewatering;

- The removal of buildings and other structures at closure consistent with the post-mine land uses;
- Post-closure environmental monitoring programs and contingency plans; and
- Compliance with state air and water quality standards.

The DEQ Director would issue a Record of Decision (ROD) documenting the decision on the operating permit application. The ROD is a public notice identifying what the decision is, the reasons for the decision, and any special conditions surrounding the decision or its implementation.

The roadway proposed to be used to haul the ore from the BHJV Mine site out to a proposed transfer facility crosses Forest Service lands and must be evaluated by that agency under the National Environmental Policy Act (NEPA). Although the two actions are related, DEQ and the Forest Service have separate decision making processes. The Forest Service is conducting a separate analysis and will issue its own decision document. Information on the Forest Service process can be found at http://www.fs.fed.us/nepa/fs-usda-pop.php/?project=35069.

ES-5. Public Involvement

DEQ opened the scoping period for the BHJV Mine EIS on March 8, 2013. On March 21, 2013 DEQ held a scoping meeting in Butte, Montana. Comments made at the meeting and those received via postal mail or e-mail were collected by DEQ and entered into the administrative record. DEQ published notices of the scoping period and the scoping meeting in the Butte newspaper, *The Montana Standard*, on Sunday, March 10 and Sunday, March 17, 2013; and in *The Whitehall Ledger* on Wednesday, March 13 and Wednesday March 20, 2013. In addition, DEQ mailed scoping notices to 132 agencies and individuals who had expressed interest in the project. The scoping period ended on April 8, 2013. Comments received by DEQ focused on waste rock geochemistry, weeds, water quality and effects on surface and groundwater supplies, air quality, dust, socioeconomic effects, haul route alternatives, land use and recreation, visual resources, fisheries and wildlife, and the MEPA process.

Issues were identified through the agency and public scoping process, through DEQ's review of the 2013 Operating Permit Application, and through interagency discussions on the development of alternatives. Issues were evaluated to determine whether the Proposed Action or an alternative would result in significant impacts. MEPA provides direction on determining the significance of impacts (ARM 17.4.608(1), MCA 75.1.201).

The major issues identified include:

Water Management

- Adit closure and mine water distribution;
- Water treatment and disposal;
- Groundwater quality;
- Surface water quality;
- Long-term monitoring of water quality;

Haul Route Selection

- Use of County and Forest Service roads;
- Alignment of haul route; and
- Potential impacts to wildlife and fisheries along proposed haul routes.

ES-6. Alternatives Description

Alternatives fully evaluated in this EIS are the No Action Alternative, the Proposed Action, Alternative Haul Routes, and the Agency-Mitigated Alternative. Some alternatives were evaluated and eliminated from further consideration. The alternatives discussion also includes reclamation of the areas disturbed. Complete descriptions of each alternative are provided in Chapter 2 of the Draft EIS.

No Action Alternative

Under the No Action Alternative, DEQ would not approve BHJV's operating permit application. BHJV currently holds Exploration License No. 00680 and has developed areas covering approximately 20 acres within the Pony Placer Claim and Northern Claims permit area boundaries (Figure ES-1). The No Action Alternative assumes that BHJV could continue any and all activities approved under its exploration license; therefore, the No Action Alternative is a "status quo" approach.

Proposed Action

The Proposed Action would allow underground mining at the proposed BHJV Mine, adding approximately 12 acres to the disturbances within the permit areas including the area required to develop a portion of the haul route on private lands. The haul route would follow Forest Service Road No. 84 west to the Forest Service boundary and then a new section of road would be constructed across a parcel of private land just south of Highland Road (Figure ES-1). During active mining, the large ore trucks would make approximately 20 round trips per day, five days per week (BHJV, 2013). The portion of the haul route on private land would be closed to public traffic.

The operating facilities would essentially remain the same as those approved under the existing exploration license. The changes that would occur under the Proposed Action relate to the extent of mine excavation underground, the amount of waste rock removed and ore extracted for processing, the need for mine waste water treatment and disposal, the haul route used to transport ore off site, and the development of a transfer facility to accommodate moving the ore to a processing plant off-site.

Alternative Haul Routes

DEQ has identified two haul route alternatives to the route included as part of the Proposed Action. The two routes are briefly described below. Additional details and impacts analysis for each route are included in Chapter 2 and Chapter 4, respectively.

Highland Road (West) Parallel Route

BHJV haul trucks would proceed west from the mine entrance on Highland Road for approximately eight miles to the Forest Service Boundary. This segment of the Highland Road is part of Forest Service Road No. 84. West of the Forest Service Road Boundary, Highland Road becomes a county road. Beginning at the Forest Service Boundary, a new haul route would be constructed that closely parallels the existing Highland Road. The haul route would rejoin Highland Road approximately one third of a mile south of the proposed transfer facility located adjacent to Interstate-15. During active mining, the large ore trucks would make approximately 20 round trips per day, five days per week (BHJV, 2013). The haul route across private land would be closed to public traffic.

Highland Road (North)/Roosevelt Drive

Under this alternative, highway legal dump trucks would proceed north on Highland Road for approximately nine miles to Roosevelt Drive. This segment of the Highland Road is part of Forest Service Road No. 84. The haul route would continue to the northeast on Roosevelt Drive to Highway 2. This portion of Roosevelt Drive is a county road. The smaller capacity of the highway legal dump trucks would necessitate increasing the number of haul trips to approximately 30 round trips per day, five days per week (Tetra Tech, 2013a). The haul route would follow publicly accessible roadways.

Agency-Mitigated Alternative

MEPA allows the decision-making agency to propose alternatives to the Proposed Action that would meet the purpose and benefits while reducing or mitigating potential impacts. The Agency-Mitigated Alternative may include changes to some aspects of the Proposed Action while other aspects remain unchanged. The aspects of the Proposed Action addressed under the Agency-Mitigated Alternative are the water quality monitoring plan, an asbestos monitoring stipulation, and the water treatment system location and process.

Under the Agency-Mitigated Alternative, BHJV would expand its proposed water quality monitoring plan and add monitoring wells. The water treatment facility, originally planned to be housed underground in the mine workings, would be relocated to a structure adjacent to the mine portal near the other support facilities on the existing portal pad. This would alleviate the need to maintain access to the inner workings of the mine and would allow more frequent assessment of the water treatment after mine closure. BHJV would submit an asbestos monitoring plan for the ore.

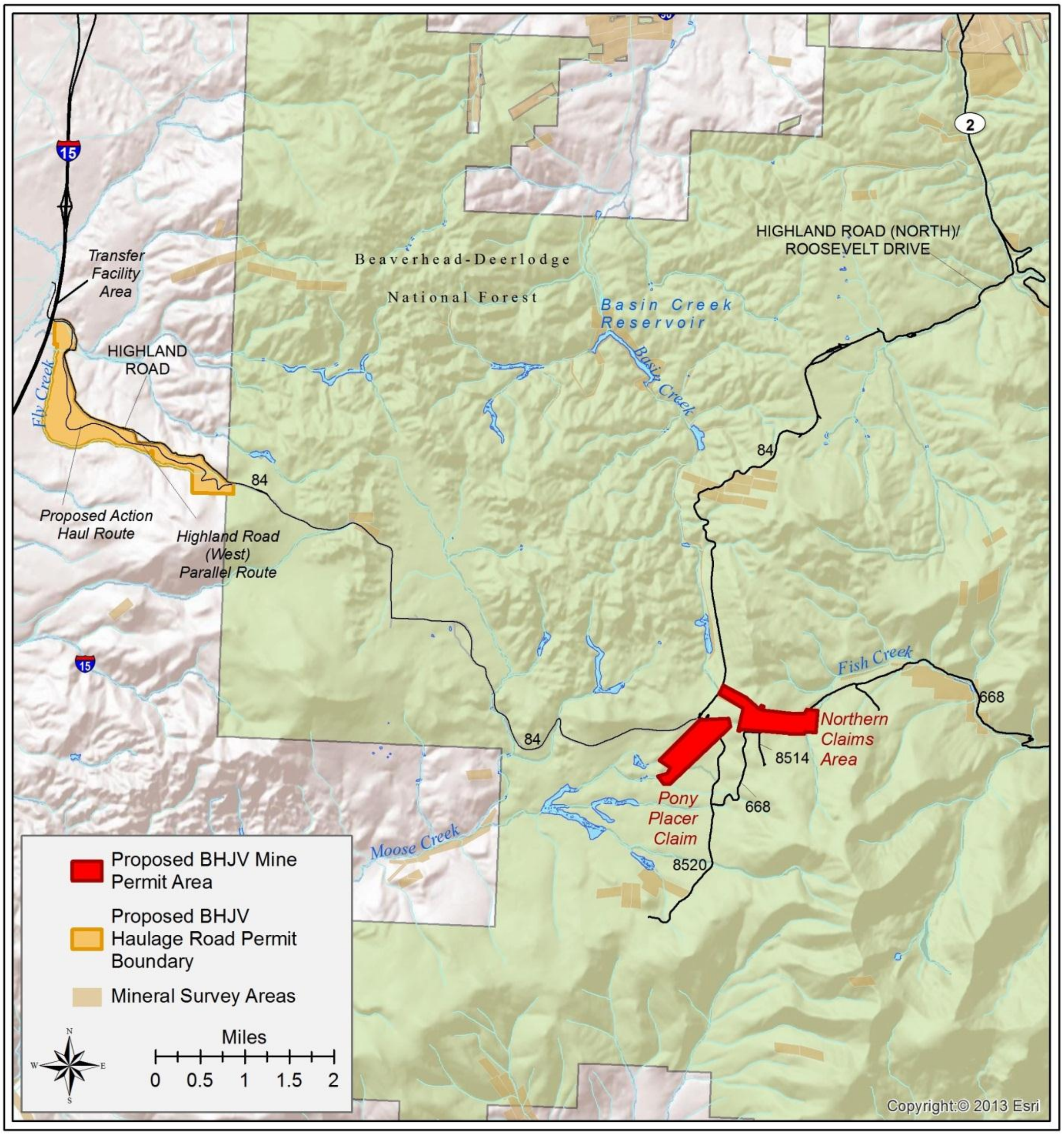

Figure ES-1. Proposed Permit Boundaries for the Butte Highlands Joint Venture Mine and Proposed Private Haul Route, Silver Bow County, Montana.

Alternatives Considered and Eliminated

During scoping, additional route alternatives were evaluated for moving ore from the mine to the off-site milling facility where ore would be processed. However, these routes were dismissed due to conflicts over easements, environmental concerns, and safety issues. Other alternatives related to the final plugging of the historic Highland mine adit were also considered; however, the alternative to leave the adit open was dismissed due to of the level of uncertainty related to monitoring and water treatment needs. Another alternative to plug the adit with an adjustable valve was considered but dismissed due to concerns that if the technology was not reliable, then the adit would need to be excavated and replugged. Again, the uncertainty related to the reliability of this option led to its dismissal.

ES-7. Environmental Consequences

The following sections provide a summary of the effects of implementing each alternative. Information is focused on activities and effects where different levels of effects can be distinguished between alternatives. Detailed effects analyses for each alternative are found in Chapter 4 of the Draft EIS.

Proposed mining activities were found to have minimal to no effect on several of the resource areas analyzed, and there were minimal differences between the potential effects of each alternative. These resource areas include soils, hazardous materials, air quality, power supply, noise, cultural resources, socioeconomics, land use, recreation, and visual scenery. These resource areas are not discussed further in this summary and a more detailed description of potential effects is found in Chapter 4 of the Draft EIS.

Resource areas where there could be potentially substantial impacts under one or more alternatives include geology, vegetation and wetlands, surface water, groundwater, transportation, fisheries, and wildlife. The differences in potential effects between alternatives for these resource areas are described in the sections below. Potentially substantial impacts are summarized in Table ES-1.

Geology

The BHJV project is in a historic mining area. Additional exploration and mining in the area will exhibit similar land use practices that have occurred in the recent past. The impact to the geology will be much less with underground mining then if an open pit was designed to extract the ore.

Under the No Action Alternative, BHJV would remove 10,000 tons of geologic material as part of the exploration license. There would be no additional removal of geologic material under the No Action Alternative. The geology within the mined area would be irreversibly and permanently altered.

Under the Proposed Action, mined material would be removed from the subsurface at a rate of approximately 800 tons per day, which includes both ore and waste rock. The estimated mineral resource to be developed is 1,200,000 tons. The voids would be backfilled with cemented waste rock fill at a rate of 600 to 700 tons per day. The mining and backfilling would permanently and irreversibly alter the subsurface geology by removing native rock and replacing it with a mixture of backfilled material. The BHJV proposes mitigation for the risk of surface subsidence by mining a minimum of 300 feet below the surface (BHJV, 2013).

Data available to-date indicate that waste rock generated during the BHJV drilling program do not present a hazard related to asbestos exposure. However, variability throughout the deposit suggests that some zones of the underground workings could contain asbestiform minerals. The waste rock would be periodically screened for asbestiform minerals.

Neither of the haul route alternatives would create a different level or extent of impacts to surficial geologic resources from the impacts anticipated due to the development of the haul route described under the Proposed Action.

Vegetation and Wetlands

There would be no impacts to vegetation resources (vegetation communities, rare plant species, or noxious weeds) through implementation of the No Action Alternative. All previously permitted surface disturbances that affect vegetation resources have already occurred. Continued use of the land application disposal system (LAD), if pursued, may have the potential to increase the water supply to the wetlands to the west of LAD 2, but the overall impact to the wetland complex is likely to be negligible.

Under the Proposed Action, the vegetation communities within the analysis area would be impacted by removal of vegetation and soil for construction of roads and facilities. A total of 12.7 acres of native vegetation is expected to be disturbed and later reclaimed. This total includes 0.5 acres for the laydown and yard area, approximately 10 acres for the proposed haul route permit area, 0.5 acres for the transfer facility, and 1.7 acres for a new MPDES pipeline (BHJV, 2013).

The Proposed Action has potential to produce impacts to wetlands and riparian vegetation communities adjacent to construction areas by altering hydrology or increasing sedimentation. These changes would persist for the life of the mine project until reclamation is complete.

There is potential for impacts to special status plants from the Proposed Action if these plants are killed or displaced by construction. Special status plants may experience secondary impacts through temporary loss of suitable habitat that may be cleared, graded, or otherwise developed during the Proposed Action. Competition due to introduced weeds may also hinder native and special status plants

The Proposed Action would disturb 12.7 acres of land, and provide an increase in potential pathways for dispersal of weed seeds. Land clearing would provide disturbed areas that are susceptible to invasion by noxious weeds. Existing weed populations disturbed by the Proposed Action would have an opportunity to spread via increased vehicular traffic and earth moving activities. Increases in abundance and distribution of noxious weeds have the potential to displace common and rare native plants, to reduce overall plant community diversity, and to degrade wildlife habitats.

The wetlands near the proposed private haul route are riparian and follow the channel of Fly Creek. The proposed road alignment avoids the wetland areas and is unlikely to impact them. Impacts to the wetlands due to road construction would be short term and highly localized to the area near the stream crossing. The wetlands are far enough removed from the proposed road alignment to make impacts due to runoff from the new road or accidental spills unlikely.

Minor secondary impacts to wetlands near the BHJV Mine site from the Proposed Action may occur after mine closure if the groundwater hydrology is affected. The proposed mine site sits on the Continental Divide and once the adit is closed, it is unclear how the cessation of dewatering will affect groundwater flow and dispersal among the three watersheds straddling the Continental Divide. However, given the shallow soils and location of the larger wetland complexes, it is anticipated that any impacts to wetland hydrology would be minor.

The Highland Road (West) Parallel Alternative haul route, moving the haul route to parallel the existing Highland Road, would not change the level or extent of impacts to vegetation resources from the impacts anticipated due to the development of the haul route as described under the Proposed Action. Moving the haul route away from the relatively undisturbed pasture lands to an area that is set aside as a road right-of-way would decrease the level of disturbance to native vegetation and may reduce the overall likelihood of weed spread. The parallel haul route moves the roadway farther from the wetlands and Fly Creek and would decrease the potential for impacts to these areas as well.

Surface Water Resources

The existing exploration license permits land application for the disposal of mine water. This system includes underground sumps, surface settling ponds, and three LAD sites. Under the proposed Operating Plan, BHJV intends to install underground dewatering wells, dewater the mine area ahead of mine development, treat the dewatering water, and discharge it under a MPDES permit. BHJV has been issued a MPDES permit that allows discharge of treated mine water to outfalls located on Fish Creek, the Middle Fork of Moose Creek, and Basin Creek. Water produced from the dewatering wells and any excess water reporting to the underground workings would be treated to meet the non-degradation standards of the MPDES permit.

Under the No Action Alternative there is a potential for reduction in stream flow rates. Under the existing exploration license, dewatering operations may cause a reduction of groundwater recharge to surface water bodies. The reduction in flow volume was not estimated as part of the existing exploration license.

Under the Proposed Alternative, stream flow rates would be altered from current conditions. The adit discharge to Basin Creek will stop after dewatering efforts lower the groundwater elevation below the adit elevation. This is estimated to occur within one month after dewatering begins

(BHJV, 2013). The current operating plan proposes discharge of the water from the water treatment plant. A flow rate of 350 gallons per minute (gpm) to Basin Creek is proposed. This flow rate will more than account for the 150 gpm of historic discharge from the adit (BHJV, 2013).

Water will also be discharged to two tributaries of the Middle Fork of Moose Creek with proposed flow rates of 60 gpm to one tributary and 140 gpm to the other tributary. The average combined baseline discharge for these two Moose Creek tributaries is 170 gpm. An average flow of 200 gpm will be discharged to Fish Creek increasing the volume of water flowing through the creek.

Additional proposed surface disturbance for the Proposed Action include a 0.5 acre expansion of the laydown area and approximately 11 acres of additional disturbance associated with an ore transfer facility and a new ore haulage road. This additional area would have the potential for higher erosion rates due to lack of vegetation with increased sediment loading to the surface water bodies. Basin Creek, lower Fish Creek, and upper Moose Creek are anticipated to be sensitive to disturbance.

The potential for augmented flow conditions to destabilize the stream channels was evaluated as part of a fluvial geomorphology study (BHJV, 2013). Results of this study indicate that the current stability of receiving streams is not likely to change as a result of the increased flow planned as part of the MPDES discharge.

Runoff from the ore transfer facility and ore haulage road could increase the volume of water delivered to stream channels, elevate the peak streamflow rate, and cause accelerated erosion in stream channels. Roads can increase peak flows by routing runoff more directly to stream channels. The construction and presence of these new roads could result in increased sediment load to Divide Creek, Fly Creek, Climax Gulch, and Curly Gulch during the life span of the mine.

Under the Highland Road (West) Parallel route the haul route would be moved to parallel the existing Highland Road. This would not increase the level or extent of impacts to surface water resources from the impacts anticipated due to the development of the haul route described under the Proposed Action. Moving the haul route away from the channel of Fly Creek to an area that is set aside as a road right-of-way would decrease the level of disturbance and may reduce the overall likelihood of sediment or pollutants entering the stream.

Groundwater

Current groundwater level in the historic mine adit is 7,339 feet NGVD (National Geodetic Vertical Datum of 1929). Groundwater elevations would be lowered under the No Action Alternative as a result of dewatering operations at the BHJV Mine to ensure dry conditions during bulk sampling. Much less dewatering would occur under exploration when compared to active mining. The area of groundwater impact would be less than the Proposed Action due to the limited duration of dewatering.

The primary impact to groundwater under the Proposed Action alternative would be similar to the No Action; however, the Proposed Action would impact a greater geographic extent for a longer duration of time. At the end of the first dewatering period, the water level is expected to be at an elevation of approximately 6,300 feet. Water levels would be maintained at this 6,300 feet NGVD level during mining. A constant pumping level would be established to maintain mine water levels below the target depths for the duration of mining. Mine dewatering is not predicted to impact baseflow in Moose Creek or the southern tributary to Fish Creek. Flow from the historic Highlands Mine portal (WS-1) is predicted to cease when dewatering begins, and then begin to flow approximately eight years after mining has ended. A northern tributary to Fish Creek is predicted to have a reduction in baseflow of about 12 gpm, which is less than 10 percent of the flow predicted. Flows during spring runoff and precipitation events are not expected to be impacted.

Water from the historic Highlands Mine portal currently (premining) flows at a rate of approximately 125 gpm into a channel which feeds the Basin Creek Reservoir. Dewatering is expected to stop the outflow of water from the portal after approximately one month of dewatering. A water-tight plug will be placed at closure to prevent flow from the portal following recovery of groundwater levels, approximately 7.5 years after mining ceases. Plugging of the historic Highland Mine adit would eliminate flow from the adit and promote return of the groundwater system to historic premining conditions and fracture flow pathways. Because mine dewatering activities would cause a cessation of flow from the historic Highland Mine adit, it is possible that the Basin Creek wetland may not be sustained during the active period of mining without supplementation of water flow.

Fish Creek Wetland 1 appears to exist in conjunction with a perched aquifer that is not directly connected to the permanent groundwater system. Depth to the water table is greater than 12 feet and it is unlikely that the deeper regional groundwater system sustains the wetland vegetation in Wetland 1.

Wetland 1 and 3 in the headwaters of the Moose Creek drainage appear to possibly have a connection between shallow and deep groundwater. Data from piezometers installed in Wetlands 1 and 3 suggest a slight negative (downward) hydraulic gradient in both wetland areas. Moose Creek wetlands may be impacted from fluctuations in water levels at the site.

Plugging of the historic Highlands adit may result in the formation of seeps or springs as water currently discharging from the adit is redirected into fractures and premining flow paths. The number and rates of flow from these new water sources would depend on their elevation relative to the ultimate post-mining water level (i.e. reduced head if they form above the level of the historic adit). BHJV will monitor the area for spring and seep formation for a minimum of one year post-closure after recovery of groundwater levels.

Groundwater from the mine dewatering operations may contain constituents that exceed groundwater quality standards or non-degradation surface water criteria. BHJV would treat mine water prior to discharge to meet non-degradation standards. Therefore, impacts to water quality from mine discharge water are not expected beyond monitoring locations.

Under the Agency-Mitigated Alternative BHJV would expand its proposed water quality monitoring plan and add monitoring wells which would allow better characterization of the groundwater recharge and ensure meeting water quality standards.

Transportation

Under the No Action Alternative, Proposed Action, and Agency-Mitigated Alternative, the following issues were evaluated to determine their potential impacts on the transportation system within the analysis area.

- Vehicle use and required roadway improvements
- New road construction
- Road maintenance
- Effects on recreational access

As noted earlier, the Forest Service is evaluating the potential impacts of the proposed BHJV Mine on the roads and lands under their jurisdiction. DEQ's impacts analysis is restricted to the areas where the agency has regulatory authority.

Under the No Action Alternative, minor improvements could be required to the Roosevelt Drive route for the transport of the bulk sample. It should have adequate width, curve radii, and surface conditions for highway-legal trucks to operate. Some minor road base and surface upgrades may be required, as well as some widening at curves and at the railroad trestle underpass.

The No Action Alternative would not include construction of any new roadways. Road maintenance requirements would likely consist of additional snow removal on Highland Road, dust suppression, and noxious weed control.

The Great Divide Mountain Bike Trail coincides with the Roosevelt Drive access route, and the No Action Alternative would have some minor effects on recreational access. This would be a lesser impact than that associated with the conflict between mountain bikes and haul vehicles under the Proposed Action. All alternatives under consideration may have an indirect impact on recreational and hunting access to the area.

Under the Proposed Action, the mine site would be accessed by two routes: Roosevelt Drive, which would be used by workers, general deliveries, and site visits, and Highland Road, which would be used to haul ore from the mine to the transfer facility near Interstate-15. A measurable increase in vehicle and truck traffic will occur on both routes.

The proposed Highland Road as it traverses Forest Service lands (Road 84) would require widening narrow areas, adding pullouts at regular intervals and where visibility requires, installing ditches and culverts, and rebuilding soft spots (BHJV, 2013). The road would also be capped with gravel. The haul route would include a three-mile segment of new roadway that would be constructed on private property. Under the Proposed Action, BHJV would perform snow removal on Highland Road all the way to the transfer facility, as well as dust control, noxious weed control, erosion control, and culvert and ditch maintenance.

Moving the haul route to parallel the existing Highland Road (Highland Road (West) Parallel Route) would not create a different level or extent of primary impacts to transportation resources from the impacts anticipated due to the development of the haul route as described under the Proposed Action. There may be slight variations in length and width of roadway construction that may impact the overall area of disturbance, but it is unlikely that the route length or capacity would differ substantially. Haul truck traffic would be separated from public traffic on the portion of Highland Road west of the Forest Service boundary.

Fisheries

Impacts to fisheries and aquatic resources would stem from changes in water availability and water quality. There are populations of westslope cutthroat trout, a species of special concern, in Basin Creek and Fish Creek.

Under the No Action Alternative there is a potential for reduction in stream flow rates. Under the existing exploration license, de-watering operations may cause a substantial delay in groundwater recharge to surface water bodies. The extent of this change is not known, but the MPDES permit estimated that groundwater storage would be reduced due to the dewatering, and that groundwater recharge after closure could take up to eight years. Decreased groundwater levels would impact surface water flows for a period after mine closure. Changes to surface water could affect aquatic organisms in wetlands as well as streams.

Under the Proposed Alternative, stream flow rates would be altered due to dewatering at the mine site. Dewatering will reduce groundwater input to streams, but BHJV will return substantial amounts of treated water in excess of average annual flows to Basin Creek, Fish Creek, and tributaries of Moose Creek. The uncertainty related to how the creeks and the aquatic ecology will adapt to the change in flows makes assessing potential impacts difficult. Plugging the historic Highland Mine adit could also negatively affect flows in Basin Creek over the long term by redirecting the mine outflow. The position of the mine along the Continental Divide complicates predicting how these alterations will ultimately resolve where the water will flow. The interim period between dewatering cessation and groundwater recharge is long enough to potentially negatively affect fish populations in the creeks near the mine site including the native westslope cutthroat trout.

Fly and Divide Creeks may be impacted during road construction, particularly at or near proposed culvert and stream crossing sites. Sediment control BMPs would be used during construction to minimize the amount of material that enters the streams and wetlands in the vicinity.

The Highland Road (West) Parallel haul route alternative would potentially decrease the level and extent of impacts to fisheries and aquatic resources from those anticipated due to the development of the haul route described under the Proposed Action. The alignment adjacent to the existing road would keep the road disturbance away from Fly Creek and could reduce the potential for impacts due to sediment input and pollutants to the creek and nearby wetlands.

Wildlife

Impacts to wildlife resources under the No Action Alternative are those that are ongoing from activities approved under the existing exploration license. Ongoing risk of roadkill from traffic along Roosevelt Road to and from the proposed mine project area exists. This impact is temporary since, under the No Action Alternative, mine closure would be initiated in less than one year after completion of exploration activities.

Under the No Action Alternative there would be the continued temporary loss of habitat associated with the exploration disturbance, surface facilities, and portions of the LAD areas (total of 68.1 acres). This temporary loss of habitat would continue until mine closure and completion of reclamation. Wildlife may avoid the BHJV exploration area or portions of the area because of the exploration activity and road traffic.

Under the Proposed Action, roadkill impacts would almost certainly increase due to the increase in traffic along Roosevelt Drive and along the proposed haul route, and would occur for the six to seven years of mine operation. In addition, 12.7 acres of temporary habitat loss would occur. Most of the habitat loss would be associated with the proposed haul route permit area and transfer facility. Disturbance to wildlife would be greater than under the No Action Alternative. Short term disturbance to wildlife would occur primarily from traffic on the proposed haul route. Species of concern such as grizzly bears and wolverines may avoid this area.

Because the work force will increase up to 54 people under the Proposed Action, impacts to wildlife may also increase. BHJV has identified protection measures for wildlife in their operating permit application.

Table ES-1. Potentially Substantial Effects by Alternative

	No Action Alternative	Proposed Action	Alternative Haul Routes	Agency-Mitigated Alternative
Geology	Alternative would result in removal of 10,000 tons of waste rock and ore under the exploration license.	Alternative would result in removal of 1,200,000 tons of waste rock and ore, with subsequent backfilling. Mining will not occur less than 300 feet below the surface to minimize risk of surface subsidence.	No impacts	Same as the Proposed Action
Vegetation and Wetlands	Alternative would result in no impacts to vegetation resources. All previously permitted surface disturbances that affect vegetation resources have already occurred.	Alternative would result in temporary impacts to vegetation and soil from construction of roads and facilities. Impacts to wetlands and riparian vegetation adjacent to construction areas may be impacted until reclamation is complete. Noxious weeds have the potential to spread due to disturbed acreage.	Moving the haul route away from the relatively undisturbed pasture lands to an area that is set aside as a road right-of-way would decrease the level of disturbance to native vegetation and may reduce the overall likelihood of weed spread. The parallel haul route moves the roadway farther from the wetlands and would decrease the potential for impacts to these areas.	Same as the Proposed Action
Surface Water	Alternative would result in potential for reduction in stream flow rates. Under the existing exploration license, dewatering operations may cause a reduction of groundwater recharge to surface water bodies.	Alternative would result in altered stream flows. Adit discharge into Basin Creek will stop after dewatering lowers groundwater below adit elevation. During mining, increased flow will occur in two Moose Creek tributaries and Fish Creek from discharge of treated water from the water treatment plant.	Moving the haul route away from the channel of Fly Creek to an area that is set aside as a road right-of-way would decrease the level of disturbance and may reduce the overall likelihood of sediment or pollutants entering the stream or wetlands.	Increased monitoring may allow detection of water quality exceedances.

	No Action Alternative	Proposed Action	Alternative Haul Routes	Agency-Mitigated Alternative
Groundwater	Alternative would result in lower groundwater elevation as a result of dewatering operations.	Alternative would impact groundwater similar to No Action Alternative, but depth and rate of dewatering would be greater and would have greater geographic extent for a longer period of time. Pre-mining discharge from underground workings to Basin Creek and associated wetland would stop. Adit will be plugged at end of mining to eliminate discharge into Basin Creek. Seeps or springs may develop as water currently discharging from the adit is redirected into fractures and pre-mining flow paths. The potential for dewatering Fish Creek and Moose Creek wetlands exists, and additional monitoring data are recommended. Water levels will likely rebound post-mining.	No additional impacts from either haul route alternative	Increased monitoring may allow detection of water quality exceedances. Additional measures to monitor groundwater levels during dewatering would minimize uncertainty associated with the groundwater drawdown model.
Transportation	Alternative would result in 22-ton highway-legal dump trucks to haul approximately 450 truckloads using Roosevelt Drive.	Alternative would include two routes. Roosevelt Drive would be used by workers, general deliveries, and site visits. Highland Drive out to Interstate-15 would be used to haul ore from the mine to the transfer facility. Both routes would require an increase in vehicle traffic and road upgrades. The ore haul route to the transfer station would require construction of a new parallel road. Effects on recreational uses by mountain bike riders and hunting season access would occur, but mitigations are proposed.	West Alternative: Same impacts as the Proposed Action North Haul Route Alternative: Using the smaller highway legal trucks would necessitate increasing the number of round trips per day from 20 to 30 haul truck loads.	Not addressed as part of the Agency-Mitigated Alternative

	No Action Alternative	Proposed Action	Alternative Haul Routes	Agency-Mitigated Alternative
Fisheries	Alternative would result in potential for reduction in stream flow rates. Under the existing exploration license, de-watering operations may cause a reduction of groundwater recharge to surface water bodies.	Stream flow rates would be reduced due to delayed groundwater recharge after dewatering ceases at the mine site. Level and extent of impacts would be difficult to predict, but reduced stream flows would negatively impact native westslope cutthroat trout populations.	Moving the haul route to parallel the existing Highland Road would potentially decrease the level and extent of impacts to fisheries and aquatic resources from those anticipated described under the Proposed Action. The alignment adjacent to the existing road would keep the road disturbance away from Fly Creek and could reduce the potential for impacts due to sediment input and pollutants to the creek and nearby wetlands.	Increased monitoring may allow detection of water quality exceedances which could prevent adverse effects to aquatic ecology.
Wildlife	Alternative will include temporary and ongoing risk of roadkill from traffic along Roosevelt Road to and from the proposed mine project area.	Alternate would likely result in increase in roadkill due to the increase in traffic along Roosevelt Drive and along the proposed haul route. This impact would persist for the 6-7 years of mine operation. Alternative would result in 12.7 acres of additional habitat loss compared to the No Action Alternative. Most of the habitat loss would be associated with the proposed haul route permit area and transfer facility (approximately 11 acres). Alternative would result in more wildlife disturbance than the No Action Alternative.	Selection of the Highland Road (West) Parallel haul route alternative would not change the level or extent of impacts to wildlife from those anticipated due to the development of the haul route as described under the Proposed Action. The Highland Road (North) Roosevelt Drive haul route would increase the total number of truck trips and may lead to an increase in roadkill.	Not addressed as part of the Agency-Mitigated Alternative

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Executive Summary

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Acronyms and Abbreviations

Acronym	Description
µS/cm	micro Siemens per centimeter
ABA	Acid Base Accounting
ags	above ground surface
amsl	above mean sea level
AP	Acidification Potential
ARD	Acid Rock Drainage
ARM	Administrative Rules of Montana
ARMB	Air Resources Management Bureau, a division of Department of Environmental Quality (DEQ)
ASARCO	Company Name
BACT	Best Available Control Technology
bgs	below ground surface
BHJV	Butte Highlands Joint Venture
BLM	Bureau of Land Management
C	clay loam
CaCO3	Calcium Carbonate
cfs	cubic feet per second
CL	clay loam
CO	Carbon Monoxide
CO_2	Carbon dioxide
CRF	Cemented Rock Fill
CS	clean sand
CWA	Clean Water Act
DEQ	Department of Environmental Quality
DEQ-AMRB	Department of Environmental Quality Air Resources Management Bureau
EA	Environmental Assessment

Acronym	Description
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
Fe	Iron
$Fe_{(1-x)}S_2$	Chemical formula for pyrrhotite
ft^3/day	cubic feet per day
FWP	Montana Department of Fish, Wildlife, and Parks
gpm	Gallons per minute
GWIC	Groundwater Information Center
HAPs	Hazardous Air Pollutants
HRM	Hard Rock Mining
HRM	High Recovery Membrane
HUC	Hydrologic Unit code
IPR	Interstage Precipitation Reactor
K	Potassium
km	Kilometers
Kw	Water Erosion Potential of the whole soil
L	Loamy sand
LAD	Land Application Disposal
LAD#MW	Land Application Disposal Monitoring Wells
LHD	Load Haul Dump
LP	Liquid Petroleum
LS	Loamy sand
MAAQS	Montana Ambient Air Quality Standards
MCA	Montana Code Annotated
MDT	Montana Department of Transportation
MEPA	Montana Environmental Policy Act
MFISH	Montana Fisheries Information System
Mg	Magnesium

Acronym	Description
mg/L	Milligrams per liter
MINEDW	Mine dewatering soft water
mm	Millimeter
MMRA	Montana Metal Mine Reclamation Act
MNHP	Montana Natural Heritage Program
MNPS	Montana Native Plant Society
MPDES	Montana Pollutant Discharge Elimination System
mS/cm	milliSiemens per centimeter
MSHA	Mine Safety and Health Administration
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Protection Act
NGVD	National Geodetic Vertical Datum of 1929
NNP	Net Neutralization Potential
NOI	Notice of Intent (associated with storm water permitting)
NO_X	Nitrogen Oxides
NP	Neutralization Potential
NPS	Nonpoint Source
NRCS	Natural Resources and Conservation Service
NSR	New Source Review
NWI	National Wetland Inventory
Pb	Lead
PEM	Paulstrine Emergent
PFO	Palustrine forested
pH	Power of Hydrogen
PLM	Polarized Light Microscopy
PM	Particulate Matter
PM_{10}	Particulate Matter less than 10 microns in diameter
PNV	Potential Natural Vegetation

Acronym	Description
PRISM	Parameter-Elevation Regressions on Independent Slopes Model
PSD	Prevention of Significant Deterioration
PSPC	Potential Species of Concern
PSS	Palustrine Scrub-Shrub
PTE	Potential to Emit
RCRA	Resource Conservation and Recovery Act
RO	Reverse Osmosis
ROD	Record of Decision
S	Sulfur
SMES	Small Miner Exclusion Statement
SMU	Smoke Management Units
SNOTEL	SNOw TELemetry
SO_2	Sulfur oxides
SOC	Species of Concern
SPCC	Spill Prevention, Control, and Countermeasures
SPLP	Synthetic Precipitation Leach Procedure
SWPPP	Storm Water Pollution Prevention Plan
TMDL	Total Maximum Daily Loads
TPY	Tons per Year
TSS	Total Suspended Solids
UIC	Underground Injection Control
USDA FS	United States Department of Agriculture Forest Service
USGS	United States Geological Survey
VOC	Volatile Organic Compounds
VWT	Vibrating Wire Transducers
WQA	Water Quality Act
WW	Water Well

Glossary and Useful Terminology

Term	Definition
303 (d) listed water bodies	Section 303(d) of the Clean Water Act requires that states periodically identify waters that do not or are not expected to meet applicable water quality standards
401 certification process	Refers to section 401 of the Water Quality Act, which allows states to make decisions about wetlands
Acid base accounting	Used to determine the acid consuming properties of the waste rock
Acid rock drainage	Water from pits, underground workings, waste rock, and tailings containing free sulfuric acid. The formation of acid drainage is primarily due to the weathering of iron pyrite and other sulfur-containing minerals. Acid drainage can mobilize and transport heavy metals which are often characteristic of metal deposits
Actinolite	A bright-green or grayish-green mineral, a variety of asbestos, occurs in long needle-like crystals. Occurs in metamorphic rocks or altered igneous rocks
Adaptive management	System of management practices based on clearly identified outcomes, the monitoring of the outcomes, and facilitating management changes that will best ensure that outcomes are met
Adit	An opening drive horizontally into the side of a mountain or hill in order to provide access to a mineral deposit
Aerobic	An oxygen rich environment
Agency-mitigated alternative	A plan that has been altered by a governing agency
A-horizon	The first distinguishable layer of soil
Alkalinity	The quantitative capacity of water to neutralize an acid
Alluvium	Sand, silt, gravel, and similar materials transported and deposited by water
Alpine Zone	The habitat above the timber line
Alteration assemblage	Mineralization from hydrothermal fluids within a host formation characterized by a sequence of minerals and textures
Amphibole	A group of complex silicate minerals that contains a combination of calcium, sodium, magnesium, aluminum, and iron ions
Antiforms	A fold that has the oldest layers at the core of the fold
Antimony	An element that is found with sulfide mineral deposits. Elevated concentrations of antimony in surface water and groundwater poses risks to the environment and human health concerns.
Aquifer	A subsurface rock or sediment unit that is porous and permeable and can store

Term	Definition
	useful quantities of water
Archean	A measure of geologic time, called a Geologic era, from approximately 3.75 to 2.5 billion years ago
Argillite	A compact rock, derived either from mudstone or shale with less visible laminations and fissile properties than shale
Arkosic	A type of sandstone that contains at least 25% feldspar
Asbestiform mineral testing	Testing for presence of minerals that form asbestos fibers
Assay	A chemical test performed on a sample of ores or minerals to determine the amount of valuable metals contained within the ore
Attainment area	An area where the air quality currently meets or exceeds NAAQS primary standards
Atterberg limits	Test to estimate strength and settlement characteristics of soils
A-vein	Thin alteration assemblage within the diorite consisting of quartz, potassium feldspar, and diopside with envelopes of coarse-grained biotite and black olivine.
Backslope	When the angle of underlying rocks are divergent from the angle of the land surface
Barrier plug	A mix of cement, rebar, reinforced concrete and aggregate installed in the bedrock within the adit designed to contain the water within the mine workings once flooded.
Bedrock	Solid rock underlying the soil or other unconsolidated material
Belt Supergroup	An assemblage of mesoproterozoic sedimentary rocks, primarily mudstones, deposited 1.47 to 1.4 billion years ago.
Biotitie	A black to dark brown or dark green mineral in the mica group that forms in crystalline rocks. The mineral is in the mica family.
Boulder batholith	Late Cretaceous granitic intrusion hosting rich mineralized deposits of copper, silver, gold, zinc, and lead in southwestern Montana.
Brecciated	A rock that resembles breccia, a course grained rock formed of angular broken rock fragments.
Buttress	A projecting intrusion that acts as a support
Cadmium	An element that is blue-white and soft enough to be cut with a knife. Used in alloys with low melting points to reduce the coefficient of friction and resistance to fatigue. Also used for solder, in batteries, some television tubes. Elevated concentrations of cadmium in surface water and groundwater poses risks to the environment and human health concerns.

Term	Definition
Calc-silicate	A rock composed primarily of calcium and silicate rich minerals
Cambrian	Geologic time period, 570-510 million years ago.
Chalcopyrite	A bright yellow tetragonal mineral that occurs in cooper ore. The minerall consists of iron, copper and sulfur ions.
Class I Air Quality	Areas of special national or regional natural, scenic, recreations, or historic value for which the PSD regulations provide special protection. It allows the smallest incremental growth and accommodates only a small degree of air quality deterioration
Class II Air Quality	Areas that can accommodate normal, well-managed industrial growth
Class III Air Quality	Areas that allow for the largest increments of growth and allow for a larger amount of development that Class I or II
Class V Underground Injection Permit	Permit required to inject non-hazardous fluids underground. In Montana, the Environmental Protection Agency, Region 8, oversees the permitting process
Clastic sediments	Sediment made of broken rock fragments that are moved and redeposited by running water
Clean Air Act	Requires EPA to set national Ambient Air Quality Standards for pollutants considered harmful to public health and the environment by establishing primary and secondary air quality standards
Clean Air Act of Montana	Title 75, Chapter 2, Montana Code Annotated, Montana legislature providing adequate remedies for the protection of the environment specifically pertaining to air quality
Clean Water Act	The basis for the basic structure for regulating the discharge of pollutants from point sources to waters of the United States
Coarse grained	A particle size measuring between 0.5 and 1 mm
Conex box	A standardized reusable steel box used for safe, efficient and secure storage and movement of materials
Conglomerate	A course grained sedimentary rock composed of rounded to subangular fragments
Contact metamorphism	The process of thermally altering rock due to intrusion of magma
County Weed Control Act	Title 7, Chapter 22, Part 21, Montana Code Annotated, Montana legislature providing for the management of noxious weeds
Cretaceous period	Geologic period approximately 65-140 million years ago
Cryofluvents	Floodplain soils formed in cold climates
Cumulative effects	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions

Term	Definition
Cut/fill mining	A selective method of mining in which horizontal slices of ore are removed and the void is filled with waste material
Devonian	Geologic period approximately 400 to 360 million years ago
Dewatering	Removal of water from an area
Diagenesis	The process by which sediments become rocks
Diatoms	A single celled plant that grows in both marine and fresh water
Dike	An intrusion of magma that cuts across rock layers
Diopside	A silicate mineral varying in color from white to green. Occurs in metamorphic rocks containing a combination of magnesium, calcium, silica, and oxygen ions.
Diorite	An igneous rock dark in color containing mainly feldspars, biotite, hornblende, and pyroxene minerals and quartz to a much lesser extent
Dip	The angle of a rock slant
Direct effects	Effects that have a direct cause and effect relationship with a specific action. These are called “primary impacts” under MEPA
Dissemination	Minerals that are dispersed throughout a rock, instead of being concentrated in an area
Dolomite	A carbonate sedimentary rock similar to limestone, but with a higher magnesium content
Dolomitization	The process by which a limestone is converted to a dolomite through mineral replacement of calcium with magnesium
Drain field system	Sub-surface gravel lined infiltration basin
Ecotone	A transition area between two ecosystems
Effluent	Outflow of water (or another liquid) from a natural body of water or from a man-made structure
Electrical conductivity	The measure of a material's ability to transport electric charge
Erodibility	The quality, degree, or capability of a substance to wear away
Estuarine	Pertaining to or formed in a partly enclosed costal body of water where fresh and salt waters meet
Exceedances	Occurs when a parameter goes beyond what has been stipulated as a designated limit
Faults	A surface or zone in which two rock masses were displaced
Federal Land Policy and Management Act of 1976	Establish public land policy and to provide for the management, protection, development, and enhancement of the public lands

Term	Definition
Feldspar	An abundant silicate mineral group that is unusually white or clear that composes approximately 60% of the earth's crust containing aluminum and various compositions of other minerals.
Felspathic	A rock containing felspars
Fine grained	A rock with crystals ranging in size from 1/8 to 1/4 millimeter
Fissile	The capability of being easily split along closely spaced planes
Fold	A geologic structure in which layers or rocks have been permanently bent or curved as a result of deformation
Footslope	The gently sloping base of a hill
Footwall	The rock found on the underside of a vein or ore
General Mining Act of 1872	A US law that governs prospecting and mining for economic minerals on federal public lands.
Geotechnical	The application of scientific methods and engineering principles to solve a problem
Granite	An igneous rock containing mostly quartz and feldspars, usually light in color
Growth media rating	A rating to determine potential based on electrical conductivity, pH, texture, and coarse fragment content.
Hornfels	A fine grained contact metamorphic rock
Host rock	A rock that is older than the rocks or minerals introduced into it, formed within or adjacent to it
Humidity cells	A kinetic testing analysis designed to study the rate of sulfide mineral oxidation and used to simulate long-term mining and post mining conditions
Hydraulic conductivity	Rate at which groundwater moves through porous media
Hydraulic plug	See barrier plug
Hydrostratigraphy	Describes the structure of subsurface porous materials in reference to the flow of groundwater
Hydrothermal	Of or pertaining to hot water, the action by the hot water, or the products of the action
Indirect impacts	Effects that occur at a different location or later in time than the action that triggers the effect. These are called “secondary impacts” under MEPA.
Interbeds	layers of sedimentary rock in a different sedimentary rock
Intrusive rock	Igneous rocks formed from magma and crystallized within the earth's crust
Invasive plant species	A nonnative plant that thrives and can sometimes take over when introduced to a new area

Term	Definition
Iron oxide	A collective name for chemical compounds composed of iron and oxygen
Irretrievable commitment of resources	The use or consumption of the resource is neither renewable nor recoverable for use by future generations until reclamation is successfully applied
Keyed	When a support is placed into a cut in bedrock
K-feldspar	A potassium rich mineral that is a part of the feldspar family
Kinetic tests	Weathering of geologic material in a laboratory controlled environment in order to confirm the potential to generate acidity and to determine the rates of acid generation, sulfide oxidation, neutralization, and metal depletion
Lacustrine	Of pertaining to or formed in a lake or lakes
Leachate	A solution obtained by separating or dissolving minerals from a rock with water or a solution
Limestone	A sedimentary rock containing at least 50% calcium carbonate, formed in marine environments
Loam	A mixture of clay, silt, and sand
Lode mining	Mining of a mineral deposit that was deposited in veins within a rock
Macroinvertebrates	Aquatic insects, shellfish, and snails that cling to rocks and other material in the streambed
Magnetite	A black to steel gray iron oxide mineral with magnetic properties. Found in igneous and metamorphic rocks
Manganese	An element often found in combination with iron. It is used to improve the strength, stiffness, hardness, wear resistance, and hardenability of steels and other industrial uses. It is an important trace element in nutrition, but in higher quantities it can be toxic
Massive sulfide	A rock with an unusual abundance of metallic sulfide minerals e.g. pyrrhotite, pyrite, molybdenite, galena, sphalerite
Meagher dolomite	The dolomite part of the Meagher Formation
Meagher Formation	A medium to coarse grained light grey to buff limestone and dolomite
Medium grained	A particle size measuring between 0.25 and 0.5 mm
Metal mobility	The ability of a dissolved metal to move through water, rock, or soil
Meta-siltstone	A siltstone that has been subject to metamorphism
Micaceous	Consisting of or pertaining to mica minerals
Millisiemens	Measure of electric conductance
Mineralization	The process by which minerals are introduced into a rock

Term	Definition
Mississippian	Geologic period 360-320 million years ago
Mitigation	Actions that could be taken to reduce adverse impacts of the alternatives being presented
Molybdenite	A soft lead-gray hexagonal mineral. It resembles graphite in appearance and to the touch, but is bluer. An ore associated with massive sulfide deposits
Montana Nonpoint Source Management Plan	The management of polluted runoff to Montana's surface and groundwater from uncontrolled sources
Montana Water Quality Act	Regulatory framework for protecting, maintaining, and improving the quality of water for beneficial uses
Montane Zone	Habitat in the upland slopes below the timber line
Mother Lode Fault zone	A fault that contains a minerals related to other workable mineral veins
Mudstone	A rock composed of mud, similar to the composition of shale, but without the laminations
National Environmental Policy Act	Assure that all branches of government give proper consideration the environment prior to undertaking any action that could significantly impact the environment
National Historic Preservation Act	Signed into law in 1966 in an effort to preserve historical and archaeological sites in the U.S.
Nitrate	An inorganic ion that is soluble in water and are found in mineral deposits. It is used for fertilizers, oxidizing agents, and making explosives
No Action Alternative	The action proposed in a NEPA document is not taken and the environment stays the same
Noise dosimeter	A specialized meter intended to measure the noise exposure a person would experience over a period of time
Nonattainment areas	Regions which the EPA has designated, by rule, as not consistently attaining NAAQS limits
Nondegradation rules	Title 17, Chapter 30, Subchapter 7, Montana Code Annotated, requires the DEQ to protect high quality state water from degradation. The rules apply to any activity that may affect the quality of surface or groundwater
Nondiscretionary statutes	Requirements which are applicable to all actions on federal lands even though they may not be reflected in the oil and gas stipulations
Nonpoint source pollution	Substances that erode directly into surface waters or from aerially transported substances deposited on land and water
Normal fault	The vertical displacement of one block relative to the other
Northern claims	Group of mining claims. See Figure 1.1-2 for this area of the mining claim.

Term	Definition
Noxious weeds	An invasive plant species that has been deemed harmful to surrounding habitats
Observation pit	A hole dug to observe soils below ground level.
Olivine	An olive-green grayish-green magnesium iron silicate mineral that crystallizes early from magma and weathers easily. Weathers into serpentine
Overhand mining	Process of mining by which a cut is made, ore extracted, then backfilled. The next cut is made above the backfilled cut
Paleozoic era	A measure of geologic time, approximately 580-245 million years ago
Palustrine	All freshwater wetlands dominated by trees, shrubs, emergent herbaceous plants, floating leaved and submerged plants, and mosses and lichens
Palustrine emergent	Wetland characterized by rooted herbaceous and grass-like plants which stand erect above the water or ground surface. Vegetation present for most of the growing season. Includes marshes, meadows, and fens
Palustrine forested	Wetland dominated by woody vegetation 20 feet or taller. Usually include an over story of trees, and understory of young trees and shrubs, and an herbaceous layer. Also includes swamps
Palustrine scrub-shrub	Wetland dominated by woody vegetation less than 20 feet tall. Plant species include true shrubs, young trees and trees or shrubs that are small or stunted because of environmental conditions. Also includes shrub swamps and bogs
Parent material	A rock from which other sediments are derived
Patented mining claim	A claim for which the federal government has passed a patent (title of ownership) to the claimant, making the area private land. This means that the claimant owns the land as well as the minerals
Periphyton	Aquatic plants that grow on underwater surfaces suck as rocks or logs
Permeability	The measure of ease a fluid substance can flow through a rock, sediment, or soil
Permian	A measure of geologic time, approximately 345-290 million years ago
Piezometer	A shallow pipe used to monitor characteristics of an unconfined aquifer, usually within 5 meters of the surface
Placer mining	Mining of alluvial (water deposited sediments) deposits for minerals
Plutons	A deep igneous intrusion (magma below the earth's surface)
Point source discharges	Discharges of wastewater
Porosity	The percentage of a bulk volume material (rock/soil) that is void of material
Potassic	A rock with a high potassium content
Proterozoic	A measure of geologic time, from 470 million to 2.5 billion years ago

Term	Definition
Pyrite	A common pale-bronze to brass yellow cubic mineral, also called fool's gold containing iron and sulfur ions
Pyrrhotite	An iron sulfide mineral similar to pyrite but with variable iron content
Quartzite	A metamorphic rock consisting of mainly quartz, usually formed by the recrystallization of sandstone or chert
Reclamation	The return of lands by mining or mining-related activities to an approved postmining land use which has stability and utility comparable to that of the premining landscape except for rock faces and open pits which may not be feasible to reclaim to this standard.
Riffle	A natural shallow area in a stream bed which causes the water surface to break as it crosses the shallow area, causing waves
Riparian	Pertaining to or situated on the bank of a body of water
Riparian area	Habitats along the edge of water rivers and streams
Riverine	Pertaining to or formed by a river
Run-of-mine waste rock	Composite samples of mine waste rock including all alteration assemblages within each lithology
Sandstone	A sedimentary rock composed of rounded or angular fragments of sand
Sandstone	A clastic sedimentary rock with sand sized grains
Scarify	To make cuts or scratches in the surface of something
Scoping	Solicit participation from the public and interested agencies regarding the direction, breadth, and extent of the analysis contained in an environmental document
Sedimentary	A rock formed by the deposition of material on the surface of the earth and within bodies of water
Selenium	A metallic grey triagonal mineral. Elevated concentrations of selenium in surface water and groundwater poses risks to the environment and human health concerns
Serpentine	A common group of silicate minerals that are green to brown, have a greasy or silky luster, and slightly soapy feel Containing mainly magnesium, iron, silica, oxygen, and hydrogen ions with minor amounts of other trace minerals
Shear/fracture zone	A zone of rock that has been broken apart by parallel fractures, the area is often mineralized by ore-forming solutions
Shotcrete	Concrete conveyed through a hose and projected with compressed air at a high velocity onto a surface
Sill	An igneous intrusion that parallels the bedding, foliation, or the formation layers of a sedimentary or metamorphic rock

Term	Definition
Siltation	Siltation is the pollution of water by fine particulate terrestrial clastic material, with a particle size dominated by silt or clay.
Siltstones	A sedimentary rock formed from silt size particles
Skarn deposit	Metamorphic rocks composed of limestone or dolostone that have come into contact with an igneous intrusive body
Skarn metasomatism	Calcium bearing rocks, such as limestone and dolomite, that have been chemically altered
Smoke management units	A group consisting of federal, state, tribal, and private land managers and public health and regulatory agencies which focus on prevention of smoke impacts from fire projects
Soil horizon	Layers with different physical characteristics that lay parallel to the soil surface
Spiral ramp	A spiral tunnel which circles either the flank of the deposit or circles around the deposit. Allows access to the mine
Specific Yield	The ratio of the volume of water that a given mass of saturated rock or soil will yield by gravity to the volume of that mass
Steppe	A vast semiarid grass covered plain
Stocks	A small plutonic body with less than 40 square miles and no known floor
Stope	An excavation in a mine from which ore has been extracted
Strata	Multiple sheet like layers of sedimentary rock that are visibly separable from the layers above and below
Substrate	The substance, base, or nutrient, or other material on which an organism lives and grows
Syenogabbro	A plutonic rock consisting of gabbro and feldspar
Synforms	A fold in rocks in which the strata dip inward from both sides toward the axis
Synthetic precipitation leaching procedure	EPA test method 1312 used to determine the mobility of metals caused by acidic conditions
Tertiary	A period of geologic time, from 57.8-23.7 million years ago
Test pit	An area in which observation pits are dug to collect observations of soils
Thallium	An element that occurs as a byproduct of heavy metal sulfide ores. Thallium is used in electronics, pharmaceutical industry, and in glass manufacturing. Can be toxic in high quantities
Thrust fault	A fault caused by horizontal compression which results in older rock layers being displaced over younger rocks.
Toeslope	The lowest part of a slope or cliff

Term	Definition
Total hardness	A measure of the sum of the ions of calcium and magnesium as well as some other alkali metals
Transducer	A device placed in a water well to measure pressure by calculating the height of the water column. Can also measure temperature and specific conductance
Traveling kick net	A net used to collect macroinvertebrates during stream sampling
Triassic period	A measure of geologic time, from approximately 245 to 208 million years ago
Underhand mining	Working/excavating the deposit from the top to the bottom
Vat-leach gold extraction method	The process of using cyanide salts to extract gold from finely crushed ore in water. The cyanide binds to the gold ions, and makes them soluble in water, allowing separation from the rock
Veinlet	A small or secondary vein of minerals
Ventilation raise	Ventilation raises are excavated to provide ventilation for the workplaces, and can be modified for use as emergency escape routes
Vuggy	Pertaining to a small cavity in a vein or rock
Water erosion potential	The general susceptibility of a soil to sheet and rill erosion
Whole rock metal concentrations	The average amount of metal estimated to be in the entire rock formation
Wolsey formation	A thick sequence of grey green to dark green and black interbedded dolomitic mudstone and shale, with some siltstone and carbonate interbeds

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Chapter 1: Purpose and Benefits of the Proposed Action

1.1 Introduction

The Purpose and Benefits section of an Environmental Impact Statement (EIS) provides the context for the decision to be made. The purpose of the proposed issuance of the Hard Rock Operating Permit (operating permit) for the Butte Highlands Joint Venture (BHJV) underground mine is to allow BHJV to pursue extraction of mineral resources from its mining claims in accordance with the Montana Metal Mine Reclamation Act (MMRA) (82-4-301 et. seq. Montana Code Annotated (MCA). The BHJV gold mining project is located approximately 15 miles south of Butte, Montana (Figure 1.1-1). The proposed permit boundaries for the project are shown in Figure 1.1-2. In Chapter 1, the permitting background and history is explained, and the legal and procedural framework required to issue a mining permit in Montana is examined. The Department of Environmental Quality (DEQ) must decide whether to issue the BHJV operating permit as submitted (Proposed Action), to deny it (No Action Alternative), or to modify it (Agency-Mitigated Alternative) based on an examination of the potential impacts to the affected resources under DEQ's regulatory authority.

1.2 Butte Highlands Mine Background

The proposed Butte Highlands Mine is located on the Continental Divide on patented mining claims surrounded by the Beaverhead-Deerlodge National Forest (USDA FS) (Figure 1.1-2). The Butte Highlands deposit is a high-grade gold skarn deposit. Skarns form when molten igneous rock (magma) and associated hot fluids alter (metamorphose) surrounding rock that it intrudes. Skarns most commonly form when igneous rock contacts limestone. The area has a rich mining history that includes placer and underground mining, ore processing, and a community, Butte, which since its inception, has supported these activities. The BHJV Mine is in the Highlands Mining District close to the boundary between the Basin Creek and Highlands mining districts, delineated by Forest Service Road 84 (Highlands Road). Gold was first discovered in the area in 1866 when placer mining activities occurred in the area. In 1870, placer mining ended and the district was inactive for many years until 1930 when the Butte Highlands Mining Company initiated the construction and operation of the underground Highlands Mine. The Highlands Mine operated through 1942 when Federal Order L-208 ceased all gold and silver mining activities in the district.

The Highlands Mining District remained relatively inactive until the 1980s and 1990s when new exploration activities were conducted under DEQ approved exploration licenses. Major companies such as Placer Dome, Battle Mountain Gold, ASARCO, and others drilled 178 drill holes (totaling 61,338 feet) into the Nevin Hill area where the Butte Highland ore deposit is situated. In 2007, Timberline Resources Corporation (Timberline) acquired the property and initiated surface drilling activities. In 2009, Timberline formed a joint venture partnership and continued mine exploration activities under the name Butte Highlands Joint Venture (BHJV) under DEQ Exploration License No. 00680.

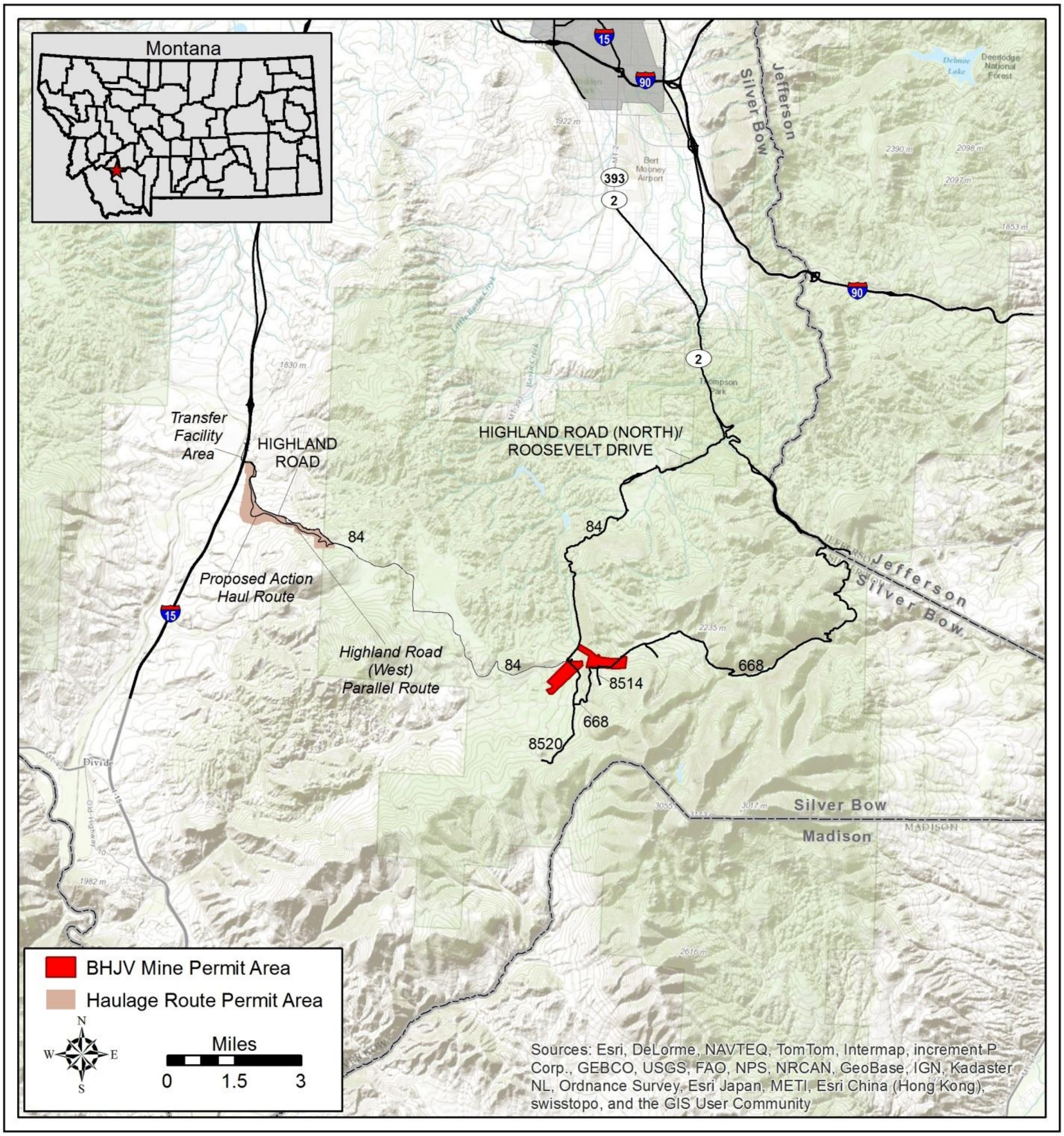

Figure 1.1-1. General Location Map for the Proposed Butte Highlands Joint Venture Mine, Silver Bow County, Montana.

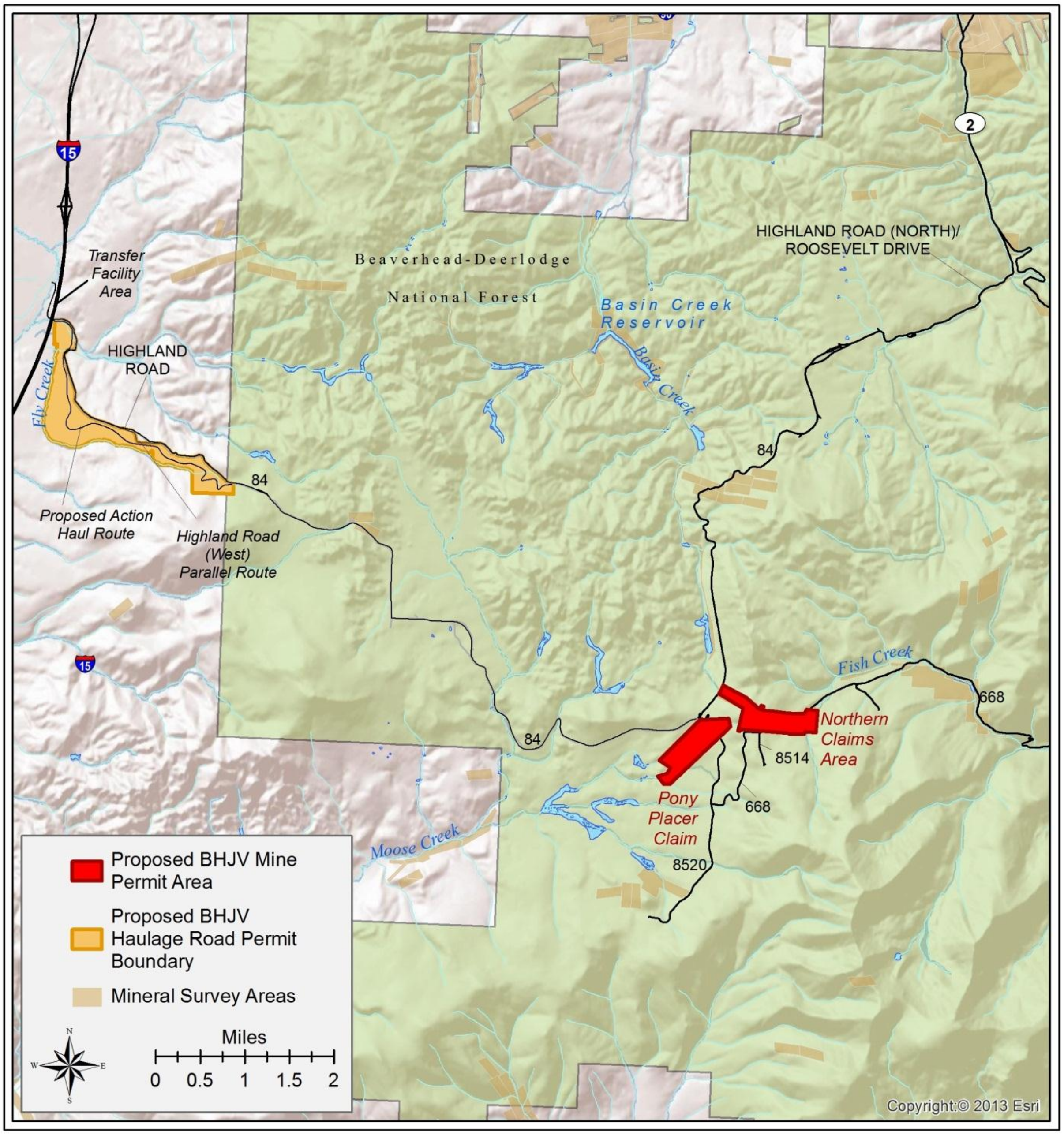

Figure 1.1-2. Proposed Permit Boundaries for the Butte Highlands Joint Venture Mine and Proposed Private Haul Route, Silver Bow County, Montana.

1.2.1 Butte Highlands Project Development

BHJV submitted an amendment to its DEQ exploration license to obtain authorization to construct a decline from which to conduct underground exploration. DEQ approved the exploration license amendment for this underground work in 2009 and development of the underground exploration activities commenced.

BHJV submitted an application for an operating permit to DEQ in May 2010. The operating permit application underwent four deficiency reviews with responses/revisions prior to BHJV receiving a Letter of Completeness and Compliance in December 2012. A Draft Operating Permit was issued at that time. A final operating permit application was prepared in January 2013 to incorporate final replacement pages and eliminate all superseded information provided during the deficiency review process.

During the operating permit deficiency review process, BHJV submitted an application for a Montana Pollutant Discharge Elimination System (MPDES) permit from DEQ. This application seeks authorization to discharge treated mine dewatering water to Basin, Fish, and Moose creeks located in the vicinity of the mine. DEQ issued a Letter of Completeness on the MPDES application in July 2012 and the draft permit was issued in April 2013. The final MPDES permit MT0031755 was issued August 1, 2013.

An application to discharge mine dewatering water using an underground infiltration system under a Class V Underground Injection (UIC) Permit from the United States Environmental Protection Agency (EPA) Region 8 was submitted in January 2013. EPA deemed the application complete later that month and is currently reviewing the application to determine whether to issue a draft permit.

BHJV obtained a Road Use Permit from the Forest Service in 2009 to use portions of Forest Service Road 84 to the east (Roosevelt Drive) for mine support activities. The permit also allowed use of Forest Service Road 84 to the west (Highlands Road) as an ore haulage route between the mine and the Forest Service boundary in route to an ore-transfer facility to be constructed adjacent to Interstate-15 (Kelley, USFS Minerals Administrator, pers. com. 2013). This permit expired in December 2012. Subsequent to a change in permitting regulations, the Forest Service later directed BHJV to submit a Plan of Operations for hauling ore along this route. This Plan of Operations was submitted to the Forest Service in February 2013 and is currently under environmental review by the USDA FS.

DEQ determined that an EIS is required to evaluate potential impacts from the proposed mining project prior to granting a Final Operating Permit.

1.3 Montana's Hard Rock Mining Permit Process

DEQ regulates the mining of all ore, rock, or substances except oil, gas, bentonite, clay, coal, sand, gravel, peat, soil materials and uranium under the MMRA. DEQ is required to issue timely and complete operating permit decisions for mining and reclamation of hard rock operations. In addition, the permitting process ensures appropriate public involvement through compliance with the Montana Environmental Policy Act (MEPA). A mining operation in Montana may apply for an exploration license, which usually provides for drill holes and trenches, but may also include an adit to access the ore body and assess the viability of the mining site. The operator may also file a Small Miner Exclusion Statement (SMES) if the mine would disturb five acres or less. All SMES operations exceeding five acres of total unreclaimed surface disturbance, must apply for an operating permit**.**

Once DEQ receives an operating permit application, the agency reviews it for completeness and compliance under the MMRA. DEQ may request additional information or modification of the application in order to deem it complete or to bring it into compliance. After the mine operator has adequately responded to DEQ's completeness and compliance review, DEQ issues a draft operating permit. This is the point in the process where review under MEPA begins. The MMRA regulates aspects of the permit related to mining and mine reclamation; MEPA is procedural, and its requirements provide for adequate review of state actions in order to ensure that environmental impacts to the human environment are fully considered and disclosed to the public (75-1-102(1), MCA).

1.4 Other Agencies Involved

The BHJV Mine would be situated on privately-held (patented) mining claims surrounded by Forest Service lands within the Beaverhead-Deerlodge National Forest. The roadway proposed to be used to haul the ore from the mine site out to a proposed transfer facility crosses Forest Service lands and must be evaluated by that agency under the National Environmental Policy Act (NEPA). Although the two actions are related, DEQ and the Forest Service have separate decision making processes. The Forest Service is conducting a separate analysis and will issue its own decision document. Information on the Forest Service process can be found at http://www.fs.fed.us/nepa/fs-usda-pop.php/?project=35069.

1.5 DEQ's Responsibilities and Decisions

DEQ administers the MMRA, which governs the mine operating permit, as well as the Clean Air Act of Montana (75-2-101, et seq., MCA), and the Montana Water Quality Act (75-5-101, et seq., MCA). The Montana Water Quality Act provides a framework for the classification of surface water and groundwater according to their beneficial uses. The Montana Water Quality Act establishes water quality standards and permitting programs to control the discharge of pollutants into state waters. DEQ has been authorized by the EPA to administer water discharge permits, including storm water permits under Section 401 of the Federal Clean Water Act (33 USC 1251, et seq.). Discharges to groundwater are regulated under the MMRA. Mining operations must comply with Montana surface water and groundwater quality standards. The Section 401 certification process ensures that discharges comply with applicable state water quality standards and that there would be no violation of state law if a federal permit or license is approved. In Montana, DEQ provides Section 401 certification pursuant to state rules (ARM 17.30.1701 et seq.).

When DEQ issues an air quality permit under the Clean Air Act of Montana, the permit must authorize the construction and operation of the facility or emitting unit subject to the conditions in the permit and to the requirements of the Act. The permit must contain any conditions necessary to assure compliance with the Federal Clean Air Act, with the Clean Air Act of Montana and rules and regulations adopted under those acts.

DEQ must also comply with MEPA (75-1-101, et seq., MCA) and other applicable state laws. DEQ must prepare an EIS to disclose the potential impacts of the Proposed Action, the No Action Alternative, and any other reasonable alternatives. DEQ will make a final permitting decision in a Record of Decision (ROD). The ROD is a concise public notice of DEQ's decision, explaining the reasons for the decision and any special conditions surrounding the decision or its implementation.

1.6 Scope of the Analysis

The geographic scope of this EIS includes the existing infrastructure related to the BHJV Mine, the areas within the proposed mine permit boundary, and the area related to the potential haul road construction site and transfer facility (Figure 1.1-2). The EIS presents descriptions of the Proposed Action and alternatives, including the No Action Alternative and the Agency-Mitigated Alternative (Chapter 2); descriptions of the affected environment for all potentially affected resources (Chapter 3); and an analysis of the impacts of the alternatives (Chapter 4).

1.7 Public Involvement Process

One of MEPA's objectives is to ensure that the public is informed of and participates in the review process. MEPA directs agencies to: invite participation in the determination of the scope of any EIS; provide a 30 day public review period for the draft EIS; and include the agency's response to substantive public comments in the final EIS. A public hearing on the draft EIS will be held during the public review period.

1.8 Issues Identified During Scoping

DEQ opened the scoping period for the BHJV Mine EIS on March 8, 2013. On March 21, 2013 DEQ held a scoping meeting in Butte, Montana. Comments made at the meeting were collected by DEQ and entered into the administrative record, as well as comments received via postal mail or e-mail. The scoping period ended on April 8, 2013. DEQ published notices of the scoping period and the scoping meeting in the Butte newspaper, *The Montana Standard*, on Sunday, March 10 and Sunday, March 17, 2013; and in *The Whitehall Ledger* on Wednesday, March 13 and Wednesday March 20, 2013. In addition, DEQ mailed scoping notices to 132 agencies and individuals who had expressed interest in the project.

The intent of scoping is to solicit participation from the public and interested agencies regarding the direction, breadth, and extent of the analysis contained in an EIS. Comments are evaluated based on their content and relevance and the jurisdiction of DEQ and associated agencies. Scoping comments may redirect the analysis or assist in development of alternatives.

Thirteen individuals or entities submitted written comments to DEQ, in addition to the comments recorded at the March 21 scoping meeting, during the public scoping period. The majority of comments were from individual citizens. The Montana Department of Transportation, the Jefferson Local Development Corporation, and the Montana Mining Association submitted comments on behalf of their respective organizations. Several commenters addressed more than one topic or resource area in their submittals. The transcribed comments from the March 21 meeting were collected anonymously. Thirty-five individuals were recorded on the attendance sheet at the scoping meeting. Three of the individual comment letters received expressed support for the proposed BHJV mine, but did not request specific direction or analyses in the EIS. These comments were duly noted, but no response was required. The remaining comment letters contained at least one substantive issue addressed in this EIS. Government agencies that participated in the scoping process and preparation of the EIS are identified in Chapter 6.

Several commenters addressed more than one relevant resource area. Comments focused on waste rock geochemistry, weeds, water quality and effects on surface and groundwater supplies, air quality, dust, socioeconomic effects, haul route alternatives, land use and recreation, visual resources, fisheries and wildlife, and the MEPA process. Comments were received that were beyond the scope of this EIS such as comments on the portion of the haul route that would pass through Forest Service lands, and a request to expand the analysis area to include all three receiving watersheds.

The Forest Service will complete a NEPA analysis separate from the DEQ MEPA analysis. This process is briefly described in Section 1.4. The request to extend the analysis area to include the Clark Fork, Big Hole, and Columbia Rivers would go beyond the direction of MEPA to include data analysis commensurate with the importance of the impact (MEPA Model Rules IX(3)). The EIS will analyze the level of impacts that are likely to occur based on the proposed amount of water discharge and potential for pollutants and sediments to be delivered to the receiving waters. As part of the EIS, DEQ will evaluate the level of potential impacts for each resource, and this will determine the impact analysis space, or geographic area to be assessed. MEPA (75-1-201(2) (a), MCA) states that an EIS may not include a review of actual or potential impacts beyond Montana's borders.

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Chapter 2: Description of the Alternatives

2.1 Overview

This chapter describes the process of developing and selecting reasonable alternatives to the Proposed Action. To be considered for further analysis, each potential alternative had to meet the purpose and benefits of allowing BHJV to pursue extraction of mineral resources from its mining claims, as well as regulatory, environmental, and economic feasibility criteria. In addition, each alternative must be deemed to be reasonable. A reasonable alternative is one that is practical, technically possible, and economically feasible. In most instances, economic feasibility of a Proposed Action as defined in MEPA is determined solely by the economic viability for "similar projects having similar conditions and physical locations and determined without regard to the economic strength of the specific project sponsor" (75-1-201, MCA).

Alternatives were evaluated and placed into the following categories:

- The No Action Alternative assumes that DEQ would not issue BHJV's operating permit. Exploration actions already approved under BJHV's exploratory license would continue.
- The Proposed Action describes BHJV's mine plan and its reclamation plan as submitted in its application for an operating permit.
- Alternative Haul Routes that are modifications of the Proposed Action that are reasonable and would support the purpose and benefits of the Proposed Action.
- The Agency-Mitigated Alternative identifies alternative components that are reasonable and that would support the purpose and benefits of the Proposed Action.
- Alternatives considered and eliminated include alternatives or alternative components that were examined but eliminated from detailed study.

To facilitate comparison of alternatives, background information is included on Montana's mining laws and rules and regulations to provide context on how the State permits mining activities as well as other required permits and environmental standards with which BHJV must comply. This review is not exhaustive; rather it provides an overview of the most pertinent regulations. The MMRA is contained in 82-4-300 *et seq.*, MCA; The MEPA is contained in 75-1-100 *et seq.*, MCA; the Montana Water Quality Act is contained in 75-5-101 *et seq.*, MCA; Montana's non-degradation policy is found in 75-5-303, MCA; and the Clean Air Act of Montana is contained in 75-2-100 *et seq.*, MCA. Readers are encouraged to read the primary source material for more complete understanding of the laws and rules and regulations that govern mining and resource policy in Montana.

2.1.1 Development of Reasonable Alternatives

The Proposed Action is a permitting action and would have potential implications for future land-use. A list of the alternatives considered in detail, and those considered but dismissed is provided in Table 2.1-1. A condensed description of the potential impacts is provided in Table 2.10-1 at the end of this chapter. These potential impacts relevant to each resource area are detailed in Chapter 4.

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Table 2.1-1. Description of the Alternatives Under Consideration and Alternatives Dismissed.

	Alternative	Ore Haul Route[a]	Additional Surface Disturbance	Total Surface Disturbance	Comments
1	No Action	Roosevelt Drive	No additional	Total area disturbed is 68.1 acres	Activities permitted under exploration license
2	Proposed Action	BHJV would proceed west on Highland Road for approximately eight miles to the Forest Service Boundary. This segment of the Highland Road is part of Forest Service Road No. 84. At the Forest Service Boundary going west, Highland Road becomes a county road. Beginning at the Forest Service Boundary, BHJV would construct a new haul road approximately 3 miles long. The haul route would rejoin Highland Road near the proposed transfer facility located adjacent to Interstate-15. Ore hauling: 30-ton, center-articulated trucks would haul approximately 20 round trips per day, five days per week (BHJV, 2013)	12.7 acres	Total area is 80.8 acres	
3	Highland Road (West) Parallel Route	BHJV would proceed west on Highland Road for approximately eight miles to the Forest Service Boundary. This segment of the Highland Road is part of Forest Service Road No. 84. At the Forest Service Road Boundary going west, the Highland Road becomes a county road. Beginning at the Forest Service Boundary, a new haul route would be constructed that generally parallels the existing Highland Road. The haul route would rejoin Highland Road approximately one third of a mile south of the proposed transfer facility located adjacent to Interstate-15. Ore hauling: 30-ton, center-articulated trucks would haul approximately 20 round trips per day, five days per week (BHJV, 2013)	10 acres for road and 2.7 for new facilities at mine site	Total area is 80.8 acres	
4	Highland Road (North)/Roosevelt Drive	BHJV would proceed north on Highland Road for approximately nine miles to Roosevelt Drive. This segment of the Highland Road is part of Forest Service Road No. 84. The haul route would continue to the northeast on Roosevelt Drive to Highway 2. Roosevelt Drive is a county road. Ore hauling: Highway legal dump trucks would require approximately 30 round trips per day, five days per week (Tetra Tech, 2013a)	2.7 for new facilities at mine site	Total area is 70.8 acres (no acreage for road)	Would require some improvements on Roosevelt

	Alternative	Ore Haul Route[a]	Additional Surface Disturbance	Total Surface Disturbance	Comments
5	Agency-Mitigated Alternative	Not addressed	Same as Proposed Action	Same as Proposed Action	Increased groundwater monitoring and more monitoring points. Water treatment facility to be moved to surface to ease post-closure maintenance.

[a] Employee and vendor traffic will access mine using Roosevelt Drive for all alternatives

Alternatives Considered and Dismissed

	Alternative	Ore Haul Route	Total Surface Disturbance	Comments
6	Fish Creek Road Haul Route	Fish Creek Road	Not quantified	Multiple stream crossings, road upgrade difficult, safety issues
7	Other USDA FS Haul Route Roads	Several options considered	Not quantified	Would require much longer routes, road upgrade difficult, safety issues, wetland and stream impacts
8	Highland Road Haul Route	Existing Highland Road	No Additional	Conflicts with existing road easement
9	Highland Mine Adit Left Open (not plugged)	NA	No Additional	May require long term water quality treatment and monitoring
10	Highland Mine Adit Plugged, but with Regulation Valve	NA	No Additional	Plug would allow future closure, but technology is not reliable

2.2 Project Area

The Butte Highlands Project is located on the Continental Divide approximately 15 miles south of Butte, Montana (Figure 1.1-1). The proposed mine is situated on patented lands surrounded by the Beaverhead-Deerlodge National Forest. The primary access route to the mining claims is Forest Service Road 84 (Highland Road). The proposed underground mining activities would be located within patented claims held or controlled by BHJV. The patented mining claims are divided into two distinct areas located adjacent to Forest Service Road 84 (Highland Road) along the Continental Divide. The largest claim, the Pony Placer Claim encompasses approximately 154 acres and is accessed via Forest Road 8250 (Camp Creek Road). The Northern Claims Area consists of 10 smaller claims with a consolidated area of 166 acres (Figure 1.1-2). There is minimal developed road access to the southern edge of these claims via Forest Road 668 (Fish Creek Road).

Pony Placer Claim	Northern Claims Area	
	Only Chance	Red Mountain
	Atlantic	Murphy
	Barnard	Purchance
	Island	JB Thompson
	Main Chance	Main Ripple

The mineral deposits are situated primarily on the Murphy, Only Chance, Purchance, and Red Mountain patented claims and these would be the focus of mine development. The majority of surface disturbance would occur within the Pony Placer Claim. The BHJV owns and controls through leases the surface and mineral rights over the majority of the permit boundary in the vicinity of the adit. All other land and mineral rights within 1/2 mile of the permit boundaries at the mine site are under Forest Service ownership.

2.3 Existing Approvals

This EIS will focus on the decision to be made related to issuing BHJV's operating permit as submitted in January 2013. BHJV has Exploration License No. 00680 that was issued in 2007 as part of the process for establishing the project. Throughout this document it is important to distinguish between activities that have already been approved as part of this Exploration License and those that are being considered under this EIS as part of the Draft Operating Permit which was issued by DEQ on December 7, 2012. To clarify, the exploration license allows exploration activities only. The operating permit, if approved, would allow mining. The following sections explain some of the approvals that BHJV has obtained. Copies of the materials and permits referenced here were provided as part of BHJV's draft operating permit.

General Mining Act of 1872

The legal right to mine is granted by the General Mining Act of 1872 which authorizes BHJV to hold the mineral rights to land affected by the operating permit via patented and unpatented mineral lode claims and to conduct mining on this land.

DEQ Exploration License No. 00680

BHJV received its Exploration License for the Butte Highlands Project in October 2007. In August of 2009, BHJV received DEQ approval to amend their existing exploration program. Under the newly amended program, Timberline and the BHJV are continuing to advance the Project to further stages of exploration by gaining a better understanding of their resource through additional drilling, technical investigations for mine planning, and metallurgical testing. A modification to the license was submitted by BHJV and approved by DEQ in November 2009 for minor adjustments to the orientation of the land application disposal area (LAD) 2.

DEQ Air Quality Permit 4449-00

In accordance with DEQ regulations for preparing the Exploration Plan, BHJV submitted an Air Quality Permit Application to DEQ's Air Resources Management Bureau. DEQ issued DEQ-ARMB Permit #4449-00 in October 2009.

DEQ General Permit for Storm Water Discharges Associated with Construction Activity

In accordance with DEQ regulations for discharge of storm water from a construction site, BHJV submitted a Notice of Intent (NOI MTR 103517) and a Storm Water Pollution Prevention Plan (SWPPP) to the DEQ. This authorizes the project to discharge storm water in accordance with the limitations, monitoring requirements, and other provisions set forth by the General Permit. The SWPPP would be updated as needed to address storm water discharges from new disturbances proposed under the operating permit such as new sections of road and an ore-transfer facility.

DEQ Montana Pollutant Discharge Elimination System (MPDES) Permit

DEQ requires that groundwater from mine dewatering meet non-degradation criteria in order to be discharged directly to surface water. Discharge from BHJV's proposed system would require both a MPDES permit for discharge to surface water and a Class V UIC Permit from EPA Region 8 for discharge to an underground infiltration system. The EPA has received the UIC permit application and it is under review. The MPDES permit (MT0031755) was released for public comment by DEQ on April 15, 2013. This permit was issued on August 1, 2013.

Forest Service Road Use Permit

The Forest Service issued a Road Use Permit for the exploration activities to permit year-round road use of those roads managed by this agency. The USDA FS authorized the use of Forest Service Road 84 (Highland Road to the west and Roosevelt Drive to the east) to access the property along with two Forest Service roads that are adjacent to the patented claims (Forest Service Roads 8250 and 668). This permit was issued in September 2009, but expired in December 2012 (Kelley, pers. com. 2013). The use of the roads is part of the action under consideration in the Forest Service Environmental Assessment (EA) of the proposed haul route.

2.4 No Action Alternative

Under the No Action Alternative, DEQ would not approve BHJV's draft operating permit as final. BHJV currently holds an Exploration License No. 00680 and has developed approximately 20 acres within its patented claims for the surface facilities for the exploration program. The No Action Alternative assumes that BHJV could continue any and all activities approved under their Exploration License; therefore, the No Action Alternative is a "status quo" approach. The following sections describe what kinds of activities and surface disturbance are currently parts of its Exploration License.

2.4.1 Exploration and Operations

Under the MMRA, "Exploration" includes all activities that are conducted on or beneath the surface of lands and that result in material disturbance of the surface for the purpose of determining the presence, location, extent, depth, grade, and economic viability of mineralization in those lands, if any, other than mining for production and economic exploitation; and all roads made for the purpose of facilitating exploration (82-4-303, MCA). BHJV could remove up to 10,000 tons of ore as a bulk sample under their current Exploration License. This would provide a project life of less than one year. To this point none of the bulk sample has been removed and brought to the surface.

The current Exploration License was issued October 17, 2007. Since issuance in 2007, BHJV has drilled a total of 139 holes totaling 90,416 feet, including underground drilling from approximately 4,500 feet of exploration development completed in 2010 and 2011 that included a decline collared on the southern slopes of Nevin Hill. In 2012, a core from 115 underground and surface holes was entirely relogged for magnetic susceptibility, lithology, alteration, structure, and mineralization; this new logging formed the basis of updated geologic interpretations of the subsurface that were completed on a series of cross sections.

2.4.1.1 Exploration Decline

In 2010 and 2011, BHJV constructed a total of approximately 4,500 feet of underground decline and related development in order to conduct underground exploration drilling to test the skarn mineralization at depths deeper than are practical using surface drilling. The portal to the decline was constructed on the northeast corner of the Pony Placer patented claim. Approximately 4,500 feet of exploration workings were completed, which allows access for drilling from both the hanging wall and footwall of the mineralization (MDA, 2013).

2.4.1.2 Backfilling

Backfilling would not be employed under exploration. Waste rock would be stockpiled on site and graded. Some waste rock generated would be disposed underground.

2.4.1.3 Waste Rock Handling

A maximum of 150,000 tons of mine development rock would be excavated and brought to surface during the life of the exploration activities. Waste rock would primarily be generated from the footwall diorite during development of both the access ramps and stopes. There are currently 100,000 tons of Meagher dolomite waste rock stored in the waste rock stockpile permitted for the exploration decline phase of the project.

2.4.2 Project Facilities

BHJV has cleared approximately 20 acres along the northern boundary of the Pony Placer Claim to accommodate the surface facilities including an office, dry facility, core shed, a 50-foot by 80-foot shop facility, soil stockpiles, the waste rock stockpile, a crushing and screening plant, a parking area, and two settling ponds. Access to the exploration facilities is provided by a gravel road that intersects Forest Service Road 8250 (Camp Creek Road).

All existing portal site facilities are shown on Figure 2.4-1. The following is a list of existing, permitted facilities at the site:

Office/Dry Facility	Two modular trailers (24 feet by 66 feet) are used to provide offices and dry facilities.
Core Shed	A building was constructed to house the core generated during exploration. This building would remain and be used for operations.
Septic System	A septic system was installed to manage domestic waste water for the Project. The system was sized for 49 workers on site during a 24-hour period.
Shop Facility	A 50-foot by 80-foot building (fabric-covered) was constructed for exploration and would be used for the same purposes during mine operations.
Generators	Two generators were authorized and air permits issued for exploration. These units would be used for mine operations and include two primary units. These are housed in Conex boxes.
Fuel/Oil Storage/Wash Pad	A 50-foot by 80-foot building (fabric-covered) with a concrete pad was constructed at the site to hold fuel, oils and lubes, antifreeze, and a vehicle wash pad.
Silo, Batch Plant, Sand Pile, and Shotcrete Plant	A cement silo, slurry plant, and shotcrete plant were all installed during the exploration phase. Sand for shotcrete production is stored in a pile approximately 40 feet in diameter. A cemented rockfill (CRF) backfill plant would also be installed under the Exploration License.
Ponds	Two ponds were constructed to manage site run-off and exploration water. The ponds have a combined capacity of approximately 2.5 million gallons with a requirement to maintain a minimum of 561,000 gallon reserved capacity for storm water (25-year, 24-hour event). Pond levels are maintained to ensure the storm capacity is always available. The ponds would be used for mine operations.
Water Treatment Plant	Water treatment plant for treatment of water pumped from the mine prior to disposal to LAD or discharge to surface water.

Secondary containment is designed into the facility and a water recycling sump is included, and sized appropriately. The following fuels /lubricants are stored at this facility:

- 6,000 gallon double walled tank (diesel)
- 2,000 gallons oil/lubricants - various bulk sizes

A fuel and lubricant truck would be used to dispense fuel to mobile equipment and a fueling station is included at this site. Methods of spill prevention and response are described in the project Storm Water Pollution Prevention Plan required as part of the project Notice of Intent (NOI MTR 103517) to proceed with construction activities under the Statewide General Storm Water Permit.

No fuel would be stored in the underground workings. Used oil would either be used on site as a fuel source for on-site heaters or sent to an appropriate facility off-site for reuse.

2.4.3 Bulk Sample Handling and Processing

Ore for a bulk sample would be mucked from the various working faces throughout the underground workings. Load Haul Dump (LHD) units would pick up broken ore and load it into haul trucks. These trucks would transport the ore up the access ramp to a stockpile located adjacent to the portal within the current surface facility footprint. The bulk sample stockpile is designed to hold approximately 5,000 tons of ore. The bulk sample would be transported for metallurgical testing using Roosevelt Drive pending Forest Service approval of a Road Use Permit.

2.4.4 Exploration Water Management

It was necessary to lower the groundwater level prior to development of the underground workings. Dewatering was conducted during exploration using a single dewatering well. When in operation, the exploration project dewatered the mine workings at a rate of approximately 100 gallons per minute (gpm). If exploration is reactivated, water quantity inflow would be expected to be low at first, but then it may increase as exploration decline development advances to greater depths or when fault zones are encountered. An increase in dewatering rate is anticipated during the next phase of bulk ore sampling.

Water currently discharges from the historic Highland Mine adit workings under natural flow conditions into the headwaters of Basin Creek. All surface water sampling results have shown water quality in compliance with water quality standards.

The new exploration workings are not connected to the historic workings. Since the new exploration decline portal is above the water table, there is no discharge and the water level in the exploration workings has been at a fairly constant level since the portal was temporarily sealed in 2011. The new exploration decline portal is above the water table so water will not discharge from the recent exploration work.

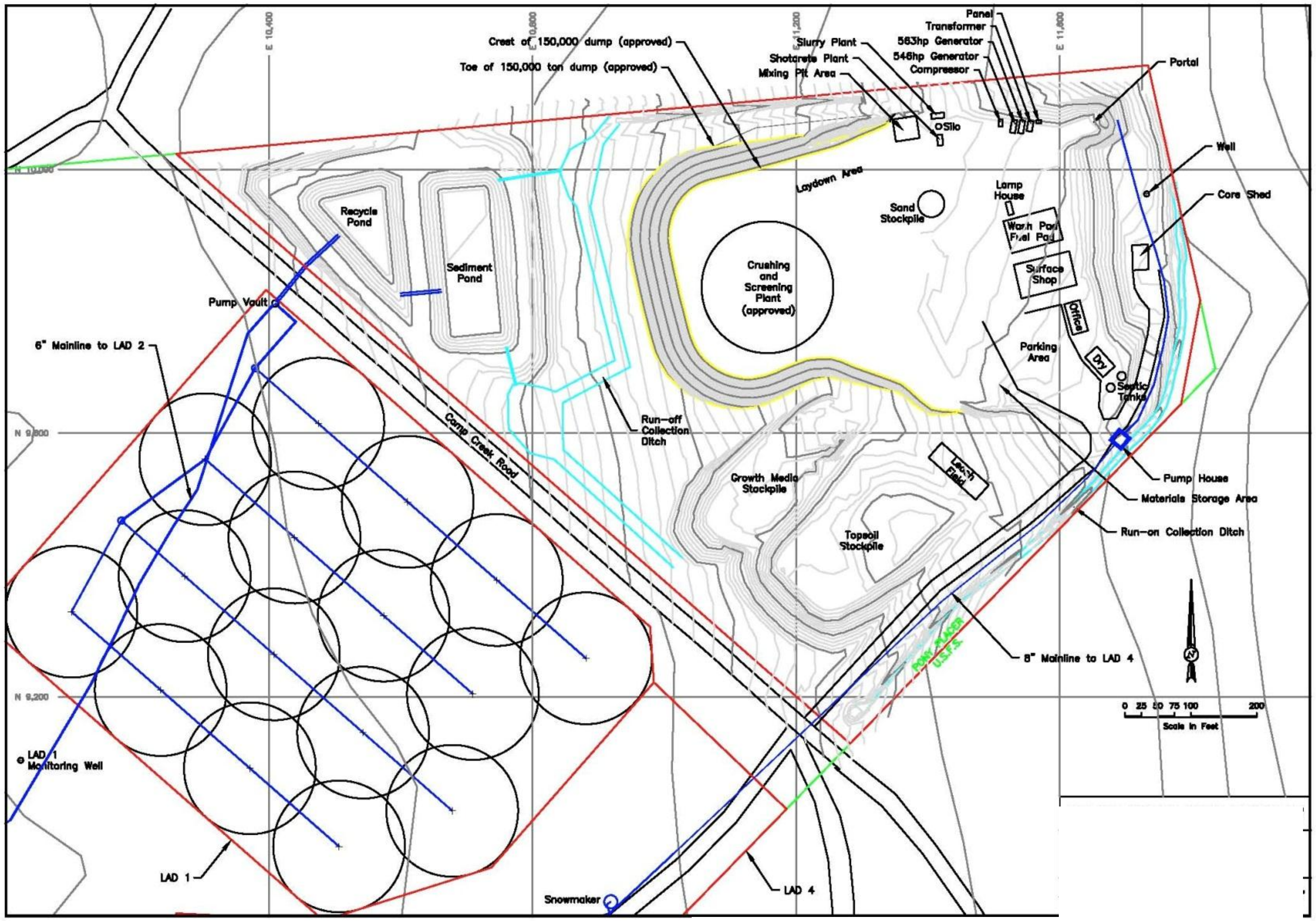

Figure excerpted from BHJV Operating Permit application

Figure 2.4-1. Existing Portal Site Facilities for the Proposed BHJV Mine, Silver Bow County, Montana.

Water run-off from the waste rock pile and other facilities is captured in diversion ditches and routed to sedimentation and recycle ponds for use in exploration development processes or is discharged to a LAD system approved as part of the exploration license. Water quality and quantity data have been collected by BHJV and the current conditions are summarized in Chapter 3.

2.4.5 Land Application Disposal Areas

Approximately 42.7 acres of LAD areas are approved in the exploration plan and consist of three separate sites (LAD 1, LAD 2, and LAD 4). Each site is divided into cells. LAD 1 was modified for surface sprinkler use, LAD 2 site was modified to provide subsurface winter LAD and includes buried pipe, and LAD 4 was added to the exploration plan as a snowmaking site including seven tower-mounted Super Polecat Snowmakers. LAD 4 was recently approved for subsurface summer and winter LAD and includes buried pipe.

BHJV reactivated exploration in September 2013. The decline would be dewatered at a rate up to 500 gpm. Under the approved LAD plan, water is sent from the pond and delivered to one of three LAD areas. LAD 1, LAD 2, and LAD 4 have been constructed under the BHJV Exploration License. Water is delivered to the LAD 1, LAD 2, and LAD 4 via three buried pipelines. These main distribution lines pass under Forest Service Road 668 (Fish Creek Road) to gain access to the LAD 1, LAD 2, and LAD 4 sites. Valves control water flow to the desired cell(s). Regular rotation of the LAD cells is necessary to apply water appropriately to meet design expectations. The rotation minimizes runoff, allows evapotranspiration to occur, and prevents saturation of the soil. A groundwater monitoring well is located below each LAD area and monitored for any water quality changes. Refer to Figure 2.4-2 for the locations of the LAD monitor wells.

WS-8, defined as the uppermost spring in the Middle Fork of Moose Creek, is the highest point in the drainage where streamflow occurs. WS-6 is down gradient of both LAD 1 and LAD 2. Well LAD1MW is down gradient of LAD1 (the sprinkler LAD system), and well LAD2MW is down gradient of LAD2 (the subsurface LAD system). A total of eight surface water sites, plus monitoring wells, were monitored monthly during the exploration phase. In December 2012, after exploration activities were temporarily suspended, monitoring frequency of all sites was decreased to quarterly. During the next phase of exploration, monthly sampling of WS-6 and quarterly sampling of other sites, and weekly sampling of the discharge to the LADs will be completed.

The LAD sites are visually inspected to ensure surface ponding and run-off is not occurring. Seasonal adjustments are required to the amount and time water is applied to each cell in a LAD area. LAD options include sprinkling on LAD 1 during warmer weather, and all-season disposal at LAD 2 and LAD 4 including snowmaking on the Pony Placer in LAD 4 during cold weather. The underground perforated pipes in LAD 2 and LAD 4 are used during weather that precludes the use of LAD 1 subject to the following conditions:

- water discharged through LAD 2 and LAD 4 meets Montana Groundwater Standards,

- sampling in the LAD 2 and LAD 4 monitoring wells and surface monitoring sites demonstrate that groundwater and surface water quality are not being adversely impacted by the LAD 2 and LAD 4 sites, or
- water discharged through LAD 2 and LAD 4 would be treated, if required, before discharge.

A fourth land application disposal area, LAD 3, has been permitted under the exploration license but has not been constructed.

Based on information found in BHJV annual report, approximately 42 million gallons of water was discharged to LAD 1 and 2 during the 2010-2011 reporting year (BHJV, 2013). In addition, approximately 5.1 million gallons of water was discharged thought the snow-makers dewatering test in January 2011. Stormwater collected in the two lined ponds has also been periodically discharged to the LAD system. After dewatering restarts in September 2013, BHJV would advance the decline. BHJV would collect the 10,000 ton bulk sample and send it off for testing. BHJV also plans to test the proposed water treatment system.

2.4.6 Freshwater Distribution and Supply

A water supply well is located near the portal, and it supplies potable water to the operations. BHJV uses water collected underground as needed for drilling water, dust suppression, and other water needs.

2.4.7 Sewage Treatment and Solid Waste Disposal

BHJV installed a septic system, approved by Silver Bow County, as part of the exploration activities. The BHJV septic system is designed and permitted for up to 49 people on site in a 24-hour period.

2.4.8 Personnel

BHJV anticipates employing approximately 25 people to operate the facilities and perform the activities approved under the exploration license.

2.4.9 Transportation

BHJV personnel would use Roosevelt Drive as their primary access route to and from the mine. Any excavated ore for a bulk sample would be hauled down Roosevelt Drive using highway-legal trucks.

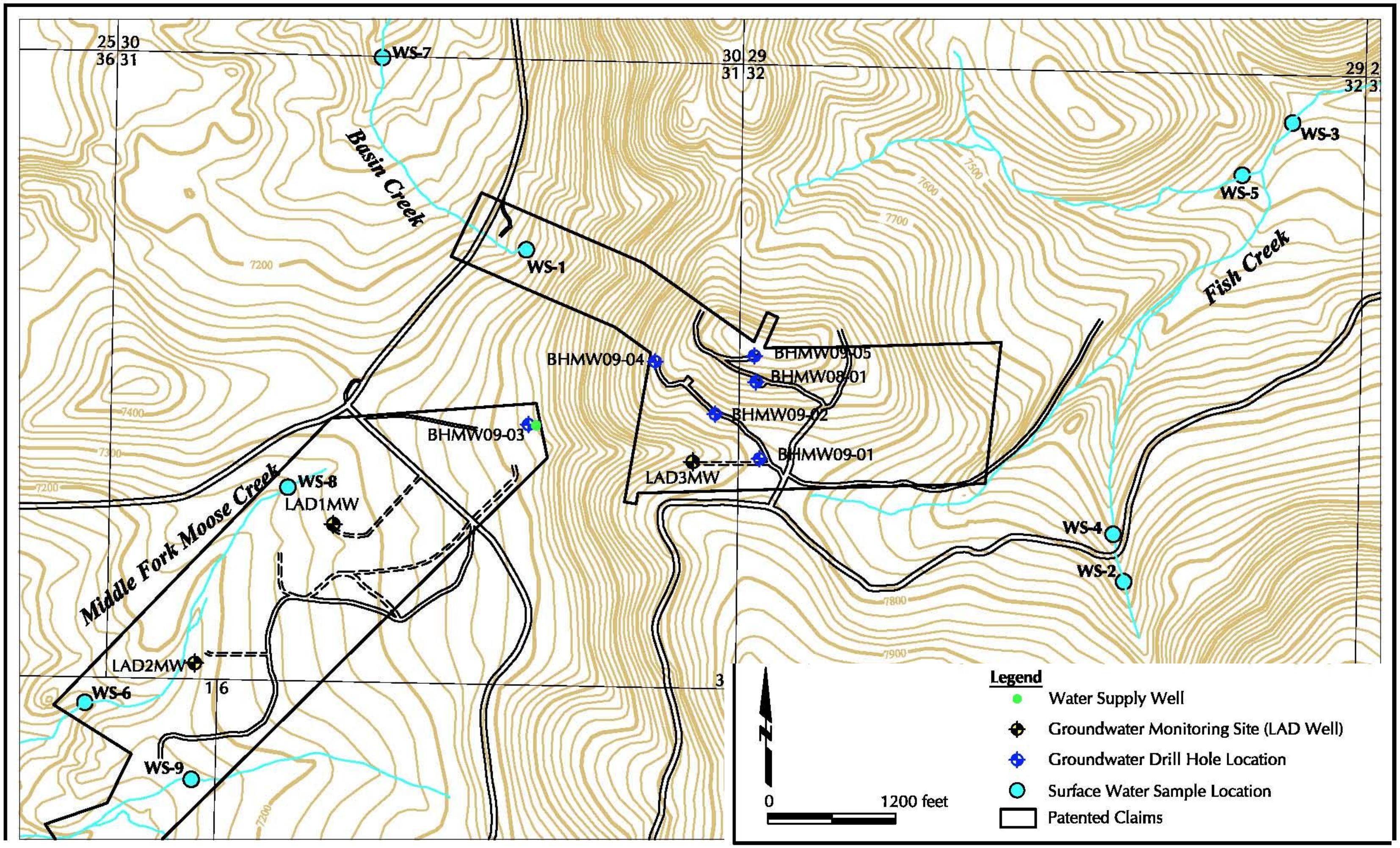

Figure 2.4-2. Existing and Proposed Land Application Disposal Sites for the Proposed BHJV Mine, Silver Bow County, Montana.
Figure excerpted from BHJV Operating Permit application

2.4.10 Reclamation Plan

A reclamation plan was completed and approved for the exploration license. BHJV would initiate reclamation of the exploration facilities if a decision to proceed with operations does not occur within a two year period after completion of exploration activities. The decision to initiate temporary closure or final closure would be based on economic conditions at that time. BHJV would notify the agencies of the intent to initiate reclamation at the site. Reclamation includes retaining the current land uses of grazing, logging, recreation, wildlife habitat, and other similar rural land uses. BHJV will retain certain roads and structures on the property to provide access and to support reclamation activities while recontouring the remaining roads and removing any buildings not required during reclamation. The initial plan would involve resloping the waste rock dump, breaking up any concrete pads, plugging and backfilling the portal to match adjacent topography, regrading the ponds so that they no longer hold water, scarifying the yard area, covering any and all disturbed areas with soil that would be seeded with a native seed mix, and retaining a sediment control program until the site has demonstrated stability (DEQ, 2009).

2.4.11 Post-Mining Land Use

The patented Pony Placer Claim and the Northern Claims Areas currently support grazing, logging, recreation, wildlife habitat, and other similar forest land uses. BHJV anticipates retaining the preexploration land uses after exploration ceases. To maintain the private land value and use, some constructed features would be retained for private land management activities.

Reclamation activities would be implemented to meet decline closure requirements, ensure site stability, minimize erosion, and provide a self-sustaining vegetative plant community. Meeting these objectives would support post-exploration land uses.

2.5 Proposed Action

Under the Proposed Action, BHJV would pursue mining the deposit and transport the ore to an off-site facility for processing. Under the MMRA, "mining" commences when the operator, in this case BHJV, first mines ores or minerals in commercial quantities for sale, beneficiation, refining, or other processing or disposition or first takes bulk samples for metallurgical testing in excess of the aggregate of 10,000 short tons (84-4-303, MCA).The operating facilities would essentially remain the same as those approved under the existing exploration license. The primary differences relate to the extent of mine excavation underground, the amount of waste rock removed and ore extracted for processing, the amount of groundwater produced from dewatering, treatment of wastewater, the haul route used to transport ore off site, and the development of a transfer facility if needed to accommodate moving the ore to a processing plant off-site.

There are additional surface disturbances proposed at the BHJV Mine site including a water pipeline, modifications to LAD 3, and the haul route for the ore that would follow Forest Service Road 84 (Highland Road) and other private and county roads out to US Interstate-15 (Interstate-15). This section will focus on the aspects of the Proposed Action that differ from the No Action Alternative. Details on the differences are provided in sections that parallel those described under the No Action Alternative (Section 2.4). A summary of the plan is provided in this section; however, the reader is referred to the operating permit application for more detailed descriptions of the Proposed Action.

BHJV has certain requisite permits in-hand or in application with regulators to allow mining. The mine life is projected to be approximately five years with underground development taking approximately one year for a total mine life of six to seven years. Initial production rates would play a role in determining the actual mine life. There are other resources existing on the claim block and additional drilling could identify additional resources that could be mined and extend the mine life. Any extension of the mine's life or additional infrastructure required would undergo environmental review and permitting through DEQ. Final construction would be initiated immediately after issuance of the operating permit.

2.5.1 Mine Development

The targeted deposit is a high-grade gold skarn system that BHJV proposes to develop and extract using underground mining methods. In general, mining would require dewatering in advance to access the blocks of ground to be mined, drilling and blasting of rock followed by transport to a surface storage facility, transport of the ore to a transfer facility if needed, contracted off-site ore processing, and on-site reclamation following completion of mining.

2.5.1.1 New Highland Adit Expansion

BHJV intends to use the approved and partially constructed underground exploration workings as the primary starting point for mine production. Initial development would focus on access to the various ore zones and ventilation requirements if not completed under the exploration program. The main access ramp would be extended 1,550 feet with two spiral stope access ramps totaling 6,300 feet constructed to access the ore zone. One ramp would access the ore zones above the decline and a second ramp would be driven from the end of the decline to access the deeper ore zones. Both ramps would be developed principally within the footwall diorite of the mine. A series of localized ramps totaling 7,000 feet would be driven from various locations along the spiral ramp system to access the ore zones (Figure 2.5-1).

The deposit is shaped and orientated such that overhand and underhand cut and fill mining methods can be efficiently employed. Cut and fill mining is a mining method in which horizontal slices of ore are removed and the void left is filled with waste material. The nominal mining rate would be approximately 400 tons per day of both ore and waste rock for a total production of about 800 tons per day. Drilling and blasting would be an integral part of the mine development and would be employed following all Mine Safety and Health Administration (MSHA) safety regulations for the handling, storage, and use of explosives. Blasting would occur seven days per week and could occur during any or all shifts.

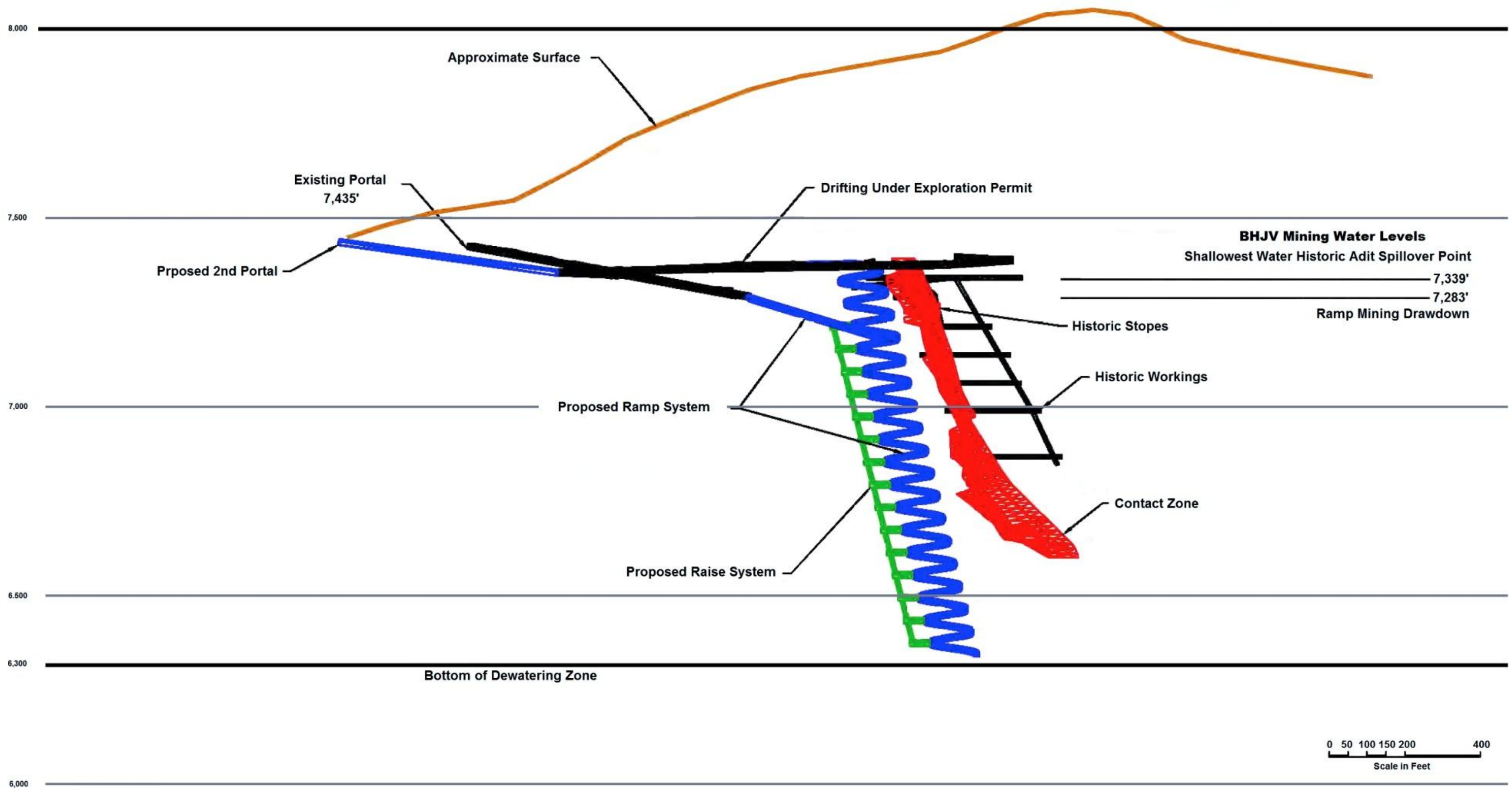

Figure excerpted from BHJV Operating Permit

Figure 2.5-1. Underground Mine Workings for Proposed BHJV Mine, Silver Bow County, Montana. Cross-Section, Looking Northwest.

2.5.1.2 Mine Backfilling

Backfilling of portions of the underground working would be necessary to provide structural support and safe working conditions within the mine as development proceeds. The backfill would consist of a Cemented Rock Fill (CRF) using Portland cement with waste rock aggregate. Cement addition rates would vary but are expected to range from two to seven percent. Backfill design criteria would be evaluated on a stope by stope basis, with the need for structural support determining if bulk waste rock backfilling or cemented rock fill is required. Water used to prepare the CRF is proposed to consist of mine dewatering water and brine produced as a waste stream from the proposed mine water treatment system.

The proposed cut and fill mining method is anticipated to consume the majority of the waste rock generated during mine operations. Waste rock generated that is not required to be backfilled to support ore extraction would likely be disposed of underground in mined out voids.

2.5.1.3 Ventilation Raise/ Second Adit

A ventilation raise was proposed in the initial exploration plan. The mining plan has since changed and the ventilation raise is no longer needed. Instead, a second adit would be constructed near the main access adit at the portal pad area (Figure 2.4-1). The second adit would be sized to the same dimensions as the existing exploration adit, 15 feet wide, 16 feet high, and approximately 600 feet in length. Waste rock generated during the construction of the second adit would be placed at the existing waste rock storage area.

2.5.1.4 Waste Rock Handling

An estimated total of approximately 310,000 tons of waste rock would be excavated and potentially brought to the surface during the life of the mine. Waste rock would primarily be generated from the footwall diorite during development of both the access ramps and mining stopes; however, it is anticipated that some of the development could be completed in ore and this mined material would report to the ore stockpile.

Some portion of the waste rock generated from development of the ramp and mine stopes would be brought to the surface for temporary storage prior to being incorporated with cement in backfill used for structural support within the mine. The proposed cut and fill mining method is anticipated to consume all of the waste rock generated during mine operations. Waste rock generated that is not required to be backfilled to support ore extraction could be disposed of underground in mined out voids, but BHJV expects that all waste rock would ultimately be used as mine backfill.

There are currently 100,000 tons of Meagher dolomite waste stored in the waste rock stockpile permitted for the exploration decline phase of the project. The waste stockpile has been redesigned to hold a total of 250,000 tons during the production phase. There are currently no plans to store more than 250,000 tons of waste rock on the waste rock stock pile at any time.

Additional details of the waste rock that would be generated during mine production are discussed in Section 3.3. Waste rock monitoring will be completed to characterize the material generated on an on-going basis. Monitoring will include geochemical testing analyses to better understand waste rock composition, acid/base potential, and other important elements to assist in proper management of waste rock. The data collected for waste rock characterization would include:

Whole Rock Analyses	AGP and ANP
Asbestos Testing	Meteoric Water Mobility Test*
Acid Base Accounting	Kinetic Testing*

*Selected Samples

Samples of waste rock generated during development will be completed to provide a representative set of samples of the material and geology of the rock encountered. A waste rock sample will be collected every 1,000 feet of decline/development excavated. A minimum of one sample for each rock unit will be collected in the event the encountered length is less than 1,000 feet. A geologist knowledgeable about the deposit will supervise the collection of representative samples.

2.5.2 Mine Facilities

The infrastructure developed during exploration would be used to support the mine operations and would continue to provide the primary infrastructure necessary for the Project. Additional support facilities would include a mobile assay lab, two 15,000-gallon fuel tanks, implementation of the approved LAD 3 site if not activated during the 2013 exploration program, and another laydown area. Figure 2.4-1 shows the proposed new disturbance. Table 2.5-1 compares the mine facilities above and below ground under the No Action Alternative and the Proposed Action.

2.5.2.1 Added Laydown Area

Increased materials, equipment, and other activities would require an expansion of available area to store idle equipment, and mine supplies. A new laydown area is proposed on the Pony Placer Claim (Figure 2.4-1). The laydown area would result in approximately 0.5 acres of new disturbance (Table 2.5-1).

2.5.2.2 Assay Laboratory

A small assay laboratory would be located on site to support the mine operations. This would be a standard assay facility that would be located in a trailer adjacent to the existing office facilities. This facility would be located within the permitted disturbed area; therefore, no new disturbance would be required for this facility.

The assay lab would consist of a small jaw crusher and pulverizer to prepare the ore samples for assaying. Drying ovens, furnaces, and other equipment required to perform assay determinations at the proposed mine would be located in the assay lab. The furnaces would either be liquid petroleum (LP) gas or electric.

Hazardous waste from the assay lab would be sent to a Licensed Hazardous Waste Treatment Facility using a Licensed Hazardous Waste Hauler. BHJV would contract out these services.

2.5.3 Ore Handling and Processing

Ore would be mucked from the various working faces throughout the mine. Load haul dump (LHD) units would pick up broken ore and load it into haul trucks. These trucks would transport the ore up the access ramp to a stockpile located adjacent to the portal within the current surface facility footprint. The ore stockpile is designed to hold approximately 5,000 tons of ore.

Ore would be loaded from the stockpile into 30-ton center-articulated trucks, and hauled west to an ore transfer facility located adjacent to the Interstate-15 Feely interchange. At the ore transfer facility, ore would be unloaded from the center-articulated trucks and reloaded into 22-ton highway trucks. The entire unloading and reloading process would take place within the proposed 120-foot by 100-foot covered ore transfer facility. It is anticipated that no more than 400 tons of ore would accumulate at the ore transfer storage site. Ore would be hauled from the BHJV Mine to the ore transfer facility year-round, Monday through Friday. Hauling is planned for two 8-hour shifts per day for a total of about 20 haulage truck round trips per day. Snow removal and road maintenance would occur during these same two shifts as well as during a third shift (night shift) as needed.

Gold from the Butte Highlands ore can be recovered using conventional cyanide gold recovery methods; on-site processing of the BHJV ore is not proposed. The Golden Sunlight Mine is a possible site for ore milling and the Mine is willing to enter into a contract to process Butte Highlands' ore. Golden Sunlight is currently approved to use conventional vat-leach gold extraction methods at their Mine. If BHJV favorably evaluates other potential off-site milling opportunities, these opportunities would be discussed with DEQ before initiating shipments to any of the sites.

2.5.4 Mine Water Management

It would be necessary to lower the groundwater table prior to additional development of mine workings. BHJV intends to install additional underground dewatering wells to effectively dewater the planned mine development and production areas in advance of mining. As the mine is developed to deeper levels, other underground wells would be drilled to replace those that are no longer productive.

The predicted dewatering rate for the BHJV Mine was estimated to be about 750 gallons per minute throughout the first 4½ years of the mine life as the mine development is extended down to 6,300 feet elevation. This would allow the dewatering level to advance at least 50 feet lower than the ultimate anticipated mine development level (BHJV 2013, Appendix Z). The model predicts that pumping rates could be reduced to about 500 gallons per minute to maintain the water level at 6,300 feet.

DEQ requires that groundwater from mine dewatering meet non-degradation criteria in order to be discharged directly to surface water. BHJV is evaluating the effectiveness of either a reverse osmosis (RO) water treatment process or an ion exchange treatment system. Discharge from the selected water treatment system would require both a MPDES permit, (received August 2013), for discharge to surface water and a Class V UIC Permit from EPA Region 8 for discharge to an underground infiltration system. The underground infiltration system would be used as a contingency measure to dispose of a portion of the treated water discharge in the event that one of the surface water outfalls became temporarily inoperative. The EPA has received the UIC permit application and it is under review. The MPDES permit (MT0031755) was released for public comment by DEQ on April 15, 2013. The MPDES permit (MT0031755) was issued August 1, 2013.

Water from the dewatering wells would be pumped either to settling sumps for use in mining processes or directly to the treatment system. Water run-off from the waste rock pile and other mine facilities would continue to be captured in diversion ditches and routed to sedimentation and recycle ponds for use in mine processes or discharge to the approved LAD system. During the production phase, run-off stored in the ponds would be routed to the treatment system. All water treated would discharge to the MPDES/UIC proposed outfalls if approved.

Two water treatment systems are currently being considered for use at BHJV Mine to treat mine water potentially containing metals, nutrients, total suspended solids, and pH that may exceed approved MPDES discharge standards The RO system is anticipated to consist of a High Recovery Membrane (HRM) system in conjunction with a proprietary and proven Interstage Precipitation Reactor (IPR) treatment method. The proposed IPR method is capable of further processing the concentrate streams from HRM systems, allowing for elevated levels of removal of constituents of concern necessary for the intended surface water discharge of the resulting treatment system effluent while maximizing overall water recovery (Tetra Tech, 2012a). Water treatment using the RO system would produce a relatively small waste stream of concentrated brine. Disposal options for the brine are detailed in the operating permit and would consist of incorporating the brine with the CRF prior to backfilling into the underground mine workings.

The ion exchange (IX) water treatment system would include the strong acid cation resin / strong base anion resin (SAC/SBA) system utilizing proprietary “Higgins Loop” technology Coagulant addition would occur prior to ion exchange. Filtration would also be used to optimize removal of phosphorous and total suspended solids. For the Butte Highlands Project, assuming a conservative dewatering rate of 750 gpm, the proposed ion exchange system would generate approximately 1,500 gallons of brine each day. Disposal options of the brine are being evaluated and could include incorporation into cemented waste rock backfill or trucking to an off-site licensed disposal facility.

2.5.5 Land Application Disposal Areas

Three LAD areas are currently in place to the south of the portal pad and a fourth area (LAD 3) would be installed under the proposed mining plan of operations. An additional seven acres of LAD area are permitted with LAD 3 located on the Red Mountain Patented Claim. LAD 3 would include drip emitters and be divided into cells with dimensions of approximately 200-feet by 200-feet for each cell. LAD 1 has operated at a rate of 160 gallons per minute (gpm), LAD 2 has operated at a rate of 70 gpm, and LAD 4 has an application rate of approximately 350 gpm for snow-making (Rogness, 2011). However, LAD 1 and LAD 2 are expected to have an average application rate of 50 to 70 gpm each, with LAD 1 functioning in the non-winter season and LAD 2 operating in the winter (Rogness, 2011). LAD 3 has not been operated during exploration dewatering and no capacity is provided for it. However, the LAD system is planned to be used only as a back-up for the discharge pipelines and water treatment system under the Proposed Action.

2.5.6 Freshwater Distribution and Supply

Prior to exceeding the regulatory limit of 25 employees, BHJV would submit an application for the potable water system to DEQ. It is expected that no change would occur in the water distribution system to obtain approval for the full staffing level plan for the project of 49 employees.

BHJV would continue to use water collected underground as needed for drilling water, dust suppression, and other water needs underground.

2.5.7 Sewage Treatment and Solid Waste Disposal

No septic expansion would be needed under the Proposed Action.

2.5.8 Personnel

The BHJV would increase the workforce for the Project over the 25 employees used for the exploration plan. There would be generally three phases for the Project which include preproduction, production, and reclamation periods. Staffing for reclamation would be the same for all alternatives under consideration and is detailed in Section 2.6.5.

2.5.8.1 Preproduction Phase

This phase of the Project would be staffed similar to the exploration phase and would likely involve 25 to 30 employees. This number could fluctuate seasonally by five to ten people, depending when mine operations commence.

The preproduction phase would involve mine development that is necessary to access the ore zones, ventilate the mine, handle ore, and other functions prior to full scale mine operation. It is not expected that the preproduction phase would extend beyond six months.

2.5.8.2 Production Phase

Staffing levels for this Project are expected to be relatively stable. During the production phase, mine staffing would be increased to support both mine development and mine operations. In addition, technical and administrative staff would be required to support the operations. The BHJV would have up to nine employees working at the site. BHJV employees would include geologists, project management, environmental, and other operational positions. The mine contractor would have up to 45 employees for the Project. This includes four supervisors and 41 hourly employees. Underground development and mining would continue 24 hours per day, seven days per week. Two 12-hour shifts would be worked each day. Crew sizes and shift rotation would dictate the total number of employees at the site at any given time.

The total employment for the Project would be 54 employees, or an increase of 24-29 employees above what is anticipated for the exploration phase (BHJV, 2013).

Table 2.5-1. Comparison of Activities, Facilities, and Surface Disturbance Under Consideration for the No Action Alternative, Proposed Action, and Agency-Mitigated Alternative for the Proposed BHJV Mine, Silver Bow County, Montana (BHJV, 2013).

	No Action Alternative	Proposed Action	Agency-Mitigated Alternative
Surface Exploration Disturbance	1.5 acres (list disturbance types)	Same as No Action	Same as No Action
Hydrology Drill Holes, includes Road Areas and Drill Pads	1.4 acres	Same as No Action	Same as Proposed Action
Underground Exploration Drilling	88,157 feet drilled from 2008 through 2012	1,000 feet/year	Same as Proposed Action
Surface Facilities	20.2 acres	Same as No Action plus 2.2 acres for laydown area and MPDES pipelines, and 10.5 acres haul road, and transfer facility	Same as Proposed Action
Office/Dry Facility	Two modular trailers (24 feet x 66 feet)	Same as No Action	Same as No Action
Core Shed	Approximately 25 feet x 60 feet	Same as No Action	Same as No Action
Septic System	System sized for 49 workers	Same as No Action	Same as No Action
Shop Facility	50 foot x 80-foot fabric lined building with concrete floor	Same as No Action	Same as No Action
Generators	Two generators housed in Conex boxes	Estimates indicate 3-365 kW and 1-325 kW diesel backup generator would be needed.	Same as Proposed Action
Fuel/Oil Storage/Wash Pad Building	Water recycling sump	Same as No Action	Same as No Action
Fresh Water Well and Distribution System	Water well located near the portal is approved for 25 employees	Expand use of well for multiple shifts of employees. No change in distribution system required.	Same as Proposed Action
Assay Lab Trailer	None	Small assay lab in trailer adjacent to office building.	Same as Proposed Action
Water Treatment System	None	Two options under consideration, a Dual Membrane RO System and an ion exchange system	Site water treatment plant at surface rather than underground.
Settling Ponds	Two ponds with 1.5 million and 1.0 million gallon capacity sized to handle the 25 year-24 hour storm	Same as No Action	Same as No Action

	No Action Alternative	Proposed Action	Agency-Mitigated Alternative
Mine Portals	One	Two	Same as Proposed Action
Decline/Ramp	Approximately 6,700 feet have been developed; Adit 15 by 15 feet in size.	Expand Main Ramp by 1,550 feet, stope access ramps 6,300 feet, other localized ramps 7,000 feet.	Same as Proposed Action
Secondary Adit	Not applicable	Approximately 600 feet long; Adit 15 feet wide by 16 feet high	Same as Proposed Action
MPDES Pipelines	None	1.7 acres	Same as Proposed Action
Ore Transfer Facility	NA	0.5 acres for building and access road/driveway	Same as Proposed Action if Feely route is selected; NA if Roosevelt Drive is selected
Soil Stockpiles	34,800 cubic yards in approximately 1.5 acre stockpile	800 cubic yards more from new laydown area in stockpile; Transfer facility soil stored in facility; private road soil would be stored in windrow adjacent to the road.	Same as Proposed Action
Waste Rock Stockpile	150,000 tons	Expand to 250,000 ton capacity	Same as Proposed Action
Laydown Area	None	0.5-acre storage area for idle equipment and supplies	Same as Proposed Action

	No Action Alternative	Proposed Action	Agency-Mitigated Alternative
Access Routes			
Mine personnel and material and supply deliveries	Roosevelt Drive/Highland Road/FR 8520	Same as No Action	Same as No Action
Ore hauling route	NA; Bulk sample would be hauled out on Roosevelt drive using a Road Use Permit from USDA FS	Existing Roads: FR 8520 and Highland Road (FR84) (42,600 feet); then 19,800 feet of new private road (see next row); then 3,500 feet of Curly Gulch Road (County Road)	
Private Ore Haulage Road	None	10.0 acres	Not applicable
Total New Disturbance Areas	0	12.7 acres	None
LAD Areas	45 acres	Same as No Action	Same as No Action
LAD Area 1	12.3 acres used for surface sprinkler application	Same as No Action	Same as No Action
LAD Area 2	11.0-acre winter LAD Area with buried pipeline used when weather precludes use of LAD Areas 1 and 3	Same as No Action	Same as No Action
LAD Area 3	6.7 acres used for drip emitters (Approved buy not constructed yet)	Same as No Action	Same as No Action
LAD Area 4	12.6-acre snowmaking site with 7 snowmakers and underground infiltration system	Same as No Action	Same as No Action
LAD 1 & 2 Pipeline Access Road	2.3 acres	Same as No Action	Same as No Action
LAD 3 Access Road	0.1 acre	Same as No Action	Same as No Action
Total Disturbance	68.1 acres (Figure 9 and Table 2.2.1)	80.8 acres	70.8, Same as Proposed Action without haul route disturbance

	No Action Alternative	Proposed Action	Agency-Mitigated Alternative
Life of Operations	Less than one year	6-7 years including underground development based on mining rate of 800 tons per day ore and waste rock.	Same as Proposed Action
Transportation			
Roosevelt Drive Supply and Vendors Trips per Day and per Week	Approximately 5-10 per day, weekly trips will vary.	15-20 per day and 92-102 per week	Same as Proposed Action
Ore Haulage Route	None	20-haul trucks per day/ 5 days per week	Same as Proposed Action
Waste Rock Monitoring	Representative samples collected for whole rock geochemical analysis, asbestiform mineral screening, SPLP metal mobility testing, and acid-base potential (ABA)	Same as No Action	Same as No Action
Subsidence Buffer Zone	None for Existing Decline	300 feet for Secondary Adit	Same as Proposed Action

2.5.9 Transportation

BHJV has proposed to haul ore west to Interstate-15. Ore trucks would leave the mine site on Forest Service Road #84 (Highland Road) and travel west approximately eight miles to the Forest Service Boundary. Proposed improvements on the segment of Highland Road that is the same as Forest Service Road 84 include widening narrow areas to 16 feet, adding 22-foot wide turnouts where needed, installing ditches and culverts, and rebuilding soft spots. The road would be capped with gravel. The Beaverhead-Deerlodge National Forests are currently conducting an environmental review regarding use of the Forest Service Road No. 84 as a haul route. The environmental review should be completed in 2014.

West of the Forest Service boundary, Highland Road becomes a county road that crosses several private parcels. In December of 2011, the City and County of Butte-Silver Bow executed an Easement Agreement with landowners to resolve litigation over the scope of Butte-Silver Bow County's right-of-way along the Highland Road. Under the terms of the Easement Agreement, the owners granted an easement to Butte-Silver Bow County for a county road in the existing location of the Highland Road. The Easement Agreement requires that the use of the county road be consistent with its historic use. The hauling of ore from the Highland Road does not appear to be consistent with the historic use of the Highland Road.

Because the Easement Agreement precludes BHJV from hauling ore across a portion of private property, BHJV proposes to construct a new haul road beginning at the Forest Service boundary. The new haul road would be located generally to the south of the Highland Road across private ranches and be approximately three miles long. The new haul road would be constructed with a 24-foot wide road surface, culverts, ditches, gravel, and gates at each end. The haul road would rejoin the Highland Road approximately one-third of a mile south of the transfer facility located adjacent to Interstate-15. About 750 feet of county road adjacent to old US Highway 91 would be widened to 36 feet, and the bridge and culvert at Divide Creek would be replaced. Improvements on the county road would be required to comply with Silver Bow County road specifications (Figure 2.5-2).

The ore transfer facility is located on private land, and BHJV holds leases with the affected landowners.

2.5.10 Reclamation Plan

The Proposed Action results in approximately 12.7 acres of additional disturbance that would be required for full-scale mine operations. The acreage is associated with expansion of the laydown area, construction of the ore haulage road, and construction of the ore transfer facility. The reclamation plan that was approved for the exploration license remains valid and the additional disturbed acreage would follow the same provisions and procedures outlined and approved in the current requirements. BHJV would not depart from this reclamation plan without written approval from DEQ. A discussion of the reclamation plan is detailed below.

2.5.10.1 Initiation of Reclamation

BHJV would initiate final reclamation closure once mine activities are completed. Temporary reclamation closure would occur if warranted based on economic factors. The BHJV would notify the agencies of the intent to initiate reclamation at the site.

2.5.10.2 Post-Mining Land Use

Post-closure land use described in the exploration license reclamation plan remains the same for the additional acreage proposed for disturbance under the Proposed Action.

2.5.10.3 Site Facility Removal

BHJV is the owner of the private property used for the exploration activities. The items retained to support private land use after mine closure would remain the same. This would include:

- Main Access to the Surface Facilities; and
- Access to the LAD 1 and 2 Sites.

BHJV would still retain the following structures:

- Geologic Core Shed Building;
- Water Well(s);
- 1-Water Tank (Potable);
- Septic System, Leach field; and
- Gate, Fencing.

Unless requested by the private landowner, the covered building at the ore-transfer facility would be dismantled and removed from the site. The concrete foundation and pad would be broken and buried on site. The area would be regraded to original contour, salvaged soil reapplied, and a DEQ approved seed mix used to revegetate the site.

2.5.10.4 Reclamation of Ore Haulage Road and Transfer Facility

During clearing of the proposed laydown area, ore-transfer facility, and private haulage road, BHJV would salvage an additional 35,400 cubic yards of topsoil and growth media (800 cubic yards from the laydown expansion, 2,400 cubic yards from the ore-transfer facility, and 32,200 cubic yards from the private haulage road), which would be used to reclaim these areas. Sections of the ore haulage road located on private property would be regraded to original contour and reseeded with a DEQ-approved seed mix.

The covered structure at the ore transfer facility would also be dismantled and removed and the concrete foundation broken and buried unless the private landowner decided to retain the structure.

The Silver Bow County and USDA FS sections of the ore-haulage road may not require reclamation depending on the type of improvements made and the terms of the Road Use Agreement with the USFS and the agreement between the County and BHJV. Reclamation bonds would be posted with these agencies if required.

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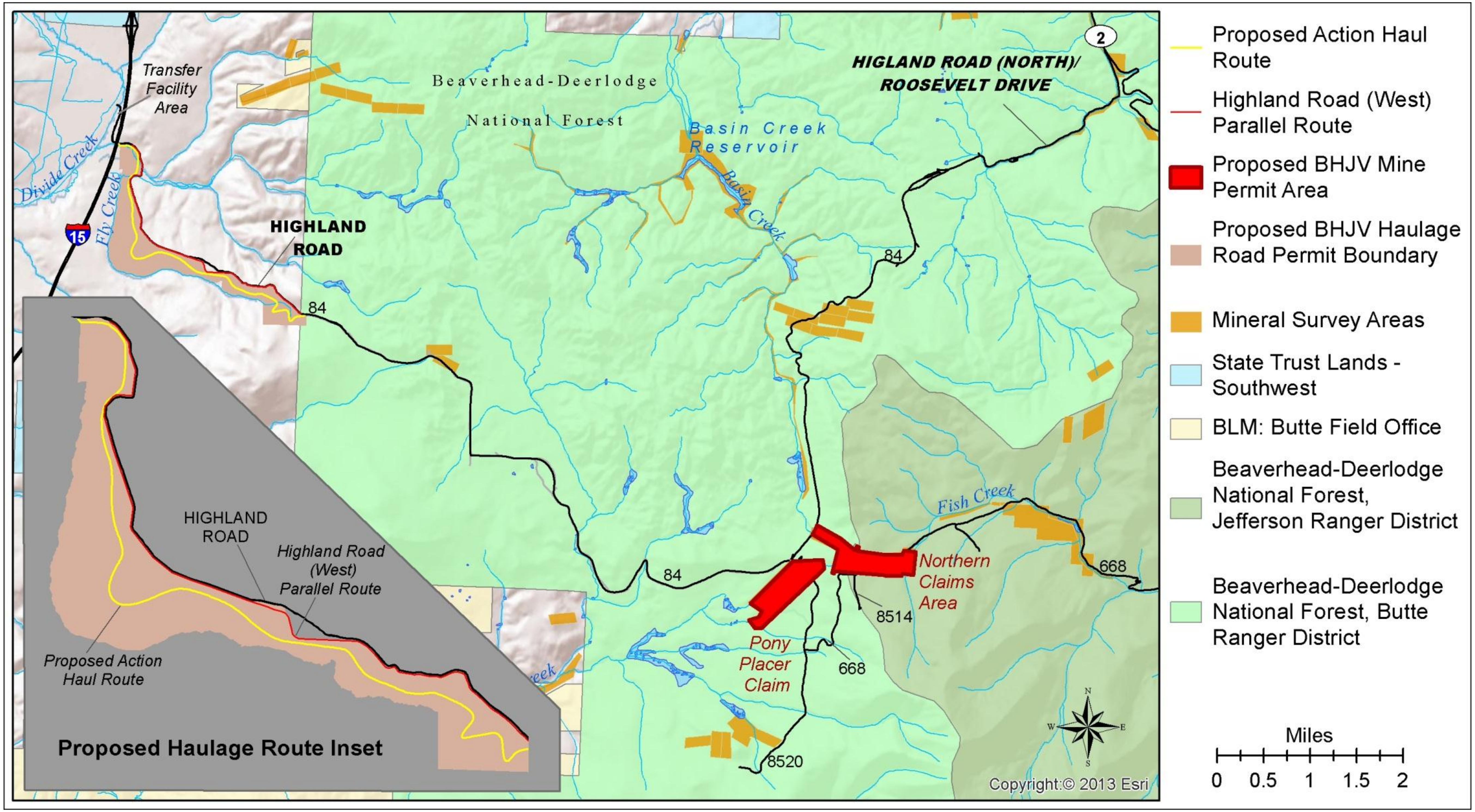

Figure 2.5-2. Alternative Haul Routes for the Proposed BHJV Mine, Silver Bow County, Montana.

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2.6 Reclamation Plan - Common to All Alternatives

This section outlines the proposed reclamation activity that would be carried out when exploration and/or mining activities are complete under any alternative being considered. Exploration License No. 00680 has an approved reclamation plan and bond calculation by DEQ. A small amount of additional disturbance necessary to support full scale mine operations would be reclaimed under the Proposed Action, but all methods and guidelines would remain the same. BHJV would not depart from this reclamation plan without written approval from DEQ.

All activities and facilities, except some portions of the transportation corridor, are located on private lands (Figure 2.5-2). Some facilities have value to the private landowner and these facilities would remain in place after reclamation activities are completed. Two phases of reclamation would occur, the first being an interim reclamation phase (temporary mine closure) during which a number of facilities would be retained rather than reclaimed in order to facilitate resumption of mining activities at some later date. The second phase of reclamation is the final closure phase when all facilities would be reclaimed except those remaining for post-mining use by the private land owner.

The Appendix lists the facilities and equipment used at the BHJV Mine, the method used to reclaim each item, and also reports whether the item would be reclaimed during the temporary or final closure phase, or retained for future use.

Reclamation methods described in the approved plan would remain valid and reclamation of all acreage would follow the same provisions and procedures outlined in the plan. The reclamation plan is summarized in the following sections. The complete reclamation plan is available on the DEQ website as part of the operating permit.

2.6.1 Site Facility Removal

BHJV is the owner of the patented claims currently used for exploration activities that would also be used for mining activities under the Proposed Action. For this reason, BHJV would retain the established roads on the property to provide access. These would include the main access to the surface facilities, and access to the LAD 1 and LAD 2 sites off of Forest Service Road 8250.

While the access road to the LAD 1 and LAD 2 sites would be retained, it would be lightly scarified and revegetated in order to provide a two-track road after reclamation. Roads and drill pads associated with exploration drilling would be reclaimed. In addition, all equipment and supplies would be removed from the site when no longer required to support reclamation activities. Some structures and other items have value to BHJV and private landowners (e.g. the private landowners where the ore transfer facility and ore haulage road would be located) and would be retained on the site following reclamation. Items that would be retained on site are listed below:

BHJV Mine Site	Ore Haul Route and Transfer Facility
Geologic core shed building	Gate, fencing
Water well(s)	Covered Ore Transfer Facility and the associated access road[a]
1-Water tank (Potable)	
Septic system/leach field	
Gate, fencing at access road	

[a] if requested by the private landowner

Most equipment and the majority of facilities at the site consist of portable units that would be loaded onto trailers and hauled away or loaded onto trailers after dismantling (e.g. the water treatment system).

2.6.2 Surface Facility Reclamation

Once the buildings and other equipment have been removed, the portal pad area would be regraded. The majority of regrading would occur on the waste rock dump where side slopes would be reduced from a 2:1 to a 2.5:1 slope. The surface of the portal pad would be graded and sloped away from the regraded waste rock dump to prevent storm water from running on to the slopes.

Additional regrading would occur at the Sediment and Recycle Pond location. The two 80-mil liners within the Sediment and Recycle Ponds would first be cut and buried in place so as not to retain water. Two 15-inch diameter culverts that discharge into the Sediment Pond as well as the 8-inch diameter culvert connecting the Sediment Pond to the Recycle Pond would be removed and hauled off-site. The ponds would then be regraded to eliminate their ability to store water, and regrading would occur in such a manner as to blend and match the adjacent topography.

Approximately 10,000 cubic yards of material from the Recycle Pond embankment would be pushed with a dozer to backfill and regrade the Recycle Pond and Sediment Pond. The fences installed around the ponds would be removed as part of closure activities. The two 50-foot x 75-foot concrete pads from beneath the Wash/Fuel and Surface Shop buildings would be broken up and buried in place with a minimum of three feet of overlying fill material.

The yard area and laydown area would be scarified to eliminate soil compaction that occurred during operations. Only a minor amount of regrading would be completed to preserve the generally flat topography of the area for future post-mining land use. Once all regrading activities are completed, soil placement would occur. There are currently 12,000 cubic yards of subsoil (excavated during construction of the Sediment and Recycle Ponds) and 35,600 cubic yards of topsoil stockpiled near the portal pad. The current soil stockpile should be sufficient to place a 7-inch subsoil cover and approximately 22 inches of topsoil across the portal pad, waste rock dump, Sediment and Recycle ponds, and soil stockpile areas. Alternatively, there is enough material to place 4.5 inches of subsoil and 13 inches of topsoil across the entire 20.2 acres permitted for the Portal Pad / Surface Facilities area.

More cover material may be needed to reclaim smaller disturbances associated with the LAD system (e.g., snow gun pads and minor excavations for pipe plugging), diversion ditches, and other miscellaneous areas. If it is determined that thicker soil placement is required in certain areas, BHJV would assess the various areas and prioritize soil placement to maximize revegetation opportunities. Some areas may get a thinner soil horizon to ensure adequate soil is available for higher priority areas. Amendments and other means would be reviewed and considered to enhance the opportunity for revegetation success on these areas. Sediment control structures would remain until the revegetation and BMPs demonstrate erosional stability, at which time the portal pad run-on and run-off diversions would be regraded and reclaimed.

2.6.3 Underground Mine Closure and Water Management Plan

This section contains subsections that detail mine flooding; plugging of the historic Highland Mine adit and the new BHJV Mine adits; water sampling during groundwater recovery and flooding of the backfilled mine; and water management during closure and post-closure. These components are described from the lower levels to the upper levels of the mine and through the closure process. Based on aquifer test date, dewatering operations are expected to stem the flow of water from the historic Highland Mine adit portal shortly after pumping is initiated, probably within the first two weeks. Under an MPDES permit, BHJV proposes to replace the existing flow from the Butte Highland adit to Basin Creek with treated water at a rate of 150 to 350 gallons per minute. Operationally, this water would be piped underground from the water treatment plant where it would be released through the historical adit for discharge at the portal to Basin Creek. This would minimize the risk of potential freezing problems with surface discharge lines during the winter months (BHJV, 2013).

Treated water would also be discharged to two tributaries of the Middle Fork of Moose Creek via a buried pipe extending from the current mine portal at flow rates of 60 and 140 gpm. Treated water would be discharged to a tributary of Fish Creek by piping underground from the water treatment plant to the bottom of the cased borehole DWW10-01. The pipeline system would extend up to the surface through the unused portion of the borehole and then through buried piping along the existing roads on BHJV to the Fish Creek tributary discharge point (BHJV, 2013).

2.6.3.1 Mine Flooding

Once mining is completed, and prior to plugging any adits, and flooding of the workings, all mobile equipment, unused supplies, explosives, and other similar items would be removed. No equipment, fluids, or materials, other than installed ground support and hangers, would be left underground at permanent closure. The pumps would be turned off, removed, and the workings permitted to flood.

Operationally, the lowest level of mine dewatering would be an elevation of about 6,300 feet. During mine flooding, the upper level of the new BHJV Mine portals would be closed with locking gates and air doors to prevent public access to the mine. These barriers would permit authorized access to the mine for direct observation and sampling as appropriate during flooding.

During mine flooding, the voids and pore spaces in the cemented waste rock backfill in the mined-out workings are expected to be filled by regional groundwater. The groundwater would move vertically and laterally from sources outside of the mineralized zone into the backfilled mine workings and the dewatering cone of depression. The groundwater composition is expected to reflect regional groundwater quality, similar to that currently discharging from the historic Highland Mine adit. The adit discharge is presently being used as one component of the background water quality against which the MPDES permit non-degradation criteria would be developed and compared. After the dewatering pumps are shut down and the water table begins to rebound, water in the backfill voids would be diluted from groundwater as it flows into the mine from surrounding areas. This suggests that considerable dilution of water in the mined out zone would take place.

BHJV would monitor water quality as the underground workings refill. Monitoring would take place in a screened well in the vicinity of the spiral access ramps. These spiral ramps are not currently proposed for backfilling, so water quality samples would represent a zone of mixing of regional groundwater and water from the grouted and backfilled mine workings. Samples of the mine water would be collected semi-annually and analyzed for the same list of parameters that is currently used for groundwater monitoring wells to document changes in water quality over time.

Based on the groundwater model presented with the operating permit, the water level in the mine is expected to rise to an elevation of 7,340 feet over a period of seven to eight years. Mine water would flow down the historic Highland Mine adit and discharge at the portal at an elevation of 7,300 feet (see Figure 2.5.2). The discharged water may not meet non-degradation standards with respect to pre-mining discharge water quality because of chemical changes resulting from grouting of mine inflows, backfilling of portions of the mine workings using cemented mine wastes, and nitrogen compound residues resulting from explosives used during mining. As such, BHJV proposes installation of a hydraulic plug in the historic Highland Mine adit for permanent closure, water quality monitoring as mine flooding continues, retaining water level at elevations where seeps are not developed, and pipe mine water to an appropriate LAD that will satisfy groundwater discharge requirements.

2.6.3.2 Historic Highland Mine Adit Plug

BHJV proposes to control the flow of water from the historic Highland Mine adit at closure through construction of a water-tight hydraulic plug(s) in the adit. Because of the inability to access the 2,300-foot long historic,70 to 100-year old Highland Mine adit from the portal in order to evaluate ground conditions to the proposed plug stations, adit plugs would be installed from underground during closure within either new or rehabilitated mine workings. These plugs would be 15 to 20 feet in length and keyed into solid bedrock at locations with good rock mass quality. The plug(s) would be a mix of rebar reinforced concrete and aggregate, with very high cement content. They would be designed to contain water with greater than the 125 feet of hydrostatic head (55 psi) expected to develop behind this plug once the mine is flooded in full closure. If needed, high-pressure grouting of the bedrock adjacent to the plug would be undertaken to minimize the risk of water from the mine pool flowing through fractures in the host rock adjacent to the plug. The areas adjacent to the plugs would be backfilled with mine waste rock to minimize the risk of any future mine collapse damaging the water-tight plugs. This plug closure would likely eliminate any possibility of future discharge from the historic Highland Mine adit to Basin Creek, although other pathways for mine water to discharge may occur and will be evaluated (BHJV, 2013). The plug closure would also serve to reduce the flow of water through the exposed mined-out and backfilled zones during flooding, thereby reducing the availability of oxygen and additional metals load to Basin Creek, Fish Creek, or Moose Creek.

At other mines where this plugging closure method has been applied (i.e., World's Fair Mine, Patagonia, Arizona (Kirk, Welter, Stormzand, & Curiel, 2011) , and the Glengarry Mine in the New World District (Kirk, Bogert, & Marks, 2012), water moves laterally from the regional groundwater system to fill the mine void. In the case of the Glengarry Mine, significant improvement in local groundwater quality has been observed over a short period of time with groundwater discharges occurring along reestablished pathways in pre-mining fracture systems that in turn reactivate historic pre-mining seeps and springs. Significant improvement in surface water quality downgradient of the closed adit discharge is also observed at the Glengarry Mine site. At the World's Fair Mine, 100 percent of the adit discharge was eliminated; however, there are no groundwater monitoring wells in the vicinity of the World's Fair Mine to be used to compare changes in groundwater quality.

2.6.3.3 New Butte Highland Mine Main Access and Secondary Portal/Adit Plugs

After the historic Highland Mine adit is plugged, BHJV anticipates that water would continue to rise through the cone of depression and backfilled mine workings until reaching an estimated elevation of 7,435 feet at the new BHJV Mine adits (decline) portals. However, the final elevation of mine water is not certain, and water levels in the main access and secondary (ventilation) portals would be monitored and the portals sealed prior to any release of water from the underground workings. Based on a premining water level of 7,465 feet (see evidence presented in Section 2.5.4.1 Mine Flooding, above), it is unlikely that a barrier plug would be needed for adit closure with an elevation difference of as little as 30 feet (13 psi). BHJV thus proposes to construct a CRF plug at or near each of the two portals at mine closure. A water-tight barrier plug would be designed and specified for use if future monitoring during closure and flooding of the underground workings indicates a risk of high pressure discharge from the access and secondary portals. BHJV would consult with DEQ on which closure method would be necessary at the time of closure based on direct observation of water level changes.

The plug proposed for the new Butte Highlands adits would use either CRF or a conventional cement plug. Under the CRF approach, a 10 to 20-foot zone of cemented rock would be placed into the opening. Timber or other similar structure would be used to temporarily hold the CRF material until the cement has cured, thereby forming a solid rock plug. This method would be cost effective and timely, as equipment and materials necessary to construct the plug should be readily available. Alternatively, if groundwater pressure conditions warrant, BHJV may install conventional, hydraulic barrier concrete plugs. It is assumed the conventional barrier plug would be located reasonably close to the portal. The remaining decline that is open to the surface would be backfilled with waste rock.

Boulders could be placed over each portal as a final security measure, if available on site. For either portal plug method used, fill material would be placed over the CRF material/boulders as a final cover for revegetation. The fill would be placed with an approximately 3:1 slope.

The barrier plug would be designed to contain any anticipated hydrostatic head while stemming any potential discharge from the portals. Based on the groundwater modeling it is expected that the mine may take as little as an additional two to three months to fill the remaining 125 vertical feet from the historic Highland Mine adit level (7,339 feet) to the reported premining groundwater level of 7,465 feet. Therefore, the total estimated time required for groundwater to reestablish itself from the 6,300 foot base of dewatering to the premining groundwater surface is estimated to be less than eight years post-closure.

Elevated groundwater levels ultimately established after closure of the BHJV Mine should provide quantities of water similar to those that existed prior to operation of the historic Highland Mine in the areas of the various drainage basins through seeps and springs, surface water, wetlands, and natural recharge of groundwater base flow into surface water channels.

2.6.3.4 Water Sampling During Groundwater Recovery and Mine Flooding

BHJV would monitor water quality and groundwater elevation as the underground workings refill. Monitoring would take place in a screened well in the vicinity of the spiral access ramps (Figure 2.5-2). These spiral ramps are not currently proposed for backfilling, so water quality samples would represent a zone of mixing of regional groundwater and water from the grouted and backfilled mine workings. Changes in water levels would be continuously recorded using a transducer during this period of time. Samples of the mine water would be collected semi-annually and analyzed for the same list of parameters that is currently used for groundwater monitoring wells or a list approved by DEQ at closure. If needed, as the water elevation changes, water levels could also be measured and samples collected semiannually by accessing the mine through the portal gates and air doors proposed for temporary closure.

Following rebound of groundwater to an elevation above the spill over elevation in the historic Highland Mine adit (7,339 feet), the down-gradient areas in the vicinity of the mine would be inventoried for the re-establishment of seeps and springs. It is proposed that this inventory be conducted annually from mid-July through mid-August within one mile of the portal area of the new BHJV Mine. If seeps or springs are discovered, their flow and water quality would be measured. Sampling should be continued both in the mine pool and from any seeps and springs that formed until at least one year after a maximum and stable groundwater table elevation was established. The decision to terminate this portion of the monitoring program would be made in consultation with DEQ.

There is uncertainty as to which elements, if any, may present an issue with post-mining. If the water that would discharge from seeps after closure would be chemically identical when compared to water currently discharging from the historic mine, then the water would be acceptable for discharge without treatment. If the results of the humidity cell testing accurately represent post-mine water quality, then no groundwater quality exceedances would occur. However, in the event that post-closure seepage quality is not as predicted by either existing mine drainage quality or humidity cell testing results, then downgradient sites must be protected from degradation and BHJV would lower the water table by drilling into the mine void and draining the water to the LAD area, possibly through a treatment system.

2.6.3.5 Water Management

Based on past experience at other mines, installation of the proposed adit plugs in closure would likely eliminate any discharge from the mine portals (BHJV, 2013). If minor water discharges of less than a few gallons per minute from the portal continue in closure, BHJV would direct this flow through a buried piping system originating inside the portal to a near-portal sub-surface gravel-lined infiltration basin just outside the portal.

BHJV would develop the details of any mitigation strategy in conjunction with DEQ Hard Rock and Water Protection Bureaus at the time of closure when the need for and specific objectives of such strategies would be better defined. The passive mitigation strategies presented above would be capable of operating long-term if needed. Based on the amount of time that elapsed between mining of the historic Highlands adit and the discharge of water that is considered to represent background conditions at that location, it is understood that water discharging from seeps, springs, and/or the new Butte Highlands adit would meet DEQ MPDES water quality standards and closure guidelines within 0 to 70 years.

2.6.3.6 Land Application Disposal Areas and MPDES Discharge Pipes

Three LAD areas are currently in place to the south of the portal pad and a fourth area (LAD 3) would be installed under the proposed mining plan of operations. All four LAD areas would be decommissioned during final closure unless needed for passive treatment of mine discharge.

Surface pipelines, snow guns, and other surface equipment used for land disposal would be removed from the site. At LAD 4, seven four-foot diameter concrete pads used to support snow guns would be broken and buried in place beneath three feet of fill material and revegetated.

The ends of the buried LAD and MPDES discharge pipelines would be exposed, plugged with either PVC caps or cement, and buried. Ground disturbances from this work would be revegetated, but it is not anticipated that any work would be required to reclaim the actual water application area. Watering over the operational period of the LAD areas should establish robust vegetative cover.

Reclamation would be completed on roads and monitoring wells associated with the LAD areas. Two LAD area monitoring wells would be plugged in accordance with applicable laws by filling the casings with bentonite chips, cutting the casing below ground surface, backfilling, and revegetating the disturbance. The 14, five-foot deep piezometers monitoring the LAD 2 area would be reclaimed by removing the casing, excavating/backfilling the boring, and revegetating the disturbance at each piezometer location.

Approximately 2,000 feet of access road connects Forest Service Road 8250 (Camp Creek Road) to the LAD 1 and LAD 2 sites. This road would be reclaimed by lightly scarifying and reseeding in order to maintain the road in a stable two-track condition.

2.6.3.7 Ventilation Raise/ Second Adit

A ventilation raise was proposed in the initial exploration plan. The mining plan has since changed and the ventilation raise is no longer needed. Instead, a second adit would be constructed near the main access adit at the portal pad area. It would be closed and reclaimed in the same fashion as the main production adit.

2.6.3.8 Hydrology Holes

Five drill holes were developed to test hydrologic conditions during exploration. These borings, and one exploration boring drilled to the surface, would be plugged according to applicable laws and the casing cut off below ground level. The drill pad areas would be regraded and scarified prior to placing soil over the surface. Road access to the sites would also be regraded and scarified prior to soil placement and reseeding.

2.6.3.9 Revegetation Efforts

Disturbed areas would be reseeded as soon as possible once they are regraded and receive cover soil placement. This would limit the ability of weed species to become established on reclaimed sites. A DEQ-approved seed mix would be broadcast at the rate of 50 pounds of pure live seed per acre. BHJV would develop a weed management control plan with DEQ input and Silver Bow County approval and would perform noxious weed control for three years after completion of reclamation earthwork (BHJV, 2013).

2.6.3.10 Reclamation Monitoring

A monitoring program would be developed in consultation with DEQ to evaluate revegetation success, erosion control effectiveness, and to identify the presence or absence of water quality impacts. This data would be used to identify when bond release milestone are met and/or to trigger contingency measures. Contingency measures might include further actions to promote revegetation (e.g. reseeding, additional soil amendments, and herbicide application), erosion control, or other measures as determined through consultation with DEQ.

Water quality monitoring as described in Section 2.5.4.4 would continue after closure, and BHJV would consult with DEQ before modifying the sampling frequency or parameter list.

2.6.4 Personnel

During reclamation, limited staffing would be required. An estimated 10 people would be required for closure and would include contractors and BHJV staff. During the long-term post-closure monitoring, staffing levels would vary depending on the monitoring and other activities that may be required.

2.7 Alternative Haul Routes

2.7.1 Highland Road (West) Parallel Route Alternative

The first segment of the Highland Road (West) Parallel Route would be the same as the haul route under the Proposed Action Alternative. Ore trucks would leave the mine site on Highland Road and travel west to the Forest Service Boundary. This segment of Highland Road is part of

Forest Service Road No. 84. Proposed improvements on the segment of Highland Road that is the same as Forest Service Road 84 include widening narrow areas to 16 feet, adding 22 foot wide turnouts where needed, installing ditches and culverts, and rebuilding soft spots. The road would be capped with gravel. The Beaverhead-Deerlodge National Forests are currently conducting an environmental review regarding use of the Forest Service Road No. 84 as a haul route. The environmental review is slated for completion in 2014.

West of the Forest Service boundary, Highland Road becomes a county road. As discussed in the description of the Proposed Action, an Easement Agreement executed by the City and County of Butte-Silver Bow limits use of the county road as it crosses the Kelly's property to historic uses. As a result, from the Forest Service boundary, a new haul route would be constructed that closely parallels the existing Highland Road except for approximately one half mile where the new haul road would deviate farther to the south. Other minor deviations from the generally parallel route would occur as needed to avoid rock outcrops or other circumstances that present construction obstacles.

The road would be built to county specifications and would be 16 feet wide and located within a 24-foot wide right-of-way. The 24-foot right-of-way would be leased from two private landowners along a total distance of 19,800 feet for a total acreage of 10.9 acres. The northern boundary of the private road right-of-way would be separated from the existing southern county road right-of-way by a median strip (private land) measuring between 5 and 10 feet wide. A fence would be constructed where needed to control access and to ensure separation of ore trucks from public access.

It is anticipated that the total 10.9 acres of land inside the right-of-way would be disturbed during construction activities. Reclamation and revegetation of areas inside the right-of-way but outside of the road footprint would be completed as soon as possible after construction resulting in 7.3 acres of non-reclaimed land over the long term. Three culverts would be replaced during road construction and drainage control BMPs such as ditches and proper sloping would be implemented along the length of the road.

The haul route would rejoin Highland Road approximately one-third of a mile south of the proposed transfer facility located adjacent to Interstate-15.

This alternative road route is being proposed by DEQ to provide a number of benefits relative to the Proposed Action haul route. Placing the road adjacent to the existing roadway minimizes and concentrates disturbed acreage. This alignment would reduce construction and reclamation costs as well as the potential for impacts to wetlands and riparian areas by moving the road farther from Fly Creek. Unlike the Proposed Action haul route, this alternative would avoid fragmenting the private landowners' ranch land. This would facilitate grazing operations and minimize the potential for encounters between cattle and haul traffic.

2.7.2 Highland Road (North)/Roosevelt Drive Alternative

BHJV would proceed north on Highland Road for approximately eight miles to Roosevelt Drive using 22-ton, highway legal, dump trucks with no trailers. This portion of Highland Road is a segment of Forest Service Road No. 84 and was built for logging truck traffic. It has adequate width, curve radius, and surface for highway legal trucks to operate. Some minor road base and surface upgrades would be required. Dust control, snow plowing, and road maintenance by BHJV would be required. The Beaverhead-Deerlodge National Forests are currently conducting an environmental review regarding use of the Forest Service Road No. 84 as a haul route. The environmental review is scheduled for completion in 2014.

From the Forest Service Boundary, the haul route would continue to the northeast on Roosevelt Drive to Highway 2. Since Roosevelt Drive is a county road it would require some widening in curves, and at the railroad trestle underpass. Minor improvements to the road base and about four miles of new pavement may be required.

2.8 Agency Mitigated Alternative

The Agency-Mitigated Alternative addresses potential impacts to water quality and the location of the proposed water treatment facility.

2.8.1 Water Quality Monitoring

To better characterize the aquifer characteristics, its relationship to surface water, and the water quality that can be expected during mine dewatering, additional monitoring wells would be necessary. Field parameters and water quality samples would be collected. This additional sampling would provide better information on the possible impacts of mine dewatering on local wetlands. The water analyses would provide ongoing insights into the water treatment needed to meet the water quality standards.

2.8.2 Moving the Water Treatment Plant to the Surface

Water from dewatering the mine workings would be disposed at the surface or within the LADs. This water would likely need to be treated prior to disposal. The water treatment plant would be located on the surface, rather than installed underground as proposed by BHJV, in the area of the other mine facilities. This location would allow access to the plant during mine operation and post closure (as needed).

2.9 Related Future Actions

Currently, the only related future action that has the potential to affect the alternatives under consideration is the parallel NEPA process that the Forest Service is completing for the portion of the proposed haul route that crosses USDA FS and other lands. DEQ is in consultation with the Beaverhead-Deerlodge National Forest, but DEQ’s approval of BHJV’s operating permit is not contingent upon the Forest Service selecting a preferred haul route. The two agencies and their respective environmental review processes are independent. DEQ is not aware of any other relevant actions under review by another state agency with the potential to affect the cumulative impacts of this action.

The City of Butte has discussed the potential for changes to the Basin Creek Reservoir and its surface water intake and water treatment plant. This reservoir supplies part of Butte’s public water supply. No permits or plans have been drafted at this time. MEPA requires that related future actions may only be considered in an agency’s cumulative impacts analysis when these actions are under concurrent consideration by any agency through pre-impact statement studies, separate impact statement evaluations, or permit processing procedures (75-1-208(11), MCA).

2.10 Alternatives Considered But Dismissed

Under MEPA, a reasonable alternative is one that is practical, technically possible, and economically feasible. In addition, any alternative under consideration must be able to meet the purpose and need of the Proposed Action. During scoping, alternatives to the Proposed Action were suggested and discussed by agency representatives and the BHJV. Alternatives covered in this section include alternatives or alternative components that were considered and eliminated from detailed study. For each alternative discussed, the agency includes a synopsis of the changes proposed and a discussion of why the alternative or component was dismissed.

2.10.1 Determination of Ore Haulage Route

Several ore haul route alternatives were evaluated for moving ore from the mine to an off-site milling facility where ore would be processed (Table 2.1-1). Three alternative haul routes were carried forward and analyzed. Alternative routes that were considered but dismissed included:

1. Using the existing Highlands Road to access the Feely interchange at Interstate-15;
2. Forest Service Road 668 (Fish Creek Road) northeast to Highway 2; and
3. Numerous other alternate routes using Forest Service, county, and private roads out of the Highlands Mountains.

Ultimately, the Highland Road to Interstate-15 ore haul route was selected for the mine's permit application. However, this route was modified as it crossed private property west of the Forest Service boundary and east of the highway due to easement restrictions of the existing county road. The modified route is described in the Proposed Action and included in the operating permit application (BHJV, 2013). Pertinent details of the dismissed routes are described below and the reasons for their removal from consideration are provided.

2.10.1.1 Using the Existing Highland Road to Access the Feely Interchange

This route would have directed the ore haul trucks down Highland Road (and along the county road) to the proposed transfer facility and on to Interstate-15 at the Feely Interchange. Because BHJV was unable to resolve a conflict related to the road easement agreement among the landowners and Butte-Silver Bow County, this alternative was removed from consideration.

2.10.1.2 Forest Service Road 668 (Fish Creek Road) to Highway 2

Proposed ore hauling on this route used 30-ton center-articulated trucks from the mine site via Forest Service Road 8250 (Camp Creek Road), then Forest Service Road 668 (Fish Creek Road) to a private ranch. Inside an existing ore transfer facility at the ranch, the ore would have been off-loaded and reloaded onto highway legal trucks. Highway legal trucks would have followed Cedar Hills Road, then Montana Highway 41 north to reach Montana Highway 2. This route is about 45 miles in length.

Originally ore haulage out Forest Service Road 668 (Fish Creek Road) directly to Montana Highway 2 was proposed; however, the Forest Service requested BHJV to haul across a ranch on a private road and then on Cedar Hills Road. From April 2011 through June 2012 BHJV held a lease with the ranch owners for ore haulage and transfer facilities. The lease was dropped when it became obvious that this route would not be used.

Forest Service Road 668 (Fish Creek Road) was proposed to be widened to 16 feet with 22-foot wide turnouts where needed for passing. The road surface would have been raised in areas where it is lower than the surrounding ground and collects water. The road surface would have been capped where boulders protrude through the existing road surface. Culverts and bridges would have been replaced to meet aquatic criteria and Forest Service standards. All upgrades would have been achieved by widening to the uphill side of the road, thus avoiding impacts to the flood plain.

Cedar Hills Road, a dirt and gravel road, would have been rebuilt and maintained to accommodate daily truck traffic. Dust control and road maintenance by BHJV would have been required on the Forest Service Road 8250 (Camp Creek Road), Forest Service Road 668 (Fish Creek Road), private roads, and Cedar Hills Road. Environmental impacts would have included effects from road reconstruction. Road upgrades/repairs were roughly estimated at $1,000,000 to $2,000,000. Haulage costs were estimated at $25 per ton. This route was dropped due to a combination of length of travel, complexity of securing the route across multiple public and private lands, potential environmental impacts to extensive wetlands and streams, and high construction and haulage costs.

2.10.1.3 Other Ore Haul Routes

A number of other haul routes were considered but dismissed. The routes headed in various directions away from the mine site. These routes were each dismissed on the basis of a number of factors that made them unfeasible. These factors included but were not limited to:

- The current poor condition, undersized, or otherwise inadequate roads;
- The relative amounts of sufficient road improvements to allow heavy truck traffic;
- The number of stream crossings (with suitable culverts to be installed); and
- The length of wetlands, streams, and riparian habitat that those roads traversed or travelled alongside.

2.10.2 Highland Mine Adit Left Open

As an alternative to plugging the historic Highland Mine Adit that feeds into Basin Creek, it was proposed to leave the adit open and allow mine water to flow out unimpeded. However, BHJV would be required to monitor water quality and to provide for long-term water treatment to ensure that the water would meet non-degradation standards. Basin Creek is a closed basin for the city of Butte water supply; therefore, any discharge to the creek would be required to meet non-degradation standards. This alternative was removed from consideration because of the level of uncertainty related to monitoring and water treatment needs.

2.10.3 Highland Mine Adit Plugged, but with Regulation Valve

Another alternative to plugging the adit with backfill material would be to plug it with an adjustable regulation valve. This alternative would allow BHJV to close off the adit if water quality monitoring indicated that the outflow did not meet non-degradation standards. However, the technology that would support such a valve has not been proven to be reliable, and if the valve was not able to close off the entire flow, then additional excavation or retrofitting would be needed to close off the adit completely. In addition, the Highlands Mine adit is not currently accessible from the surface. The historic adit would require great expense to access it from the surface, while access may be available from the new mine workings after it is dewatered. The uncertainty related to the reliability of this option led to its dismissal.

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Table 2.10-1. Potentially Substantial Effects by Alternative.

	No Action Alternative	Proposed Action	Alternative Haul Routes	Agency-Mitigated Alternative
Geology	Alternative would result in removal of 10,000 tons of waste rock and ore under the exploration license.	Alternative would result in removal of 1,200,000 tons of waste rock and ore, with subsequent backfilling. Mining will not occur less than 300 feet below the surface to minimize risk of surface subsidence.	No impacts	Same as the Proposed Action
Vegetation and Wetlands	Alternative would result in no impacts to vegetation resources. All previously permitted surface disturbances that affect vegetation resources have already occurred.	Alternative would result in temporary impacts to vegetation and soil from construction of roads and facilities. Impacts to wetlands and riparian vegetation adjacent to construction areas may be impacted until reclamation is complete. Noxious weeds have the potential to spread due to disturbed acreage.	Moving the haul route away from the relatively undisturbed pasture lands to an area that is set aside as a road right-of-way would decrease the level of disturbance to native vegetation and may reduce the overall likelihood of weed spread. The parallel haul route moves the roadway farther from the wetlands and would decrease the potential for impacts to these areas.	Same as the Proposed Action
Surface Water	Alternative would result in potential for reduction in stream flow rates. Under the existing exploration	Alternative would result in altered stream flows. Adit discharge into Basin Creek will stop after dewatering	Moving the haul route away from the channel of Fly Creek to an area that is set aside as a road right-of-way would decrease	Increased monitoring may allow detection of water quality

	No Action Alternative	Proposed Action	Alternative Haul Routes	Agency-Mitigated Alternative
	license, dewatering operations may cause a reduction of groundwater recharge to surface water bodies.	lowers groundwater below adit elevation. During mining, increased flow will occur in two Moose Creek tributaries and Fish Creek from discharge of treated water from the water treatment plant.	the level of disturbance and may reduce the overall likelihood of sediment or pollutants entering the stream or wetlands.	exceedances.
Groundwater	Alternative would result in lower groundwater elevation as a result of dewatering operations.	Alternative would impact groundwater similar to No Action Alternative, but depth and rate of dewatering would be greater and would have greater geographic extent for a longer period of time. Pre-mining discharge from underground workings to Basin Creek and associated wetland would stop. Adit will be plugged at end of mining to eliminate discharge into Basin Creek. Seeps or springs may develop as water currently discharging from the adit is redirected into fractures	No additional impacts from either haul route alternative	Increased monitoring may allow detection of water quality exceedances. Additional measures to monitor groundwater levels during dewatering would minimize uncertainty associated with the groundwater drawdown model.

	No Action Alternative	Proposed Action	Alternative Haul Routes	Agency-Mitigated Alternative
		and pre-mining flow paths. The potential for dewatering Fish Creek and Moose Creek wetlands exists, and additional monitoring data are recommended. Water levels will likely rebound post-mining.		
Transportation	Alternative would result in 22-ton highway-legal dump trucks to haul approximately 450 truckloads using Roosevelt Drive.	Alternative would include two routes. Roosevelt Drive would be used by workers, general deliveries, and site visits. Highland Drive out to Interstate-15 would be used to haul ore from the mine to the transfer facility. Both routes would require an increase in vehicle traffic and road upgrades. The ore haul route to the transfer station would require construction of a new parallel road. Effects on recreational uses by mountain bike riders and hunting season access would occur, but mitigations are proposed.	West Alternative: Same impacts as the Proposed Action North Haul Route Alternative: Using the smaller highway legal trucks would necessitate increasing the number of round trips per day from 20 to 30 haul truck loads.	Not addressed as part of the Agency-Mitigated Alternative

	No Action Alternative	Proposed Action	Alternative Haul Routes	Agency-Mitigated Alternative
Fisheries	Alternative would result in potential for reduction in stream flow rates. Under the existing exploration license, de-watering operations may cause a reduction of groundwater recharge to surface water bodies.	Stream flow rates would be reduced due to delayed groundwater recharge after dewatering ceases at the mine site. Level and extent of impacts would be difficult to predict, but reduced stream flows would negatively impact native westslope cutthroat trout populations.	Moving the haul route to parallel the existing Highland Road would potentially decrease the level and extent of impacts to fisheries and aquatic resources from those anticipated described under the Proposed Action. The alignment adjacent to the existing road would keep the road disturbance away from Fly Creek and could reduce the potential for impacts due to sediment input and pollutants to the creek and nearby wetlands.	Increased monitoring may allow detection of water quality exceedances which could prevent adverse effects to aquatic ecology.
Wildlife	Alternative will include temporary and ongoing risk of roadkill from traffic along Roosevelt Road to and from the proposed mine project area.	Alternate would likely result in increase in roadkill due to the increase in traffic along Roosevelt Drive and along the proposed haul route. This impact would persist for the 6-7 years of mine operation. Alternative would result in 12.7 acres of additional habitat loss compared to the No Action Alternative. Most of the habitat loss would be associated with the proposed haul route permit area and transfer facility (approximately 11 acres).	Selection of the Highland Road (West) Parallel haul route alternative would not change the level or extent of impacts to wildlife from those anticipated due to the development of the haul route as described under the Proposed Action. The Highland Road (North) Roosevelt Drive haul route would increase the total number of truck trips and may lead to an increase in roadkill.	Not addressed as part of the Agency-Mitigated Alternative

	No Action Alternative	Proposed Action	Alternative Haul Routes	Agency-Mitigated Alternative
		Alternative would result in more wildlife disturbance than the No Action Alternative.		

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Chapter 3: Affected Environment

3.1 Introduction

Chapter 3 describes components of the existing environment that could be affected by the Proposed Action or alternatives to the Proposed Action. The Proposed Action is described in detail in Section 2.3 of Chapter 2.

Chapter 3 serves three purposes: (1) it provides a baseline from which to analyze and compare alternatives and their impact; (2) it ensures that DEQ has a clear understanding of the environment potentially affected by the Proposed Action; and (3) it provides the public information to evaluate the agency's alternatives, including the Proposed Action. The environmental components described in this chapter include air, water, geology, soils, vegetation, fish and wildlife, cultural, visual, land use, transportation, and socioeconomics. In general, the affected environment is defined by the extent to which the implementation of the Proposed Action would affect each resource. The study areas are defined in the methods sections for each resource, as they may vary in location and extent. The MEPA Model Rules (IX(3)) direct DEQ to include descriptions that are no longer than is necessary to understand the effects of the action and alternatives. Data analysis must be commensurate with the importance of the impact. As such, the discussions are limited to resources within areas where the issuance of the operating permit would create new disturbance or affect the surrounding area, or where proposed activities would change from those permitted under BHJV's Exploration License.

There are two distinct sites with the potential to be affected by the Proposed Action; 1) the BHJV Mine site and the patented claims surrounding it, and 2) the areas where the proposed haul routes and transfer facility would be constructed on private lands. Because the two areas are separated by several miles and over 1,000 feet in elevation, their environments and resources differ substantially in many respects. Several sections of this chapter discuss the two areas separately for clarity.

Each section below summarizes the current conditions by resource. Activities approved or completed under the Exploration License are part of the existing environment and will be included in this chapter. Much of the information in this chapter was compiled as part of the operating permit submittal (BHJV, 2013) or as part of a preliminary project description report (Tetra Tech, 2013). Data collected from electronic databases and other online resources were also important in the evaluation of the project area environment. Data queries were rerun and updated as appropriate. Chapter 3 does not contain all of the information from the operating permit or its appendices, rather this chapter attempts to distill the key aspects of the environment that are most likely to be affected by any alternative under consideration. Sections will refer the reader to pertinent references where original study results can be reviewed. A compilation of all references used in the EIS is provided in Chapter 8.

3.2 Geology and Minerals

This section provides a description of the general and site-specific geologic setting, alteration, and ore mineralization in the vicinity of the BHJV Mine and the proposed haul route and transfer facility.

3.2.1 Overview and Study Area

The BHJV Mine is located within the Highland Mountains 15 miles south of Butte, Montana, in Silver Bow County. The mine is located on the Montana Bureau of Mines and Geology Geologic Map of Butte South 30' and 60' quadrangle (2012). The topography of the project area is characterized by rolling forested foothills and meadows along the Continental Divide on the west flank of the Highland Mountains. A review of topographic maps indicates the elevation of the Pony Placer Claim ranges from 7,120 to 7,440 feet above mean sea level (amsl). The portion of the Northern Claims parcel that was surveyed near Highland Road ranged from approximately 7,200 to 7,400 feet amsl (USGS Mt. Humbug 7.5 minute topographic map (1996)). The project area covers the headwaters of drainage basins for three creeks: Fish Creek, Basin Creek, and Moose Creek. A surficial geologic map of the mine site is presented in Figure 3.2-1. Detailed subsurface geology is shown in Table 3.2-1.

3.2.2 Methods

Much of the geologic and mineral interpretations were provided in the preliminary project description report and the BHJV operating permit application (BHJV, 2013; Tetra Tech, 2013). The geologic and stratigraphic descriptions were derived from mapping and reporting recently completed by McDonald et al. (2012) and modified from Ruppel, O'Neill, and Lopez (1993). Geologic mapping and description of gold deposits in Montana were obtained from reports by Frishman et al. (1993), and Pearson et al. (1990).

3.2.3 Results

3.2.3.1 Geologic Setting

BHJV is located in a geologically complex area of southwestern Montana. The area is underlain by a series of sedimentary rocks which include, from oldest to youngest:

- Proterozoic (1470 to 1400 million years ago) meta-sediments of the Belt Supergroup
- Middle Cambrian (550 million year old) sedimentary rocks
    - Flathead Formation (quartz sandstone)
    - Wolsey Formation (shale and limestone)
    - Meagher Formation (limestone and dolomite)
    - Park Formation (shale)
    - Pilgrim Formation (limestone).

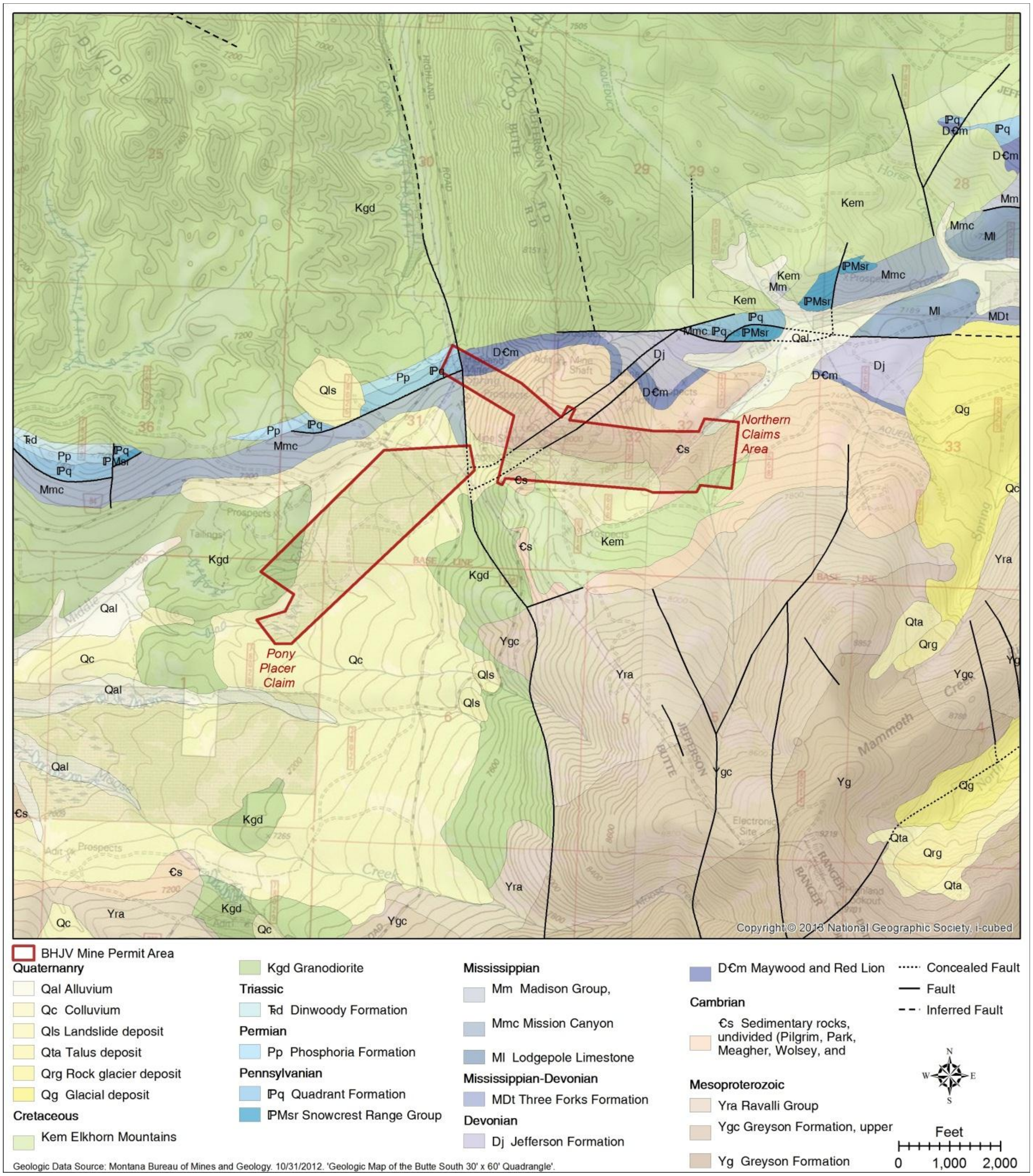


Figure 3.2-1. Geologic Map of the Butte Highlands Joint Venture Project Area in the Vicinity of the Proposed Mine.

Table 3.2-1. Stratigraphic Interpretation Underlying the BHJV Mine

Formation		Code	Description	Approximate Thickness (feet)
Cretaceous Intrusive Rocks				
	diorite	Kd	diorite and minor syenogabbro and gabbro plugs, dikes and sills.	Variable
	Transitional diorite	KdT		
	Gabbro	Kgb		
Cambrian Formations				
	Pilgrim	Cpi	Medium to light gray, fine-grained limestone and dolomite	170
	Park	Cp	Green fissile shale with thin beds of feldspathic sandstone and limestone flat-pebble conglomerate, strongly altered to biotite and hornfels	130
	Meagher	Cm	Medium to dark gray fine-grained limestone with lighter gray, black, gold, or rust-colored dolomite	170
	Wolsey	Cw	Olive green, irregularly bedded micaceous shale and fine-grained arkosic sandstone, locally altered to skarn	170
	Flathead	Cf	Pink gray, fine to medium grained sandstone to quartzite	70
Mesoprotorozoic				
	Undivided Belt Supergroup		Meta-siltstones and sandstones	Unknown

The Cambrian strata generally dip steeply (60 degrees) north and are locally folded into a sequence of northward plunging folds. This entire sedimentary sequence was intruded by a variety of intrusive rocks which are all part of or related to the Boulder Batholith (BHJV, 2012). The intrusive units are all Cretaceous or younger and include large plutons, small stocks, dikes, and sills of varying composition. Both Cambrian and Precambrian sedimentary rocks, due to their proximity to the hydrothermal systems, have undergone contact metamorphism (heating and recrystallization) and alteration. The structural geology is relatively complex near the contact zone between Late Cretaceous to Tertiary (65 million year old) intrusive rocks of the Boulder Batholith to the north, and much older folded and low angle thrust faulted Proterozoic and Paleozoic (Cambrian) sedimentary rocks to the south (McDonald, Elliott, Vuke, Loon, & Berg, 2012). Thrust faulting took place during the Late Cretaceous prior to emplacement of the Late Cretaceous and Early Tertiary (65 - 50 million years ago) Boulder Batholith. During the Early Tertiary, the Highland Mountain range was uplifted along normal faults (Elliot, Loen, Wise,

& Blaskowski, 1992). The geologic formations, mineralization, and alteration encountered as part of the Butte Highland mining project, are described in the following section.

3.2.3.2 Geologic Formations, Mineralization, and Alteration

Mineralization at BHJV occurs predominantly along a shear or fracture zone. Mineralization results from alteration within the host formation and is characterized by a sequence of minerals known as an alteration assemblage. Gold-bearing skarn is an alteration present as a replacement deposit hosted in the Wolsey Formation. Skarn deposits form when hot, water-rich and acidic fluids, typically derived from intrusive bodies, come in contact and react with carbonate-rich rocks such as limestone or dolomite. During the reaction, hydrothermal fluids mobilize carbon dioxide (CO_2) from the carbonates which release calcium and magnesium. The calcium and magnesium combine with silica in the hydrothermal fluids to form a suite of calc-silicate minerals that typify skarn altered deposits. This skarn mineralization replaces selective limestone and dolomite beds with calc-silicate minerals and often co-deposits metal and or sulfides from metal-rich hydrothermal fluids. The BHJV Mine gold deposit is a result of this skarn mineralization. The mineralization and alteration of the Meagher, Wolsey, and Flathead Formations and diorite intrusives are described in the following sections.

Meagher Formation

The Meagher Formation is a medium- to coarse-grained light grey to buff limestone and dolomite. The unit is strongly altered and recrystallized to marble along the contact with the Wolsey, creating a barrier to fluid movement between the two units. Farther from the contact with the Wolsey, the formation is locally vuggy and texturally altered to sand by partial recrystallization.

Olivine is locally altered to serpentine which can also be a source of asbestos. Trace amounts of pyrrhotite ($Fe_{(1-x)}S_2$) are associated with olivine/diopside specks, bands and veinlets. Pyrrhotite is an iron sulfide mineral with variable iron content and has also been called magnetic pyrite because the color is similar to pyrite, and it is weakly magnetic. Gold does not appear to be associated with the massive zones of pyrrhotite.

Wolsey Formation

The Wolsey Formation is a thick sequence of grey-green to dark green and black, interbedded dolomitic mudstone and shale, with some siltstone and carbonate interbeds. The Wolsey is altered to some degree by contact metamorphism resulting in a sequence of variable skarn, hornfels, and recrystallized dolomitic marble. This alteration occurs as olivine and diopside (relatively high temperature, Fe (iron), Mg (magnesium) silicates) as individual crystals or grains, and masses and veinlets of olivine and diopside altered to serpentine. Sedimentary structures are not well preserved. Mineralization occurs as pyrrhotite and lesser amounts of pyrite and chalcopyrite as disseminations and wispy veinlets, irregular masses and fracture coatings, and locally magnetite and pyrite with serpentine veinlets. Multiple open rubble zones occur near the Meagher/Wolsey contact as do massive pyrrhotite lenses.

Flathead Formation

The Flathead Formation is a tan to pink, very fine-grained to massive sandstone with quartz pebble conglomerate interbeds. The unit is altered to quartzite, and quartz grains are cemented with quartz overgrowths. Alteration occurs as disseminated biotite and minor diopside veinlets. Mineralization occurs only as iron oxide minerals on fractures and as casts of relict pyrite cubes.

Diorite Intrusive

The diorite intrusive is a gray to green to dark green, fine- to medium-grained intrusive that often exhibits a salt and pepper color developed from alternating masses of olivine and diopside, and adjoining feldspar. Alteration occurs as abundant replacement of diopside crystals with actinolite (amphibole silicate mineral) in an altered feldspar matrix that exhibits pervasive potassic biotite and K (potassium) feldspar alteration. Mineralization in diorite occurs predominantly as fine-grained dissemination of pyrrhotite and diopside, and as quartz K-feldspar veinlets. Pyrite occurs on some fractures; and pyrite, trace amounts of chalcopyrite and molybdenite also occur in quartz- K-feldspar veinlets. The diorite does not appear to be genetically associated with skarn development, nor the hydrothermal heat source for the main stage mineralization event.

3.2.3.3 Ore Controls

The Wolsey Formation is the principal host rock for the Butte Highland deposit and contains most of the mineable gold resources. Mineralization occurs primarily in association with the Mother Lode Fault zone, localized within the Meagher Dolomite at shallow depths, along the Wolsey/Meagher contact at intermediate depths, and in the Wolsey Formation at deeper depths along the structure (Figure 3.2-1). Parallel ore shoots also occur within the Wolsey Formation in the footwall of the fault. Several geologic controls appear to have focused the development of alteration assemblages, and deposition of sulfide and gold mineralization.

The Mother Lode Fault created zones of weakness and several zones of brecciated rock along which alteration was localized and into which hydrothermal fluids migrated. This structural control becomes very apparent in the uppermost levels of the historic workings, where the fault zone diverges from the Wolsey/ Meagher contact, with mineralization being developed only in the Meagher along the fault. Structural control is also suggested by mineralization of the Wolsey in the fault zone (away from the formational contact at depth).

A second order control for gold-bearing mineralization is the calc-silicate alteration and selective bed replacement developed within the Wolsey Formation. Selective beds in the Wolsey Formation have been affected by extensive calc-silicate alteration and replacement mineralization. It is most often shaley, calcareous, carbonate-rich limestone or dolomite interbeds that can maintain the porosity and permeability that allow for their replacement as selected beds. In this regard, mineralization is also localized along the Meagher/Wolsey contact, again probably because this contact becomes a permeability barrier as the limestone recrystallizes to marble. Massive zones of pyrrhotite occur locally along this contact, which are occasionally as much as several feet thick. These massive sulfide zones are only sometimes enriched with gold.

Finally, the diorite intrusive located in the footwall of the fault appears to have acted as a buttress against which structural thinning of the more easily deformed Wolsey Formation occurred. This buttressing effect also opened up internal brecciated zones in the Wolsey Formation during a folding event that prepared these zones for subsequent calc-silicate replacement. Many of these structurally prepared zones are parallel to the overall dip of the units and the fault zone. The location of the diorite intrusive and the contact between the Meagher and Woolsey Formations defines target zones for future mineral exploration.

3.2.3.4 Gold Mineralization

Most of the gold mineralization recently identified by drilling in the Butte Highland deposit occurs in association with structural zones or with sulfides within skarn-altered and replaced beds. Gold deposition is spatially, and likely genetically related to this alteration event. Within the skarn-altered zones, gold occurs as disseminations (presumably as free gold) and in association with thin pyrrhotite, pyrite, and magnetite veining within the replaced unit. Gold is extremely fine-grained and not visible to the naked eye. Native gold was discerned in only one sample of ore from the Butte Highlands deposit despite the fact that there are numerous multi-ounce assay intervals from the definition drill core.

3.3 Waste Rock Geochemistry

This section describes the geochemistry of the waste rock as described in the operating permit including the chemical composition and alterations of the primary waste rock lithologies (BHJV, 2013). A lithology describes the physical characteristics of a rock such as color, mineral composition, and grain size. The proportions of the main waste rock lithologies along with their acid-generating and metal mobility potential will be discussed in this section. Acid can be generated from chemical reactions of air, water, and sulfide-bearing rocks resulting in a phenomenon called acid rock drainage (ARD). ARD is water with low pH and high acidity and often high levels of dissolved metals.

3.3.1 Overview and Study Area

A total of 310,000 tons of waste rock would be excavated during the expected 6 to 7 year mine life (BHJV, 2013). Waste rock would be excavated during development of the underground mine workings and brought to the surface to be placed on the waste rock pile until it is used as aggregate in the cemented rock backfill. Because waste rock would be incorporated with cement and backfilled into the mine, a total of no more than 250,000 tons of waste rock would be stored in the waste rock pile at any time (BHJV, 2013). It is expected that all waste generated during mining would ultimately be placed back underground inside the mine workings.

The analysis includes the three main waste rock lithologies that would be encountered, diorite, Meagher Formation, and Wolsey Formation, and the various alteration assemblages associated with each lithology. The waste rock lithologies and alteration assemblages will be described in Section 3.3.3.1.

3.3.2 Methods

Data to characterize the waste rock geochemistry is compiled from historic exploration drilling records and two more recent exploration drilling programs at the BHJV Mine site. Table 3.3-1 presents the geochemical studies reviewed.

Table 3.3-1. Geochemical Evaluations Performed for BHJV

Data	Sample Source	Tests Completed	Completion Date
Historic Data and 2008 Exploration Drill Holes	All Project Lithologies	Visual Characterization of Sulfides and Ore Assays	2009[1]
	Composited Meagher and Wolsey Formations	Static Tests ABA, Whole Rock Metal Concentrations, Kinetic Tests (Humidity Cells)	2009[1]
2010 - 2011 Exploration Drill Holes	Composites of all waste rock alteration assemblages	Whole Rock Metal Concentrations and Static Testing ABA	2012[1]
	Composites of waste rock alteration assemblages	Metal mobility SPLP and asbestiform mineral testing	2012[2]
	Backfill: Run-of-Mine waste rock, cement, and brine	Static ABA and metal mobility SPLP tests	April 2013[3]
	Run-of-Mine waste rock samples	Kinetic Testing (Humidity Cells)	August 2013[4]

Notes:
ABA: Acid Base Accounting
SPLP: Synthetic Precipitation Leach Procedure
[1]BHJV 2013
[2]Tetra Tech and Enviromin, Inc. 2013a
[3]Tetra Tech and Enviromin, Inc. 2013b
[4]Enviromin, Inc. 2013

In 2008, BHJV completed waste rock characterization testing and exploration drill holes at BHJV and presented the results in an appendix to the operating permit (BHJV, 2013). Incorporating historic drilling records and the 2008 testing results, BHJV compiled a report providing an initial assessment of the sulfide content of the various mine lithologies using visual estimation of sulfide concentrations as well as ore and mineral composition from assay data (BHJV 2013, Appendix O). Sulfide-bearing rock generally has high acid-generating potential. Klepfer Mining Services composited intervals from four exploration drill holes completed in 2008 that best represented the Wolsey and Meagher Formations' waste lithologies and used the composite samples in tests for acid generation potential and metal mobility (BHJV 2013, Appendix P). The tests completed were Static Acid Base Accounting (ABA) testing, Whole Rock Metal Concentrations, and Kinetic Tests (humidity cells). ABA testing is used to determine acid-generating and acid consuming properties of the waste rock. ABA testing results are qualitative while humidity cell testing provides a direct measurement of acid generation and acid consumption rates. The humidity cell analyses are a type of kinetic test designed to study the rate of sulfide mineral oxidation and used to simulate long-term leaching in aerobic (oxygen-rich) environments, typical of what would be expected during mining.

The 2009 geochemical evaluations completed by BHJV and Klepfer Mining Services were completed prior to the current underground mine plan which includes the construction of spiral decline ramps to access the ore zone largely in the footwall diorite intrusive. This plan would result in the excavation of a considerably larger volume of diorite than previously expected. For this reason, a supplemental geochemistry evaluation was warranted and this work was recently completed (Tetra Tech and Enviromin, Inc., 2013a). To ensure the supplemental geochemical data represented the full range of mineralization and metal content of waste to be excavated during operations, a three-phase approach was implemented. The first phase included the initial sample collection during the 2010-2011 BHJV underground exploration drilling program. The second phase included a selection of sample intervals representative of each alteration assemblage and spatially well distributed throughout the zone where mine workings would be excavated. The samples were submitted for laboratory analysis of whole-rock total metal concentrations and ABA testing (Tetra Tech and Enviromin, Inc., 2013a). The third phase submitted run-of-mine composite samples of the waste rock lithologies and all alteration assemblages (Table 3.3-2) for metal mobility testing using a Synthetic Precipitation Leach Procedure (SPLP), asbestiform mineral characterization, and a 25 week kinetic test to further evaluate the long-term weathering behavior of diorite and Wolsey Formation (Enviromin, Inc., 2013).

The run-of-mine composite samples were used for additional geochemical tests to evaluate the acid generation potential, metal mobility, and geochemical characteristics of the proposed cemented waste rock backfill. Samples submitted for analysis during this study consist of run-of-mine waste rock combined with varying amounts of both cement and reverse osmosis (RO) system brine to represent the various compositions of the cemented waste rock backfill that may be placed into the mine (Tetra Tech and Enviromin, Inc., 2013b). The tests performed were static (ABA) and metal mobility (SPLP). The results of these tests will be discussed in Section 4.3.3 under the Proposed Action. Results of the geochemical evaluations are summarized below. Descriptions of sampling and analytical methods are provided in the original documentation of these studies and are summarized briefly as needed.

3.3.3.1 Waste Rock Types and Proportions

Waste rock that would be excavated during mine operations includes three primary lithologies: diorite, Wolsey Formation, Meagher Formation, and a minor volume (less than 1 percent) of the Flathead Formation. Various alteration assemblages are present within each waste rock lithology as shown in Table 3.3-2. The waste rock lithologies are broken into subcategories based on alteration assemblage although the relative proportion of each subcategory has not been determined (BHJV, 2013). The waste rock lithologies are summarized briefly in this section. The lithologies are described in more detail in Section 3.2.3.

Table 3.3-2. Waste Rock to be Excavated from the BHJV Mine

Waste Rock Lithology	Alteration Assemblage	Percentage of Waste Rock Volume
Diorite Intrusive	Diopside-Rich	68.1
	Olivine-Rich	
	Potassic	
	"A-Vein"	
Meagher Formation	Unaltered	10.7
	Recrystallized	
	Marble-Rich	
Wolsey Formation	Mica-Rich	20.7
	Diopside Dominant	
	Olivine/Serpentine Dominant	
	Massive Sulfide	
Flathead Formation	Quartzite	0.5
Total		**100**

Source: Tetra Tech and Enviromin, Inc., 2013a

3.3.3.2 Geochemical Evaluations

The earliest evaluation of BHJV waste rock focused on an initial assessment of sulfide content within the various rock units and was based on previous/historic drilling data (BHJV, 2013). Correlation of sulfide content with any given lithology was found to be variable, presumably due to inconsistency in drill hole logging methods between the various drilling programs. The data provided by BHJV is considered preliminary while subsequent characterizations provide more reliable data. The results did conclude that the highest sulfide and iron content was found in the Wolsey Formation, followed by diorite and Meagher Formation (BHJV, 2013). The Wolsey Formation was the only unit considered to be sampled in its entirety for all lithologies.

A second, more detailed, evaluation of waste rock geochemistry for BHJV was completed in 2009 (BHJV, 2013, Appendix P). This study used composited intervals of material collected from four drill holes to represent the Wolsey and Meagher Formations waste rock lithologies in tests for acid generation potential and metal mobility. Static acid-base accounting (ABA) tests, whole rock analysis, and humidity cell kinetic tests were performed.

ABA testing determines the acidification potential (AP) and immediately available neutralization potential (NP) of a finely ground rock sample (Sobek, Schuller, & Smith, 1978). ABA data for the waste rock samples were compared to Bureau of Land Management (BLM) and EPA guidelines to evaluate their potential to generate acidity (Table 3.3-3) (EPA, 1994; BLM, 1996).

These guidelines are based on the measured values of AP and NP of a sample in units of tons $CaCO_3$ / kiloton of rock, allowing calculation of the net neutralization potential (NNP) as NP less AP and the neutralization potential ratio (NP:AP) as NP divided by AP (INAP, 2012). The ratio of NP to AP values, along with NNP, is used by regulatory agencies to conservatively assess the static acid generation potential of rock samples. An NP:AP ratio of less than 1 is indicative of a high potential for acid generation, while ratio results above 3 indicate that acid generation is unlikely.

ABA test results identified the Meagher Formation samples to be strongly neutralizing with NP:AP ratio equal to 488 and NNP equal to 974 tons $CaCO_3$/kton while the Wolsey Formation samples had uncertain to unlikely acid generation potential with NP:AP ratio equal to 1.2 and NNP equal to 50 tons $CaCO_3$ /kton (BHJV, 2013, Appendix P). NNP results greater than 20 tons $CaCO_3$ /kton indicate that acid generation is unlikely (Table 3.3-3).

Table 3.3-3. Acid-Base Account Criteria for Classifying Acid Generation Potential of Rock Samples

Classification	ABA Criteria	
	NP:AP	NNP tons $CaCO_3$ /kton
Potentially Acid Generating	<1	<-20
Uncertain Acid Generation Potential	1 to 3	-20 to +20
Unlikely to Generate Acid	>3	> +20

Source: BLM (1996) and EPA (1994)

Results of whole rock analysis indicated the Meagher Formation sample was very low in sulfide while the Wolsey Formation had much higher sulfide content.

Neither the Meagher nor Wolsey Formation samples generated acid during subsequent kinetic testing in humidity cells (operated for 23 weeks). Acid reactivity of rocks is measured in pH units. The pH scale varies from 0 to 14 with low numbers indicating acidity and high numbers indicating alkalinity (basic); a pH 7 is considered neutral. Values of pH measured in humidity cell test extracts from both waste rock samples were stable and ranged from 8.2 to 9.3 for the duration of the testing (BHJV, 2013, Appendix P). Similarly, concentrations of sulfate and alkalinity were also stable throughout the test. Metal concentrations were measured in the humidity cell extracts during week 1, and weeks 5 through 23 to provide data to evaluate metal mobility from the waste rock samples (BHJV, 2013, Appendix P). Average concentrations calculated for the 23-week test period were compared to then-current DEQ-7 drinking water and aquatic life standards (DEQ, 2010). All measured constituents were in compliance. The same was true for aquatic life standards with the possible exceptions of cadmium and copper which were not detected using reporting limits (0.0001 mg/L and 0.01 mg/L, respectively), which were greater than applicable surface water standards at that time (BHJV, 2013).

The results of the static and kinetic testing suggest no potential for acid generation from Meagher Formation and an uncertain but unlikely acid generation potential of Wolsey Formation waste rock. Alternately, the high to moderate carbonate content of both rock formations have a significant capacity to minimize (i.e. buffer) acid-generating potential individually and certainly when combined together (BHJV, 2013, Appendix P). Metal content varies between the Meagher and the Wolsey Formations but humidity cell test results indicate a limited metal leaching capacity (BHJV, 2013, Appendix P). The results are limited since the test was only designed for two waste rock lithologies. At the time of testing, the current mining plan was not established and the diorite was not considered part of the waste rock lithologies. Additionally, the study used composited intervals of the Wolsey and Meagher Formations waste lithologies and did not account for the different alteration assemblages within the lithologies.

The 2012 geochemical evaluations characterized the individual alteration assemblages within each waste rock lithology and included diorite which would comprise the greatest volume of waste rock under the proposed mine plan (Table 3.3-2) (Tetra Tech and Enviromin, Inc., 2013a). Samples submitted for total metal and ABA analysis included composites for each alteration assemblage and the results are presented in Table 3.3-4.

Table 3.3-4. Summary of Acid-Base Account Data for BHJV Mine Waste Rock Samples

Lithology	Alteration Assemblage (n)	NP:AP			NNP (tons $CaCO_3$/kiloton)		
		Min	Mean	Max	Min	Mean	Max
diorite	Diopside-Rich (5)	1.5	6.5	13	19	45	67
	Olivine-Rich (4)	4.3	39	133	73	234	397
	Potassic (5)	0.5	5.2	11	-41	65	190
	“A-Vein” (3)	1.9	13	33	36	67	102
Meagher Formation	Unaltered (4)	525	5,615	120,004	1,050	1,093	1,200
	Recrystallized (5)	428	8,246	108,004	854	987	1,080
	Marble-Rich (5)	480	4,660	104,004	302	861	1,120
Wolsey Formation	Mica-Rich (10)	2.2	904	71,704	16	198	83
	Diopside Dominant (10)	0.7	10	37	-145	84	400
	Olivine/Serpentine Dominant (11)	2.9	32	144	38	258	457
	Massive Sulfide (5)	0.2	0.7	1.6	-378	-161	135

n = number of samples
NP:AP = Neutralization Potential / Acidification Potential
NNP = Net Neutralization Potential (NP-AP=NNP)
For samples with AP below detection, NP:AP was calculated using the reporting limit of AP value of 0.1. Refer to Table 3.3-3 for acid generation potential classification

These data suggest that, on average, no waste rock lithology or alteration assemblage was potentially acid-generating except for the Wolsey Formation where massive sulfide mineralization is developed. Samples of some lithologies and alteration assemblages were potentially acidic (Table 3.3-4). For example, minimum values of NP:AP and NNP for each alteration assemblage showed that all Meagher Formation samples were net neutralizing while some diorite (potassic) and Wolsey Formation (diopside dominant) samples were potentially acid-generating. In addition, diorite ('A-Vein'), and the remaining Wolsey Formation alteration assemblages included some number of samples of material with uncertain acid generation potential (Tetra Tech and Enviromin, Inc., 2013a).

Based on results of static ABA tests (Table 3.3-4), samples were further composited for metal mobility testing and determination of asbestiform mineral content. Metal mobility testing using the EPA Method 1312 Synthetic Precipitation Leach Procedure (SPLP) was conducted on composite samples representing each of the lithologic alteration assemblages for diorite and Wolsey Formation samples and a single composite representing the Meagher Formation. Extracts produced by this test were of generally good quality with most parameters present at concentrations below analytical detection limits. Cadmium from diorite ('A-Vein') composite exceeded the chronic aquatic life standard for this element. Other exceedances were limited to secondary standards for iron and manganese for diorite ('A-Vein'), one other diorite sample, and the Wolsey Formation (massive sulfide) composite.

Because serpentine mineralization was found in some samples of waste rock, particularly associated with the Wolsey Formation lithology, the potential for asbestiform minerals was evaluated. Samples were submitted for mineralogical analysis to screen for asbestiform minerals. All nine samples were determined to contain trace amounts of non-asbestiform actinolite and no asbestiform amphibole or serpentine minerals were reported. While actinolite can sometimes exist as an asbestiform mineral, Polarized Light Microscopy (PLM) confirmed that this was not present in the BHJV Mine samples (Tetra Tech and Enviromin, Inc., 2013a).

Subsamples analyzed during the 2012 geochemical evaluations were composited to create run-of-mine waste rock samples and used to build kinetic humidity cell test columns. The run-of-mine samples were created by combining lithologic composites and included all alteration assemblages within a given lithology (Enviromin, Inc., 2013). The kinetic tests were conducted for 25 weeks by McClelland Laboratories of Sparks, Nevada using ASTM methodology (5744-07). Sulfide oxidation and acid neutralization parameters were measured weekly and a comprehensive suite of metals were analyzed for effluent collected on varying weeks (Enviromin, Inc., 2013).

The 2013 results after 25 weeks of kinetic testing of the run-of-mine waste rock samples indicated that both the Wolsey Formation and diorite are net neutralizing materials, with little potential to produce acid (Enviromin, Inc., 2013).The following list summarizes the kinetic testing results.

- The effluent pH was alkaline throughout the duration of the test.
- Redox potential was oxidizing, with the exception for week 0, which is typical for kinetic testing redox conditions.
- Conductivity values were low and generally stable.
- Iron and sulfate releases were low.

- Acidity was not detected in diorite composite weekly extracts and only in week 0 of the Wolsey Formation composite weekly extracts.
- Alkalinity was detected in all weekly extracts.

Samples of humidity cell effluent were analyzed for a suite of metals at detection limits specified by DEQ (DEQ, 2012). Concentrations of copper, iron, and selenium were detected at or above the Montana surface water quality standards in the effluent from the Wolsey Formation humidity cell for the first three weeks of the kinetic test. Effluent from diorite humidity cell only exceeded the Montana surface water quality standard for thallium in week 12 of the test (Enviromin, Inc., 2013; DEQ, 2012). Metal concentrations in humidity cell effluent from the Wolsey Formation and diorite did not exceed groundwater concentrations at any point during the test (Enviromin, Inc., 2013; DEQ, 2012).

The results of the kinetic tests obtained through week 25 have provided sufficient information for making informed decisions about waste rock management and mine planning during operation of the proposed BHJV mine. The test cells yielded stable effluent chemistry results for many weeks, and both Enviromin, Inc. and DEQ agreed upon the termination of these kinetic tests at week 25 (Environmin, Inc., 2013).

3.3.3.3 Geochemical Conclusions

The 2009 and 2012 geochemical evaluations indicated uncertain potential to produce acidic mine water for several lithotypes as well as additional information regarding metal release potential under oxidative weathering conditions. Therefore, additional testing was conducted by composting run-of-mine waste rock samples for SPLP analysis and kinetic testing.

The results after 25 week of kinetic testing of the run-of-mine waste rock samples indicated that both the Wolsey Formation and diorite are net neutralizing materials, with little potential to produce acid (Enviromin, Inc., 2013). Throughout the kinetic tests, the pH remained elevated in both the Wolsey Formation and diorite test cells, with available alkalinity under oxidizing conditions. Although the Wolsey Formation composite produced sulfate at low levels throughout the test, it remained neutral in pH, with available alkalinity (Enviromin, Inc., 2013).

In terms of potential for metal release, the Wolsey Formation composite released copper, iron, and selenium, at concentrations which exceeded surface water standards only briefly in early weeks of kinetic testing (Enviromin, Inc., 2013). The diorite composite resulted in surface water exceedances of thallium during week 12 of kinetic testing, which was not reflected in the SPLP results. The SPLP results for diorite composite yielded one exceedance of surface water standards for cadmium with no exceedances reported during kinetic testing. The kinetic testing resulted in cadmium concentrations below both the Montana surface and ground water and generally below the method detection limit (Environmin, Inc., 2013; DEQ, 2012). Metal concentrations from the Wolsey Formation and diorite composites did not exceed groundwater concentrations at any point during the kinetic test (Enviromin, Inc., 2013).

Therefore, the results of the geochemical testing conducted for BHJV indicate no potential for release of concentrations of metals above groundwater standards (DEQ, 2012) from either the Wolsey Formation or diorite waste rock lithologies, and very low potential for exceedances of surface water standards.

3.4 Soil Resources

Baseline studies completed in 2009 evaluated soil resources in the vicinity of the BHJV Mine prior to disturbance activities associated with exploration (BHJV, 2013). The baseline study methods and results for the proposed mine area, and additional information on soils present along the mine haulage road and within the ore transfer facility boundary, are included. Soils information was obtained from studies done by the mine during exploration and operating plan development (BHJV, 2013; Tetra Tech, 2013).

3.4.1 Overview and Study Area

Baseline soil investigation activities focused on the areas to be disturbed by mine activities including the adit portal area and land application disposal (LAD) areas located within the Pony Placer claim and Northern Claims Areas (Figure 3.4-1). More recently, additional data were obtained for soils present within the proposed permit boundaries encompassing the private ore haulage road and ore transfer facility (Figure 3.4-2).

3.4.2 Methods

The soil baseline study summarized existing Natural Resources Conservation Service (NRCS) soil survey data for soils within the study area and evaluated these soils for use as plant growth media or as a low-permeability capping material (AMEC, 2009). Soils were evaluated using data collected from ten test pits distributed across the study area.

Samples from the test pits were analyzed for agronomic properties, concentrations of selected metals, and geotechnical tests for properties relevant to water permeability. Bulk samples from test pits outside the Main Surface Facilities were analyzed for particle size distribution and Atterberg Limits. The objective of the Atterberg Limits test is to obtain basic information about the soil properties to estimate strength and settlement characteristics. Soil observations were also recorded from a small area of intensive test pitting where 24 observation pits were located on a grid with 200-foot spacing in the southwest portion of the Pony Placer claim where LAD 2 is located.

Additional analytical work was conducted in 2011. Seven soil samples originally collected during the 2009 baseline study from within and near LAD 1, LAD 2, and LAD 4 were submitted for analysis of 11 metals using SPLP methodology to evaluate metal mobility from soils within the LAD areas (BHJV, 2013).

In addition to the 2009 baseline survey data, soil survey information for the ore-transfer facility and private ore haulage road soils were obtained from the NRCS Web Soil Survey database (NRCS, 2012a). Analytical data have not been collected for the ore-transfer station or ore haulage road soils (Tetra Tech, 2013).

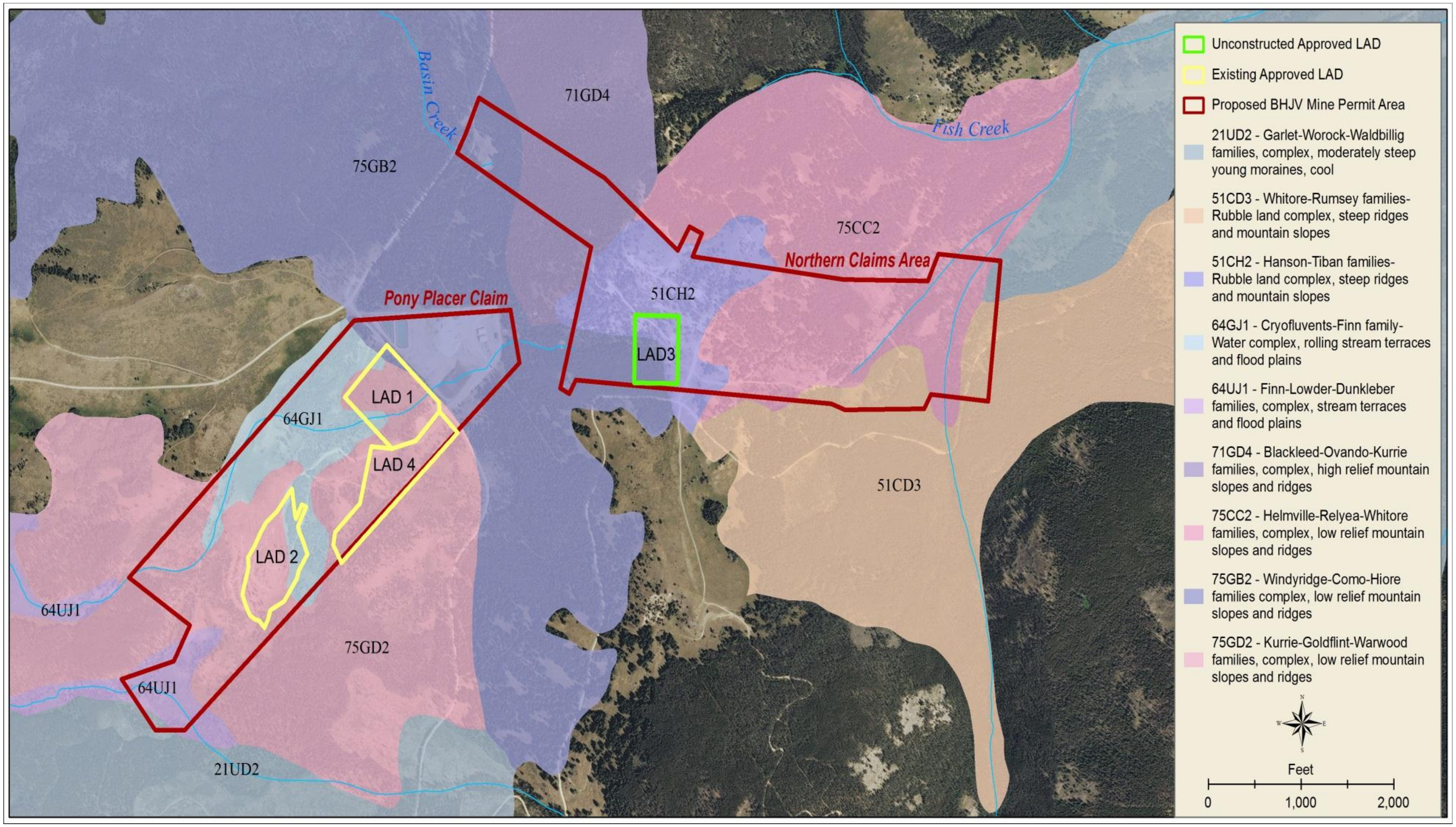


Figure 3.4-1. Soils Map for the Area in the Vicinity of the Proposed Butte Highlands Joint Venture Mine, Silver Bow County, Montana.

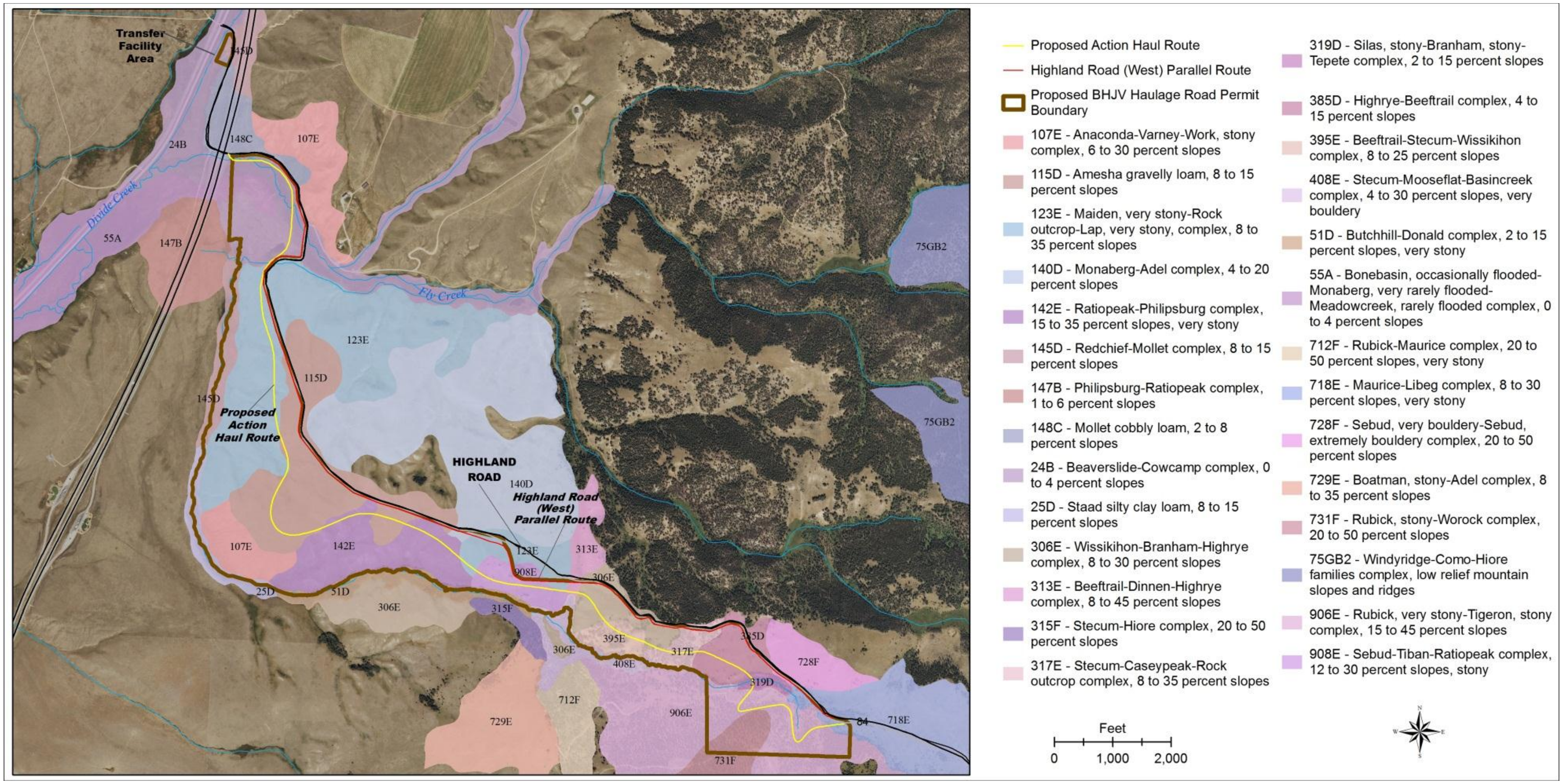


Figure 3.4-2. Soils Map for the Area in the Vicinity of the Proposed Haul Route and Ore Transfer Facility Butte Highlands Joint Venture Mine, Silver Bow County, Montana.

3.4.3 Results

Four NRCS soil map units cover the project area in the vicinity of the mine portal pad and 19 additional map units are present within the footprints of the ore-transfer facility and private ore haulage road (NRCS, 2012) Data describing soils within the proposed permit boundaries of the mine include NRCS soil map unit descriptions for all soils in the area and analytical data collected during the 2009 baseline study. A summary of the soil types and location are provided below. Detailed information can be found in the operating permit (BHJV, 2013).

3.4.3.1 Mine Portal Soils

Map units identified in the vicinity of the mine portal include the following:

- Windyridge-Como-Hiore families, complex low relief mountain slopes and ridges (75GB2);
- Hanson-Tiban families-Rubble land complex, steep ridges and mountain slopes (51CH2);
- Cryofluvents-Finn family-Water complex, rolling stream terraces and flood plains (64GJI); and
- Kurrie-Goldflint-Warwood families, complex low relief mountain slopes and ridges (75GD2).

Map unit 75GB2 is located on the backslope areas facing west above FS Road 8250, covering the mine portal pad area of the Pony Placer claim, the lower elevation areas of the Northern Claims Area, and the FS land separating the lower and Northern Claims. This map unit comprises all of the area disturbed during construction of the portal pad facilities and that which would be disturbed during expansion of the mine laydown area.

Map unit 51CH2 is located on the highest elevation portions of the Project area. The properties of 51CH2 soils, such as slope, drainage class, and saturated hydraulic conductivity, were found generally to correspond with the observed shallow soil with prevalent coarse material encountered in two of the test pits.

Map unit 64GJI is located in low-lying areas adjacent to Middle Fork Moose Creek. Standing water was observed in test pits in 64GJI at depths of <60 inches. The soil observed in one of the test pits in 64GJI and adjacent pits in the intensive pitting area generally corresponded with the cryofluvents component of this map unit. Small willow trees and surface channels indicated the seasonally saturated conditions that occur at the ground surface in this area.

Map unit 75GD2 is located in footslope and toeslope areas below FS Road 8250, but generally above the areas of seasonal stream channels in map unit 64GJI. Observed conditions in two test pits in this map unit were somewhat similar to the Finn component, whereas one test pit was similar to the Kurrie component.

3.4.3.2 Private Haulage Road and Ore-transfer Area Soils

The 19 map units identified in the vicinity of the haul road and ore-transfer area include the following:

- Kilgore, Mooseflat, and Philipsburg, complex, flood plains, alluvial fans and low hills (24B);
- Foxgulch Libeg complex, rolling hills and toeslope (51D);
- Anaconda-Varney-Work, stony complex, hills and stream terraces (107E);
- Philipsburg-Ratiopeak complex, low rolling hills (115D);
- Sebud, stony-Danielvil-Monaberg, complex, rolling hills (123E);
- Ratiopeak-Philipsburg complex, escarpment (142E);
- Danielvil-Philipsburg complex, alluvial fans (145D);
- Philipsburg-Monaberg complex, fan remnants (148C);
- Wissikihon-Branham-Highrye complex, alluvium hills (306E);
- Beeftrail-Dinnen-Highrye complex, alluvium hills and side slopes (313E);
- Stecum-Caseypeak-Rock outcrop complex, hills (317E);
- Silas, Stony-Branham, stony-Tepete complex, mixed alluvium hills and drainage ways (319D);
- Highrye-Beeftrail complex, ridges and colluvium/residuum hills (385D);
- Beeftrail-Stecum-Wissikihon complex, residuum granite hills (395E);
- Stecum-Mooseflat-Basincreek complex, bouldery granite residuum, mountains (408E);
- Maurice-Libeg complex, argillite colluvium, mountains (718E);
- Rubick, stony-Worock complex, quartzite colluvium, mountains (731F);
- Rubich, very stony-Tigeron, stony complex, quartzite colluvium, mountains (906E); and
- Sebud-Tiban-Ratiopeak complex, quartzite colluvium, mountains (908E).

Map units 24B, 145D and 148C, are located in the vicinity of the ore-transfer facility. Dominant landform is a shallow sloping alluvial plain. Map units 24B and 145D are deep poorly drained soils located on the flood plain. The soil texture is silty loam in the upper horizons increasing in coarse fragment content with depth. Map unit 148C is elevated above the flood plain. The soil properties are well-drained with moderate to high capacity to conduct water. The soil texture is sandy loam in the upper horizon trending to gravelly loam with depth. These map units are rated by the NRCS as having “fair” reclamation potential.

Map units 115D, 107E, 123E, 142E, and 306E are located at the mountain front, as the private ore haulage road breaks out of the mountain terrain into the hill and alluvial fan terrain. The dominate topography is rolling hills. The soils are well drained with moderate to high water conductive properties. The soils are typically thin with a loam to sandy loam texture. The NRCS rated these soils as having “fair” reclamation potential.

Map units 313E, 317E, 319D, 385D, 395E, 408E, 718E, 731F, 906E, and 908E are located in the eastern more mountainous region between the mine and the ore transfer area. The dominant topography is mountains with argillite, quartzite, and granite parent material. The soils are rocky with a thin, if present, organic layer.

3.4.3 Analytical Results

Soils in the vicinity of the mine portal were rated with respect to their potential for use as growth media during the baseline study (BHJV, 2013). The growth media rating is based on electrical conductivity, pH, texture, and coarse fragment content. Growth media soil characteristics are shown in Table 3.4-1 (Tetra Tech, 2013). With the exception of coarse fragments, all agronomic parameters analyzed rated the soils either “Ideal” or “Moderate” for use as growth media. Electrical conductivity of all samples ranged from 0.14 to 0.70 milliSiemens (mS)/centimeter (cm) and pH ranged from 6.0 to 7.6 for 26 of 33 total samples. The remaining seven samples had pH that ranged from 5.4 to 5.9. Organic matter content ranged from 0.12 percent to 12.6 percent (BHJV, 2013, Appendix K).

Table 3.4-1. Growth Media Rating System for Butte Highlands Mine Baseline Soil Survey[1]

Soil Characteristic	Rating			
	Ideal	Moderate	Fair	Poor
USDA texture	SiL, L, SCL, SiCL, CL	SL, LS	CS, SC, SiC	C
Saturated Paste pH	6 to 8	5 to 6 or 8 to 8.5	4.5 to 5 or 8.5 to 9	<4.5 or >9
Electrical Conductivity (mS/cm)	<4	4 to 6	6 to 10	>10
Coarse Fragment Content (percent) for Flat Areas	<15	15 to 25	25 to 35	>35
Coarse Fragment Content (percent) for Steep Areas	15 to 25	<15 or 25 to 35	0 or 35 to 60	>60

SiL = silty loam
CS = clean sand
LS = loamy sand
SC = sandy clay
SCL = sandy clay loam
CL = clay loam
SiCL = silty clay loam
L = loam
S = sand
C = clay
SiC = silty clay
mS/cm = milliSiemens per centimeter

[1] Source: BHJV, 2013, Appendix K

Measured coarse fragment content varied between samples and ranged from 0 percent to 70 percent. Coarse fragment content is the most limiting for growth media use and was therefore used to distinguish soils having different reuse potentials (BHJV, 2013). Of 33 soil depth increments sampled across the soil baseline study area, only three were rated as having a “Poor” potential for use as growth media on steep or exposed slopes. Because soils needed to reclaim flat areas require a lower coarse fragment content, a greater number of samples (i.e. 15 out of 33) were rated as having either “fair-to-poor” or “poor” potential for use as growth media in these areas. The remaining 18 samples were rated as “ideal” for use as growth media on flat areas.

As discussed above, soil from map unit 75GB2 is the only soil that currently is or would be stockpiled at the mine portal pad. Surface depth increments at each of these locations were rated as “ideal” for reclamation of flat areas and were rated ideal” to “fair-to-poor” for reclamation of steep areas.

3.4.3.1 Soil Erodibility

Soil erodibility was assessed during the 2009 baseline study using procedures described in the National Soil Survey Handbook (USDA, 1993). All test pits contained soil with a low or medium degree of water erodibility (< 0.40 Kw). Surface runoff class ranged from low to high, depending on the combination of permeability and slope at the test pit locations. Wind erodibility was highest for sandy loam texture in the A-horizon and less than 15 percent coarse fragment content. Wind erodibility was lowest for loam surface textures and >35 percent coarse fragments. It was determined that soils present in the baseline study area require a high degree of protection from erosion due to limited rooting depths of vegetation resulting from shallow root-restrictive layers present in many locations (BHJV, 2013).

Soils on slopes over 50 percent generally are considered unsalvageable due to equipment limitations and worker safety. Depth of soil, percent of rock fragments in the soil over 2 mm in size, and soil textures are the main properties used to determine the soil's use in reclamation. It is DEQ's policy that all soils on less than 2:1 slopes with less than 50 percent rock fragments are considered salvageable.

3.4.3.2 Metal Analysis

Total metal concentrations measured in the baseline soil samples showed that arsenic was elevated (up to 88 mg/kg) in the uppermost horizons of most test pits and in some cases were above DEQ's (2005) Generic Action Level of 40 mg/kg for arsenic in soil (BHJV, 2013). Copper, manganese, nickel, and zinc were also commonly detected at concentrations above the analytical reporting limits. None of the metal concentrations, however, were above the upper range limit of background concentrations reported for the western United States (Shacklette and Boerngen, 1984).

Seven soil samples collected in and near LAD1, LAD2, and LAD4 were submitted for metal mobility testing using SPLP methods (BHJV, 2013). The metals included: arsenic, cadmium, copper, lead, manganese, molybdenum, nickel, selenium, silver, thallium, and zinc. For each of the seven samples, concentrations of all metals analyzed were below analytical reporting limits (Tetra Tech, 2013).

3.5 Vegetation and Wetland Resources

3.5.1 Overview and Study Area

Existing conditions of vegetation resources (vegetation communities, special status plants, wetlands, and noxious weed species) were inventoried for the BHJV Mine areas. These areas include the mine portal and proposed discharge pipeline areas within the Pony Placer Claims, the proposed private haul route permit area, and the area surrounding the proposed transfer facility. Plant nomenclature follows Lesica 2012.

3.5.2 Methods

The operating permit (BHJV, 2013), Project Description and Existing Conditions Report (Tetra Tech, 2013), and data provided from online databases such as the Montana Natural Heritage Program (MNHP) and Montana Department of Fish, Wildlife, and Parks (FWP) were reviewed to compile the existing conditions for vegetation resources in the BHJV study area described in Section 3.5.1 above. The review of existing conditions was conducted to assess the potential for impacts to special status plant species and vegetation communities, and to assess the potential to promote the introduction or spread of noxious weed species from the Proposed Action.

The authors of the background documents included reviews of the following datasets to compile the list of known or potential vegetation resources within the study area:

- Potential Natural Vegetation (PNV) Classification for Western and Central Montana and Northern Idaho;
- National Land Cover Dataset for Montana;
- Montana Gap Analysis Project 90 meter Land Cover Data;
- Montana Climax Vegetation (NRCS, 2010);
- 1km Advanced Very High Resolution Radiometer (AVHRR) Land Cover Grid for Montana (EROS);
- USDA FS Region 1 Vegetation Mapping Program;
- USDA FS Timber Layer;
- US Fish and Wildlife Service (USFWS) Endangered Species Program;
- Highland Mountains vegetation survey (Lesica, 1993);
- Highland Mountains vegetation survey update (Mincemoyer, 2005);
- Montana Department of Agriculture website (noxious weed data);
- Field observations (Kline and Klepfer, 2010);
- Montana Natural Heritage Program (MTNHP);
- Montana Field Guide (MTNHP).

Additional wetland investigations were conducted along the proposed private haul route and in the vicinity of the proposed transfer facility in 2013, and are summarized below (Sandefur, 2013).

3.5.3 Results

The study area straddles the Continental Divide within the upper portion of the drainages of Basin Creek, Fish Creek, and Middle Fork Moose Creek (Placer Pony Claims area), and through a portion of Beaverhead-Deerlodge National Forest along Fly Creek (proposed private haul route permit area) and Divide Creek (transfer facility). Lesica (1993) conducted surveys in the vicinity of the study area on Forest Service and private lands above 6,000 feet elevation south of Pipestone Pass, west of the Jefferson River valley, and east and north of the Big Hole River Valley. The study area is composed primarily of forest areas dominated by fir, pine, and spruce; and non-forested areas vegetated with shrubs, forbs, and grasses (BHJV, 2013). Lesica (1993) describes foothill vegetation in the area as a steppe community dominated by big sagebrush (*Artemisia tridentata*), rabbitbrush (*Chrysothamnus* spp.), shrubby cinquefoil (*Dasiphora fruticosa*), and Idaho fescue (*Festuca idahoensis*). The forested communities were described as predominantly coniferous forest dominated by Douglas-fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta*) (Tetra Tech, 2013).

The proposed private haul route permit area crosses land with low- to moderate-cover grassland habitats and extends into Douglas-fir and mixed fir/lodgepole pine forest, riparian and sagebrush communities (Table 3.5-1). The ore transfer area, located adjacent to Divide Creek, is primarily vegetated by sagebrush but includes some riparian vegetation (Table 3.5-1).

The Pony Placer claim is primarily unforested, composed of a mosaic of wet meadows, shrublands, and quaking aspen (*Populus tremuloides*). To the northeast, the Northern Claims Area is dominated by Douglas-fir, lodgepole pine, and subalpine fir (*Abies lasiocarpa*) forest (Table 3.5-1) (Tetra Tech and Enviromin, Inc., 2013a).

Table 3.5-1. Vegetation Community Types within the Proposed Permit Boundary

Dominant Vegetation	Total Permit Area	
	Acres	Percent
Ore Transfer and Private Haul Road Permit Boundary[1]		
Low- to moderate-cover grasslands	124	35
Douglas-fir	43	12
Douglas-fir and lodgepole pine	16	5
Sagebrush	120	34
Riparian vegetation	52	14
Total	355	100
Mine Claim Permit Boundary[2]		
Aspen	18	6
Douglas-fir	78	25
Lodgepole pine	88	28
Mesic shrub	3	1
Mixed conifer	0.5	<1
Subalpine fir	32	10
Xeric shrub	90	29
Total	309.5	100

Sources: [1] ReGAP (WSAL, 1998), [2] R1 VMap (USFS, 2011). Table from Tetra Tech 2013.

According to field work conducted by Kline Environmental Research, LLC in 2009, the forested portions of the study area include stands dominated by fir and western larch (*Larix occidetalis*), groves of quaking aspen and fir, lodgepole pine, and fir and spruce (Kline and Klepfer, 2010). Unforested areas were observed to be densely to moderately vegetated with a variety of shrubs, forbs, and grasses. They described the Pony Placer claim as mainly unforested and gently sloping with stands of spruce and aspen and scattered wet meadows.

3.5.3.1 Special Vegetation Communities

Basin Creek Research Natural Area (RNA) is located within one mile of the mine portal, downstream of the study area. Numerous ponds are wetlands are located along Basin Creek within the RNA. Basin Creek RNA features spruce habitat types and wetland communities typical of the Beaverhead-Deerlodge National Forest. High water tables within Basin Creek support lush riparian vegetation (MTNHP, 2013).

3.5.3.2 Special Status Plants

In his 1993 survey of the Highland Mountains, Lesica documented seven Montana Species of Concern (SOC) or Potential Species of Concern (PSOC) that are currently known to occur in the Highland Mountains of Silver Bow County: sapphire rockcress (*Boechera fecunda*), Idaho sedge (*Carex idahoa*), dense-leaf draba (*Draba densifolia*), Lemhi beardtongue (*Penstemon lemhiensis*), small-flowered pennycress (*Noccaea parviflora*), slender fleabane (*Erigeron gracilis*), and Hall's rush (*Juncus hallii*). During their 2009 survey, Kline Environmental Research, LLC documented what they believe could have been limestone larkspur (*Delphinium bicolor* ssp. *calcicola*) in the Pony Placer claim. A search of the USFWS Endangered Species Program website identified whitebark pine (*Pinus albicaulis*) and Ute ladies'-tresses (*Spiranthes diluvialis*) with potential to occur in the study area. The MTNHP has documented high northern buttercup (*Ranunculus hyperboreus*) in the area. Since the Lesica survey, slender fleabane and Hall's rush have been removed from the MNHP list; slender fleabane has no other special-status designation and will not be included in further analysis. Table 3.5-2 below summarizes the special status plant species with potential to occur in the study area.

Sapphire rockcress - Lesica (1993) located sapphire rockcress in the Moose Town and Fish Creek areas; the nearest known occurrence is within 1.5 miles of the mine portal. It was found in mineral soil on south- or west-facing slopes, associated with sparse grasses or open limber pine woodlands. The Montana Field Guide describes habitat for this species as areas of relatively sparse vegetation on steep slopes with periodic natural erosion (Tetra Tech, 2013). Suitable habitat for this species may be present within the mine portal area.

Idaho sedge - Lesica (1993) located Idaho sedge in the Moose Town and Fish Creek areas. One occurrence is within 2.5 miles west of the mine portal within Curly Gulch (MTNHP, 2013). It was found in drier ecotonal areas of wet meadows along streams in areas influenced by calcareous parent material. This finding is consistent with a description in the Montana Field Guide (MTNHP, 2013); "Idaho sedge inhabits moist alkaline meadows, often along streams. It most often occupies ecotonal areas between wet meadow and sagebrush steppe, and appears to be restricted to nearly level sites in the high valleys of southwest Montana." This description of suitable habitat is similar to that of some areas in the Pony Placer claim (Tetra Tech, 2013).

Limestone larkspur - The Montana Field Guide (2013) reports the habitat for limestone larkspur as shortgrass prairie and grass-sagebrush communities on limestone-derived soils, usually with coarse fragments at the surface or on limestone outcrops. Kline Environmental Research, LLC located a species of larkspur (*Delphinium bicolor*) in a moist location within the Pony Placer claim (Kline and Klepfer, 2010). They were unable to positively identify this species, but believed it had potential to be limestone larkspur rather than the common little larkspur (*D. bicolor* ssp. *bicolor*).

Dense-leaf draba - Lesica (1993) located this species near Interstate Highway 90 in coarse, sandy, granite-derived soil on a steep, south-facing bank. The Montana Field Guide (MTNHP, 2013) describes habitat for this species as gravelly, open soil of rocky slopes and exposed ridges in the montane to alpine zones. Lesica (1993) located this species in the Moffet

Mountain, Moose Town, and Fish Creek/Limekiln Hill areas. The plant appeared to be widespread throughout much of the Highland Mountains in silty to loamy soils of mesic to moist steppe and grasslands.

Hall's rush – Lesica (1993) located one population of Hall's rush in the Moose Town area. The population was observed on moist soil at the drier margins of a wet meadow adjacent to an old logging road.

Small-flowered pennycress - Lesica (1993) located this species on an open, exposed slope and a moist area of a flood plain. According to the Montana Field Guide (2013); "In Montana it is known from Beaverhead, Carbon, Madison, Park and Silver Bow counties, where it is found from mid-elevation grasslands to alpine turf (6,500 to 10,000 feet). It most often inhabits sagebrush steppe dominated by *Artemisia tridentata* ssp. *vaseyana* and *Festuca idahoensis*." One known occurrence of this species is within 0.5 mile northwest of the mine portal (MTNHP, 2013). There is potential for areas within the mine portal area to provide suitable habitat for this species.

Lemhi beardtongue - Lesica (1993) located this species in the Moose Town and Fish Creek areas approximately 0.5 mile east of the mine portal (MTNHP, 2013). The habitat was described as an open, dry exposure on a mountain slope, on sandy soils from calcareous parent material. Lesica considered this species to be tolerant to (and to benefit from) moderate levels of disturbance, but threatened by mining and grazing. According to the Montana Field Guide (2013); "In Montana, Lemhi beardtongue occurs on moderate to steep, east- to southwest-facing slopes, often on open soils. In Beaverhead County, it generally grows below or near the lower extent of Douglas-fir and/or lodgepole pine forest, in habitat dominated by big sagebrush and bunchgrasses, including western wheatgrass *(Agropyron smithii]*) and Idaho fescue. Within these habitats, Lemhi beardtongue prefers areas that are more sparsely vegetated. The species is not restricted to any particular geological substrate, and has been found on granitic soils as well as limestone and other sedimentary substrates. Soils are often very gravelly, however soil texture is highly variable and ranges from sand to fine clay. Field surveys from 1986-1989 indicate that it is most commonly found on gravelly loams. Some populations grow partially or entirely on roadbanks." There is potential for this species to occur around the mine portal.

Whitebark pine – Lesica (1993) reported that whitebark pine dominates subalpine and timberline forest within the Highland Mountains. Beetles and white pine blister rust have impacted many populations of whitebark pine.

High northern buttercup -- High northern buttercup is a stoloniferous perennial herb with prostrate stems that can be found growing on wet soils around ponds, seeps, springs, and along streams from montane to alpine habitats (MTNHP, 2013). This species has been documented within two miles of the proposed private haul route permit boundary. This species has potential to occur along Fly Creek adjacent the proposed private haul route and along Divide Creek near the ore transfer facility.

Table 3.5-2. Special-Status Plant Species with the Potential to Occur within the Study Area

Scientific Name **Common Name**	**Status[1] USFWS/State/Forest Service/BLM/MNPS**	**Blooming period**	**Habitat and Elevation**	**Distribution Information**
Boechera fecunda sapphire rockcress	Montana SOC USFS Sensitive BLM Sensitive MNPS Rank 1	Late April-early June	Rocky, calcareous, montane slopes 5,500-8,000 feet	Occurs in Highland Mountains, Silver Bow County. This species was documented in 1993 within 1.5 miles southeast of the mine portal (MTNHP, 2013).
Carex idahoa Idaho sedge	Montana SOC USFS Sensitive BLM Sensitive MNPS Rank 2	Fruiting June-September	Wetland/riparian above 6,000 feet	Occurs in Highland Mountains, Silver Bow County. The nearest documented occurrence is approximately 2.5 miles west of the mine portal (MTNHP, 2013).
Delphinium bicolor ssp. *calcicola* limestone larkspur	Montana PSOC MNPS Rank 3	Late spring to early summer	Rocky soils in shortgrass prairie and sagebrush communities on limestone outcrops 4,200-6,900 feet	Southwestern Montana, endemic to Montana. Potentially present within the Pony Placer claim (Kline and Klepfer, 2010).
Draba densifolia dense-leaf draba	Montana SOC MNPS Rank 2	May-July	Gravelly, open soil of rocky slopes and exposed ridges in the montane to alpine zones 2,600-12,000 feet	Occurs in Highland Mountains, Silver Bow County
Juncus hallii Hall's rush	USFS Sensitive MNPS Rank 3	July-August	Exposed slopes, stream banks, and meadows in montane and alpine areas 5,200-9,800 feet	Occurs in Highland Mountains, Silver Bow County
Noccaea parviflora small-flowered	Montana SOC BLM Sensitive	Late June-early July	Meadows (moist, montane to alpine)	Occurs in Highland Mountains, Silver Bow County. This species was documented in 1992 within 0.5

Scientific Name **Common Name**	**Status[1] USFWS/State/Forest Service/BLM/MNPS**	**Blooming period**	**Habitat and Elevation**	**Distribution Information**
pennycress	MNPS Rank 3		6,500-10,000 feet	mile northwest of the mine portal (MTNHP, 2013).
Penstemon lemhiensis Lemhi beardtongue	Montana SOC USFS Sensitive BLM Sensitive MNPS Rank 2	Early June-late July	Sagebrush-grasslands	Occurs in Highland Mountains, Silver Bow County. Several occurrences of this species have been documented approximately 0.5 mile east of the mine portal (MTNHP, 2013).
Pinus albicaulis whitebark pine	USFWS Candidate Montana SOC USFS Sensitive	NA	Subalpine forest, timberline 4,200-12,000 feet	Occurs in Highland Mountains, Silver Bow County
Ranunculus hyperboreus high northern buttercup	Montana PSOC	August	Wet soil around ponds, seeps, springs and along streams from montane to alpine	Documented occurrences in southwestern Montana, including Silver Bow County. Nearest known occurrence within 2 miles southeast of the proposed private haul road (MTNHP, 2013).
Spiranthes diluvialis Ute ladies'-tresses	USFWS Threatened Montana SOC MNPS Rank 2	Early July-late October	Wetland/Riparian 4,300-6,850 feet	Documented occurrences in Beaverhead, Jefferson, and Madison counties

[1] **USFWS: Candidate**: Those taxa for which sufficient information on biological status and threats exists to propose to list them as threatened or endangered. The USFWS encourages their consideration in environmental planning and partnerships; however, none of the substantive or procedural provisions of the Act apply to candidate species.
USFWS: Listed threatened: Any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (16 U.S.C. 1532(20)).

Montana SOC: –Montana Species of Concern: native taxa that are at-risk due to declining population trends, threats to their habitats, restricted distribution, and/or other factors. Designation as a Montana Species of Concern or Potential Species of Concern is based on the Montana Status Rank, and is not a statutory or regulatory classification. Rather, these designations provide information that helps resource managers make proactive decisions regarding species conservation and data collection priorities.
Montana PSOC: Montana Potential Species of Concern: Potential Species of Concern are native taxa for which current, often limited, information suggests potential vulnerability.

USFS Sensitive: U.S. Forest Service Manual (2670.22) defines Sensitive Species on Forest Service lands as those for which population viability is a concern as evidenced by a significant downward trend in population or a significant downward trend in habitat capacity. The Regional Forester (Northern Region) designates Sensitive species on National Forests in Montana. These designations were last updated in 2007 and they apply only on Forest Service-administered lands.

BLM Sensitive: Species are defined by the BLM 6840 Manual as those that normally occur on Bureau administered lands for which BLM has the capability to significantly affect the conservation status of the species through management.

Montana Native Plant Society (MNPS) Rank 1: The viability of the species in the state is Highly Threatened by one or more activities. Associated threats have caused or are likely to cause a major reduction of the state population or its habitat that will require 50 years or more for recovery, 20 percent or more of the state population has been or will be affected, and the negative impact is occurring or is likely to occur within the next 5 years.
MNPS Rank 2: The viability of the species or a portion of the species habitat in the state is Threatened by one or more activities, though impacts to the species are expected to be less severe than those in Category 1. Associated threats exist but are not as severe, wide-ranging or immediate as for Category 1, though negative impacts are occurring or are likely to occur.
MNPS Rank 3: The viability of the species in the state is Not Threatened or the Threats are Insignificant. Associated threats are either not known to exist, are not likely to occur in the near future or are not known to be having adverse impacts that will severely affect the species' viability in the state.

Ute ladies'-tresses – Ute ladies'-tresses occurs in alkaline wetlands, swales, and old meander channels that dry up by mid-summer (Montana Field Guide, 2013). It is restricted by specific hydrologic requirements and is limited to areas within major river drainages.

3.5.3.3.Noxious Weeds

Montana's county noxious weed list identifies noxious weeds for the State pursuant to the County Weed Control Act (7-22-2101(5), MCA). Lesica (1993) documented the presence of 16 species of noxious weeds in the Highland Mountains, previously thought to occur in there, but not yet observed. These 16 species and their Montana noxious weed priority ratings are presented below. It is likely that additional noxious weed species have become established in the Highland Mountains since Lesica's field survey. The complete list of noxious weeds of concern to the Montana Department of Agriculture (those known to occur in the Highland Mountains and those likely to occur, but not yet observed) is listed below.

Table 3.5-3. Noxious Weeds with the Potential to Occur within the Study Area

Noxious Weeds Reported in the Highland Mountains, Silver Bow County		
Scientific Name[1]	**Common name**	**State weed priority[2]**
Lepidium draba	hoary cress (whitetop)	2B
Centaurea diffusa	diffuse knapweed	2B
Centaurea maculosa	spotted knapweed	2B
Acroptilon repens	Russian knapweed	2B
Leucanthemum vulgare	oxeye-daisy	2B
Cirsium arvense	Canada thistle	2B
Convolvulus arvensis	field bindweed	2B
Cynoglossum officinale	houndstongue	2B
Euphorbia esula	leafy spurge	2B
Isatis tinctoria	Dyer's woad	1B
Lepidium latifolium	perennial pepperweed	2A
Linaria dalmatica	Dalmatian toadflax	2B
Linaria vulgaris	yellow toadflax	2B
Ranunculus acris	tall buttercup	2A
Tanacetum vulgare	common tansy	2B

Noxious Weeds with Potential to Occur Highland Mountains, Silver Bow County

Scientific Name[1]	Common Name	State Weed Priority[2]
Berteroa incana	hoary alyssum	2A
Bromus tectorum	cheatgrass	3
Butomus umbellatus	flowering rush	1B
Centaurea solstitialis	yellow starthistle	1A
Chondrilla juncea	rush skeletonweed	1B
Cytisus scoparius	Scotch broom	1B
Echium vulgare	blueweed	2A
Elaeagnus angustifolia	Russian olive	3
Hieracium aurantiacum	orange hawkweed	2A
Hydrilla verticillata	hydrilla	3
Hypericum perforatum	St. Johnswort	2B
Iris pseudacorus	yellowflag iris	2A
Lythrum salicaria	purple loosestrife	1B
Myriophyllum spicatum	Eurasian watermilfoil	1B
Polygonum cuspidatum	Japanese knotweed	1B
Potamogeton crispus	curlyleaf pondweed	1B
Potentilla recta	sulfur cinquefoil	2B
Senecio jacobaea	tansy ragweed	2A
Tamarix ramosissima	saltcedar	2B

Source: Montana Department of Agriculture 2010; Lesica 1993; Tetra Tech 2013
[1]Nomenclature from Lesica (2012)
[1] Definition of State Priorities:

Priority 1A	These weeds are not present in Montana. Management criteria will require eradication if detected; education; and prevention.
Priority 1B	Limited presence in Montana. Management criteria would require eradication or containment, where present, and prevention and education elsewhere.
Priority 2A	Common in isolated areas of Montana. Management criteria would require containment and suppression where common; and eradication, prevention, and education where less abundant. Management shall be prioritized by local weed districts.
Priority 2B	Abundant in Montana and widespread in many counties. Management criteria would require containment and suppression where abundant and widespread; and eradication, prevention and education where less abundant. Management shall be prioritized by local weed districts.
Priority 3	Regulated Plants: (NOT MONTANA LISTED NOXIOUS WEEDS) These regulated plants have the potential to have significant negative impacts. The plant may not be intentionally spread or sold other than as a contaminant in agricultural products. The state recommends research, education and prevention to minimize the spread of the regulated plant.

3.5.3.4 Wetlands

3.5.3.5 Mine Permit Boundary Areas

The topography of the project area is characterized by rolling forested foothills and wet meadows along the Continental Divide on the west flank of the Highland Mountains. A review of topographic maps indicates the elevation of the Pony Placer Claim ranges from 7,120 to 7,440 feet above mean sea level (amsl). The portion of the Northern Claims Area that was surveyed near Highland Road ranged from approximately 7,200 to 7,400 feet amsl (USGS Mt. Humbug 7.5 minute topographic map (1996)). An internet query found that there is no National Wetland Inventory (NWI) mapping within the BHJV Mine area permit boundaries. The thin soils and high water table contribute to several wetland areas within the Pony Placer claims area, while wetlands in the Northern Claims Area are limited to narrow riparian bands along Fish Creek and two unnamed tributaries to Fish Creek (Eakin, 2010; Eakin, 2012). Two unnamed perennial streams originate on the west side of the Highland Mountains and flow westerly into the Pony Placer Claim where they join together at the southern end of the claim. A large wetland complex has formed in the area near the junction of these two drainages and is mapped as wetland on the US Geological Survey (USGS) 7.5 minute Mt. Humbug, MT topographic map (1996). The unnamed stream, resulting from the joining of the two streams, in the Pony Placer claim is a tributary to the Middle Fork Moose Creek.

Twelve wetlands were delineated in the Pony Placer Mine Claim comprising 14.7 acres, and three wetland areas were delineated in the Northern Claims Area, comprising 1.2 acres (Eakin, 2010; Eakin, 2012). Delineated wetlands were classified using the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al., 1979*)*. Classifying wetlands and waters under this system requires identification of the delineated areas major class association (riverine, palustrine, lacustrine, estuarine, or marine), general vegetative cover type, primary source of hydrology, and factors related to the origin of the wetland or water. Wetland classes in Montana are limited to riverine, palustrine, and lacustrine. Wetlands identified in the BHJV Mine area are most appropriately classified under the Cowardin system as palustrine emergent (PEM), palustrine scrub-shrub (PSS), and palustrine forested (PFO) wetlands. Palustrine wetlands are those dominated by trees, shrubs, or persistent emergent vegetation and may or may not include a large open water component. Primary sources of wetland hydrology appear to be surface water from direct precipitation and high groundwater levels at or near the surface with evidence of some areas of inundation (Eakin, 2010).

The wetlands associated with Middle Fork Moose Creek and tributaries (Wetlands 1 and 3) are considered seasonally flooded wetlands and make up over 85 percent of the total wetland acreage. The water regime for the remaining wetlands would be considered saturated based on the topography and limited or lack of surface water associated with the wetlands (Cowardin et al., 1979). Wetland delineations were conducted in October when groundwater levels are indicative of drier conditions as opposed to spring time when recent snowmelt can create higher levels of saturation. Therefore, the wetland delineations are likely to reflect the minimum overall wetland acreage present.

Recent cattle grazing was evident throughout the entire Pony Placer Claim with much of the wetland herbaceous vegetation eaten or crushed and widespread deep pocking of the hydric soils. Also, past selective logging in some wetland areas associated with the Pony Placer Claim was evident by the number of stumps still remaining. Wetland vegetation was consistent with the wet meadows identified by Lesica (1993).

The three wetlands in the Northern Claims Area were associated with headwater areas of streams. Two wetlands were associated with the headwaters areas of Fish Creek and its unnamed tributary, and the third wetland was associated with the portion of Basin Creek downstream of the old adit outfall just above where Basin Creek flows under Forest Service Road No. 84 (Highland Road). The two wetlands associated with Fish Creek are palustrine emergent wetlands. The wetland associated with Basin Creek is a palustrine forested wetland. Hydrology for these wetlands is likely related to direct precipitation and high groundwater levels at or near the surface.

3.5.3.6 Ore Haul Route Permit Area and Transfer Facility

Wetlands within the permit boundary for the ore haul route extend along the riparian edges and are augmented by seeps and springs near Fly Creek and Climax Gulch (Sandefur, 2013). Provisional NWI mapping within the permit boundary identified the majority of Fly Creek as riparian forested wetland. The field investigation identified that wetland habitat along Fly Creek is more narrow than depicted by the NWI map. Climax Gulch supports a healthy wetland riparian community consisting of willows, sedges, rush, meadow foxtail, and various other wet meadow grasses. This wetland extends along Curly Gulch for its entire length within the permit boundary (Sandefur, 2013).

The two-acre ore transfer facility area, located on the west side of Interstate-15, was delineated for wetlands during the April, 2013 field survey (Sandefur, 2013). Although the NWI indicates a palustrine emergent wetland in the southeast corner of this area, no wetlands or other aquatic resources were identified within this area during the field investigation (Sandefur, 2013). Divide Creek and its associated wetland riparian area are located just to the west outside of the permit boundary.

3.6 Surface Water Resources

Surface water resources are streams, rivers, lakes, and other bodies of water open to the atmosphere. Surface water resources are located within a land area known as a watershed and support beneficial uses including agricultural, aquatic life, drinking water, and recreation. Watersheds collect, convey, store, and otherwise drain water within the watershed. A watershed is a land feature that can be identified by tracing a line along the highest elevations between two drainage areas on a map, often a ridge (USGS, 2009). Surface water resources could be affected by mining related reclamation activities or long-term water quality of mine discharges. The following section discusses existing surface water resources in the vicinity of the BHJV Mine.

3.6.1 Overview and Study Area

The study area for surface water resources includes the mine portal and proposed discharge pipeline areas within the Pony Placer Claims, the proposed private haul route permit area, and the area surrounding the proposed transfer facility. The BHJV Mine area straddles the continental divide and is located within three separate watersheds. The three watersheds in the study area include:

- Basin Creek to the north of the site on the west side of the Continental Divide,
- Fish Creek to the east of the site on the east side of the Continental Divide, and
- Moose Creek to the west of the site but on the east side of the Continental Divide.

Watersheds located on the west side of the Continental Divide are tributary to the Clark Fork River basin which drains to the Columbia River and ultimately to the Pacific Ocean. Watersheds located on the side east of the Continental Divide are tributary to the Missouri River basin which drains to the Gulf of Mexico. Surface waters in Basin Creek flow west-northwest to the Clark Fork River basin. Prior to joining the Clark Fork River, Basin Creek flows north into Basin Creek Reservoir, then into Silver Bow Creek near Butte (BHJV, 2013). Basin Creek serves as a public water supply for the city of Butte. Surface waters in Fish Creek flow to the east toward the Jefferson River. Surface waters in Moose Creek flow west to the Big Hole River. The Big Hole River is a tributary to the Jefferson River, which is tributary to the Missouri River. A map of the watersheds included in the study area is shown in Figure 3.6-1.

The two acre ore transfer facility, located on the west side of Interstate-15 is located in the Divide Creek watershed. Divide Creek flows south towards the Big Hole River. The private haul route permit area is adjacent to Fly Creek. Fly Creek terminates into a series of irrigation ditches. Climax Gulch and Curly Gulch drain portions of the private haul route permit area near the intersection with Interstate-15. Both are headwater streams that converge approximately 800 feet upstream of the permit boundary (Sandefur, 2013). The ditches deliver irrigation water to the mouth of Fly Creek or flow into Divide Creek. The location of the ore transfer facility and private haul route is shown on Figure 1.1-2.

3.6.2 Methods

The existing conditions of surface water resource described in this section were provided in the Project Description and Existing Conditions Report- BHJV Mine Project (Tetra Tech, 2013) and the BHJV operating permit application (BHJV, 2013). This report and the operating permit describe the water quality data and instream flow measurements routinely monitored in Basin Creek, Fish Creek, and Moose Creek. Additional information about surface water resources was also found from the USGS National Water Information System (USGS, 2013) and from DEQ's Clean Water Act Information Center (DEQ, 2012a). Regulatory information was found from DEQ's online content (DEQ, 2013).

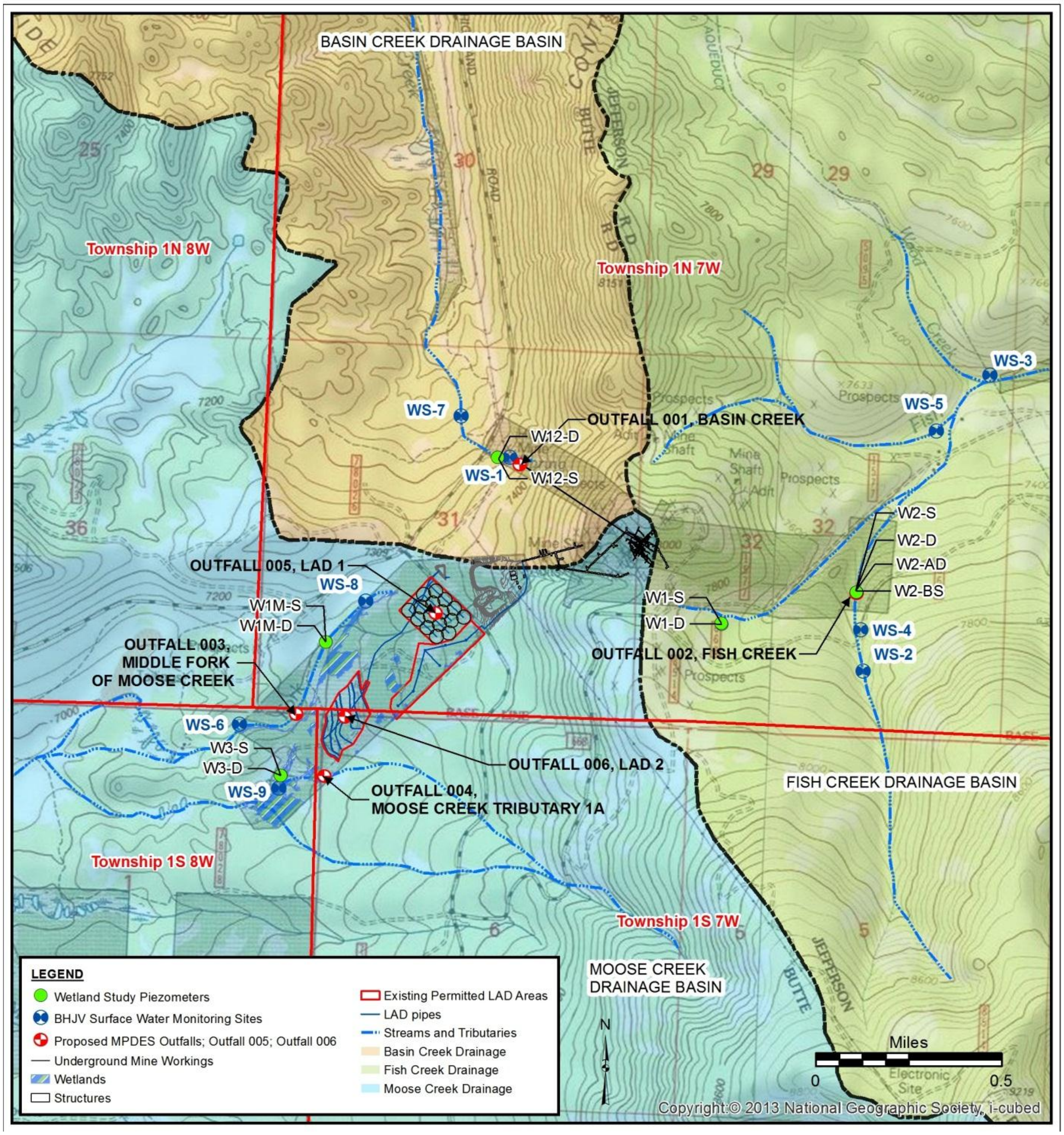


Figure 3.6-1 Watershed Boundary Map for Area Surrounding the Proposed Butte Highlands Joint Venture Mine, Silver Bow County, Montana.

3.6.3 Regulatory Environment

The regulatory framework for water resources in Montana includes:

- The Federal Clean Water Act
- The Montana Water Quality Act (75-5-101, *et seq*., MCA)
- Nondegradation Rules (17.30.701 et seq., ARM)
- Metal Mine Reclamation Act (82-4-301 et. seq., MCA)
- Montana Pollutant Discharge Elimination System (MPDES)
- Montana Nonpoint Source Management Plan

The Federal Clean Water Act provides for the restoration of the Nation's water (33 USC 1251 et seq.). The U.S. Environmental Protection Agency (EPA) delegated most of the implementation of the Clean Water Act (CWA) to the State of Montana. Designated beneficial uses of Montana's state waters include recreation, water supply, fisheries, aquatic life, and wildlife. The CWA requires that the State of Montana establish priority ranking for waters on the Section 303(d) list of impaired waters and to develop Total Maximum Daily Loads (TMDLs) for these waters. TMDLs are one of many tools in the CWA to help achieve the Act's main objective to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." (CWA section 101(a)). Montana regulations (MCA 75-5-703(3)) require that "all necessary TMDLs" be completed for water bodies on the 1996 303(d) list.

Section 303(d) of the CWA requires the listing of water bodies and outlines a program for addressing water body segments with impairments that preclude them from meeting standards designated for beneficial uses. These impairments to water quality include both point and non-point sources. DEQ is the lead agency for development of Water Quality Plans and TMDLs for 303(d)-listed water bodies.

The CWA regulates discharge of dredged or fill material into any water of the U.S., including wetlands (33 USC 1344) and provides the regulatory framework for assessing impacts to water quality. Section 404(b)(1) guidelines prohibit discharges of dredged or fill material into waters of the United States, including wetlands, if a practicable alternative to the proposed discharge exists that would have less adverse impacts on the aquatic ecosystem (provided that the alternative does not cause other significant adverse environmental impacts) (40 CFR 230(a)).

The reclamation bond that a mine operation must submit before DEQ issues a permit or approves a permit amendment must be sufficient to ensure compliance with the Montana Water Quality Act (WQA). The WQA provides a regulatory framework for protecting, maintaining, and improving the quality of water for beneficial uses. Pursuant to the WQA, DEQ has developed water quality classifications and standards, as well as a permit system to control discharges into state waters. Mining operations must comply with Montana's regulations and standards for surface water and groundwater. The WQA requires DEQ to protect high-quality state water from degradation. The nondegradation rules (17.30.701 et seq., ARM) were adopted to implement the Act. The nondegradation rules apply to activities that may affect the quality of surface or groundwater, but do not apply to exploration unless there is a discharge to surface water.

Nondegradation determinations are typically associated with a mixing zone except for carcinogens. A mixing zone is a limited area, within a surface water or groundwater, where dilution of a discharge may occur. All applicable water quality standards and nondegradation limits must be met at the end of a mixing zone. There are numerous restrictions on the size, the location, the changes that are allowed within a mixing zone, and if DEQ may grant a mixing zone. The reader can consult the mixing zone rules (ARM 17.30.501 et seq.) for more details.

Simply put, the purpose of the nondegradation rules is to protect high-quality state ground and surface waters. High quality waters are those waters whose quality is higher than the established standards (high quality state waters are defined in 75-5-103(10), MCA). Some nondegradation limits are set at definite concentrations called trigger levels (listed in Department Circular DEQ-7) or at a percentage of the lowest applicable water quality standard. Other nondegradation limits are qualitative, such as those for nitrogen and phosphorus in surface water. Whenever a person conducts an activity that may impact water quality, they must comply with the nondegradation requirements (this applies whether the activity is or is not regulated by DEQ). If the activity is regulated by DEQ, DEQ will ensure compliance with the nondegradation requirements prior to issuing its permit or other authorization. A person may also request a nondegradation significance determination and submit information to DEQ to demonstrate the activity will cause nonsignificant degradation of state waters. The proposed activity may not begin until DEQ has determined the activity will cause nonsignificant degradation or has issued an authorization to degrade. Many dischargers are required to monitor their discharge quality or the water in the mixing zone to ensure long-term compliance with the nondegradation requirements.

In addition, DEQ administers the MMRA under which the BHJV Mine is applying for an Operating Permit. One of the MMRA's purposes is to ensure that the usefulness, productivity, and scenic values of all lands and surface waters affected by mining and exploration receive the greatest reasonable degree of protection and that the lands are reclaimed to beneficial uses. The act and its rules define the steps to be taken in issuing an operating permit or revising an approved operating plan for reclamation of an applicant's proposed or modified mine operation. Pursuant to Section 82-4-336 (10), MCA, DEQ may not issue a permit or approve an amendment to a permit unless the reclamation plan prevents the pollution of air or water.

BHJV has received an MPDES permit for use during mining operation. The goal of the MPDES program is to control point source discharges of wastewater such that water quality in state surface water is protected. The MPDES establishes effluent limits, treatment standards, and other requirements for point source discharges to state waters including groundwater. Levels of water quality that are required to maintain the various beneficial uses of state surface waters are set forth in the water quality standards of Circular DEQ-7 and discharges to waters may not violate these standards (DEQ, 2012). All point sources of wastewater discharge are required to obtain and comply with MPDES permits. The effluent limitations and other conditions for certain categories of wastewaters are required to be treated to federally-specified minimum levels based on available and achievable water treatment technologies. Additionally, effluent limits and permit conditions are established to protect beneficial uses and applicable water quality standards.

The nondegradation rules are a part of the water quality standards that apply to new or increased sources of pollution. These rules prohibit significant increases in discharge of toxic and deleterious materials to state waters, unless it is affirmatively demonstrated to the DEQ that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of these waters. Each MPDES permit issued is designed to protect the state surface water quality at the point of discharge. In addition, recognizing the dynamic nature of streams and the potential additive or cumulative effects of pollutants, MPDES permits also address stream reach or basin-wide pollution problems.

Nonpoint source (NPS) water pollution is managed through the Montana Nonpoint Source Management Plan. NPS contaminants are transported to streams, lakes, wetlands, and groundwater by precipitation, snowmelt, and stormwater runoff. Nonpoint pollution also comes from substances that erode directly into surface waters or from aerially transported substances deposited on land and water. Common nonpoint pollutants include sediment, nutrients (nitrogen and phosphorus), temperature changes, metals, pesticides, pathogens, and salt.

NPS pollution is a significant problem in Montana, comprising the single largest cause of water quality impairment on a statewide basis (DEQ, 2012). There is strategy for implementing non-point source pollution controls for all activities that may impair water quality. Strategies include integrated project planning that considers temporal and spatial distribution of impacts, identification of priority restoration needs, implementing restoration, implementing best management practices (BMPs) on all ground disturbing activities, monitoring, and adjusting BMPs, or mitigating actions as needed to ensure that Montana Water Quality standards are met and designated beneficial uses of water are protected.

3.6.4 Results

3.6.4.1 Watershed Boundary

The water resources study area for the BHJV site incorporates headwater portions of Basin Creek, Fish Creek, and Moose Creek watersheds. Basin Creek (HUC 12 170102010201) encompasses 26,742 acres and is tributary to the Upper Clark Fork River (HUC 8 17010201). Fish Creek (HUC 12 100200050501) encompasses 34,460 acres and is tributary to the Jefferson River (HUC 8 10020005). Finally, Moose Creek (HUC 12 100200041201) encompasses 28,827 acres and is tributary to the Big Hole River (HUC 8 10020004) (Figure 3.6-1). A HUC is a hydrologic unit code defined by the USGS to classify and identify individual drainage basins.

The water resources study area for the ore transfer facility and the private haul road incorporates portions of Divide Creek, Fly Creek, Climax Gulch, and Curley Gulch. Fly Creek is adjacent to the private haul road, and is a 1,500-acre drainage that originates in the Highlands Mountains near the Continental Divide.

3.6.4.2 Watershed Condition

Existing stream channels within the mine permit boundary areas have been affected by natural causes (climate cycles, beaver activity etc.), livestock grazing, and human caused modifications including logging, dams, berms, placer mining disturbances, pipelines, and other diversions. Appendix AJ in the operating permit application documents a 2012 investigation conducted to evaluate the condition and overall stability of stream channels within the vicinity of the BHJV Mine. The focus of the investigation was on potential mine dewatering discharge points considered to be permitted for a MPDES discharge and included both a field portion and desktop analysis of apparent and calculated channel stability. Results of the field investigation concluded that stream channels within the mine permit boundary areas are stable or marginally stable under existing natural flow conditions. In other words, the evaluated channel cross sections and lengths of stream channel or reaches generally appeared to be transmitting an equal balance of sediment flowing in and flowing out. The evaluated reaches did not exhibit excessive erosion or deposition of sediment along the channel bed or banks from the natural cycle of stream flow.

The following stream reaches and their tributaries were shown in the investigation to generally consist of fine grained bed material: lower Basin Creek, lower Fish Creek, and upper Moose Creek. The desktop stability analysis showed these locations, under existing flow conditions, to be unstable. However, based on observations during the field investigation, the reaches appeared to be in generally stable condition (Tetra Tech, 2013). The presence of dense wetland vegetation on the bed and banks or the presence of beaver dams may prevent large-scale downcutting and sedimentation in unstable areas. These reaches are anticipated to be sensitive to disturbance. Based on gradation of bed material, Moose Creek currently appears to be in a less stable condition compared to Basin and Fish Creeks. Moose Creek enters a large wetland complex below the study area (on private property). The capacity and residence time provided by this wetland likely serves to trap sediment thereby limiting or preventing further downstream transport.

Fly Creek has three springs within the permit boundary that provide surface water (Sandefur, 2013). The channel fluctuates between a narrow thread with discontinuous open water, and broader swales with saturated soils (Sandefur, 2013). The springs likely support perennial surface hydrology in Fly Creek until the lower reach of the watershed. Throughout the Fly Creek drainage, wetlands range in width from a narrow thread along the stream channel to the full width of the valley floor and appear to be a function of valley gradient. Fly Creek exits the permit boundary and flows approximately 1.3 miles through an arid landscape before reentering the permit boundary. Fly Creek is characterized by a narrow channel and appears to be a losing reach as evidenced by reduced discharge in the downstream direction. Surface water was not present within Fly Creek above where the stream terminates into a network of irrigation ditches.

The approximate 6,400-acre Climax Gulch and Curly Gulch drainage originates in the Highland Mountains and runs west and south just over four miles prior to its confluence with Divide Creek. Both Climax Gulch and Curly Gulch are headwater streams that converge approximately 800 feet upstream of the haul route permit boundary. A diversion on Curly Gulch periodically delivers water into an irrigation network connected to the mouth of Fly Creek. During the field survey, it appeared this irrigation ditch had not conveyed water within the past few years (Sandefur, 2013).

3.6.4.3 Surface Water Monitoring Program

A baseline surface water monitoring program for the BHJV Mine was initiated in the fall of 2008 as part of the exploration program. Surface water monitoring has been generally completed on a quarterly to monthly basis on up to nine stations established in the Basin Creek, Fish Creek, and Middle Fork Moose Creek watersheds. Monitoring has consisted of collecting and analyzing water quality samples and measuring or estimating surface stream flow at designated monitoring stations. The locations of monitoring stations and others included in the baseline surface water monitoring program are shown in Figure 3.6-1. Surface water monitoring stations and the location of the watershed are identified in Table 3.6-1. Figure 3.6-1 also shows other surface water features in the vicinity of the BHJV Mine.

Table 3.6-1. Baseline Surface Water Monitoring Program Monitoring Stations

Monitoring Station Name	Watershed	Location Note
WS-1	Basin Creek	Uppermost station in headwaters of Basin Creek near the historic Highlands Mine adit discharge, downgradient of Outfall 001
WS-2	Fish Creek	Headwaters of Fish Creek upstream and east-southeast of the Mine area
WS-3	Fish Creek	Northwest of Mine area, furthest downstream monitoring station in Fish Creek
WS-4	Fish Creek	Headwaters of Fish Creek upstream and east-southeast of the Mine area, just downstream from WS-2, down gradient of Outfall 002
WS-5	Fish Creek	Northwest of Mine area in Fish Creek tributary
WS-6	Moose Creek	Middle Fork Moose Creek west and downgradient of LAD2 and Outfall 003
WS-7	Basin Creek	Located approximately 1,000 feet further downstream of WS-1
WS-8	Moose Creek	Upper most headwaters of Middle Fork Moose Creek west and downgradient of LAD1
WS-9	Moose Creek	Moose Creek Tributary 1A downgradient of Outfall 004

3.6.4.4 Surface Water Quantity

Stream flow rates are documented in the Project Description and Existing Conditions Report-BHJV Mine Project (Tetra Tech, 2013). The highest elevation streams present within the vicinity of the BHJV Mine area exhibit seasonal flow variations with peak stream flow typically occurring in June through August for Basin and Fish Creeks. Peak stream flows in Moose Creek generally occur slightly earlier in April through July. Minimum flows in all three watersheds generally occur December through April. Stream flow in the headwaters of Basin Creek is dominated by discharge from the historic adit. Average stream discharge rates in Basin, Fish, and Moose Creeks, through baseline monitoring, are summarized in Table 3.6-2.

Table 3.6-2. Average Stream Discharge Rates as Measured from 2008 to 2011, BHJV Mine Permit Boundary Areas.

Monitoring Station Name	Watershed	Average Discharge (gpm)
WS-1	Basin Creek	105
WS-2	Fish Creek	---
WS-3	Fish Creek	180
WS-4	Fish Creek	---
WS-5	Fish Creek	---
WS-6	Moose Creek	34
WS-7	Basin Creek	93
WS-8	Moose Creek	10
WS-9	Moose Creek	126

Source: Tetra Tech 2013

3.6.4.5 Surface Water Quality

The baseline water monitoring program included the collection and laboratory analysis of water quality samples from the established monitoring stations. Water samples were analyzed for total recoverable and/or dissolved metals, common ions, nutrients, and general physiochemical parameters. In addition, stream flow was recorded at the time of each sample collection. Analytical results of the baseline water quality monitoring are provided in Appendix A of the Project Description and Existing Conditions Report- BHJV Mine Project (Tetra Tech, 2013). A summary of these results are described below.

Basin Creek

Basin Creek monitoring stations, WS-1 and WS-7, exhibit relatively hard (200 mg/L total hardness) calcium bicarbonate type water. Surface water pH values near the historic mine adit are neutral to slightly alkaline in the range of pH 7.0 to 8.0 and increase slightly downstream to a range of pH 8.0 to 9.0. Surface water near the historic mine adit is of good quality with no exceedances of aquatic life standards. Water quality degrades slightly downstream (WS-7) with occasional exceedances of the hardness based aquatic life standards, both chronic and acute, for total recoverable copper. Additionally, total recoverable iron has on occasion exceeded the chronic aquatic life standard at downstream station WS-7. Both stations exhibited low or non-detect concentrations for most metals. No seasonality to Basin Creek water quality has been identified.

Fish Creek and tributaries

Fish Creek surface water is a calcium bicarbonate type with relatively low total hardness of less than 30 mg/L. As total dissolved solid concentrations increase downstream, total hardness increases to be a relatively hard value of 150 mg/L. Surface water above the Project site exhibits neutral to slightly alkaline pH in the range of pH 7.0 to 8.0 and increases slightly downstream of the Project area with a range of pH 8.0 to 9.0. Surface water in Fish Creek is of good quality with no exceedances of aquatic life standards with the exception of one reported occurrence on April 27, 2010 where lead slightly exceeded the hardness-based chronic aquatic life standard at station WS-4. All stations exhibited low or non-detect concentrations for most metals. No seasonality to Fish Creek water quality has been identified.

Middle Fork Moose Creek and tributaries

All three Moose Creek stations exhibit relatively hard (greater than 150 mg/L total hardness) calcium bicarbonate type water. Surface water pH values at all locations are neutral to slightly alkaline in the range of pH 7.0 to 8.5. Surface water is of good quality with no exceedances of aquatic life standards except for the occasional exceedances of the hardness based chronic aquatic life standard for total recoverable copper. Water quality improves slightly downstream (WS-6) with fewer exceedances of the hardness-based aquatic life standards and lower total dissolved solids concentrations present. All stations exhibited low or non-detect concentrations for most metals. No seasonality to Basin Creek water quality has been identified.

The fisheries report covering the haul route permit area and the operating permit do not discuss water quality and instream flows for Divide Creek, Fly Creek, or Curly Gulch. The ore transfer facility is located just west of Divide Creek. The facility site is adjacent to, but does not encroach upon, any wetlands or other aquatic resources (Sandefur, 2013).

3.6.4.6 Beneficial Water Use (Surface and Groundwater)

Beneficial uses of surface water in the vicinity of the BHJV Mine area include agriculture, aquatic life, drinking water, and primary contact recreation. Two of the streams in the Project area (Fish Creek and Moose Creek) are classified as B-1, which indicates the water is to be maintained suitable for drinking, culinary, and food processing purposes after conventional water treatment (ARM 17.30.607,610, and 623). Fish Creek and Moose Creek are considered “impaired” as reported by the 2012 Section 303(d) list of impaired water bodies in Montana (DEQ, 2012). Fish Creek is impaired from its headwaters to the mouth (19.9 miles) for the following reasons: a) alteration of in stream or streamside vegetative cover, b) low flow alterations, c) sedimentation/siltation. Probable causes of impairment include grazing in riparian zones, diversions for irrigation systems, and forest roads. Moose Creek is impaired from its headwaters to the mouth (17 miles) for alterations to flow and sediment/siltation with irrigation as the probable cause (DEQ, 2012). Fish Creek is identified as not supporting beneficial uses of aquatic life and primary contact recreation. Moose Creek is identified as not supporting beneficial uses of aquatic life and partially supporting primary contact recreation. Fish Creek is identified as fully supporting agriculture and drinking water uses. A sedimentation/siltation TMDL has been completed for both Fish Creek and Moose Creek (DEQ, 2012).

Basin Creek is classified as A-Closed because it is a water supply source for the city of Butte. This classification indicates the water is to be maintained suitable for drinking, culinary, and food processing and other purposes after simple disinfection (ARM 17.30.607 and 621).

3.6.4.7 Water Rights

A water rights search of the Montana Department of Natural Resources and Conservation (DNRC) Water Rights Bureau database was conducted (Tetra Tech, 2013). The search queried water rights permits in a 2-mile radius buffer around the BHJV Mines patented mining claims and revealed 35 unique active water right permits for both surface and groundwater sources. A summary table of these water right permits is provided as Table 3.6-3. The table summarizes the owner, water right permit number, point of diversion, the type of water right, the priority year, and the beneficial purpose of each water right permit as recorded in DNRC's water right database (DNRC, 2013). The recorded beneficial water right purpose of these 35 water right permits includes mining (7), stock (20), irrigation (4), fishery (2), municipal (1), and domestic (1). Several water right permits include multiple points of diversion. BHJV Mine has claim to the following water right permits:

1) 41D 195449 00 with surface water source from unnamed tributary of Middle Fork Moose Creek, 1935 priority date, maximum flow rate of 2.0 cubic feet per second (cfs), and an unspecified volume;
2) 41G 195447 00 with surface water source from unnamed tributary to Fish Creek, 1905 priority date, maximum flow rate of 1.25 cfs, and an unspecified volume;
3) 76G 195450 00 with surface water source from Basin Creek, 1868 priority date, maximum flow rate of 1.25 cfs, and maximum volume of 302 acre-feet per year; and
4) 41G 195448 00 with groundwater source from spring from unnamed tributary to Basin Creek, 1932 priority date, maximum flow rate of 2.41 cfs, and an unspecified volume. Note that this water right permit has groundwater source in the Basin Creek watershed, but is beneficially used in the Moose Creek watershed.

Other claimed surface water rights associated with mining in the BHJV Mine area exist as well. The use and/or modification (required for existing water rights with new points of diversion or changes to claimed flow rate or volume) of active water rights claims by BHJV or its partners would be regulated by Montana water law.

Table 3.6-3. Summary of Water Rights in the Vicinity of the Proposed BHJV Mine, Silver Bow County, Montana.

Owner	Water Right Number	Waterbody	Point of Diversion			Water Right Type[a]	Year	Purpose
			Township and Range	Section	Quarter Section			
Butte-Silver Bow County	41G 17063 00	Fish Creek	1N 7W	3	SESWSW	SC	1866	Municipal
Butte Highlands JV LLC	41G 195447 00	Fish Creek	1N 7W	32	SENENW	SC	1905	Mining
Butte Highlands JV LLC	41G 195448 00	Fish Creek	1N 7W	31	SWNE	SC	1932	Mining
Forest Service	41G 50579 00	Fish Creek	1N 7W	32	SWSWSW	SC	1906	Stock
USDA Forest Service	41G 54479 00	Fish Creek	1N 7W	29	NENESW	SC	1906	Stock
USDA Forest Service	41G 54480 00	Fish Creek	1N 7W	20	NESESW	SC	1906	Stock
USDA Forest Service	41G 54483 00	Fish Creek	1N 7W	28	NENENE	SC	1906	Stock
USDA Forest Service	41G 54484 00	Fish Creek	1N 7W	32	NWSWSE	SC	1906	Stock
Highland Gold Properties Inc.	41G 95775 00	Fish Creek	1N 7W	32	NENENE	SC	1866	Mining
Dave & Mark Stratton	41G 95776 00	Fish Creek	1N 7W	28	E2SW	SC	1866	Mining
			1N 7W	28	E2SW	SC	1866	Mining
Butte Highlands JV LLC	76G 195450 00	Basin Creek	1N 7W	31	SENWNE	SC	1868	Mining
USDA Forest Service	76G 50738 00	Basin Creek	1N 7W	31	NWNENW	SC	1906	Stock
USDA Forest Service	41G 54478 00	Fish Creek	1S 7W	4	SWSWNW	SC	1906	Stock
USDA Forest Service	41D 54354 00	Moose Creek	1S 7W	6	NWNENE	SC	1906	Stock
USDA Forest Service	41D 57032 00	Moose Creek	1S 7W	6	S2N2	SC	1906	Stock
			1S 7W	6	NENESE	SC	1906	Stock

Owner	Water Right Number	Waterbody	Point of Diversion			Water Right Type[a]	Year	Purpose
			Township and Range	Section	Quarter Section			
USDA Forest Service	41D 57032 00		1S 8W	1	NESENE	SC	1906	Stock
Butte Highlands JV LLC	41D 195449 00	Moose Creek	1S 7W	6	SWSENE	SC	1935	Mining
Brownell & Rosati Family Trusts	41D 134016 00	Moose Creek	1S 8W	2	SWNESE	SC	1875	Irrigation
			1S 8W	2	SWNESE	SC	1875	Irrigation
Brownell &Rosati Family Trusts	41D 134017 00	Moose Creek	1S 8W	2	NENESE	SC	1879	Irrigation
			1S 8W	2	NENESE	SC	1879	Irrigation
Joan &Tileo Forcella	41D 30009737	Moose Creek	1S 8W	1	N2S2	SC	1873	Stock
			1S 8W	1	N2S2	SC	1873	Stock
Mont. Dept of Fish Wildlife and Parks	41D 30017524	Moose Creek	1S 8W	1	SWSW	WR	1985	Fishery
USDA Forest Service	41D 54346 00	Moose Creek	1N 8W	35	NWSWNW	SC	1906	Stock
			1N 8W	35	SW	SC	1906	Stock
			1S 8W	2	W2W2NW	SC	1906	Stock
			1S 8W	2	NWNWSW	SC	1906	Stock
USDA Forest Service	41D 54348 00	Moose Creek	1N 8W	25	W2	SC	1906	Stock
			1N8W	35	E2E2	SC	1906	Stock
			1N8W	36	W2NW	SC	1906	Stock
			1S 8W	2	NWNWNE	SC	1906	Stock

Owner	Water Right Number	Waterbody	Point of Diversion			Water Right Type[a]	Year	Purpose
			Township and Range	Section	Quarter Section			
USDA Forest Service	41D 54351 00	Moose Creek	1S 8W	2	SW	SC	1906	Stock
USDA Forest Service	41D 54352 00	Moose Creek	1S 8W	1	N2SWNE	SC	1906	Stock
			1S 8W	1	NW	SC	1906	Stock
			1S 8W	2	S2SENE	SC	1906	Stock
USDA Forest Service	41D 57032 00	Moose Creek	1S 7W	6	S2N2	SC	1906	Stock
			1S 7W	6	NENESE	SC	1906	Stock
			1S 8W	1	NESENE	SC	1906	Stock
USDA Forest Service	41D 57033 00	Moose Creek	1S 8W	1	N2N2	SC	1906	Stock
Kearns, Robert &Debbie	41D 93186 00	Moose Creek	1N 8W	35	SWSESE	SC	1940	Irrigation
			1N 8W	35	SWSESE	SC	1940	Irrigation

Source: DNRC 2013
[a] SC= Statement of Claim, R = Water Reservation

3.7 Groundwater Resources

Groundwater resources are water beneath the earth's surface that flows through the porous spaces in soils or bedrock. Groundwater may eventually discharge at the surface in the form of a spring, seep, or wetlands, or may be pumped out of the ground. The following section discusses existing groundwater resources in the vicinity of the BHJV Mine. An analysis of groundwater resources includes the physical movement through the aquifer, the volume, and the chemical characteristics.

3.7.1 Overview and Study Area

The study area for existing groundwater conditions at the proposed BHJV Mine site is located on the Continental Divide approximately 15 miles south of Butte, Montana, and includes three watersheds (Figure 3.6-1):

- Basin Creek to the north of the site on the west side of the Continental Divide,
- Fish Creek to the east of the site on the east side of the Continental Divide, and
- Moose Creek to the west of the site but on the east side of the Continental Divide.

The groundwater within each watershed likely flows in similar directions to the surface water. For instance, groundwater located on the west side of the Continental Divide flows towards the Columbia River and ultimately the Pacific Ocean. Groundwater on the east side of the Continental Divide flows toward the Missouri River basin which drains to the Gulf of Mexico. Groundwater in the project area flows primarily in bedrock formations, with some flow in shallow unconsolidated alluvial deposits along stream channels. .

The groundwater is defined by the established monitoring well network and surface water monitoring locations which focus on a relatively small area around the mine site of approximately one square mile. Monitoring locations are shown on Figure 3.6-1.

3.7.2 Methods

The existing conditions of the groundwater resources at the BHJV Mine site were provided in the Project Description and Existing Conditions Report- BHJV Mine Project (Tetra Tech, 2013) and the BHJV operating permit application (BHJV, 2013). The data for characterizing the existing groundwater conditions in the vicinity of the BHJV Mine site is available from a number of baseline studies. Additionally, the following studies were reviewed.

- Amec Geomatrix, Inc., "Hydrogeologic Characterization Report, BHJV Mine Project," January 2009 (BHJV, 2013, Appendices C, E and F)
- Savor Environmental Services, "Water Quality Data and Summary Report for the Butte Highlands Project, March 2010 (BHJV, 2013, Appendix D)
- Timberline Resources, "Water Quality Data for Surface and Underground Monitoring Sites," 2008-2011 (BHJV, 2013, Appendix S)
- Itasca Denver Inc., "Hydrogeologic Characterization and Numerical Groundwater Modeling for the Butte Highlands Underground Mine," January 2012 (BHJV, 2013, Appendix Z)
- Arcadis, "Initial Site-Wide Water Balance," September 2012 (BHJV, 2013, Appendix AG)

- Tetra Tech, “Hydrological Investigation of Wetlands Near Butte Highland Mine – Interim Report,” November 2012

3.7.3 Results

A summary of the hydrostratigraphy, monitoring well and groundwater well network, groundwater chemistry, aquifer testing and analysis, numerical groundwater model, water balance, and wetlands hydrology with be presented in this section. A more detailed presentation of these results is located in the original BHJV operating permit appendices as described above.

3.7.3.1 Hydrostratigraphy

The hydrostratigraphy describes the structure of subsurface porous materials in reference to the flow of groundwater. This discussion is limited to two baseline hydrogeologic reports completed in 2009 and 2012 (BHJV, 2013, Appendices C, E, F, and Z).

Groundwater beneath the BHJV Mine site flows primarily in bedrock formations, with some flow in unconsolidated alluvial deposits along the stream channels (BHJV, 2013, Appendix C). The groundwater flow direction is assumed to follow surface topography and area drainage systems at roughly the same hydraulic gradient. In deeper bedrock aquifers, groundwater flow direction and gradients likely are much more complex. A groundwater elevation contour map has not been provided in the baseline studies or the operating permit application packet. Given the limited number of groundwater monitoring locations, a groundwater elevation contour map would not be very representative.

Similar to other mountainous regions with bedrock aquifers, groundwater recharge is dominated by infiltrating precipitation which occurs mostly as snowmelt. Groundwater flows from mountain recharge zones to lower elevations along rivers and creeks, but also through stratigraphic units and structures. Direct infiltration of precipitation and leakage from area losing streams is also another source of groundwater recharge. Because the BHJV Mine site is situated on the Continental Divide, groundwater flow originating as recharge to the area likely flows in a radial pattern into three watersheds: Basin Creek (Clark Fork River), Fish Creek (Jefferson River), and Moose Creek (Big Hole River) (Figure 3.6-1).

Total groundwater flux was estimated to be up to 26,000 ft^3/day from a one-square mile area surrounding the proposed BHJV Mine (BHJV, 2013). This estimate was based on a climatic study of recharge using Parameter-Elevation Regressions on Independent Slopes Model (PRISM), an average precipitation coverage rate of 24.5 inches/year (BHJV, 2013, Appendix AG), and 19 percent infiltration over the mine area based on a nearby study in the Tobacco Root Mountains (Magruder, Woessner, & Running, 2009). An independent analysis of the infiltration percentage by the Maxey-Eakin method was later performed, and the difference between the Tobacco Root study and Maxey-Eakin method was less than 1 percent (BHJV, 2013, Appendix Z).

The hydraulic conductivity controls the rate of groundwater movement through porous media. The hydraulic conductivity at the BHJV Mine site is dependent on the secondary permeability resulting from fractures created by folding, faulting, and intrusions. This is partly because many of the geologic strata have undergone some form of metamorphism (gneiss, schist, quartzite), diagensis (dolomitization) and/or mineral replacement (skarn metasomatism) which tends to reduce primary permeability (BHJV, 2013, Appendix Z). Initial inflows to the mine workings from fractured rock are large and are due to depletion of water from localized storage in secondary permeability features; however, long term flows are governed by the ability of the semi-regional structures, such as faults and fractures, to transmit water from areas of recharge.

Regional stratigraphic units that have similar hydrogeologic properties can be classified into hydrostratigraphic units. A hydrostratigraphic unit is not limited to a particular geologic formation and previous studies at BHJV have defined nine units from youngest to oldest (BHJV, 2013, Appendix Z):

1. Granitic and dioritic intrusive rocks (Late Cretaceous)
2. Permian to Mississippian age sediments (undifferentiated)
3. Pilgrim limestone (Upper Cambrian)
4. Park shale (Middle Cambrian)
5. Meagher limestone and dolomite (Middle Cambrian)
6. Wolsey Formation (Middle Cambrian)
7. Flathead quartzite (Middle Cambrian)
8. Belt Supergroup sediments (Middle Proterozoic)
9. Archean age schist and gneiss (undifferentiated)

The hydrostratigraphy immediately surrounding the mine area includes all of the sedimentary units from the Belt sediments to the Park shale and the dioritic intrusives (BHJV, 2013, Appendix Z). The units dip steeply (greater than 60 degrees) to the north and have been folded into a series of antiforms and synforms. The diorite primarily intrudes as a sill between the Wolsey/Meagher contact and the Wolsey/Flathead contact. The Meagher Formation was determined to be the main water-bearing unit in the mine area based on hydrogeologic characterizations conducted in 2011 (BHJV, 2013, Appendix Z).

3.7.3.2 Groundwater Monitoring

BHJV performs surface and groundwater monitoring activities in the vicinity of the BHJV Mine. The initial monitoring program was established 2008 during exploration permitting activities for the mine (BHJV, 2013). This program consisted of monthly monitoring and sample collection at seven surface water stations and quarterly monitoring of groundwater down gradient of the LAD areas. Additional locations such as the dewatering well, exploration boring completions (i.e., the five monitoring wells accessible from the surface), the water supply well, and mine ponds have also been monitored. Subsequent to the inception of the monitoring program, additional analyses and surface water monitoring locations were added and the frequency of groundwater monitoring increased to monthly in late 2009 and early 2010.

Groundwater elevations in the mine area are measured in five monitoring wells and two underground piezometers. The “monitoring wells” are exploration boreholes that have screened intervals in the Meagher Formation, Wolsey Formation, and diorite. Interpretation of water level data needs to take into account that the monitoring wells may be open across the entire length of the borehole and have limited usefulness for data interpretation. The locations of the wells are shown on Figure 3.6-1 and their completions are described in Table 3.7-1 and Table 3.7-2. The depths of the monitoring wells range from 820 to 1,285 feet below ground surface. The two underground piezometers (UGPZ1 and UGPZ2) are completed with three multilevel vibrating wire pressure transducers (VWT) designed to separately measure hydraulic heads in the Meagher Formation, Wolsey Formation, and Flathead Formation and in the contact zone between the Meagher and Wolsey Formations (Table 3.7-1). The VWT results will provide seasonal static water level data as well as provide the ability to measure aquifer responses to induced stress during aquifer testing.

Three additional water monitoring wells have been installed to monitor shallow water quality near the LAD areas. Each of the LAD wells (LAD1MW, LAD2MW, and LAD3MW) is completed to a depth of 60 feet. Water levels in LAD1MW and LAD2MW range from 5 to 23 feet below ground surface. LAD3MW has remained dry. A dewatering well (DWW10-01) was installed in 2011 as an aquifer test well and to provide premining baseline water quality data from the proposed mine workings. One additional well, designated WW, has been installed as a domestic water supply well for the BHJV facility.

Six pairs of nested piezometers were also installed in several wetlands to establish baseline groundwater gradient conditions (Table 3.7-2) (Tetra Tech, 2012). Wetlands were chosen based on their potential to be impacted by mine dewatering due to their proximity to the mine.

A brief summary of water quality from these monitoring wells is discussed in Section 3.7.3.3. Specific details of the proposed monitoring plan are outlined in the operating permit application (BHJV, 2013). This program would be revisited if the mine enters the production phase to include additional sites and/or parameters if necessary (e.g. sample collection from the reverse osmosis system or new downgradient bedrock monitoring well). The plan calls for quarterly monitoring of a reduced list of contaminants of concern compared to what was analyzed during the exploration phase of the project.

Table 3.7-1. BHJV Well and Piezometer Installation Details

Well/ Piezometer ID	Surface Elevation (ft NGVD)	Screened Interval (ft bgs)	TDX[1] Depth / Elevation (ft bgs/ft NGVD)	Pre-Mining Water Level Elevation (ft NGVD)[2]	Monitored Formation
BHH08-01	7,969	600-1,167[3]	NA	7,356	Meagher
BHH09-01	7,820	May-05	NA	7,543	Wolsey/diorite
BHH09-02	7,846	545-980[3]	NA	7,410	Wolsey/diorite
BHH09-04	7,895	620-1,120[3]	NA	7,329	Meagher/Wolsey
BHH09-05	8,045	680-1,285[3]	NA	7,350	Meagher/Wolsey
DWW10-01	7887	520-935	980/6,907	NA	Meagher/Wolsey
UGPZ-1 (upper)	7,357	NA	390/6,966	NA	Meagher
UGPZ-1 (middle)	7,357	NA	440/6,916	NA	Meagher/Wolsey Contact
UGPZ-1 (lower)	7,357	NA	490/6,866	NA	Wolsey
UGPZ-2 (upper)	7,365	NA	270/7,045	NA	Meagher
UGPZ-2 (middle)	7,365	NA	320/7,045	NA	Meagher/Wolsey Contact
UGPZ-2 (lower)	7,365	NA	370/6,995	NA	Wolsey
UGPZ-3	7,368	0-200[3]	NA	NA	Belt Supergroup

Notes: NA = not applicable, not established until after underground mine development
NGVD = National Geodetic Vertical Datum of 1929
[1]Vibrating wire pressure transducer
[2]Water-levels measured April 2010
[3]Open hole

Table 3.7-2. BHJV Wetlands Piezometer Installation Details

Piezometer Identification	Installation Date	Total Depth (Feet bgs[1])	Casing Stick-up (Feet ags[2])	Latitude / Longitude[3]	Data Logger Installed
Fish Creek Sites					
W1-D	8/13/2012	18.9	1.39	45° 47’ 23.57” N / 112° 30’ 12.8” W	Yes
W1-S	8/13/2012	12.9	2.19	45° 47’ 23.57” N / 112° 30’ 12.8” W	Yes
W2-D	8/17/2012	3.05	3.14	45° 47’ 28.7” N / 112° 29’ 46.1” W	No
W2-S	8/17/2012	1.64	4.66	45° 47’ 28.7” N / 112° 29’ 46.1” W	No
W2-AD	8/17/2012	4.5	4.05	45° 47’ 28.7” N / 112° 29’ 46.1” W	No
W2-BS	8/17/2012	2	2.6	45° 47’ 28.7” N / 112° 29’ 46.1” W	No

Piezometer Identification	Installation Date	Total Depth (Feet bgs[1])	Casing Stick-up (Feet ags[2])	Latitude / Longitude[3]	Data Logger Installed
Basin Creek Sites					
W12-D	8/17/2012	4.97	4.64	45° 47' 45.7" N / 112° 30' 59.0" W	Yes
W12-S	8/17/2012	2.24	4.22	45° 47' 45.7" N / 112° 30' 59.0" W	Yes
Moose Creek Sites					
W1M-D	9/27/2012	18.5	1.3	45° 47' 18.9" N / 112° 31' 32.0" W	Yes
W1M-S	9/27/2012	9.6	3.72	45° 47' 18.9" N / 112° 31' 32.0" W	Yes
W3-D	9/27/2012	16.35	3.25	45° 47' 00.0" N / 112° 31' 40.0" W	Yes
W3-S	9/27/2012	9.5	5.6	45° 47' 00.0" N / 112° 31' 40.0" W	Yes

[1] bgs = below ground surface
[2] ags = above ground surface
[3] datum WGS 84

3.7.3.3 Water Quality

The water quality database as of 2013 includes two or more years of monthly data collected from surface and groundwater monitoring locations, and additional data collected as early as 2008 for some locations. Groundwater at BHJV is classified as Class 1 since the natural specific conductance is less than 1,000 µS/cm (ARM 17.30.1006). In accordance with these regulations, a person or an entity may not cause a violation of the human health standards for groundwater listed in Circular DEQ-7 (2012).

Well BHH08-01 was sampled from two different drilling depths in December 2008 (Figure 3.7-1). Borehole BHH09-01 was sampled once in July 2009, BHH09-02 sampled once in August 2009, and BHH09-04 sampled once in November 2009 (BHJV, 2013, Appendix S). Dewatering well DWW10-01 was sampled initially in January 2011 and 10 times between July and the end of September. Water supply well WW was sampled four times between July 2010 and August 2012. Piezometer UGPZ-03 was sampled 12 times in 2011 between January and September. Piezometer UGPZ-04 was also sampled 12 times in 2011 between April and September. Land application area monitoring wells LAD1MW and LAD2MW have been sampled 22 and 24 times, respectively, between March 2010 and March 2012 (BHJV, 2013, Appendix S). Discharge from the historic Highlands adit (WS-1) also provides data from as early as 2008 which can be used to characterize baseline groundwater conditions.

Samples from all monitoring locations are submitted for analysis of 67 parameters including total recoverable and dissolved metal concentrations regardless of whether the samples represent surface water or groundwater and regardless of whether a water quality standard exists for the parameter. A database of water quality sample results is maintained by the mine and is provided as Appendix S of the operating permit application (BHJV, 2013). The groundwater quality data were compared to DEQ -7 groundwater quality standards (2012) and are summarized as follows;

- The arsenic concentrations in 4 of 11 samples from DWW10-01 exceeded the DEQ-7 maximum contaminant level (MCL) of 0.010 mg/L. Concentration exceedances ranged from 0.011 to 0.018 mg/L.
- The antimony concentration in samples from BHH09-01 and BHH09-04 equaled or exceeded the MCL of 0.006 mg/L, at 0.006 mg/L and 0.014 mg/L, respectively.

3.7.3.4 Aquifer Testing and Analysis

A step-drawdown test and constant-rate pumping test began on January 18, 2011 for dewatering well DWW10-01 for purposes of estimating the hydraulic properties of the hydrogeologic units in the vicinity of BHJV (BHJV, 2013, Appendix Z). The 5.4-hour step-drawdown test followed by a 10-day constant-rate pumping test with subsequent recovery measurements were designed to hydraulically stress the groundwater system so that responses in piezometers could be used to assess dewatering well performance by measuring drawdown within their respective hydrostratigraphic units; assess boundary conditions and aquifer compartmentalization; and provide the necessary hydrogeologic data for development of a numerical groundwater flow model to be used to assess the long-term underground mine dewatering requirements. A detailed discussion and presentation of aquifer test results are provided in the operating permit application (BHJV, 2013). Drawdown and recovery response was recorded in the pumping well, five monitoring wells, and the three screened zones of the two piezometers. The hydraulic conductivities of the geologic formations were estimated for the pumping and recovery phases of the pumping test. The monitored formations include the Meagher and Wolsey Formations. The lower interval of UGPZ-1 is completed in the Flathead Formation, Belt Supergroup, and diorite unit. A bulk estimate of hydraulic conductivity was attempted.

The hydraulic conductivity values were estimated using water level data recorded during early, middle, and late times during the 10-day test, and water level recovery data. Early, middle, and late time data corresponded to distinct changes in slope of the drawdown curves that indicated aquifer boundaries exist within the mine site. Estimates of hydraulic conductivity made using the early time pumping test data are judged to be the most representative of the Meagher and the Wolsey Formations in which well DWW10-01 is completed. The hydraulic conductivity values derived from the early time data in underground piezometers UGPZ-1 and UGPZ-2 are judged to be the most representative of the Meagher Formation dolomite in which these piezometers are completed. The early time average hydraulic conductivity for the underground piezometers is 9.1 feet/day (BHJV, 2013, Appendix Z). The overall average hydraulic conductivity for all monitor wells and piezometers is 7 feet/day. There is good agreement among the analyzed hydraulic conductivity values. Field investigation results compare well with published fractured rock results (Freeze and Cherry, 1979).

Varying degrees of drawdown in observation wells and piezometers (both spatially and temporally) indicate that boundary conditions do exist in the BHJV Mine site area. These boundary conditions may be directly linked to mapped faults in the project area which may act as barriers to groundwater flow (BHJV, 2013, Appendix Z). From the standpoint of mine dewatering, boundary effects are a favorable result indicating that the water-bearing rocks are compartmentalized which could limit the amount of dewatering required. After 10 days of pumping, water level recovery varied by well location and completion depth. Recovery at DWW10-01, BHH09-02, BHH09-04, UGPZ-1, and UGPZ-2 exceeded 83 percent in 10 days or less. In contrast, recovery at BHH08-01, BHH09-01, and BHH09-05 was limited to 63 percent or less after 10 days. Partial recovery after an extended pumping period is indicative of aquifer storage depletion and limited, or absent, recharge. From the standpoint of mine dewatering, this is a favorable indication of compartmentalization and limited recharge.

3.7.3.5 Numerical Groundwater Flow Model

A 3-D numerical groundwater flow model of the BHJV Mine site and the surrounding area was constructed by Itasca Denver, Inc. using the finite-element code MINEDW (Azrag et al., 1998). The model was developed in order to simulate mine dewatering and develop a prototype dewatering well (BHJV, 2013, Appendix Z). The model encompassed a much larger area than what is covered by the groundwater monitoring network at BHJV. The modeled area consists of the Highland Mountains and the surrounding drainages which are thought to be groundwater divides. The western boundary of the study area is approximately coincident with Interstate-15 in the valleys of Divide Creek and the Big Hole River. The southern boundary extends across the low hills in the McCartney Creek drainage between the towns of Melrose and Twin Bridges. The eastern boundary is along the western edge of the Jefferson River valley and the northern boundary parallels the path of Interstate-90 in Homestake Creek Canyon and in the valley of Blacktail Creek south of Butte. The BHJV Mine was positioned in the center of the model domain.

Dewatering was simulated to assess the quantity of water that would have to be pumped from underground dewatering wells to maintain "dry" conditions in the mine ramps and stopes. A theoretical dewatering blueprint was developed for the BHJV Mine site based on results from aquifer testing of DWW10-01 and site geologic and hydrostratigraphic correlations. The dewatering model used three additional dewatering wells in addition to DWW10-01. The actual dewatering well locations would depend on actual ramp locations as determined by BHJV engineers. A 3-D geologic model developed by BHJV was used to assign hydrogeologic zones for each layer of the model. There were 12 different zones incorporated in the groundwater flow model. The zones represent the different hydrogeologic units. The hydraulic properties of the Meagher and Wolsey Formations were similar to what was obtained from the aquifer test. The hydraulic properties for the other rock units were estimated during the model calibration process and correlated with literature review.

The BHJV geologic model and geologic mapping of the BHJV Mine site area were used to identify several prominent faults and other structural features such as intrusive bodies in the mine area. These faults were incorporated into the groundwater flow model based on aquifer pumping test responses from various monitoring points and pre-mining water levels in monitoring wells and spring elevations across the BHJV Mine site area. BHJV simulated the faults and intrusive bodies of the modeling report as leaky barriers to groundwater flow (low hydraulic conductivity).

Although the flooded workings of the historic Highlands Mine are believed to be hydraulically connected to the BHJV Mine, exploration excavation has not connected the workings physically (BHJV, 2013, Appendix Z). A 3-D drawing of the historic Highlands mine workings was used to assign model elements to each model layer in the historic mine area. The historic workings were represented as an area of high hydraulic conductivity and specific yield. Future mining was not discretely represented in the model because it is only necessary to predict the dewatering rate under existing conditions necessary to maintain a dewatering water elevation below the mine plan target elevations.

Rivers and streams were input model boundaries. During premining steady state conditions, groundwater that does not leave the model by stream flow, flows from the model as groundwater flow. The model was steady-state calibrated to the average long-term flow of the Historic Highlands Mine workings (measured from station WS-1) under base-flow conditions (fall/winter discharge rates) and to water levels measured in the surface monitoring wells before BHJV Mine development was initiated. Transient model calibration was accomplished by matching simulated water level elevations and drawdown to the observed water levels and drawdown measured in wells and piezometers during the 10-day pumping test.

Both steady state and transient model calibration provided mixed results. However, according to the authors, for the purposes of assessing mine dewatering requirements, calibrations are considered adequate (ITASCA, 2012). The differences between measured and simulated water levels in the mine area where dewatering will primarily occur range from zero to approximately eight feet. Reducing the error in these calibration targets would not significantly affect the predicted dewatering requirements.

3.7.3.6 Wetlands Hydrology

In summer 2013, BHJV completed a hydrologic investigation of the wetlands within the two general claims areas via a pre-mining wetland groundwater investigation to determine existing flow directions and gradient through the wetlands in order to assist with the assessment of potential impacts from the mine’s dewatering plan. An Interim hydrological investigation report was completed in November 2012 with additional data acquisition scheduled for late spring 2013 when the annual hydrograph was anticipated to have peaked. The final study results were to be presented at that time. The results of the interim study containing the limited amount of available data were reviewed (Tetra Tech, 2012).

A limited number of data have been collected from the wetlands piezometers. The three drainages monitored are Basin Creek, Fish Creek, and Moose Creek.

Basin Creek Wetlands

Data collected from Basin Creek piezometers (W12-S and -D) suggest a downward hydraulic gradient exists in Wetland 12, indicating that water is percolating into the soil from a surface or near surface source, likely the historic Highlands Mine adit discharge.

Fish Creek Wetlands

Data from Fish Creek Wetland 1 piezometers (W1-S and -D) suggest a relatively small negative (downward) hydraulic gradient during mid- to late-October that became increasingly negative in early November. These data also imply a disconnect between shallow and deeper groundwater. Groundwater levels monitored by the deeper piezometer increased in depth while the shallow piezometer groundwater level remained fairly constant. Given the depth to the water table (greater than 12 feet) it is unlikely that the deeper groundwater system sustains the wetland vegetation in Wetland 1.

Only one pair of piezometers intercepted measurable water in Wetland 2 during the period of record available for this report. Additional data are necessary to evaluate hydrologic conditions at this location.

Moose Creek Wetlands

Data from piezometers installed in Wetlands 1 and 3 in the headwaters of the Moose Creek drainage suggest a negative (downward) hydraulic gradient in both wetland areas; however, the difference in groundwater elevations between both shallow and deep piezometers is sufficiently small (about 1-foot or less) to make it difficult to draw any conclusions at this point as to the nature of groundwater in either wetland.

3.8 Hazardous Materials

Hazardous material at the current mine would be mainly associated with operation and maintenance, of equipment, site personnel, and mined materials which may exert a hazardous characteristic as a result of its composition.

3.8.1 Overview and Study Area

The exploration operation uses various fluids for use as fuel, lubricants, antifreeze, and other maintenance activities which may have hazardous characteristics. These materials have the potential to impact storm water, surface water, and local air quality and are located at the mine site in the lubricant storage area, septic system, and assay laboratory.

3.8.2 Methods

The Storm Water Pollution Prevention Plan (SWPPP), Spill Prevention, Control and Countermeasures (SPCC) Plan, BHJV operating permit, BHJV Project Description Report, and the current Air Quality Permit (#4449-03) outline potential sources of storm water, surface water pollution, and air emissions as a result of exploration activities and are described below.

3.8.3 Results

Hazardous materials which have the potential to be present at the site were identified in the data review. Two types of waste which have the potential to be hazardous and could be generated at the facility would include potential Resource Conservation and Recovery Act (RCRA) wastes and septic wastes. These materials are discussed below.

3.8.3.1 Potential RCRA Wastes

Some materials may be hazardous as products; but as wastes, these same materials may be regulated under RCRA as hazardous waste. Based on review of the documents referenced above regarding exploration materials located at the site, the following materials were noted:

- Motor Oil/Lubricants, including used motor oil, 2,000 gal (Tetra Tech, 2013)
- Diesel Fuel, 1-6,000 gallons (BHJV, 2013)
- Diesel Fuel, 2-15,000 gallons (DEQ, 2011)
- Truck Wash (Tetra Tech, 2013)

All fuel, oils, lubricants and truck wash operations are located on a 50-foot by 80-foot concrete pad covered by a fabric roof and building. The concrete pad provides secondary containment of the materials to meet the requirements of the SWPPP and SPCC plan and includes hydrocarbon skimming and a sediment settling sump sized to contain at least 110 % of the volume of the largest individual tank located inside the facility (BHJV, 2013, Appendix AK). The following fuels and lubricants are stored at this facility:

- 6,000 gallon double walled tank (diesel)
- 2000 gallons oil/lubricants - various bulk sizes

A fuel and lubricant truck will be used to dispense fuel to mobile equipment and a fueling station is included at the site. The fuel and lubricant truck is refilled with fuel at the fueling station, which is located on the concrete pad with spill containment to capture potential spills from fueling operations. Various oils and anti-freeze necessary for mine operations will be stored on the same concrete pad as the fuel tanks (BHJV, 2013; Tetra Tech, 2013).

Used oil may be transported off-site for reuse if not used as a fuel source onsite. Also, hazardous materials are hauled to and from the site by licensed hazardous waste haulers under contract to BHJV (Tetra Tech, 2013).

3.8.3.2 Septic System

A septic system was installed to support the mine operations. The system was approved with the issuance of a Butte Silver Bow County Septic Permit. It was designed and installed to serve up to 49 people in a 24-hour period. According to the operating permit, the total work force at the site would not exceed 49 people on site within a 24-hour period and no septic system expansion is planned (Tetra Tech, 2013).

3.8.3.3 Regulatory Environment

Some hazardous materials must be handled under RCRA. This act regulates the hazardous waste from “cradle to grave.” However, despite exhibiting hazardous characteristics, specific wastes associated with mining may be exempted from RCRA regulation. These materials are addressed in Section 3.3 Waste Rock Geochemistry and Sections 3.6 and 3.7, Surface Water and Groundwater.

In October, 1980, RCRA was amended with the Bevill exclusion, to exclude "solid waste from the extraction, beneficiation, and processing of ores and minerals" from regulation as hazardous waste under Subtitle C of RCRA. Specific requirements for waste materials for exclusion must be mineral processing wastes generated by operations downstream of beneficiation and originate from a mineral processing operation based on being a solid waste as defined by EPA, uniquely associated with mineral industry operations, and must originate from mineral processing operations (EPA, 2012).

Fuels, motor oils/lubricants and other hazardous materials hauled by truck must be transported to and from the site via public roads under the Department of Transportation requirements which include driver training and registration, inspections, manifesting (shipping papers), approved containers, with labeling and placarding requirements primarily under Title 49 CFR (MDT, 2011).

Waste or materials which may impact storm water or surface water are addressed in the SWPPP as part of the Notice of Intent to be covered under the Statewide General Storm Water Permit (NOI MTR 103517) as required by ARM Title 17.30.1101 or the SPCC plan as required by 40 CFR Part 112.2 (Tetra Tech, 2013).

3.9 Air Quality

The air quality of a region is primarily controlled by the type, magnitude and distribution of pollutants and may be affected by regional climate. Transport of pollutants from their source areas are affected by topography and meteorology.

3.9.1 Overview and Study Area

The Proposed Action would occur under a Montana Air Quality Permit issued by DEQ's Air Resources Management Bureau. Sources of potential air quality impacts exist at the proposed mine site where a majority of the activities occur. The ore and waste rock may contain asbestiform minerals. Asbestiform materials have potential to be hazardous to human health. Transportation of ore to the transfer facility and loading on highway-legal trucks would also occur prior to delivery to the milling facility. An additional major source (Title V) permit application would be made to account for the proposed mining activities within twelve months of the startup (DEQ, 2011). Site specific air quality monitoring was not conducted as part of this evaluation.

3.9.2 Methods

Air quality for the project area was described as part of the Air Quality Permit (#4449-03) and the BHJV operating permit application which incorporates regional climate and areas of concern, emission sources, types (fugitive or point source), quantities, and a projected ambient air quality analysis.

3.9.3 Results

The existing air quality and climatic conditions in the vicinity of the Proposed Action are detailed below. It consists of a discussion of conditions which may affect regional air quality and the existing air quality in the affected area.

3.9.3.1 Topography

The proposed BHJV Mine is located in Silver Bow County, Montana which is dissected by the Continental Divide, with the northern half of the project draining to the western side of the Divide and the southwestern and southeastern side of the project draining to the eastern side of the Divide. The Continental Divide can affect climate in the area; however, local climate appears to be uniform and typical of the coniferous mountains of western Montana (BHJV, 2013).

3.9.3.2 Climate and Meteorology

Climate in this area is generally characterized by milder winters and cooler summers in comparison to the remainder of the State. This can be manifested in a shorter growing season, with more cloudiness and humidity.

Temperatures range from – 50° Fahrenheit (F) to over 100° F; however winter season temperatures have been characterized by warmer trends of windy weather commonly known as “Chinooks” where these warmer winds may reach speeds of between 25 and 50 miles per hour.

Precipitation in the area has been largely influenced by topographic features consistent with mountain ranges with the wettest weather on the western side of the Continental Divide. Based on a SNOTEL station located in upper Basin Creek watershed at 7,180 feet above sea level, data show a 30-year annual average precipitation of 24.5 inches with about 10 inches occurring as snow-water equivalent. Most rainfall in the area occurs from May through July.

Snowfall typically occurs between November and March, but has been known to occur as early as mid-September or as late as May. This snowfall is the largest flow contribution to Montana’s streams and rivers (BHJV, 2013).

3.9.3.3 Regulatory Environment

The Clean Air Act, requires EPA to set National Ambient Air Quality Standards (NAAQS) (40 CFR part 50) for pollutants considered harmful to public health and the environment. The Clean Air Act established two types of national air quality standards. The standards or limits based on human health are called primary standards. The limits intended to prevent environmental and property damage are called secondary standards. A geographic area with air quality that is cleaner than the primary standard is called an "attainment" area; areas that do not meet the primary standard are called "nonattainment" areas. Designation of a nonattainment area is a formal rulemaking process under the EPA only after air quality standards have been exceeded for several consecutive years (DEQ, 2011).

Asbestiform materials, in their fibrous, airborne form, have potential to be hazardous to human health through inhalation and can be found in ore and waste rock. Although there is no general ban on the use of asbestos, EPA primarily regulates the material with the National Emission Standards for Hazardous Air Pollutants (NESHAP) and DEQ under the Asbestos Control Act. Some of its many uses have been banned by the Toxic Substances Control Act (EPA, 2013; DEQ, 2013).

The EPA Office of Air Quality Planning and Standards has set NAAQS for six principal pollutants, which are called "criteria" pollutants. These are particle pollution (often referred to as particulate matter (PM)), ground-level ozone as measured by volatile organic compounds (VOCs), which is necessary in the formation of ozone, carbon monoxide (CO), sulfur oxides (SO_2), nitrogen oxides (NO_x), and lead (Pb) (EPA, 2010). The NAAQS set the absolute limit for criteria air quality pollutants. Montana has adopted additional state air quality standards known as the Montana Ambient Air Quality Standards (MAAQS). The Proposed Action must demonstrate continued compliance with all applicable state and federal air quality standards.

The 1990 Clean Air Act amendments require large stationary sources of air pollution to obtain air quality permits. There are two different permitting programs for these sources which include the Title V Operating Permit program and the New Source Review (NSR) program. All major sources, those that have a potential to emit (PTE) greater than 100 tons per year (TPY) of any air pollutant, greater than 10 TPY for any hazardous air pollutants as listed in EPA's Section 112(b)1 Hazardous Air Pollutants (HAPS) (EPA, 2007) or greater than 25 TPY for any combination of HAPS have requirements under the EPA's Title V and NSR programs. The Title V program requires major sources to obtain a permit that consolidates all Clean Air Act requirements for the facility into one document and provides for public participation. The NSR program requires that major sources install the most stringent pollution control technology. All major sources within an attainment area would be required to have a Prevention of Significant Deterioration (PSD) increment evaluation under the federal NSR regulations (DEQ, 2011).

Projects subject to PSD must also demonstrate the use of Best Available Control Technology (BACT) and show that combined impacts from all PSD sources would not exceed allowable increments in air quality for nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and particulate matter – 10 micron (PM_{10}) which includes particles with a diameter of 10 micrometers or less (EPA, 2011). BACT is based on the maximum degree of control that can be achieved. It is a case-by-case decision that considers energy, environmental, and economic impact. BACT can be add-on control equipment or modification of the production processes or methods. BACT may be a design, equipment, work practice, or operational standard if imposition of an emissions standard is infeasible.

3.9.3.4 Existing Air Quality

The Butte PM_{10} non-attainment area is located north of the BHJV Mine; however, the proposed project is outside of the 6.2 mile (10 kilometer) radius of the designated area boundaries. The majority of the particulate emissions from the site would be fugitive in nature (DEQ, 2011). This is also expected during the production phase and is expected to have only localized impacts which diminish quickly with distance. Concentrations of PM_{10} are expected to have negligible impacts to the Butte PM_{10} non-attainment area (Tetra Tech, 2013).

Asbestiform minerals can be present in ore and waste rock. These materials may be hazardous in their fibrous, airborne forms and may pose health concerns when inhaled. Sampling of rock from contact zones where potential asbestiform rock (PAR) mineralization was most likely to occur was completed and analyzed using polarized light microscopy to determine presence or absence of asbestiform minerals. The evaluation resulted in the sample composition of 100% non-fibrous material indicating no presence of PAR (BHJV, 2013).

The project area is within the boundaries of the Smoke Management Units (SMU) 5 and 7 of the Montana-Idaho Airshed Group. This group consists of federal, state, tribal, and private land managers and public health and regulatory agencies which focus on prevention of smoke impacts from fire projects. The SMU forecasts smoke dispersal conditions and coordinates other smoke emissions from other members. The project area is small and not included in areas where prescribed fires are planned; therefore, membership in the Montana-Idaho Airshed group has not been warranted (BHJV, 2013).

The proposed site has had an air quality permit through the DEQ beginning in October 2009 with two permit modifications in October 2009 and October 2011. Modifications in the permit, DEQ ARMB #4449-03, included changes to generators, an addition of a compressor, and a crushing and screening plant.

The permit covers fugitive emissions, those which could not reasonably pass through a stack, chimney vent, or other functionally-equivalent opening (40 CFR Sections 70.2 and 71.2), and point source emissions, those that are released from a single point. Fugitive emissions evaluated for the air quality permit included the following: wet drilling, blasting, travel (transport) of ore trucks, front end loader, shotcrete truck, cement rock fill plant truck, loading, unloading, wind erosion, crushing, screening, transfer of cement rock fill and shotcrete, and a diesel storage tank. Point sources evaluated included the following: three diesel generators, diesel welder, diesel driven compressor, auger and silo loading, crusher, and screener.

An ambient air quality analysis was performed as part of the permit. DEQ determined that the air dispersion modeling demonstration need only account for mono-nitrogen oxides (NO_x) emissions from the new equipment proposed for the current permit. The decision was made in part based on the mine site as a minor source of emission with respect to PSD permitting and it did not require an EIS.

Results of the analysis indicated that the new sources along with a background concentration resulted in a total NO_2 concentration of 183.3 micrograms per cubic meter $\mu g/m^3$ (168.3 $\mu g/m^3$ modeled concentration and 15.04 $\mu g/m^3$ background) which was below the NAAQS of 188 $\mu g/m^3$ and the MAAQS of 564 $\mu g/m^3$ for the NO_2 1-hour limit. The modeled total annual concentration was also below the annual NAAQS and MAAQS as well.

According to the current permit, the facility has a PTE greater than 100 TPY for nitrogen oxides (NO_x) and carbon monoxide (CO). Based on the PTE, DEQ determined that the proposed mine is subject to Title V Operating Permit program and that BHJV would be required to submit an application for a Title V Operating Permit within 12 months of startup of the new equipment referenced in the current permit (DEQ, 2011).

3.10 Power Supply

The BHJV Mine facilities are served by a limited power supply that parallels Forest Service Road No. 84 (Highland Road). The transfer facility would tie into a power line near Interstate-15.

3.10.1 Overview and Study Area

The proposed mine site is a somewhat remote area, but its proximity to roads allows power access. The study area is limited to the mine facilities and all machinery and equipment that require an external power source.

3.10.2 Methods

The existing power supply was assessed using information from the operating permit (BHJV, 2013).

3.10.3 Results

3.10.3.1 Facilities

Currently, the sole power supply to the exploration area consists of a small overhead power line providing limited power to the surface facilities (i.e., office and dry building).

The power line provides electricity to the facilities approved under the exploration license such as the office, dry building, and generator engine block heaters. All other power needs (i.e., shop tent, lube/wash bay tent, the core shed, and equipment such as the crushing plant) would be met by a single generator.

During the production phase of mining, power would likely be supplied by three 365 KW diesel powered generators that would serve as the primary power sources and one 325 KW backup diesel powered generator. Air quality and noise permitting related to power generation at the site are described in Sections 3.9 and 3.11, respectively. The air quality permit would require a modification to include the generators proposed for use during the production phase.

3.10.3.2 Transfer Facility

The proposed transfer facility would tie in to existing power lines paralleling Interstate-15. Power usage would be limited to lighting and office and shop activities.

3.11 Noise

The existing environment includes activities that are approved under the Exploration License, but current activity is low at the site. Since most of the infrastructure was developed under exploration activities, little construction activity would occur during the production phase of mining. For this reason, noise levels during preproduction and production phases at the proposed mine site would not be considerably different than they were during exploration. A noise study was conducted to quantify noise levels during exploration work at the mine (BHJV, 2013, Appendix W).

3.11.1 Overview and Study Area

The area for the noise study completed in 2012 was immediately adjacent to the mine portal pad facility (Figure 1.1-2). The boundary of the portal pad represents the nearest distance that could be achieved between the public and mine-related noise sources other than trucks hauling ore from the mine to the ore-transfer facility adjacent to Interstate-15.

The study area for the proposed private haul road and transfer facility includes a one-half mile buffer along the roadway and a similar buffer around the transfer facility. Both the roadway and the transfer facility would be located in rural areas with few residences nearby. However, the proposed transfer facility would be adjacent to Interstate-15 which is an appreciable source for ambient noise.

3.11.2 Methods

Noise levels were measured on October 30, 2010 during normal operations at nine locations around the boundary of the portal pad using a Quest Technologies Q400 Noise Dosimeter set at "A" weighted, slow response, for a test period of approximately 15 to 20 minutes at each location (BHJH, 2013).

In addition to measuring sound levels during use of exploration equipment, a comparative analysis of similar sized equipment as that proposed for the production phase was conducted to estimate noise levels that could be expected during the proposed project (BHJV, 2013). This part of the noise study used sound level data for similar equipment and processes that were measured during other studies. These data were then applied to equations to estimate sound levels that would occur at the perimeter of the portal pad if that equipment were operated at the BHJV Mine site.

Noise levels for the truck traffic on the proposed haul road were estimated using accepted industrial noise standards (INC, 2010). Given that the proposed transfer facility site is adjacent to a major interstate highway, estimates for ambient noise were estimated using highway noise measurements for the city of Butte.

3.11.3 Results

3.11.3.1 Mine Claims Area

Noise levels measured at the portal pad perimeter during exploration activities ranged from 48.5 to 78.4 dB (Table 3.11-1). The highest of these values were measured in the northeast corner of the property and resulted from proximity to the stationary, diesel powered generator and compressor equipment.

The primary noise sources for the surface operations during mine production would be the following:

- Equipment backup alarms;
- Ventilation fans;
- Rock/ore handling;
- Generators and compressor; and
- Crushing and screening plant.

Of these sources, the greatest sound levels that could be realized by the public during production are expected to occur from the generator and compressor locations and the crushing and screening plant. The noise study concluded that the crushing and screening plant would generate a noise level of 63 dB at the portal pad boundary and that this level would not be great enough to contribute to the overall noise level at the boundary (Joggerst, 2102).

Table 3.11-1. Noise Measurements at Portal Pad Perimeter During Butte Highlands Exploration[1]

Measurement Event	Location Along Portal Pad Perimeter	Average Sound Level (dBA)[2]
1	Western-most point, between recycle pond and Highlands Rest Area	48.5
2	Along Camp Creek Road south of sediment pond	52.2
3	Southern-most point, near entrance to access drive	50.1
4	Eastern edge, south of core shed and offices	48.5
5	Eastern edge, due-east of core shed	68.8
6	North-east tip, north of core shed and east of diesel equipment	71.4
7	Northern edge, due-north of generators and compressor	78.4
8	Northern edge, due-north of slurry plant	69.2
9	Northern edge, west of slurry plant	52.6

[1] From BHJV (2013, Appendix W).
[2] A-weighted decibels.

The noise study also estimated that the maximum overall noise level that would be realized at the portal pad boundary during mine production would be 71 dB. This value was estimated based on a doubling of the sound level for the compressor and combining the measured sound level of the exploration phase generator with data from larger facilities to represent a scenario where three generators are operating simultaneously during production. The resultant sound levels were then used in calculations to represent the distance expected to separate these sources from the portal pad boundary during operations.

3.11.3.2 Haul Route and Transfer Facility

The level of highway traffic noise depends on three things: (1) traffic volume, (2) traffic speed, and (3) the proportion of trucks in the overall traffic load (US Department of Transportation, 1980). Generally, the loudness of traffic noise is increased by heavier traffic levels, higher speeds, and greater numbers of trucks. Vehicle noise is a combination of the noises produced by the engine, exhaust, and tires. The loudness of traffic noise can also be increased by defective mufflers or other faulty equipment on vehicles. Any condition (such as a steep incline) that causes heavy laboring of motor vehicle engines will also increase traffic noise levels.

Montana Department of Transportation (MDT) found that ambient noise levels for Interstate-15 east of Rocker ranged from 60 dB to 65 dB (PBS &J, 2007). Although this study is removed from the project area, the traffic moving into the study area would travel through the section of Interstate-15 that passes the proposed transfer station, and the noise study monitoring location is outside of the reduced speed limit area within Butte, so the speeds and traffic noise are likely to be similar.

3.12 Cultural Resources

This section addresses cultural resources within the BHJV Mine area and the proposed private haul route permit area (Figure 1.1-2). Cultural resources include the locations of human activity, occupation, or usage of the environment that contains sites, features, structures, objects, or landscapes that may have important archaeological and historic values. Cultural resources encompass a wide range of precontact and historic sites that include, but are not limited to, Native American campsites, properties of religious and cultural significance, including Traditional Cultural Properties (TCPs) that might still be in use today, and historic resources such as buildings, structures, objects, and districts. Generally, any site of human activity older than 50 years is considered to be a potential cultural resource.

3.12.1 Overview and Study Area

The Butte Highlands Project area is located within Sections 31 and 32, Township 1 North, Range 7 West; Sections 5 and 6, Township 1 South, Range 7 West; and Section 1, Township 1 South, Range 8 West, of the Montana Principal Meridian. The project area for cultural resources encompasses these Sections, and covers 211 acres. An area of approximately one mile around the 211 acre project area footprint was selected to be the study area for the literature review (Figure 3.12-1). BHJV also proposes to build an ore haulage road and transfer facility within Sections 11, 12, 13, Township 1 North, Range 9 West; and Sections 18 and 19, Township 1 North, Range 8 West to support the transport of ore recovered from their mining operations. The project areas are located on private land and there is no federal regulatory involvement that would trigger a Section 106 consultation under the National Historic Preservation Act of 1966, as amended. This study was prepared to support a mine operating permit requested from the State of Montana.

The Project area is situated on patented and unpatented lands surrounded by both private property and Forest Service lands (Figures 1.1-1 and 1.1-2). The area consists of valley bottom and foothill grasslands, mountain meadow and forest communities dominated by Douglas-fir and lodgepole pine. General elevations within the project area range from 5,700 to 8,000 feet above mean sea level. The project is located on land that has an extensive mining history that includes placer mining, underground mine activities, a processing mill, and a large mining community.

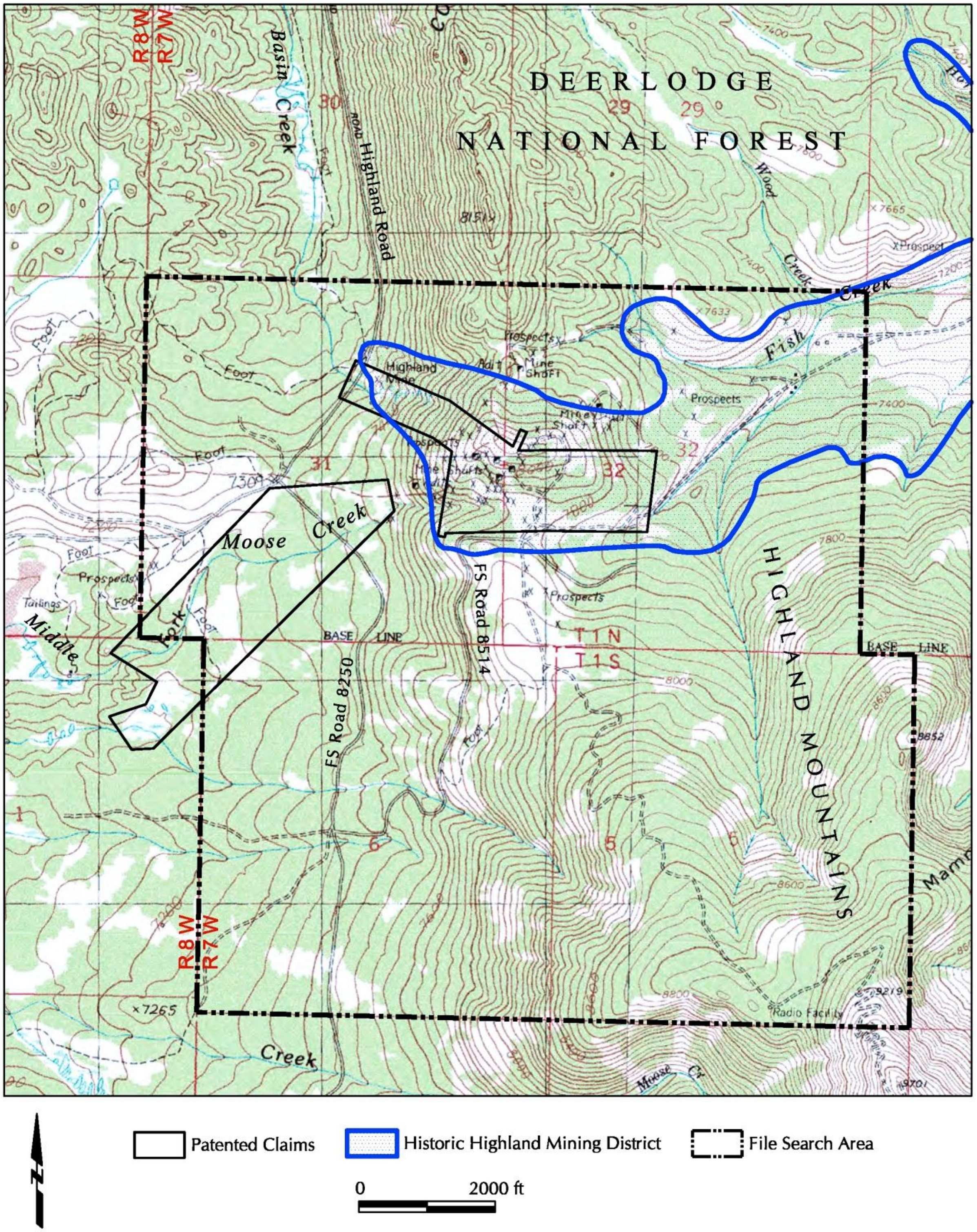


Figure 3.12-1. Cultural Resources Survey Areas for the Proposed Butte Highlands Joint Venture Mine Site. Figure excerpted from BHJV Operating Permit

3.12.2 Methods

The goals of the cultural resources record search and literature review were to: 1) identify previously recorded cultural resources and previously completed cultural resource investigations within the proposed mine project area and surrounding one mile buffer; 2) determine the significance of any identified cultural resources; 3) assess the type and amount of impacts such activities would have on identified cultural resources; 4) provide recommendations for management of any identified cultural resources; and 5) provide determination of effects to any cultural resources identified in this study.

Five separate record searches and literature reviews were conducted with the Montana State Historic Preservation Office (SHPO). Three of the searches were completed within the study area in August 2009, January 2013, and May 2013. The fourth record was conducted in order to complete the entire one mile buffer cultural resource study area and included Section 1, Township 1 South, Range 8 West. The fifth record search was conducted as part of the cultural resource inventory for the proposed 2.5 mile-long private ore haulage road (95 acres) and transfer facility (2 acres) in Silver Bow County, Montana and included Sections 11, 12, and 13, Township 1 North, Range 9 West; and Sections 18 and 19, Township 1 North, Range 8 West. The reviews were used to assess the kind and number of cultural resources that could be affected by the Proposed Action.

In August 2009, as part of the proposed Butte Highlands Project in Silver Bow County, Montana, Western Cultural Resource Management, Inc., (WCRM) requested a file search through the SHPO for Sections 31 and 32 in Township 1 North, Range 7 West and Sections 5 and 6 in Township 1 South, Range 7 West that included a query of the Cultural Resource Annotated Bibliography System (CRABS) for previous project investigations and the Cultural Resource Information Systems (CRIS) for site information. WCRM then used this information to obtain copies of relevant project reports and site forms from the Montana Archaeological Records Office (University of Montana), and the Beaverhead-Deerlodge National Forest. Additionally, WCRM conducted on-line research of the Government Land Office (GLO) cadastral survey plats, the historic indices of the homestead, mineral survey, and other land records for the file search area. Pertinent mineral surveys and plats were then obtained from the Montana State Office Public Room of the BLM. WCRM's research identified 27 project reports, 15 cultural resources, and 12 patented claims. According to the 2010 WCRM report "*A File and Literature Search of the proposed Butte Highland Exploration Project in Silver Bow County, Montana,*" of the 27 reports listed, 18 of the reports were annual administrative activity summaries. The 2009 record search did not include Section 1, Township 1 South, Range 8 West.

In 2012, BHJV's operating permit application was modified with the addition of a proposed ore haulage road and transfer facility. In order to accommodate the permit changes, an updated file search and literature review was conducted with SHPO by Tetra Tech Inc. (Tetra Tech) in January 2013. The updated record search included Sections 31 and 32 in Township 1 North, Range 7 West; Sections 5 and 6 in Township 1 South, Range 7 West; Sections 18 and 19 in Township 1 North, Range 8 West; and the expanded record search included the ore haulage route and transfer facility located within Sections 11, 12 and 13 in Township 1 North, Range 9

West. The updated record search did not reveal any additional project reports or sites within the study area. The expanded record search for the proposed ore haulage road and transfer facility identified six project reports and four cultural resource sites. Between the updated record search and the expanded search, 33 project reports and 19 cultural resource sites were identified. No prehistoric sites were identified.

In May 2013, Tetra Tech conducted a file search of Section 1, Township 1 South, Range 8 West at the request of the SHPO in order to complete the entire one mile buffer cultural resource study area. This record search identified seven project reports (of which three are included within a previous record search) and six cultural resources of which three sites had not been previously included within any BHJV project related reports. The three additional sites do not fall within the Proposed Action area and are located outside the Pony Placer Claim boundary. In addition, prior to the proposed ore transfer facility and haulage road 95-acre intensive pedestrian survey, a file search and literature review was completed for Sections 11, 12, and 13, Township 1 North, Range 9 West; and Sections 18 and 19, Township 1 North, Range 8 West. The search did not reveal any cultural resource sites, but it did reveal one project report. This project concerned an inventory of the Humbug Mountain-Tucker Creek Phosphate Right-Of-Way (Beck, 1984) that is located just outside the survey area as defined above. The combined record searches and literature reviews identified a total of 37 project reports and 22 cultural resource sites within the Project area of which five are located within the Proposed Action areas.

3.12.3 Field Methodology

In addition to the literature review, Tetra Tech conducted an intensive pedestrian survey within the two-acre area of the transfer facility and along the 2.5 mile-long ore haulage road corridor located in Sections 11, 12, 13, Township 1 North, Range 9 West; and Sections 18 and 19, Township 1 North, Range 8 West. The survey area included a 195 foot buffer to ensure an adequate inventory and to allow for minor road alignment adjustments as needed.

The intensive pedestrian inventory covered 95 acres of private land associated with the proposed transfer facility and ore haulage road. Fieldwork was conducted on May 1, 2013 and the pedestrian survey entailed transects that were spaced at 30-meter intervals within the two-acre transfer facility and along the 2.5 mile-long ore haulage road (95 acres). A Trimble GeoExplorer was used to record transects and locations of cultural resources. GPS data was differentially corrected with Pathfinder Office software. All cultural properties were recorded on CRIS forms and no artifacts were collected in the field. The inventory area and cultural resources were photographed with a digital camera. The field survey resulted in the documentation of one historic homestead site (24SB958) located along the proposed ore haulage road.

3.12.4 Results

3.12.4.1 Literature Review

The five combined literature searches resulted in the identification of 37 project reports and 22 cultural resource sites (Table 3.12-1). No prehistoric sites were located within the Project area.

The majority of the 22 sites located within the Project area have not been evaluated for the National Register eligibility criteria; four out of the 22 sites are located within the Proposed Action areas of which all four are located within the Northern Claims Area. Out of these four, two (24SB0064 and 24SB0066) are listed as undetermined, one (24SB0589) is listed as unresolved, and one (24SB0187) is listed as eligible as it contributes to a historic district. Due to the sensitivity of cultural site location information, and its protection under federal and state laws, the locations of the various cultural sites are not presented in this document.

Table 3.12-1. Butte Highlands Previously Recorded Cultural Resources

Site	Site Type	Owner	National Register Status	Year Recorded	Inside/Outside Proposed Permit Boundary
24SB0064	Historic Mining (Red Mountain City)	Forest Service	Undetermined	1977	Possibly Inside
24SB0065	Historic Mining (Cabin and Shaft)	Forest Service	Undetermined	1977	Unknown
24SB0066	Historic Log Structure (Two Cabins)	Forest Service	Undetermined	1977	Possibly Inside
24SB0067	Historic Mining (Highland City)	Forest Service	Undetermined	1977	Outside
24SB0187	Historic Mining District (Highland)	Combination	Eligible	No date	Inside
24SB0357	Historic Placer Mine	Private	Undetermined	1988	Outside
24SB0443	Historic Water Pipeline	Combination	Eligible	1991	Outside
24SB0589	Historic Hard Rock Mine (Highland Mine and Mill)	Combination	Unresolved	1996	Inside
24SB0594	Historic Placer Mine	Forest Service	Undetermined	1997	Outside
24SB0595	Historic Log Structure/ Placer Mine	Forest Service	Undetermined	1997	Outside
24SB0596	Historic Residence/Historic Placer Mine	Forest Service	Undetermined	No date	Outside
24SB0597	Historic Residence	Forest Service	Undetermined	No date	Outside

Site	Site Type	Owner	National Register Status	Year Recorded	Inside/Outside Proposed Permit Boundary
24SB0599	Historic Cribbed Log Structure (Logging)	Forest Service	Undetermined	1997	Outside
24SB0600	Historic Road/Trail (Logging)	Forest Service	Undetermined	1997	Outside
24SB0601	Historic Mining (Placer Ditches)	Forest Service	Undetermined	1997	Outside
24SB0602	Historic Political/Government (FS Administrative Site)	Forest Service	Eligible	1997	Outside
24SB0604	Historic Campsite	Forest Service	Undetermined	1997	Outside
24SB0605	Historic Mining (Highland Cyanide Mill)	Forest Service	Undetermined	1997	Outside
24SB625	Historic Road/Trail (Union Pacific Railroad)	Private	Eligible	2000	Outside
24SB0706	Historic Placer Mine (Highland Flume Placer Mine)	Private	Undetermined	1997	Outside
24SB0780	Historic Irrigation System	Forest Service	Not Eligible	No date	Outside
24SB0802	Historic Mining (Shed and Adit)	Forest Service	Undetermined	2008	Outside

3.14.4.2 Field Survey Results

A 2013 Field Survey conducted by Tetra Tech on May 1, 2013 within the ore haulage road and transfer facility located in Sections 11, 12 and 13 in Township 1 North, Range 9 West resulted in the location and documentation of one historic homestead site (24SB958). This site represents a historic homestead and includes four features: two log barns, a corral and loading chute, and the remains of a third log structure that is likely the homestead residence. The site has been evaluated for integrity and according to Tetra Tech, the site retains integrity of location and setting, but integrity of design, materials, workmanship, feeling, and association have been compromised. This site is recommended not eligible to the NRHP under Criteria A, B, C or D.

3.13 Socioeconomics

The proposed mine site is approximately five miles from the Madison County line, in a somewhat remote area near the Continental Divide, and is surrounded by the Beaverhead-Deerlodge National Forest (Figures 1.1-1 and 1.1-2). The proposed transfer facility and haul route are also within Silver Bow County. Aside from Butte, there are no towns of any size nearby, either within Silver Bow County or in adjacent counties. Silver Bow County and the city of Butte share a combined city-county government, and the federal Office of Management and Budget has designated Butte-Silver Bow County as a Micropolitan Statistical Area (Office of Managment and Budget, 2009). No other counties or towns are included in that designation, indicating that the area is fairly self-sufficient regarding its labor force, employment, and retail activities.

3.13.1 Overview and Study Area

For this study, Silver Bow County is identified as the region of influence (ROI) for socioeconomic resources including population, employment and income, housing, schools, and government and community services.

3.13.2 Methods

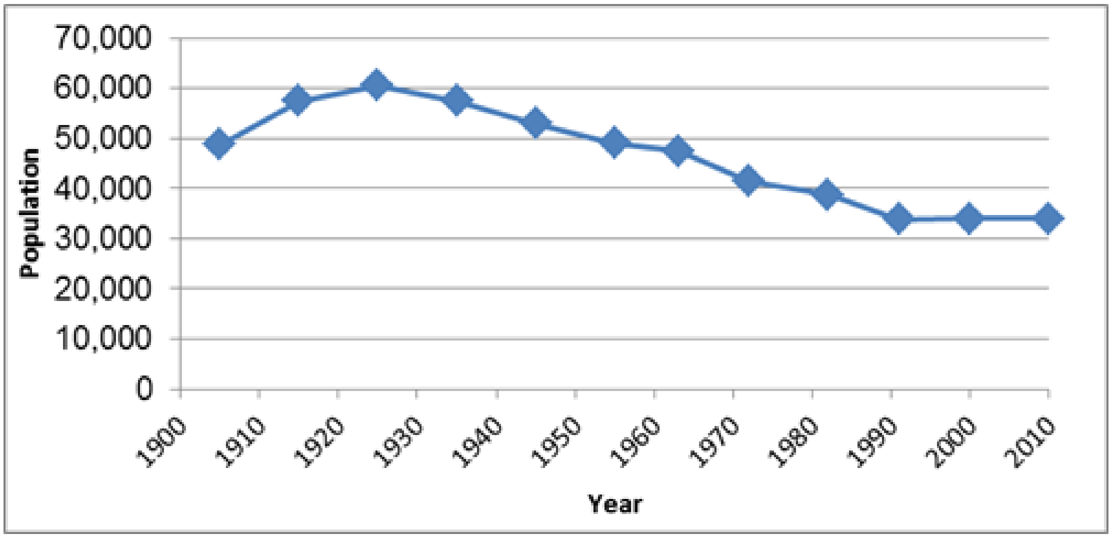
Data were collected from federal and state government sources, including the U.S. Office of Management and Budget; U.S. Census Bureau; U.S. Bureau of Labor Statistics; U.S. Bureau of Economic Analysis; U.S. Department of Interior–National Park Service; Montana Census and Economic Information Center; Montana Department of Labor & Industry; and the Butte-Silver Bow government. Other suitable sources were also used. Spreadsheet analysis was used to determine percentages and produce graphs and tables. In all cases, the study used the latest available data that are consistent and reliable.

The number potential employees (54), which would account for a less than one percent increase in ROI’s 2011 census, was considered insufficient to warrant inclusion of details about housing vacancy rates, or school and infrastructure capacity in the description of the existing environment.

3.13.3 Results

3.13.3.1 Population Characteristics

The Butte area has been a mining center since Native Americans mined chert nearby. In the second half of the 19th Century, a huge influx of Euro-Americans occurred, attracted by gold, silver, and finally, with the advent of electricity, copper. Silver Bow County population peaked around 1920 (Figure 3.13-1), but Butte remained the largest city in Montana until World War II. Today, Butte is Montana’s fifth-largest city (United State Department of the Interior, National Park Service, 2006), (U.S. Census Bureau, 2012a); (Montana Census and Economic Information Center, 2012).



Source: (Forstall 1995; USCB 2012a, 2012b)

Figure 3.13-1. Silver Bow County Population Trends, 1900-2010.

Figure 3.13-1 shows that population over the last two decades has remained very stable, increasing by 0.8 percent, compared to growth rates of about 24 percent over that period for both Montana and the United States (Forstall, 1995; U.S. Census Bureau, 2012a; U.S. Census Bureau, 2012c; U.S. Bureau of Labor Statistics, 2011).

In 2011, Silver Bow County had a population of 34,383, with the city of Butte accounting for 98 percent of the county population. The town of Walkerville, just north of Butte, is the only other population center in the County, with a population 675 in 2010 (U.S. Census Bureau, 2012a; U.S. Census Bureau, 2011).

As Table 3.13-1 shows, the County population in 2011 was nearly 95 percent white, somewhat less diverse than the state of Montana and substantially less diverse than the United States as a whole. The percentage of persons of Hispanic or Latino origin was slightly higher than Montana, but considerably lower than in the United States overall. The median age in the ROI is 41.3 years, about the same as Montana (41.0 years) but slightly higher than the United States overall (38.5 years).

Household income measures the income of all persons living in a household, whether related or not. The ROI's median household income in 2011 was only 76 percent of the United States median and 86 percent of the overall Montana value. Per capita income (PCI) is the total personal income of an area divided by that area's population. The ROI's per capita income of $22,249 represented 80 percent of the United States PCI and 88 percent of Montana's PCI (USCB 2012a).

With 16.4 percent of its population below the poverty level, Silver Bow County has higher rates of poverty than Montana (14.6 percent) and the United States (14.3 percent) (U.S. Census Bureau, 2012a).

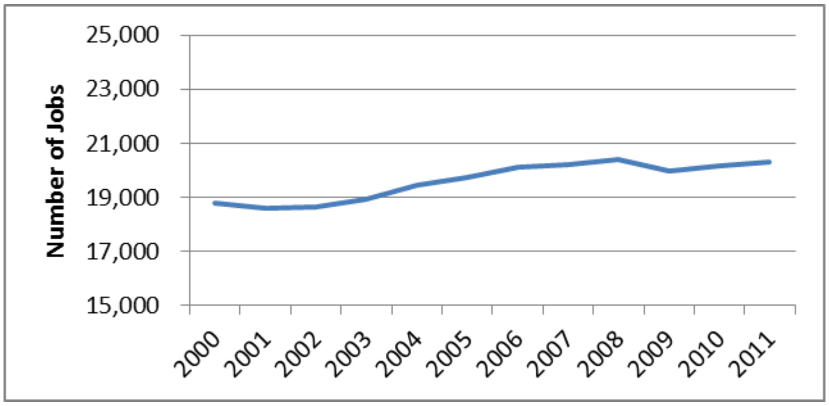
Table 3.13-1. Ethnicity and Income Characteristics for the ROI, Montana, and the United States.

2011 Ethnicity Data	**Silver Bow County**	**Montana**	**U.S.**
	Percent of total		
White	94.8	89.9	78.1
Black / African American	0.5	0.5	13.1
American Indian and Alaska Native	2.1	6.4	1.2
Asian	0.5	0.7	5.0
Native Hawaiian and Other Pacific Islander	0.1	0.1	0.2
Persons reporting two or more races	2.0	2.4	2.3
Persons of Hispanic or Latino Origin[a]	3.7	3.1	16.7
2011 Income Data	**Silver Bow County**	**Montana**	**U.S.**
Median household income 2007-2011	$ 40,030	$ 45,324	$ 52,762
Household income as percent of United States	*76*	*86*	*100*
Household income as percent of Montana	*88*	*100*	---
Per capita income, past 12 months, 2007-2011 (2011 dollars)	$ 22,249	$ 24,640	$ 27,915
Per capita income as percent of United States	*80*	*88*	*100*
Per capita income as percent of Montana	*90*	*100*	---
Persons below poverty level, percent, 2007-2011	16.4	14.6	14.3

[a]Hispanic/Latino persons can be of any race.
Source: USCB 2012a.

3.13.3.2 Economic Characteristics

Employment (the number of jobs) within the ROI has grown over the past decade, with its 20,303 jobs in 2011 representing an 8 percent increase over the 18,786 jobs in 2000 (U.S. Bureau of Economic Analysis, 2012a). This increase was despite the slight decline of about one percent in the ROI's population over the same period. As seen in Figure 3.13-2, employment dipped slightly during the recession of 2008-2009, but by 2011 had recovered beyond 2007 levels.



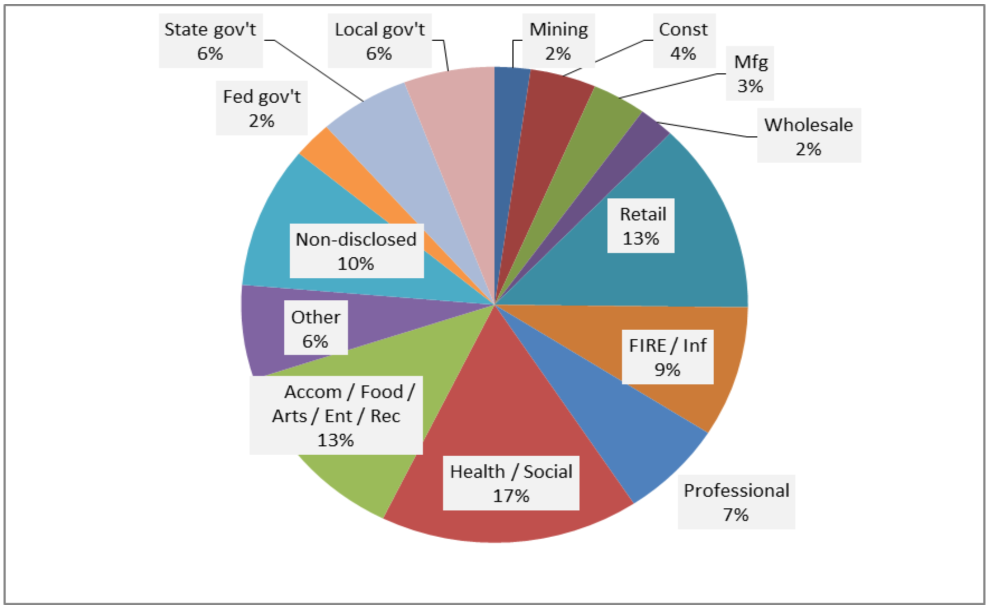
Source: USBEA 2012b.

Figure 3.13-2. Silver Bow County Employment Trends, 2000-2011.

The U.S. Bureau of Economic Analysis (USBEA) reports employment by industrial sector; these data allow an understanding of an area's economic diversity and its ability to withstand downturns in any one sector. Figure 3.13-3 illustrates the economic diversity shown in Butte-Silver Bow County, revealing that the area is more diverse than is typical for areas with a relatively small population. The data show that Butte is a market center, for both retail and services, for Silver Bow County residents and for those in surrounding areas, given the distance to other, larger communities and the difficulties of winter travel between some locations.

As Figure 3.13-3 shows, health care and social services constitute the largest employment sector in the ROI, with 17 percent of jobs. The retail sector and the sectors that include accommodations, food service, arts, entertainment, and recreation each account for 13 percent of employment, followed by finance, insurance, and information services with 9 percent. Other sectors include forestry, fishing, and related activities; utilities; transportation and warehousing; management of companies and enterprises; and administrative and waste management services. These sectors together provide 10 percent of jobs in the ROI, while government jobs at all levels make up 12 percent of total employment (USBEA, 2012c). The ROI's major public and private employers are shown in Table 3.13-2.

The U.S. Bureau of Labor Statistics (USBLS), in cooperation with state labor departments, collects employment and unemployment data for states, counties, and other areas. In 2008, as the recession began, the ROI's unemployment rates began to rise from the decade's low of 3.5 percent in 2006 and 2007. By 2011, the ROI's annual average unemployment rate had reached 6.3 percent, the highest rate during the decade. However, that rate was lower than the annual average rates for Montana (7.3 percent), or the United States (8.9 percent) (U.S. Bureau of Labor Statistics, 2012a; US Department of Labor; Bureau of Labor Statistics, 2012b). In November 2012, the ROI's preliminary unemployment rate had declined to 5.4 percent (Montana Department of Labor & Industry, 2011).



Source: USBEA 2012c.

Figure 3.13-3. Silver Bow County Employment by Sector, 2011.

3.13.3.3 Housing

In 2010, Silver Bow County had a total of 16,734 housing units, of which 15,204 (91 percent) were occupied. Of the occupied units, 66 percent (10,017 units) were owner-occupied, while 34 percent (5,187 units) were renter-occupied; this ratio is approximately consistent with Montana and the United States (U.S. Census Bureau, 2012c).

Of owner-occupied units, 40 percent were valued below $99,999; 33 percent at $100,000 to $199,999; and 24 percent at $200,000 to $499,000. Only three percent of homes were valued above $500,000. The median value of owner-occupied homes in the ROI was $122,500 (U.S. Census Bureau, 2012c).

For renter-occupied units paying rent, the monthly rent on 16 percent of the units was under $299; 62 percent ranged from $300 to $749; 13 percent were from $750 to $999; and 9 percent were over $1,000. The median rent for occupied units paying rent was $573. No rent was paid on 7 percent of total rental units (U.S. Census Bureau, 2012c).

Given Butte's population history, it is not surprising that 40 percent of its housing stock was constructed before 1939, with 14 percent constructed during the 1950s and 11 percent during the 1970s. The remainder is fairly evenly divided among the other decades until 2000, but only six percent of the existing stock has been constructed since 2000 (U.S. Census Bureau, 2012c).

Table 3.13-2. Major Employers, Silver Bow County.

Name	Type of Services	Number of Employees
Public Employers		
Butte-Silver Bow County	Local Government	676
Butte School District #1	Public Schools	564
MT Tech & College of Technology of U MT	Post-secondary Education	412
Private Employers		
Northwestern Energy	Utilities	500 to 999
St. James Community Hospital	Health Services	500 to 999
Acadia Montana	Health Services	250 to 499
Advanced Silicon Materials	Polysilicon Production	250 to 499
Montana Resources	Mining	250 to 499
Town Pump	Retail/Fuel Services	250 to 499
Walmart	Retail	250 to 499
Aware Inc.	Human Services	100 to 249
BSW	Retail	100 to 249
Butte Convalescent Center	Health Services	100 to 249
Community Counseling & Correctional Service	Adult Social Services	100 to 249
Easter Seals - Goodwill	Human Services	100 to 249
Herberger's	Retail	100 to 249
Human Resources Council Dist XII (Head Start)	Human Services	100 to 249
Silver House	Mental Health Services	100 to 249
Community Health Center	Health Services	50 to 99
Harrington Restaurant Supply	Wholesale	50 to 99
Lady of the Rockies Rehab and Living Center	Health Services	50 to 99
MSE Technology Applications Inc.	Engineering Services	50 to 99
Optimum	Cable/Telecommunications	50 to 99
Safeway	Retail	50 to 99
YMCA of Butte	Fitness	50 to 99

[a]Employment numbers for private firms are given only in ranges for privacy reasons.
Source: MT DLI 2012; Nelson 2012.

3.13.3.4 Schools

The Butte School District (public) includes seven elementary schools (K-6), two middle or junior high schools, one high school, and one alternative/adult school. Butte Central Catholic Schools includes one each elementary, junior high, and high school, while Butte Christian School provides pre-K through 12th grade. The Silver Bow Montessori School offers grades pre-K through 3rd grade. There are also three small districts in the rural portions of Silver Bow County: the Divide School District, the Melrose School District, and the Ramsay School District (Nelson Publications, Inc, 2012).

Montana Tech University of Montana, located in Butte and part of the Montana State University system, offers bachelor's and master's degrees in a wide range of programs, and is nationally recognized for its programs in areas related to mining, petroleum, and geology, among others. The College of Technology, under the administrative umbrella of Montana Tech, offers associate degrees and certificates in business, nursing, and technical/occupational fields (Montana Tech of University of Montana, 2012; Nelson Publications, Inc, 2012).

3.13.3.5 Health Care

The ROI is served by St. James Healthcare, whose hospital has 100 licensed beds and 68 in-patient staffed beds, offering a full range of emergency and long-term care. The recently renovated and expanded hospital has 600 employees and 63 physicians. Also located in the ROI are the Community Hospital of Anaconda, a 40-bed facility with emergency and other services, and a Veterans Affairs (VA) Clinic (also in Anaconda), providing primary care for veterans. The ROI also contains the Butte Community Health Center, for limited income residents; a residential center for children and adolescents; a mental health center; senior care facilities; and others (Nelson Publications, Inc, 2012).

3.13.3.6 Government and Community

The City of Butte and Silver Bow County consolidated their governments in 1977; the city-county government ("Butte-Silver Bow" or BSB) is governed by a Council of Commissioners and offers standard city services and employs a total of 676 personnel (as of 2012). In the fiscal year ended June 30, 2011, BSB had revenues of $56.3 million, with 48 percent derived from property taxes, 27 percent from intergovernmental sources, 10 percent from charges for services, and the remaining 15 percent from a variety of smaller sources. During that year, BSB had expenditures of $56.6 million, with 24 percent for public safety, 22 percent for general government, and 10 percent for public works, with the remaining 44 percent divided among several types of expenditures. The 2011 deficit was $314,188, representing 0.6 percent of revenues (Butte-Silver Bow, 2011).

The ROI is served by 99 local law enforcement personnel in the Police Department (which includes the Sheriff's Department) and the Detention Center. There are also three officers and four supervisory personnel from the State Highway Patrol. There are 33 full-time and 350 volunteer fire department personnel covering nine districts. The water supply storage and distribution system was recently updated.

In addition to numerous arts and entertainment opportunities, the community includes several attractions focusing on Butte's mining and environmental history, as well as a number of parks and nature trails (Nelson Publications, Inc, 2012) (Butte-Silver Bow, 2011). The Butte-Silver Bow Public Library has two branches to serve the community and offers a wide array of services (Butte-Silver Bow Public Library, 2012).

3.14 Transportation

The transportation resources related to the proposed BHJV Mine include existing roads and travelways that have the potential to be used to access the mine by personnel or to move ore from the mine to the transfer facility.

3.14.1 Overview and Study Area

This section addresses the transportation corridors being evaluated for access to the mine. Access to the site must be provided by roads managed by Butte-Silver Bow County and the Forest Service. BHJV is in the process of securing permits from Butte-Silver Bow County and the Forest Service for road access to the site. Lease agreements are in place with three private property owners to construct a segment of private road for use as an ore hauling route located between the Forest Service boundary and Interstate-15.

The main employee access route consists of three segments of existing roads, including parts of Roosevelt Drive, Highland Road (Forest Service Road No. 84) and Forest Service Road No. 8520. Roosevelt Drive is a paved winding road along which there are a large number of residential properties and several school bus stops. The other road segments (Highland Road and Forest Service Road No. 8520) have a gravel surface and provide access primarily to Forest Service lands. BHJV has proposed improving Roosevelt Drive by adding pullouts at regular intervals and where visibility requires, resurfacing a portion of the road, and other miscellaneous improvements.

The ore haulage route to Interstate-15 consists of several segments of existing and proposed new roads. These roads include the existing Forest Service Road No. 8520 and Highland Road (Forest Service Road No. 84) at approximately 42,600 feet to the Forest Service boundary, approximately 19,800 feet of a proposed new road on private property, and approximately 3,500 feet of the existing Curly Gulch Road (County Road).

3.14.2 Methods

Transportation resources have been characterized using information provided in the operating permit application (BHJV, 2013), the Project Description and Existing Conditions Report (Tetra Tech, 2013), and the Plan of Operations for Mining Activities on National Forest System Lands (USFS, 2013). Potential effects on recreational access, primarily related to area mountain bike routes, are based on information obtained from the Adventure Cycling Association (Adventure Cycling Association, 2011) and the Butte 100 Mountain Bike Race website (Butte 100, 2011).

3.14.3 Results

3.14.3.1 Vehicle Use and Required Roadway Improvements

The following paragraphs outline the anticipated vehicle trip generation associated with each of the proposed alternatives, as well as the roadway improvements that are anticipated to accommodate the new traffic volumes.

Under the No Action Alternative, it is anticipated that vehicle use on Roosevelt Drive would remain at approximately the same level as existing conditions, except for the potential addition of highway-legal trucks used to haul the ore allowed under the Exploration License. This is estimated to be a 10,000 ton bulk sample requiring 22-ton highway-legal dump trucks to haul approximately 450 truckloads. The approximate number of employee and delivery or vendor trips for the No Action Alternative would be 5 to 10 trips per day, or 25 to 50 trips per week.

It is anticipated that only minor improvements would be required to the Roosevelt Drive route for the No Action Alternative. It should have adequate width, curve radii, and surface conditions for highway-legal trucks to operate. Some minor road base and surface upgrades may be required, as well as some widening at curves and at the railroad trestle underpass.

3.14.3.2 Road Maintenance

Road maintenance requirements would be dependent on the agreements with Butte-Silver Bow County and the Forest Service, and private property owners for respective segments of road. BHJV has committed to properly maintaining the road surface for safe operations for both mine vehicles and general public use. BHJV would work with the Forest Service and Butte-Silver Bow County to work out an equitable road maintenance agreement.

3.14.3.3 Recreational Road Use

This section addresses the shared use of these roadway facilities with area mountain bikers. Section 1 of the Great Divide Mountain Bike Trail is a 530-mile trail from Roosville, MT near the Canadian border to Polaris, MT located west of Dillon. Maps provided by Adventure Cycling Association show that this trail passes through Butte to the south along Highway 2 and then follows the proposed mine access routes along Roosevelt Drive and Highland Road (Forest Service Road No. 84). The trail route would coincide with mine access routes until Highland Road reaches the Forest Service boundary and would deviate where the mine traffic takes the newly constructed roads on private property. The routes would coincide again near the Interstate-15 underpass to Divide Creek Road. Parts of this route are also used for the Butte 100 Mountain Bike Race, which is an annual event held on a Saturday in July with 250 riders.

3.15 Land Use and Recreation

The following sections present a discussion of land uses across the proposed mine site, private section of the haul route, and transfer facility. The operating permit application (BHJV, 2013), including Appendix L, provides additional land use information including a variety of maps showing land use across the project area.

3.15.1 Overview and Study Area

The BHJV Mine is proposed to operate on 310 acres within Sections 31 and 32 of Township 1 North, Range 7 West; Sections 2 and 6 of Township 1 South, Range 7 West; and Section 1 of Township 1 South, Range 8 West (BHJV, 2013). The 310 acres are within existing patented mine claims which are surrounded by the Beaverhead-Deerlodge National Forest (Figure 3.15-1).

Access to the Project would be via public roads and Interstate-15, with the exception of a proposed 347-acre permitted area to develop a haul road on private lands which would connect Interstate-15 with Highland Road and Forest Service Road No. 84. The haul road would be

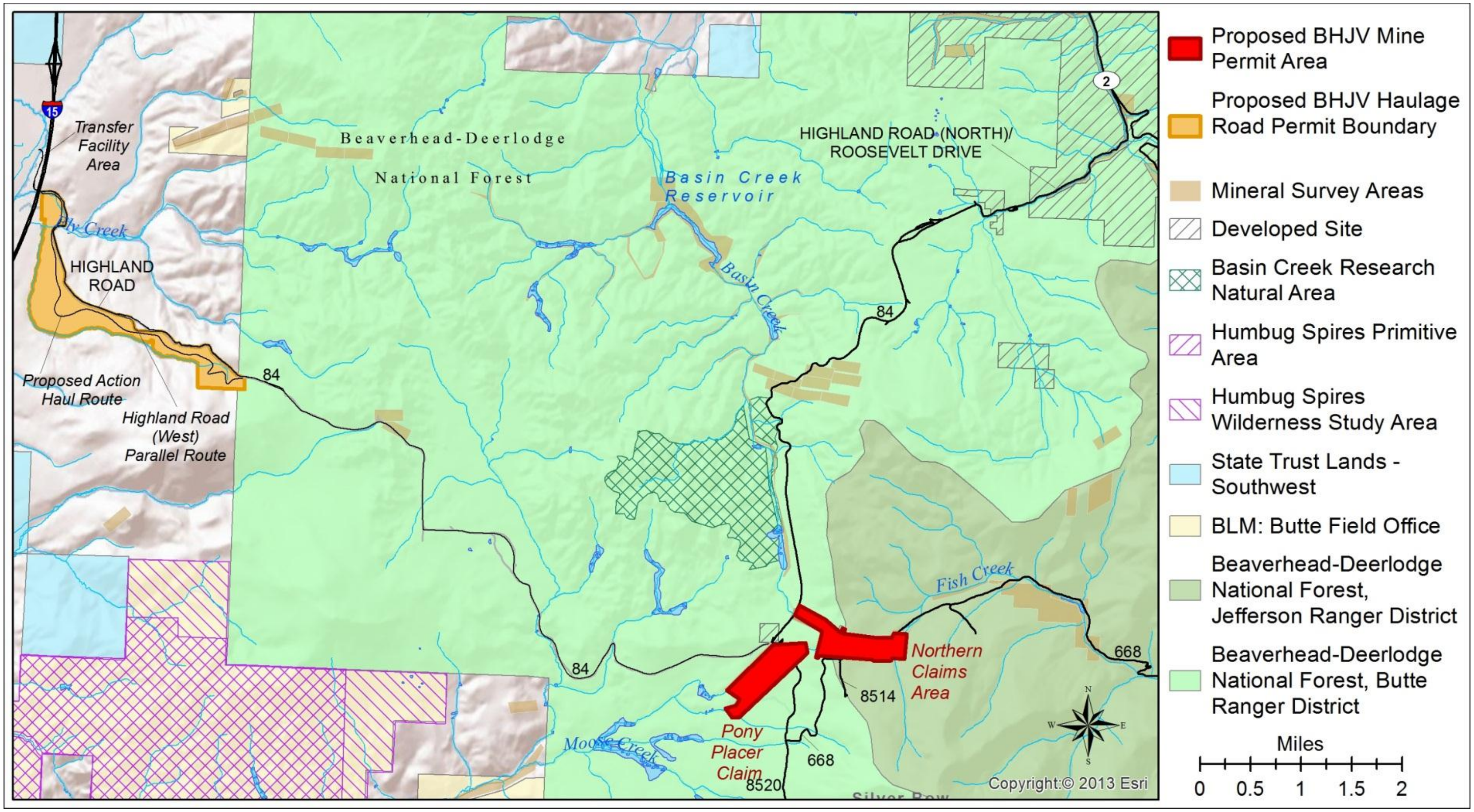


Figure 3.15-1. Land Use Categories in the Vicinity of the Proposed Butte Highlands Joint Venture Mine and Ore Haulage Route and Transfer Facility.

used to gain access to the mine from the west and to haul ore from the mine to a transfer facility located on private land adjacent to Interstate-15. The 2-acre ore transfer facility is located within Section 11, Township 1 North, Range 9 West (Figure 1.1-2). Mine employees would access the mine from the northeast via Roosevelt Drive.

3.15.2 Methods

The BHJV operating permit (BHJV, 2013), Forest Service documents, and various on-line databases were reviewed to evaluate land use at and in the vicinity of the mine operation and the proposed transfer facility. Figure 3.15-1 presents a map showing land ownership and management. The project description report cites the following sources to evaluate land use for the site area (Tetra Tech, 2013):

- Land and Resource Management Plan (USFS, 2009) establishes guidance for resource management for the Forest Service lands surrounding the Site;
- USGS quadrangle maps for Mount Humbug and Pipestone Pass;
- Montana DNRC (http://dnrc.mt.gov);
- Aerial photographs; and
- BHJV operating permit application.

3.15.3 Results

3.15.3.1 Land Ownership

The underground mining activities would be located within mine claims controlled by BHJV. Eleven of the 13 mine claims are patented with two unpatented claims located on Forest Service land (BHJV, 2013). The Richardson Family Trust claims listed below are controlled under a mineral lease agreement with BHJV. Table 3.15-1 presents the list of mine claims and ownership of those claims (BHJV, 2013).

The primary lands surrounding the site are Forest Service and agricultural lands. BHJV (2013) indicates grazing allotments exist within the project area. Areas that are not included in the grazing area are private inholdings and areas north of the Continental Divide. The area north of the Continental Divide is managed to protect water quality within the Basin Creek watershed (BHJV, 2013). There are several private inholdings in the area including land owned by Silver Bow Water, Inc. along Basin Creek, individual or family-owned parcels east and southwest of the site, and private land surrounding the Basin Creek/Highlands rest area (BHJV, 2013). Figure 3.15-1 displays general ownership and land use for the site area.

3.15.3.2 BHJV Mine Permit Area Land Use

Land use of the areas surrounding the proposed mine site are consistent with its location within a National Forest. The forest management plan (USFS, 2009) indicates the Beaverhead-Deerlodge National Forest and site area is used for recreation, including: camping, hunting, fishing, sightseeing, off-highway vehicle use, and snowmobiling. Known hiking, bicycling, and recreational opportunities in the site area include Burton Park, Mount Humbug, and the

Continental Divide National Scenic Trail. The following presents a summary of key use areas (BHJV, 2013):

- The Burton Park Management Area, southwest of the BHJV Mine, is managed for recreational opportunities as well as winter wildlife habitat.
- The Humbug Management Area, west of the BHJV Mine, is managed for recreational use, timber production, and livestock grazing.
- The Table Mountain Recommended Wilderness Management Area protects the wilderness, provides for a year-round non-motorized recreation area, and provides for hunting opportunities.

The Basin Creek Management Area is managed to protect water quality within the Basin Creek watershed. Access to portions of the management area is prohibited year-round. The area is also managed to discourage recreation and promotes wildlife security. Research Natural Areas (RNAs) are also managed within this area to protect primary features such as subalpine forest, riparian areas, herbaceous types, and spruce.

No known utility substations or communication sites are within the proposed project area. However, the Basin Creek and Fish Creek SNOTEL stations and Basin Creek/Highlands rest area are located near the Site (BHJV, 2013).

Timber in and surrounding the site area includes regenerated conifer clearcuts. BHJV (2013) indicated that the majority of the area is not suitable for timber harvest. However, there have been a variety of forest activities for the site area in the last 10 years, including piling and burning, thinning, stocking surveys, plantings, vegetation surveys, and certification of natural regeneration with and without site preparation.

3.15.3.3 Proposed Haul Route and Transfer Facility at Feely

Land use in and around the proposed haul route and transfer facility is predominantly agricultural and rural in nature. The transfer facility would be sandwiched between several transportation corridors. The proposed site is approximately 320 feet west of Interstate-15 and less than 200 feet east of Highway 91 (Frontage Road for Interstate-15) and the Burlington Northern Santa Fe (BNSF) railroad. The foothill area surrounding the proposed new haul route is used for grazing. There are no irrigated or actively cultivated lands within the proposed haul route permit area.

Table 3.15-1. Mine Claim Surface and Mineral Rights Ownership in the Vicinity of the Proposed BHJV Mine and the Associated Haul Route and Transfer Facility, Silver Bow County, Montana.

Mine Claim Ownership		
Mine Claim	**Land Ownership**	**Mineral Rights**
Pony Placer	BHJV	BHJV
Atlantic	Richardson Family Trust	Richardson Family Trust
Barnard	Richardson Family Trust	BHJV
Main Chance	Richardson Family Trust	BHJV
Island	Richardson Family Trust	BHJV
Only Chance	BHJV	BHJV
Red Mountain	BHJV	BHJV
Purchance	BHJV	BHJV
J.B. Thompson	BHJV	BHJV
Murphy	BHJV	BHJV
Main Ripple	BHJV	BHJV
BHC-1 *(Unpatented)*	Forest Service	BHJV
BHC-2 *(Unpatented)*	Forest Service	BHJV

Ownership Adjacent to Haul Road Permit Area	
Legal Description of Property	**Owner Name**
S12, T01 N, R09 W806-B, Parcel 00B, Tracts B, C AKA POR W2SW4, SW4NW4	Garrison Ranches, Inc.
S02, T01N, R09 W S2NE4, S2, LTS 1-4	Divide Creek Cattle Co, Inc.
S13, T01N, R09 W, 806-B, Parcel 001, Tract 1 AKA POR W2, E2	Garrison Ranches, Inc.
S18, T01 N, R08 W, Lot 4, POR SE4SW4, POR S2SE4	Plazzy Acreage, LLC
S19, T01 N, R08 W, ALL EXC 5 Ac NW4	Plazzy Acreage, LLC
S18, T01 N, R08 W, Parcel 000, N2, N2S2, POR S2SE4, POR SE/4SW/4 LYING N & NE of Moose Creek Forestry Rd	Kelly Don R & Lisa G[1]

Ownership of Ore Transfer Facility	
Legal Description of Property	**Owner Name**
S11, T01 N, R09 W, POR LYING WEST of I-15, Parcel ID: 859729	Divide Creek Cattle Co, Inc.

[1] Land owned by the Don and Lisa Kelly is adjacent to the existing county road. The county road and this property would be bypassed by the proposed private section of haul road.

3.16 Visual Resources

The BHJV Mine is proposed as an underground mine with support facilities and equipment located in the immediate vicinity outside the mine portal. These facilities would be visible to the public from certain vantage points. The proposed haul route portion that passes through private lands and the ore transfer facility would also be visible. This section describes visual resources near each of these areas.

3.16.1 Overview and Study Area

A two-mile radius, centered on the portal pad, was selected as the study area for the visual resource analysis. Although visual background views extend beyond two miles, this would cover the general area of the proposed development.

3.16.2 Methods

A visual screen computer image was generated for analysis (Figure 3.16-1). This figure illustrates what a viewer would see of the surrounding landscape from the Highlands Rest Area located near the western edge of the portal pad boundary. Other sources of information reviewed or consulted to augment the analysis provided in the operating permit application:

- Operating permit application (BHJV, 2013);
- Land Use Investigation for the Butte Highlands Project (BHJV, 2013, p. Appendix L);
- 2009 Beaverhead-Deerlodge Revised Forest Plan, Chap 3. Goals, Objectives, and Standards;
- USGS Quadrangle maps: Pipestone Pass, Mount Humbug;
- Google Earth, USDA Farm Service Agency image;
- GIS department, Beaverhead-Deerlodge National Forest, Dillon, Montana; and
- Landscape Aesthetics, Scenery Management System (SMS), USDA FS.

3.16.3 Results

The affected environment for visual resources extends beyond the proposed project boundary to include distant background views. One mile is generally the distance at which man-made disturbances or features are visible to the casual observer (BHJV, 2013). Disturbances or features at greater distances are discernible only as forms, lines, and outlines. Visual resources were distinctly different at the mine site as compared to the lower elevation haul route and transfer facility area. Furthermore, the two areas are separated by several miles; therefore, the results are presented under different headings below.

3.16.3.1 Proposed BHJV Mine Site

The regional landscapes are composed of current and historical levels of visual impacts including, grazing, mining, logging, and recreation. Steep hillsides are dominated by spruce, pine, and fir trees. Unforested areas display a variety of shrubs and grasses. There is also an area of riparian wetlands along Moose Creek and its tributaries.

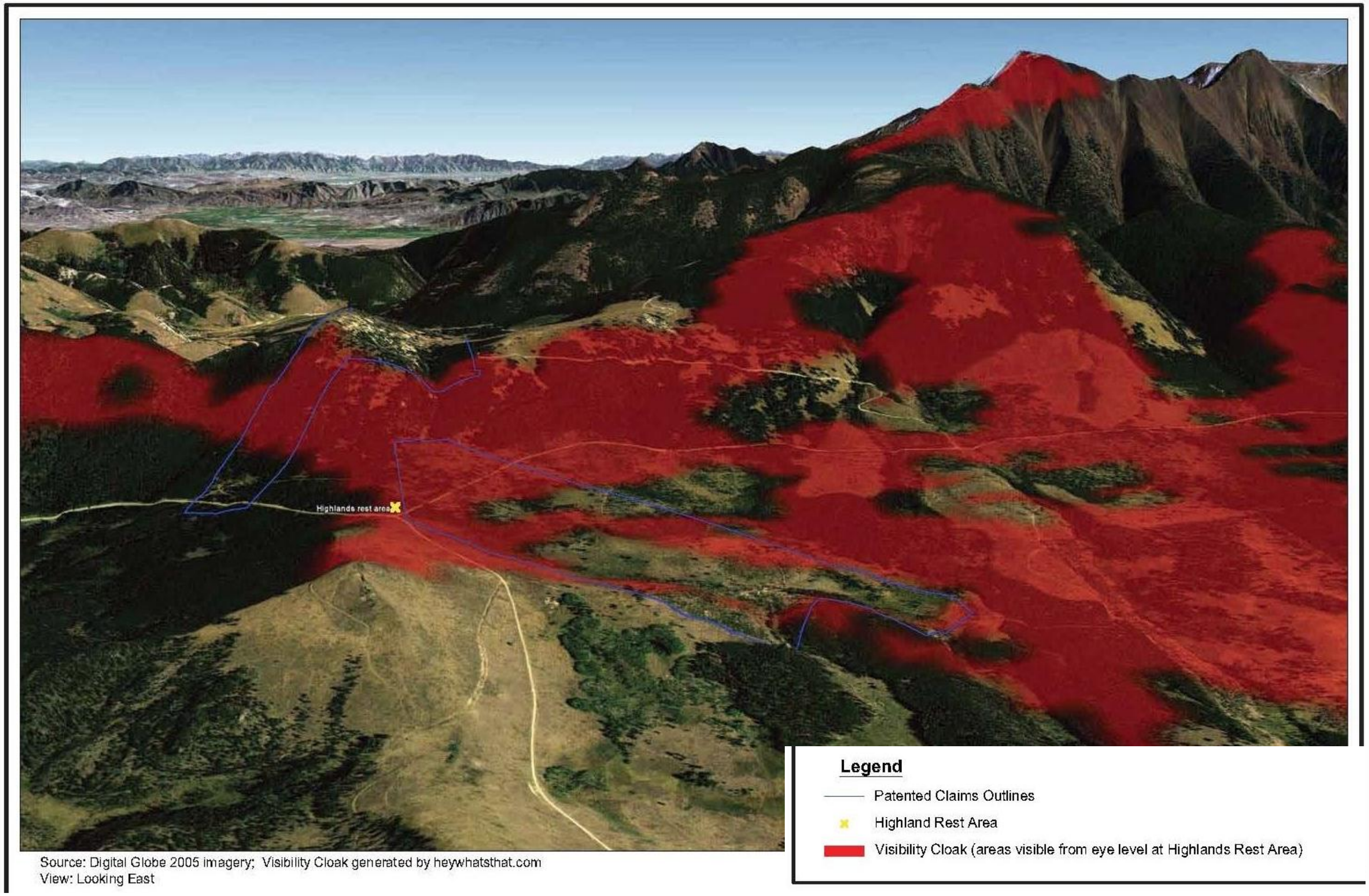


Figure 3.16-1. Visual Screen Computer Image Modeling the Area Visible from the Highlands Rest Area Looking East Toward the BHJV Mine Site. Areas Shaded Red Would be Visible at Eye Level. Figure Excerpted from BHJV Operating Permit.

The proposed mine project is not visible from any major road. However, a public parking and rest area (Highlands Rest Area) for the Continental Divide National Scenic Trail (CDNST) is located adjacent to the property. This would provide a recreational hiker as well as vehicular public access to the project facility site with an immediate foreground view. Landscapes seen close-up are more visually sensitive that those seen in muted detail from a greater distance. The surface facility (portal area) is readily visible while the historic workings are approximately 3,000 feet uphill. The Visual Screen model indicates that the historic mine workings would be out of view from the rest area view point. Visual screening is provided by a densely forested area between the viewer and historic workings at this point. Other viewing opportunities of less than one mile would occur for recreationists and hunters traveling on-foot along the CDNST.

Scenic Integrity is a measure of the degree to which a landscape is visually perceived. It is used to describe an existing situation, standard for management, or desired future condition. Scenic Integrity Levels or Objectives (SIO) for the public area surrounding the project have been mapped and are available from the Forest Service as electronic GIS files. The SIO for the project proximity is mostly mapped as high, with a small portion as moderate. High scenic integrity refers to landscapes where the character “appears” intact. Moderate scenic integrity refers to landscapes where the character “appears slightly altered.”

Scenic attractiveness measures the scenic importance of a landscape based on human perceptions of scenic beauty. Scenic Attractiveness Levels for the public area surrounding the project have been mapped and are available from the Forest Service as electronic GIS files. Most of the area around the project has been mapped as ordinary or common scenic quality (Class B - typical).

Landscape visibility addresses the relative importance and sensitivity of what is seen and perceived in the landscape. Distance is a key factor in this rating as landscapes seen close-up are more visually sensitive than those seen in muted detail from greater distances. Landscape visibility levels for the public area surrounding the project have been mapped and are available from the Forest Service as electronic GIS files. Most of the area around the project has been mapped as mg1, indicating a high level of concern with a middle-ground view. Middle-ground (1/2 to 4 miles) is usually the predominant distance zone at which National Forest landscapes are seen.

3.16.3.2 Proposed Haul Route and Transfer Facility Area

The study area landscape character consists of barren rolling hills to the west at an elevation of 5,800 feet, giving way to coniferous forests at higher elevations (7,000 feet) to the east. Pastureland and roadways influence the views.

The scenic integrity of the lower elevation haul route area is bisected by roads and roadways, poles, and fence lines. A few private residences occur near the existing Highland Road alignment (Paulson, 2013). Visual distance is considerably longer at this site than at the proposed mine site because of the lack of trees and the openness of the valley topography.

3.17 Wildlife Resources

3.17.1 Overview and Study Area

This affected environment description, and study area for baseline evaluation of potential impacts on wildlife, includes the proposed permit boundaries provided in the operating permit application (Figure 1.1-2), and up to one mile downstream from the Northern Claims Area and the Pony Placer Claim.

3.17.2 Methods

The operating permit application (BHJV, 2013) and Project Description and Existing Conditions Report (Tetra Tech, 2013) were reviewed to compile the existing conditions for wildlife. The authors of these reports reviewed the following sources to assess what wildlife species may be using the Project area:

- Forest Service Land and Resource Management Plan for the Beaverhead-Deerlodge National Forest (2009),
- Montana Natural Heritage Program and Montana Fish, Wildlife and Parks (MTNHP, 2013 and MFWP, 2013),
- Montana Field Guide (2012),
- Montana's Comprehensive Fish and Wildlife Conservation Strategy (CFWCS) (2005),
- U.S. Fish and Wildlife Service (USFWS) (2012, 2013), and
- Forest Service Management of Montana's amphibians: a review of factors that may present a risk to population viability and accounts on the identification, distribution, taxonomy, habitat use, natural history and the status and conservation of individual species (USFS, 2000).

Incidental observations of wildlife were recorded during the stream and wetland survey in 2009 (BHJV 2013, Appendix H), and western toad (*Anaxyrus boreas*) surveys were conducted concurrently with fish/aquatics sampling in August 2012 (BHJV, 2013, Appendix AH). Specific project features are at least several miles away from key wintering habitat for elk (*Cervus canadensis)* (V. Boccadori, pers. comm., 2013). However, no wildlife surveys have been completed at the proposed transfer facility and private haul road permit area. Therefore, wildlife populations and habitat conditions along the haul route were assessed based on a site visit in early April 2013, queries of the MTNHP database, and consultation with agency representatives from the FWP, USFWS, and Forest Service.

3.17.3 Results

The vegetation communities providing wildlife habitat are described in detail in Section 3.4.3 of this document. Generally, the Northern Claims Area and the Pony Placer Claim straddle the Continental Divide within the upper portion of the drainages of Basin Creek, Fish Creek, and Middle Fork Moose Creek. The elevation ranges from approximately 7,000 to 8,000 feet. The mine is surrounded by the Beaverhead-Deerlodge National Forest and the vegetation is composed primarily of forest areas dominated by fir, pine, and spruce; and non-forested areas vegetated with shrubs, forbs, and grasses (BHJV, 2013). The Pony Placer Claim area is gently sloping with scattered wet meadows and stands of aspen and spruce. Riparian wetlands exist along reaches of Middle Fork Moose Creek and its tributaries that flow through this area. The proposed mine permit area is steep, with conifer coverage ranging from sparse to dense. The area includes the headwaters of Basin Creek, but does not include important riparian or wetland habitat.

The proposed private haul road permit area ranges from about 7,000 feet elevation in Douglas-fir and mixed fir/lodgepole pine forest, to about 5,600 feet elevation in low- to moderate-cover grassland habitats and sagebrush communities. There is riparian habitat along the route. The ore transfer area, located adjacent to Divide Creek, is primarily vegetated by sagebrush but includes some riparian vegetation adjacent to Divide Creek.

The Project Area falls in the general range of many forest wildlife species: ruffed grouse (*Bonasa umbellus*), spruce grouse (*Falcipennis canadensis*), mountain lion (*Puma concolor*), gray wolves (*Canis lupus*), black bear (*Ursus americanus*), elk, moose (*Alces alces*), mule deer (*Odocoileus hemionus*), and bighorn sheep (Ovis canadensis) (BHJV, 2013, Appendix H). During the 2009 incidental observations, ruffed grouse, red-winged blackbird (*Agelaius phoeniceus*), green-winged teal (*Anas carolinensis*), western toad, Columbia spotted frog (*Rana luteiventris*), mule deer, elk, and possibly a wolf were observed within the Project Area (BHJV, 2013, Appendix H) Western toads, Columbia spotted frogs, and long-toed salamanders (*Ambystoma macrodactylum*) were observed in upper Middle Fork Moose Creek and along Fish Creek in 2012 (BHJV, 2013, Appendix AH).

Table 3.17-1 includes Montana Species of Concern (SOC) and species listed by USFWS that are known to occur within Silver Bow County in general; those known from within 2 miles of the Project Area; and sensitive species found in the Beaverhead-Deerlodge National Forest (MTNHP and MFWP, 2012; MTNHP, 2013; USFS, 2011; USFWS, 2013). Montana SOC are native animals breeding in the state that are considered to be "at risk" due to declining population trends, threats to their habitats, and/or restricted distribution. The designation as a Montana SOC is based on the Montana Status Rank, and is not a statutory or regulatory classification. These designations provide information that helps resource managers make proactive decisions regarding species conservation and data collection priorities.

Table 3.17-1. Montana Special Status Species in Silver Bow County and Sensitive Species in Beaverhead-Deerlodge National Forest (BDNF).

Common Name	Scientific Name	USFWS[1]	Forest Service	MT Species of Concern and Tier[2]	Verified occurrences in		
					BDNF	Within 2 mile radius of project[3]	Within Silver Bow County
Fisher	*Martes pennanti*		Sensitive	SOC-2	Yes		
Grizzly bear	*Ursus arctos horribilis*	T	Sensitive	SOC-1			
Wolverine	*Gulo gulo*	PT	Sensitive	SOC-2	Yes	Yes	Yes
Pygmy Rabbit	*Brachylagus idahoensis*		Sensitive	SOC-1	Yes		
Northern Bog Lemming	*Synaptomys borealis*		Sensitive	SOC-1	Yes		
Bighorn Sheep	*Ovis canadensis*		Sensitive		Yes		
Townsend's Big-eared Bat	*Corynorhinus townsendii*		Sensitive	SOC-1	Yes		Yes
Hoary Bat	*Lasiurus cinereus*			SOC-2			Yes
Fringed Myotis	*Myotis thysanodes*		Sensitive	SOC-2	Yes		Yes
Long-eared Myotis	*Myotis evotis*		Sensitive		Yes		
Long-legged Myotis	*Myotis volans*		Sensitive		Yes		
Spotted Bat	*Euderma maculatum*		Sensitive	SOC-1	Yes		
Preble's Shrew	*Sorex preblei*			SOC-2			Yes
Great Basin Pocket Mouse	*Perognathus parvus*		Sensitive	SOC-1	Yes		
Northern Goshawk	*Accipiter gentilis*			SOC-2		Yes	Yes
Bald Eagle	*Haliaeetus leucocephalus*		Sensitive		Yes		Yes
Golden Eagle	*Aquila chrysaetos*	BGEPA MBPA SCC		SOC-2			Yes

Common Name	Scientific Name	USFWS[1]	Forest Service	MT Species of Concern and Tier[2]	Verified occurrences in BDNF	Verified occurrences in Within 2 mile radius of project[3]	Verified occurrences in Within Silver Bow County
Harlequin Duck	*Histrionicus histrionicus*		Sensitive	SOC-1	Yes		
Trumpeter swan	*Cygnus buccinator*		Sensitive	SOC-1	Yes		
Veery	*Catharus fuscescens*			SOC			Yes
Greater Sage-Grouse	*Centrocercus urophasianus*	C	Sensitive	SOC-1	Yes		Yes
Brown Creeper	*Certhia americana*			SOC-2		Yes	Yes
Pileated Woodpecker	*Dryocopus pileatus*			SOC-2			Yes
Black-backed woodpecker	*Picoides arcticus*		Sensitive	SOC-1	Yes		
Peregrine Falcon	*Falco peregrinus*	DM	Sensitive	SOC-2	Yes		Yes
Black Rosy-Finch	*Leucosticte atrata*			SOC-2		Yes	Yes
Brewer's Sparrow	*Spizella breweri*			SOC-2			Yes
Flammulated Owl	*Otus flammeolus*		Sensitive	SOC-1	Yes		
Great Gray Owl	*Strix nebulosa*			SOC-2			Yes
Western Toad	*Anaxyrus boreas*		Sensitive	SOC-1	Yes		Yes

[1]BGEPA: Bald and Golden Eagle Protection Act
[2] MT Fish, Wildlife and Parks has 4 conservation status tiers based on levels of conservation need. This table includes Tier 1 (greatest conservation need) and Tier 2 (moderate conservation need).
[3] MT NHP 2013
MBTA: Migratory Bird Treaty Act

USFWS Categories
C: Candidate-Those taxa for which sufficient information on biological status and threats exists to propose to list them as threatened or endangered.
DM: Recovered, delisted, and being monitored
PT: Proposed as threatened

While the federally listed Canada lynx (*Lynx canadensis*) may occur in habitats such as those in the Wildlife Analysis Area, the MTNHP and USFWS have not reported any verified occurrences in Silver Bow County (MTNHP, 2012; Dixon, pers. comm. 2013). Grizzly bears (*Ursus arctos horribilis*) were recently added to the USFWS list of species verified in Silver Bow County (Dixon, pers. comm. 2013). Grizzly bears currently occur on the Beaverhead-Deerlodge National Forest in low densities and appear to be expanding their range (Dixon, pers. comm. 2013). Wolverine (*Gulo gulo*), proposed to be listed by the USFWS as threatened, are confirmed as occupying the Project Area where there is forest cover (MTNHP, 2013). Although the MTNHP shows greater sage grouse (*Centrocercus urophasianus)* as occurring along the western portion of the proposed haul route permit area and transfer facility, this area is marginal sage grouse habitat (Boccadori, pers. comm. 2013).

3.18 Aquatic and Fisheries Resources

The character of the aquatic resources at the proposed BHJV Mine site is distinctly different from the lower elevation areas near the proposed haul route and transfer facility. Therefore, this section is arranged into sections describing the waterbodies and resources at each area.

3.18.1 Overview and Study Area

The mine project area covers three different watersheds which consist of mainstem and tributary streams providing flows to the Clark Fork, Big Hole, and Jefferson Rivers. Seven streams were analyzed for baseline conditions and have been considered as potentially receiving impacts from the proposed project. Four of the streams are located in and around the Pony Placer Claim area along the Continental Divide. Those four streams are Basin Creek, Fish Creek, Middle Fork Moose Creek and an unnamed tributary to Middle Fork Moose Creek (BHJV, 2013). Three additional streams, Fly and Divide Creeks and Climax Gulch, intersect the proposed private haul road permit area and the proposed ore transfer facility. These streams flow through lower elevations of 5,600 to 6,800 feet above mean sea level. Fly Creek parallels the lower section of Highland Road, originating just outside of the Forest Service boundary. The reach of Climax Gulch that would be affected by the proposed project flows northwest, parallel to the existing alignment of Highland Road and is tributary to Divide Creek. Divide Creek flows southwest near Interstate-15 and alongside the proposed ore transfer facility. These waterbodies and their water quality characteristics are discussed in Section 3.6.

Basin, Fish, and Middle Fork Moose Creeks

Basin Creek flows to the northwest and originates within the BHJV Mine area. This stream is tributary to the Clark Fork River which ultimately discharges to the Columbia River. Fish Creek is a tributary to the Jefferson River and flows in an easterly direction from the project area. Fish Creek lies mostly outside of the proposed Project area, but could be subjected to effects from uphill sources or changes to groundwater supply. The Middle Fork Moose Creek and its unnamed tributary flow to the southeast from the project area and relatively large portions of the Middle Fork Moose Creek are found within the project area boundaries with a relatively short portion of the unnamed tributary intersecting the Project area. Moose Creek and its tributary streams are tributaries to the Big Hole River.

Fly and Divide Creeks and Climax Gulch

The haul road alignment runs adjacent to or crosses three streams including Divide Creek, Fly Creek and Climax Gulch. All three streams are tributary to the Big Hole River.

3.18.2 Methods

Fisheries populations, fish habitat, benthic macroinvertebrates, and periphyton were studied for baseline conditions in 2009 and 2011 in support of the proposed BHJV Mine site portion of the project. Resulting reports are contained as appendices to the operating permit application (BHJV, 2013, Appendices I and AD). Fisheries populations were surveyed for the presence or absence of fish species with an additional focus of determining relative abundance. Stream sections were blocked with nets to limit emigration and immigration during sampling periods made from downstream ends to upstream ends. Fish captured were identified and inspected with relative abundance numbers estimated by calculating a catch per unit effort. Captured fish were released back to the stream after processing.

The evaluation of fish habitat was made by following protocols published in the EPA manual, *Rapid Bioassessment Protocols for Use in Streams and Rivers* (Barbour et al., 1999). This methodology evaluates habitat quality by individually rating several habitat features. The physical and water quality parameters rated included those that are pertinent to the characterization of the stream habitat, and include such items as; in-stream features, water quality and sediment/substrate.

Benthic macroinvertebrate samples were collected in the field and then transported to a laboratory for taxonomic evaluation. At each sample location, three replicate samples were collected from high-gradient riffles using a travelling kick net method to sample an area of approximately 0.5 meters. Benthic macroinvertebrates are aquatic insects, shellfish, and snails that cling to rocks and other material in the streambed and can be collected by disturbing the substrate and allowing the dislodged organisms to be collected in the kick net. Each set of three samples is then combined and a partial sample of up to 500 individuals is identified to the lowest practical taxonomic level, usually genus or species, with a reference collection compiled for future use.

Periphyton are aquatic plants that grow on underwater surfaces such as rocks or logs. This community was sampled from a representative section of stream by selecting a representative sample of removable substrates, rocks and logs, throughout the total stream reach. Selected substrate pieces were removed from the stream and an approximate area of 0.01 square meters (10 cm on a side) was scraped of attached algal growth and placed in a labeled sample container. Periphyton grows best in shallow water areas where sunlight is prevalent, and these areas were targeted for sample collection. Collected samples were preserved and stored using standard scientific protocols. Single-celled aquatic plants, called diatoms, that were present in the streams were also identified from the samples.

Additional visual surveys were completed in 2013 along the proposed haul route and near the transfer facility site, but no biological sampling was conducted (Confluence, 2013). Reaches of Divide Creek, Fly Creek, and Climax Gulch within the project area were visually inspected and photographed between April 10 and 13, 2013 to assist in determining the potential for fish to inhabit streams within the project area that contain no data in the Montana Fisheries Information System (Confluence, 2013; MFISH, 2013).

3.18.3 Results

3.18.3.1 Basin, Fish, and Middle Fork Moose Creeks

The MFWP maintains a database (http://fwp.mt.gov/fishing/mFish/) of fish occurrences that is updated annually using public or published data from other federal and state agencies, tribes, and technical documents. Based on information contained in the database, several fish species have the potential to occur within or near the proposed project. Those fish species are: westslope cutthroat trout (*Oncorhynchus clarki lewisi*), Yellowstone cutthroat trout (*Oncorhynchus clarki bouvieri*), rainbow trout (*Oncorhynchus mykiss*), cutthroat and rainbow trout hybrids (*Oncorhynchus* species), brook trout (*Salvelinus fontinalis*) and mottled sculpin (*Cottus bairdii*). Of those species the westslope cutthroat trout and Yellowstone cutthroat trout are species of concern; classified as a sensitive species due to declining population trends, habitat loss, or restricted distribution (MTNHP, 2013). Fisheries and aquatics surveys conducted in 2011 confirmed the presence of westslope cutthroat and Yellowstone cutthroat trout in the five streams surveyed (AMEC, 2013). Westslope cutthroat trout populations are known to occur in Basin Creek and Fish Creek (Spoon, FWP, pers. comm. 2013). Fish populations encountered during surveys were relatively small, but did show evidence of being self-sustaining with the discovery of young of the year or year-one fish captured during surveys (AMEC, 2013).

Basin Creek had the highest catch per unit of effort. All fish captured appeared to be slower growing than the average for Montana streams, most likely because of the high altitude conditions in the small streams that limit overall productivity. Fish habitat surveys completed in 2009 found that, in general, streams surveyed were heavily embedded with fine particle substrates, stream bank erosion, fragmented fish habitat, and a scarcity of pools.

In general, Moose Creek had the lowest fisheries habitat value because of its low flow conditions. Moose Creek contributes to a large wet meadow complex and has a poorly defined channel in some portions. Basin and Fish Creeks scored high on habitat and fishery values as well as supporting a more diverse benthic macroinvertebrate community than the smaller tributary streams and Moose Creek (AMEC, 2013).

3.18.3.2 Fly and Divide Creeks and Climax Gulch

Divide Creek is a tributary to the Big Hole River and begins at the confluence of the East Fork and the North Fork of Divide Creek. Divide Creek flows south approximately 11.8 miles along the west side of Interstate-15 before joining the Big Hole River near the town of Divide, Montana. The MFISH assigns upstream and downstream endpoints based on river stationing beginning at the mouth of the creek at the confluence with the Big Hole River (stream mile 0.0) and extending upstream to the junction of the East and North Forks of Divide Creek (stream mile 11.8). The existing alignment of the Highlands Road crosses Divide Creek just west of Interstate-15 at approximately stream mile 10.9 (Figure 2.5-2) and runs adjacent to the creek for approximately 1/3 mile before turning east and crossing under Interstate-15. Divide Creek is listed as being periodically dewatered between stream mile 0.9 and 10.4 (MFISH, 2013). Several irrigation diversions appear to influence the hydrology of Divide Creek, and may cause Divide Creek to become dewatered during drier years. MFWP maintains a minimum instream flow of 3.0 cubic feet/second (cfs) in Divide Creek (MFISH, 2013). The priority date of this water right is July 1, 1985.

Fly Creek is a headwater stream which originates in the Highland Mountains and flows west and north approximately 3.7 miles prior to terminating near the confluence of Climax Gulch and Divide Creek (Figure 2.5-2). The downstream end of Fly Creek is captured by a ditch, severing its historic connection to either Divide Creek or Climax Gulch (Confluence, 2013). An irrigation ditch originating on Curly Gulch currently runs west across the downstream end of Fly Creek, and continues west through a culvert beneath Interstate-15. The ditch terminates in a meadow west of Interstate-15 and provides no direct connection between Fly Creek and Divide Creek. As a result, Fly Creek is essentially an isolated stream channel.

The MFISH database and MFWP have no sampling records for Fly Creek (MFISH, 2013). The lack of fish data in MFISH does not necessarily imply Fly Creek is fishless, as many small, isolated streams remain populated by various fish species. However, no fish were observed in Fly Creek during a visual inspection of the channel during the April 10 to 13, 2013 field investigation. Limiting aquatic habitat conditions along the length of the channel included lack of channel depth, vertical barriers, and low discharge. The stream does not appear to support fish populations (Confluence, 2013).

Climax Gulch is a headwater stream originating in the Highland Mountains and runs west and south approximately 4.3 miles prior to its confluence with Divide Creek. The existing alignment of the Highlands Road crosses Climax Gulch just east of Interstate-15. The MFISH database and MFWP have no sampling records for Climax Gulch or Curly Gulch (MFISH, 2013). Although no fish were observed during a visual inspection of Climax Gulch during the site visit from April 10 to 13, 2013, the stream is perennial, exhibits adequate habitat for trout, sculpin, and suckers (*Catostomus* spp.), and has a direct connection to Divide Creek. As a result, one or more of these fish species are likely to reside in Climax Gulch within the project reach (Olson, pers.comm. 2013; Confluence, 2013). The MFISH record for Climax and Curly Gulches indicates MFWP manages both streams as trout waters.

Table 3.18-1. Fish Species Data for the Seven Creeks Included in the BHJV Mine Permit Boundaries or the Proposed Haul Route Permit Boundary. Data are for the Reaches That Intersect or are Contained within These Boundaries.

		BHJV Mine Site Area				Proposed Haul Route Area		
Waterbody		**Basin Creek**	**Fish Creek**	**Moose Creek**	**Tributary to Moose Creek**	**Divide Creek**	**Fly Creek**	**Curly Gulch**
	Species origin	Species Presence[a]				Species Presence[a]		
Westslope cutthroat *Oncorhynchus clarkii lewisii*	Native SOC	Common	Rare				No data	No data
Yellowstone cutthroat *Oncorhynchus clarkii bouvieri*	Native[b] SOC			Abundant	Common		No data	No data
Brook trout *Salvelinus fontinalis*	Introduced	Rare	Abundant	Common		Abundant	No data	No data
Rainbow trout *Oncorhynchus* spp.	Introduced		Rare			Common	No data	No data
Mottled sculpin *Cottus bairdii*	Native			Common (lower reaches)		Abundant[c]	No data	No data
Longnose sucker *Catostomus catostomus*	Native	Common				Common[c]	No data	No data
Fisheries Resource Value[d]		4	3	3	No data	3	No data	No data
Trout water?		Yes	Yes	Yes	Yes	Yes	Yes	Yes

Sources: (AMEC, 2013) (FWP, 2013) (Confluence, 2013)
[a] Species presence based on field surveys between 2007-2013 (MFISH 2013)
[b] Yellowstone cutthroat trout are native to Montana, but have been introduced into the Clark Fork Watershed.
[c] Species presence based on professional judgment
[d] Fisheries Value is calculated by MT FWP using a series of habitat, water quality, fish population, and recreational value indices. Values are as follows: 1= Excellent, 2=Outstanding, 3= Substantial, 4= Moderate, 5= Poor

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Chapter 4: Alternatives Analysis

4.1 Introduction

Chapter 4 describes potential impacts to the existing environment that could occur due to the Proposed Action, the No Action Alternative, Alternative Haul Routes, and Agency-Mitigated Alternative (i.e., the alternatives carried forward for detailed analysis). Under the No Action Alternative, DEQ would not approve the BHJV's application for an operating permit. DEQ's issuance of an exploration license would remain in effect and result in environmental impacts from BHJV's exploration activities. DEQ completed an environmental assessment prior to issuing the exploration license (DEQ, 2009). The Proposed Action analyzes potential impacts stemming from the additional disturbance and activities included in BHJV's operating permit application.

The Agency-Mitigated Alternative addresses additional water quality monitoring and moving the water treatment facility to the surface of the mine to facilitate year-round maintenance. The Agency-Mitigated Alternative primarily addresses issues under water quality; therefore, impacts analysis for the Agency-Mitigated Alternative will be concentrated in Section 4.6 and 4.7.

Each alternative is described in Chapter 2. Chapter 4 serves three purposes: (1) it provides an analysis and comparison of alternatives and their impacts; (2) it ensures that DEQ has a clear understanding of the potential impacts, both positive and negative, of all alternatives under consideration; and (3) it provides the public with information to evaluate DEQ's alternatives, including the Proposed Action. Impacts are assessed for the same environmental components discussed in Chapter 3, including water, geology, soils, land use, socioeconomics, fisheries, vegetation, wildlife, air quality, cultural resources, and visual resources.

MEPA defines three levels of potential impacts: primary, secondary, and cumulative. In some instances, impacts can be minimized or avoided altogether by making changes to an alternative. These changes are called "mitigation." Mitigation may become part of the operating permit if the decision-maker decides the mitigation is necessary to comply with the substantive provisions of the MMRA. The three levels of impacts and potential mitigation are examined for each resource area as described below.

4.1.1 Primary Impacts

Primary impacts are defined by MEPA as those impacts that have a direct cause and effect relationship with a specific action, i.e., they occur at the same time and place as the action that causes the impact. One result of implementing the Proposed Action would be the development of the section of the proposed haul route on private land and the associated transfer facility. As described in Chapter 2, there would be some additional surface disturbance associated with the Proposed Action. Although many of the activities that would occur under the Proposed Action would stem from existing approvals under the Exploration License, the duration and extent of some of these activities, such as the extent of mining or the duration of mine operation would be expanded under the Proposed Action.

4.1.2 Secondary Impacts

Secondary impacts to the human environment are indirectly related to the agency action, i.e., they are induced by a primary impact and occur at a later time or distance from the triggering action. For example, a possible secondary impact of drawing down the water level in the proposed mine would be the potential for changes in the water table in the surrounding area.

4.1.3 Cumulative Impacts

Cumulative impacts include the collective impacts on the human environment within the borders of Montana of the Proposed Action or any alternative under consideration in conjunction with other past, present, and future actions related to the alternative under consideration by location or generic type (75-1-220(4), MCA). Cumulative impacts can therefore result from individual actions that are minor, but, when combined over time with other actions, become significant. Related future actions may only be considered when these actions are under concurrent consideration by any agency through pre-impact statement studies, separate impact statement evaluations, or permit processing procedures (75-1-208(11), MCA). Cumulative impacts are assessed using resource-specific spatial boundaries and often attempt to characterize trends over a timescale appropriate to the alternatives under consideration. Cumulative impacts can only be assessed for resources that are likely to experience primary or secondary impacts due to an alternative under consideration.

4.1.4 Mitigations

Mitigation includes any and all requirements imposed by DEQ to reduce adverse impacts of the alternatives being reviewed, such as:

a) avoiding an impact by not taking a certain action or parts of an action;
b) minimizing impacts by limiting the degree or magnitude of an action and its implementation;
c) rectifying an impact by repairing, rehabilitating, or restoring the affected environment; or
d) reducing or eliminating an impact over time by preservation and maintenance operations during the life of an action or the time period thereafter that an impact continues (MEPA Model Rules II(14)).

To be considered, mitigations must functionally reduce impacts related to an alternative under consideration; therefore, studies, and further consultation do not satisfy the requirements of mitigation under MEPA. Although the consequences of an agency decision must be determined, MEPA does not necessarily result in forcing a particular decision. This is especially the case when an agency is being asked to authorize an action or approve a permit that is allowed under another state law (Stockwell, 2009).

4.1.5 Residual Impacts

Residual impacts are those that cannot be avoided, even with mitigation. These are summarized for all resource areas at the end of this chapter.

4.2 Geology and Minerals

4.2.1 Primary Impacts

4.2.1.1 No Action Alternative

Under the existing exploration license, BHJV could remove up to 10,000 tons of ore for metallurgical testing from the approved decline. In addition, up to 150,000 tons of non-mineralized waste rock and some low grade ore would be removed from underground and placed on the waste rock dump near the portal. There would be no additional removal of geologic material from underground under the No Action Alternative. The geology within the decline and in surface disturbed areas would be irreversibly and permanently altered.

Only surficial non-mineralized geologic changes to roads in the area would result from improvements imposed by the Forest Service in a Road Use Permit or by Silver Bow County in allowing BHJV to haul the bulk sample for metallurgical testing on Highland Road and Roosevelt Drive (See the existing road used during exploration in Figure 2.5-1).

4.2.1.2 Proposed Action

Under the Proposed Action, geologic material would be removed from the subsurface at a rate of approximately 800 tons per day, which includes both 400 tons each of ore and waste rock. The estimated mineral resource to be developed is 1,200,000 tons. The voids would be backfilled with cemented waste rock at a rate of 600 to 700 tons per day. The mining and backfilling would permanently and irreversibly alter the subsurface geology from the current stratigraphy to a mixture of backfilled material.

4.2.1.3 Alternative Haul Routes

The use of the Highland Road (North)/Roosevelt Drive would not create a different level or extent of impacts to the geologic resources from the impacts anticipated due to the use of this existing road during exploration license or the Proposed Action.

Moving a portion of the haul route to closely parallel the existing Highland Road (which is the county road), is shown in Figure 2.5-2. This route would create a different level or extent of primary, secondary, or cumulative impacts to non-mineralized surface geologic resources from the impacts anticipated due to the development of the haul route described under the Proposed Action. An additional 11 acres of surficial non-mineralized geologic materials (soils) would be disturbed and then reclaimed at the end of mining.

4.2.2 Secondary Impacts

4.2.2.1 No Action Alternative

Subsidence is the potential change on the ground surface resulting from collapse or failure of underground mine workings. Surface subsidence features usually take the form of either sinkholes or troughs. Changes in the ground surface can occur from the collapse of a mine roof into a mine opening, resulting in fracturing and eventual caving of the overlying strata and a minimal to abrupt depression in the ground surface. The majority of surface subsidence occurs where the expansion of the collapsing rock in the workings is not great enough to fill the void. Failure generally occurs in portions of the underground workings close to the surface. The historic Highland Mine adit has collapsed near the surface in the surficial geologic materials resulting in a change in the surface topography and loss of access to the underground workings. In early September, the portal was closed using dynamite to prevent access to the abandoned mine. Cemented rock backfill is not proposed in the ore zone during the exploration phase of the project. The deepest BHJV ore zone is approximately 1,500 feet below the surface and the top of the ore zone closest to the surface is 280 feet below ground surface (BHJV, 2013). In general, the deeper the ore zone below the ground surface the lower the risk for surface subsidence. However, if the 10,000 ton bulk sample without backfill is removed closer to the surface, the risk for surface subsidence would increase.

The initial portions of the decline near the surface in non-mineralized geologic material could fail over time. A cross section of the underground workings is shown in Figure 2.5-1 All material excavated to date in the exploration adits is Meagher Formation with minor amounts of gabbroic dike lithology. The current exploration workings extend over 2,000 feet into the hillside. To develop the decline in the fractured weathered bedrock in this location, BHJV had to reinforce the underground workings with typical underground mine support materials. These supports have allowed safe access into these areas. No failure of these supports has occurred to date. The exploration plan approved decline closure includes backfilling the first 10 to 20 feet of the decline and adding a 6-foot concrete barrier to limit access to the underground workings. This backfilling would also limit subsidence in the backfilled area.

Subsidence is an unlikely secondary impact to the No Action Alternative. As described in Section 3.2, the known ore zones are deep beneath the surface which limits the potential for subsidence (BHJV, 2013). Failure of the non-backfilled, non-mineralized geologic materials where the overburden is less than 100 feet thick over the exploration decline would cause minimal change in the surface over the workings. The historic Highland Mine adit has only failed near the surface.

Asbestiform mineral testing was conducted during the exploration program to develop data for the operating permit application. Serpentine, a potential asbestiform mineral, was found in samples of waste rock. Nine samples were submitted for mineralogical analysis and were reported to contain no asbestiform minerals (Tetra Tech and Enviromin, Inc., 2013a). Data available to-date indicate that the ore and waste rock types generated during the BHJV decline development and drilling program present a minimal hazard related to asbestiform minerals exposure to the mine workers. Variability throughout the ore deposit suggests that some mineralized zones could contain asbestiform minerals where contact metamorphism of limestone produced asbestos minerals. However, the actual location or amount of potential asbestiform minerals is not known. No additional asbestiform testing is proposed during the exploration program.

4.2.2.2 Proposed Action

The secondary impacts of the Proposed Action would be similar to the No Action Alternative. The extent of mining would be greater and a secondary adit would be developed for ventilation and emergency egress from the mine. BHJV would use cemented rock backfill in the ore zones to limit waste rock on the surface and to enhance mining recovery. The backfill would limit the potential for subsidence in the ore zone.

The BHJV would avoid mining within 300 feet from the surface to minimize the risk of surface subsidence (BHJV, 2013). Ore zones identified close to the surface would be core drilled before any mining. The core would be analyzed for rock mass quality and geotechnical structure which can help identify stope stability. Each stope would be geotechnically evaluated to ensure that the planned mining method, stope width, and ground support design would provide a safe working condition and prevent surface subsidence. The planned backfilling would reduce voids and the potential for rock failures that could carry to the surface after mining is completed.

BHJV proposes developing the secondary adit in the same manner as the exploration decline. Mine supports installed would limit subsidence during operations in the shallow overburden zone. A cross section of the underground workings is shown in Figure 2.5-1. BHJV would use the same amount of backfill in the secondary adit as the exploration decline. Subsidence is an unlikely secondary impact to the Proposed Action. Failure of the non-backfilled, non-mineralized geologic materials where the overburden is less than 100 feet thick over the secondary adit could cause minimal change in the surface over the workings. The two adits entrances are above the regional water table. If the adits subsided over time behind the backfilled portions, the addition of any infiltrating water from precipitation and snow gathering in the depression would not cause the adits to discharge.

Asbestiform mineral testing conducted during the exploration phase indicate the potential for exposure to asbestiform minerals in the geologic formations is low. The same rock types would be disturbed during the driving of the secondary adit and mining the ore zone. Although there has been no identified risk of asbestiform mineral exposure, operational monitoring for asbestos is proposed in the operating permit application because of the serious health risk that asbestos exposure could present to miners (BHJV, 2013). BHJV would provide training in the awareness of asbestiform exposure for all site workers that have the potential to be exposed to airborne concentrations (BHJV, 2013). The waste rock would also be periodically screened for asbestiform minerals.

4.2.2.3 Alternative Haul Routes

Neither haul route alternative would result in substantial impacts to geology or mineral resources. Although some surface disturbance would occur to create the road bed for the Highland Road (West)/ Parallel route, no cut or fill is anticipated that would impact the geology of the area.

4.2.2.4 Agency-Mitigated Alternative

In the permit, DEQ would stipulate that BHJV submit a sampling plan for waste rock asbestiform minerals. The plan would be submitted within 90 days of operating permit approval.

4.2.3 Cumulative Impacts

4.2.3.1 No Action Alternative

In the No Action Alternative cumulative impacts are anticipated to be minimal with regard to geology and minerals. There would be few anticipated cumulative geologic impacts associated with any of the alternatives when combined with potential effects from past and present mineral exploration, mining, logging, grazing, and recreational use in the area, or related future actions.

4.2.3.2 Proposed Action

The cumulative impacts of the Proposed Action would be the same as the No Action Alternative.

4.2.3.3 Alternative Haul Routes

No aspect of the Alternative Haul Routes would increase the cumulative impacts to the geology and mineral resources above those of the Proposed Action.

4.3 Waste Rock and Ore Geochemistry

4.3.1 Primary Impacts

4.3.1.1 No Action Alternative

Development and blasting of the 6,700 foot long, 15-foot wide, and 16-foot high exploration decline ramp and removal of a 10,000 ton or bulk sample for metallurgical testing would alter the intact and largely unweathered geologic materials, increase fracturing in the underground workings, and increase exposure of the geologic materials to air and water in the underground workings. The blasted waste rock and bulk sample would be brought to the surface and stockpiled where they would be exposed to air and water. Surface and underground drilling also would alter the intact geologic materials.

The exploration phase is about two-thirds complete. Additional decline development work and removal of the bulk sample has yet to be completed. Waste rock has been mainly Meagher dolomite excavated during development of the ramp and stope access during the exploration program. Approximately 100,000 tons of waste rock, estimated to be mainly Meagher dolomite, is stored in the waste rock stockpile permitted for the exploration decline phase of the project.

Under the exploration plan, the waste rock stockpile would hold up to approximately 150,000 tons of waste rock. The waste rock stockpile would consist of mainly the Meagher and Wolsey Formations lithology. Bulk samples will be collected that are representative of the ore zone and hauled for metallurgical testing (BHJV, 2013).

4.3.1.2 Proposed Action

Similar to the No Action Alternative, the primary impact would be due to waste rock and ore being blasted and brought to the surface where the material would be exposed to air and water. An additional 15,200 feet of ramps, stope access, and raises would be developed. There is currently 100,000 tons of what is estimated to be mainly Meagher dolomite waste rock stored in the waste rock stockpile. For the Proposed Action, the waste rock stockpile would be expanded to hold 250,000 tons or an additional 150,000 tons of waste rock would be added to the waste rock stockpile and temporarily stored until underground disposal. This additional waste rock generated by the proposed action is projected to be 68.1% Diorite, 10.7% Meagher Dolomite, 20.7% Wolsey Skarn, and 0.5% Flathead Quartzite (BHJV, 2013). The ore stockpile would be designed to hold approximately 5,000 tons of material, located on the waste rock stockpile, and hauled to the mill within a few days. Up to 1,200,000 tons of ore could be mined and shipped to a mill.

4.3.1.3 Alternative Haul Routes

No aspect of the Alternative Haul Routes would affect the waste rock geochemistry.

4.3.2 Secondary Impacts

Blasting and exposing geologic materials, whether they are in a reducing or oxidizing environment, to air and water increases the potential for geochemical reactions to produce a change in the pH which could result in mobilizing soluble minerals in water. However, the results of the geochemical testing conducted for BHJV indicate no potential for release of concentrations of metals above groundwater standards (DEQ, 2012) from the waste rock lithologies, and very low potential for exceedances of surface water standards.

4.3.2.1 No Action Alternative

Secondary impacts under the No Action Alterative include a minimal potential for acid generation and metal mobility of the waste rock pile, bulk sample stockpile, and the underground mine workings over a prolonged period time. At present, most waste rock produced has been Meagher Formation dolomite, which has essentially no potential to cause acid generation. The waste rock pile will not be backfilled into the mine workings under the No Action Alternative. The acid-producing potential is low for the Meagher Dolomite and there is limited potential for waste rock to leach metals in concentrations exceeding human health or aquatic standards. Only the Meagher Dolomite and olivine-rich altered diorite were shown to be non-acid generating for all analyzed samples tested for metal mobility in support of the operating permit application. The leachate from the Meagher Dolomite in operational run-off from and percolation through the unreclaimed waste rock pile would dilute any potential water quality contributions from minor amounts of other lithologies and alteration assemblages in the waste rock pile. No exceedances of water quality standards are predicted.

The bulk sample would be stored temporarily on the surface until it can be hauled away. Any water contacting the bulk sample would be routed to the large settling ponds on site where the water would be diluted by area stormwater. This would minimize any water quality impacts from geochemical weathering of the ore materials. Groundwater would flood the underground workings washing geochemical byproducts off the decline/ramp walls. The adit would be backfilled with waste rock at closure to limit subsidence and to prevent access as described above in Section 4.2.2. The regional water table would reestablish below the level of the decline opening. Water would start to move into the regional groundwater and be diluted by regional groundwater. Decline water sampling to date has not identified any water quality parameters above groundwater standards. Adverse secondary impacts due to the No Action Alternative would be minimal.

4.3.2.2 Proposed Action

The secondary geochemical impacts of the Proposed Action would be similar to those described under the No Action Alternative. The potential to generate acid and mobilize metals would remain unchanged, but the volume of waste rock stockpiled temporarily on the surface would be greater, the length of time stockpiled would decrease to the operational period only, and cement waste rock backfill would be used to backfill the majority of the mine workings.

Metal mobility tests conducted during the exploration phase to support the application for an operating permit predicted limited potential for waste rock to leach metals in concentrations exceeding human health or aquatic life standards listed in the October 2012 version of DEQ Circular 7 (DEQ, 2012). Although the chronic aquatic life standard for cadmium was exceeded in the results from the SPLP extract from the diorite (A-vein) composite sample, the A-vein is estimated to account for a relatively small proportion of the overall 250,000 tons of waste rock that would be stored temporarily on the waste rock pile during operations. The A-vein is a thin alteration assemblage within the diorite and was estimated to account for only 0.4% of the rock intercepted during exploration drilling. It is expected that run-off from and percolation through the unreclaimed waste rock pile would be diluted, carbonate-enriched, and neutralizing. Meagher Dolomite as well as other lithologies and alteration assemblages which did not report exceedances of water quality standards in analytical results support this expectation. This dilution would limit the potential for elevated cadmium concentrations to occur in waste rock pile leachate.

On average, all waste rock lithologies and alteration assemblages tested except for the massive sulfide Wolsey Shale ore would be net neutralizing and not expected to generate acidity or mobilize metals. As mentioned above, only the Meagher Dolomite and olivine-rich altered diorite were shown to be non-acid generating for all analyzed samples. Other alteration assemblages from the diorite and Wolsey Formation lithologies contained some samples that were indicated by static testing to be either potentially acid generating or to have uncertain acid generating potential.

The diorite and Wolsey Formation lithologies would account for approximately 90 percent of the total excavated waste rock volume during the mining phase of the project. The potential for these rocks to generate acidity over a prolonged period of weathering (both on the waste rock pile and in underground mine workings) were evaluated more thoroughly using longer-term 25-week kinetic testing methods. The trends for both the Wolsey Formation and diorite were fairly stable, so the continuation of the kinetic testing beyond 25 weeks was not necessary. The results of this kinetic testing show a non-acid generating character of the Wolsey Formation and the diorite (Tetra Tech and Enviromin, Inc., 2013b).

Leachate from the waste rock pile would collect in the settling ponds and be routed to a water treatment system during mine operations and land applied. There would be very little potential for violation of groundwater quality standards. Operational verification testing for metal mobility is proposed in the operating permit application in order to assess whether the benign metal mobility characteristics of the waste rock vary or persist throughout the deposit (BHJV, 2013).

The Proposed Action would produce 160,000 tons of additional waste rock. BHJV would mine up to 1,200,000 million tons of ore. BHJV proposes to backfill all the waste rock generated as cemented rock backfill. The Proposed Action would backfill the waste rock mixed with cement and water treatment system brine into the mine workings.

Cement additions to waste rock would raise the pH of the material and could mobilize some metals such as zinc, cadmium, antimony, and arsenic. Subsamples used during the 2012 geochemical evaluations were composited to create run-of-mine waste rock samples. The run-of-mine samples were created by combining lithologic composites from all alteration assemblages (Tetra Tech and Enviromin, Inc., 2013a). The run-of-mine composites were used to build the cemented rock backfill samples for geochemical sampling. The cemented rock backfill samples included run-of-mine waste rock samples, two to seven percent cement, and varying brine proportions. A more detailed list of samples submitted for analysis and their associated compositions is described in the April 2013 report (Tetra Tech and Enviromin, Inc., 2013b). The samples were submitted for static ABA tests, compression and permeability testing, and SPLP metal mobility tests.

Results for all nine samples submitted for static ABA testing met the criteria for materials that are unlikely to generate acid, with all NNP results greater than 5.0 (Table 3.3-3) (Tetra Tech and Enviromin, Inc., 2013b). The net neutralizing character of the run-of-mine samples was enhanced by the introduction of lime in the cement. The samples with the greatest brine content (100 percent) resulted in slightly higher NNP and pH than samples with no brine content. The pH of the nine samples ranged from 9.1 to 10.8.

The extracts from the SPLP metal mobility testing were of generally good quality with most parameters present at concentrations below analytical reporting limits (Tetra Tech and Enviromin, Inc., 2013b). The results of the metal mobility testing are presented in Table 4.3-1

Table 4.3-1. BHJV Cemented Rock Fill Metal Mobility Select Results *(Tetra Tech and Enviromin, Inc., 2013b)*

Sample / Standard	Cement	Brine	Aluminum	Antimony	Arsenic	Barium	Cadmium	Copper	Iron	Selenium	pH
	%	%	Milligrams Per Liter (Total Recoverable Concentration)								
Reporting Limit			0.07	0.0005	0.001	0.03	0.00003	0.002	0.02	0.001	0.1
DEQ-7 Groundwater Standard 2			None	0.006	0.01	1	0.005	1.3	0.3 [4]	0.05	None
DEQ-7 Surface Water Standard 2,5			0.087 [3]	0.0056	0.01	1	0.00016	0.005	1	0.005	None
Run-of-Mine	0	0	--	0.0009	--	0.06	0.00009	--	0.02	--	9.1
2Cem0Bri	2	0	0.00	0.0009	--	0.04	0.00009	0.002	--	--	9.8
2Cem50Bri	2	50	1.94	0.0008	0.001	0.04	0.00006	0.002	--	0.002	10.7
2Cem100Bri	2	100	1.41	0.0007	0.001	0.05	0.00003	--	--	0.001	10.0
4.5Cem0Bri	5	0	1.06	--	--	0.10	0.00003	--	--	0.001	10.3
4.5Cem50Bri	5	50	0.71	--	--	0.11	0.00004	--	--	--	10.4
4.5Cem100Bri	5	100	1.72	0.0010	0.002	0.04	--		0.02	0.001	9.8
7Cem0Bri	7	0	0.61	--	--	0.23	--	0.002	0.03	--	10.7
7Cem50Bri	7	50	0.46	--	--	0.25	--	0.002	--	--	10.8
7Cem100Bri	7	100	0.51	--	--	0.26	--	--	--	0.001	10.8

-- = Not detected above the reporting limit.
(Tetra Tech and Enviromin, Inc., 2013b)

[1] Constituents measured at concentrations below reporting limits were excluded from this table (i.e. beryllium, chromium, lead, manganese, mercury, nickel, silver, thallium, uranium, and zinc). Phosphorous and fluoride concentrations were not presented. SPLP concentrations are total recoverable.
[2] Reported surface water standards are lowest of applicable DEQ 7 (October 2012) standards. Groundwater standards based on dissolved concentrations, surface water based on total recoverable.
[3] Aluminum standard is based on dissolved concentration and applicable to waters with pH between 6.5 to 9.0 only.
[4] Groundwater standards for iron and manganese are 2010 DEQ-7 secondary standards. These standards are not included in the October 2012 DEQ-7.
[5] Hardness dependent standards (i.e. cadmium and copper) calculated based on 50 mg/L hardness.

The results of the cement backfill geochemistry evaluation indicated that the varying proportions of cement and RO brine are not acid generating (Tetra Tech and Enviromin, Inc., 2013b). The potential of the cement backfill to mobilize metals in concentrations above DEQ-7 water quality standards is also low in the high pH conditions (Tetra Tech and Enviromin, Inc., 2013b). The permeability of the backfilled waste rock is also reduced by the cement which could likely limit interaction between groundwater and the cemented rock backfill. This could further limit the potential for any exceedances of DEQ-7 standards (Tetra Tech and Enviromin, Inc., 2013b).

The potential for acid-generation and metal mobility from the waste rock and cement waste rock backfill has been shown to be low, but small inclusions of high sulfide rock will be encountered. Thus, periodic monitoring for sulfide producing rocks is planned as part of the BHJV operating permit application (BHJV, 2013). High-sulfide rock encountered would be segregated from other waste rock lithologies and prioritized as cemented waste rock backfill.

Geochemical impacts would be limited by the specific waste rock reclamation methods to be employed. All waste rock would be backfilled into the mine as cemented rock backfill. Ore stockpiles would be hauled away for processing. Any contaminated surfaces in the operations area would be reclaimed by covering with soil and would be revegetated. The underground workings would flood above the level of the ore body creating a reducing environment and preventing the geochemical reactions that generate ARD. Water from the cemented backfill would move into the regional groundwater and be diluted by the large volume of groundwater in the Nevin Hill area.

4.3.3 Cumulative Impacts

4.3.3.1 No Action Alternative

Cumulative impacts are anticipated to be minimal with regard to geochemistry. There would be few anticipated cumulative geochemical impacts associated with any of the alternatives when combined with potential effects from past and present mineral exploration, mining, logging, grazing, and recreational use in the area, or related future actions.

4.3.3.2 Proposed Action

The cumulative impacts under the Proposed Action would be similar to those identified under the No Action Alternative.

4.4 Soil Resources

4.4.1 Primary Impacts

4.4.1.1 No Action Alternative

Soils were disturbed as part of the activities covered under the exploration license on over 20 acres of surface disturbance. Approximately 34,800 cubic yards of soil and 12,000 cubic yards of subsoil have been salvaged and stored in the soil stockpiles (BHJV, 2013).

LAD disturbance has not resulted in large scale soil impacts but rather only that which is required to bury distribution lines and other water management systems. Soil was replaced immediately after construction of the LAD was completed and the sites were seeded. Temporary storage of soil from the LAD site was needed. The soil was placed adjacent to the excavation work until the LAD site was constructed, then the soil was replaced.

If exploration ceases and the mine is not permitted, BHJV would reclaim existing disturbances with the stockpiled soils. Some soil would be irrevocably lost during soil replacement prior to the re-establishment of vegetation.

4.4.1.2 Proposed Action

Additional surface disturbance under the Proposed Action to support mine activities into full production includes a 0.5 acre expansion of the laydown area and about 13 acres of additional disturbance associated with an ore-transfer facility and a new ore haulage road on private property from the Forest Service boundary to the County Road boundary near Interstate-15 (see Figures 1.1-2 and 2.4-1).

All available soil or growth medium would be removed prior to commencing construction activities on new areas. The Proposed Action would generate an additional 800 cubic yards of soil salvaged and stored in stockpiles located near the mine portal pad during expansion of the mine laydown area.

Construction of the ore transfer facility would result in 2,400 cubic yards of soil salvaged and stored at the site while 32,200 cubic yards would be salvaged during construction of the private ore haulage road and stored in windrows along the road (BHJV, 2013). Salvaged soil would be stored until such time that reclamation would be initiated and soil is replaced onto disturbed areas. The primary impacts to soils in the new disturbances are the same as described for the No Action Alternative. No new LAD areas are proposed as part of the Proposed Action.

4.4.1.3 Alternative Haul Routes

West Alternative Route

Moving the haul route to parallel the existing Highland Road (to the Highland Road (West) Parallel Route alternative) would not create a different level or extent of impacts to soil resources from the impacts anticipated due to the development of the haul route as described under the Proposed Action.

North Alternative Route

The Highland Road (North)/Roosevelt Drive Alternative route is an existing road and was in use prior to the exploration phase of this project. Use of this haul route will cause fewer impacts to soil resources than the impacts anticipated due to the construction of the haul route as described under the Proposed Action or the above Highland Road (West) Parallel Route alternative. The existing Highland Road (North)/Roosevelt Drive haul route does not require any construction activities and only minor potential maintenance to use.

4.4.2 Secondary Impacts

4.4.2.1 No Action Alternative

Impacts on soil result from the removal and storage of soils and redisturbance during replacement after exploration. Secondary impacts to soils under the No Action Alternative would include loss of soil development and horizons, soil erosion from the disturbed areas and stockpiles, reduction of favorable physical and chemical properties, reduction in biological activity, and changes in nutrient levels. The degree or level of these specific impacts would influence the potential success of reclaiming the disturbed areas to grazing and wildlife habitat.

Replacement of soils after exploration ends and revegetation would start the soil development process again. It would take decades for soil horizons to develop again. Loss of soil development is an unavoidable impact of allowing soil disturbance.

The potential for BHJV's exploration activities to cause wind and water soil erosion ranges from a low to high degree of probability depending on soil type and texture and slope as discussed in Section 3.4. Erosion may result in a lost and degraded soil and less availability of soil for revegetation. Disturbed areas are often compacted from heavy equipment used in the soil salvage and replacement process creating potential hard-pan layers that restrict root growth (BHJV, 2013). Ripping is commonly used to relieve compaction after soil replacement. The soil stockpiles have been concurrently revegetated during the exploration process indicating their future potential for reclamation.

Due to shallow depths of root restriction, BHJV soil requires a high degree of protection from erosion in order to maintain productivity as a plant-growth medium. The following measures have been taken for the protection of soil resources during the ongoing exploration phase (BHJV, 2013):

- Soil would be placed in stockpiles as soon as possible after site disturbance;
- Berms would be constructed around the soil stockpiles to reduce soil loss from erosion;
- Seeding would occur on stockpiled soil to minimize noxious weed invasion (in late fall or early spring);
- Weed management inspections and treatment would be performed regularly; and
- Dust control measures, such as watering, would be implemented to minimize the impacts from wind erosion.

Soil restoration measures after regrading and reclamation activities may include the following:

- If it is determined that thicker soil placement is required in certain areas, BHJV would assess the various areas and prioritize soil placement to maximize revegetation opportunities;
- Additional cover material may be required to properly reclaim disturbed areas;
- Some areas may get a thinner soil horizon to ensure adequate soil is available for higher priority areas;

- Sediment control structures would remain until the site demonstrated erosion control, at which time; the portal pad run-on and run-off diversions would be regraded and reclaimed.

Total metal concentrations measured in the baseline soil samples showed that arsenic was naturally elevated in the mineralized area (up to 88 mg/kg) in the uppermost horizons of most test pits and in some cases were above DEQ's (2005) Generic Action Level of 40 mg/kg for arsenic in soil (BHJV, 2013). BHJV has installed BMPs to control erosion and stormwater is not allowed to leave the site.

Reduction of favorable physical and chemical properties occurs with soil salvage and replacement. Organic matter content in the surface horizon is generally reduced, soil structure is lost, and soil chemistry is altered. These are unavoidable impacts of allowing soil disturbance and would take decades to recover.

Soil salvage in stockpiles reduces biological activity and changes nutrient levels in the soils. Soil replacement and revegetation restarts the process. It would take decades for biological activity and nutrient levels to reach predisturbance levels. These are unavoidable impacts of allowing soil disturbance.

4.4.2.2 Proposed Action

The secondary impacts under the Proposed Action would be the similar to the No Action. Alternative except BHJV would disturb 12.7 more acres. Sediment would be controlled with standard BMPs including such methods as installing silt fences and rock check dams, etc.

4.4.2.3 Alternative Haul Routes

The Highland Road (West) Parallel Route would not create a different level or extent of secondary impacts to soil resources from the impacts anticipated due to the development of the haul route as described under the Proposed Action.

The Highland Road (North)/Roosevelt Drive Alternative haul route is an existing road. Use of this haul route will cause fewer secondary impacts to soil resources than the haul route as described under the Proposed Action or the above Highland Road (West) Parallel Route alternative. The existing Highland Road (North)/Roosevelt Drive haul route would require minor construction activities and only minor potential maintenance to use.

4.4.3 Cumulative Impacts

4.4.3.1 No Action Alternative

Public land in the vicinity of BHJV is used for logging, grazing, recreation, watershed protection, wildlife management, and mineral exploration. Future actions such as timber harvesting, grazing and road construction combined with BHJV exploration activities would have the potential to contribute to cumulative soil impacts and erosion rates. However, there are no known proposed soil disturbing projects planned in the vicinity of the BHJV Mine area.

4.4.3.2 Proposed Action

The cumulative impacts under the Proposed Action would be the same as the No Action Alternative. There are no other known proposed soil disturbing projects planned in the vicinity of the ore haul road or transfer facility area.

4.4.3.3 Alternative Haul Routes

The Highland Road (West) Parallel Route alternative would create a minimal level of cumulative impacts to soil resources as compared to the impacts anticipated due to the development of the haul route as described under the Proposed Action.

The Highland Road (North)/Roosevelt Drive Alternative haul route is an existing road, built for heavy truck traffic, and was in use prior to the exploration phase of this project. Use of this haul route will cause fewer cumulative impacts to soil resources than the impacts anticipated due to the construction of the haul route as described under the Proposed Action or the above Highland Road (West) Parallel Route alternative. The existing Highland Road (North)/Roosevelt Drive haul route does not require any construction activities and only minor potential maintenance to use.

4.5 Vegetation and Wetland Resources

During the 2009 field investigation, many discrepancies were noted between the vegetation classifications provided in available land cover datasets and what was observed in the field (Kline and Klepfer, 2010). The following assessments are made based on the information from the 2009 surveys and professional judgment of the potential for changes to the vegetation communities due to the alternatives under consideration.

4.5.1 Primary Impacts

4.5.1.1 No Action Alternative

The native vegetation communities within the exploration disturbances have experienced primary, permanent impacts from removal of vegetation and soil for construction of roads and other facilities. There would be minimal additional primary impacts to vegetation resources through implementation of the No Action Alternative. All previously permitted surface disturbance that affect vegetation resources have already occurred. Approval of additional exploration would disturb less than one acre of vegetation. Primary, permanent impacts to vegetation communities are an unavoidable impact of soil and vegetation disturbance.

The risk of primary impacts to special status plants from the No Action Alternative is minimal. None of the locations of sensitive plant species found by Lesica (1993) were within the exploration disturbance area. The disturbance areas are typical of the broader vegetation communities surrounding the exploration site.

Primary disturbance to vegetation and soil in the area may produce secondary impacts from noxious weeds (see below).

No wetlands have been directly impacted by exploration disturbance to date.

4.5.1.2 Proposed Action

The vegetation communities within the analysis area would experience primary, permanent impacts from removal of vegetation and soil for construction of additional roads and facilities. A total of 12.7 acres of native vegetation is expected to be disturbed and later reclaimed. This total includes 0.5 acres for the laydown and yard area, approximately 10 acres for the proposed haul route permit area and the 0.5 acres for the transfer facility (BHJV, 2013). Primary, permanent impacts to vegetation communities are an unavoidable impact of allowing soil and vegetation disturbance.

The risk of primary impacts to special status plants from the Proposed Action near the decline would be minimal. None of the locations of sensitive plant species found by Lesica (1993) were within the proposed haul road area. The areas of proposed facilities and the new haul road are typical of the broader area surrounding the site.

Primary disturbance to vegetation and soil in the area could produce could secondary impacts from noxious weeds (see below).

No additional wetlands would be disturbed at the proposed mine site. The wetlands near the proposed private haul route are riparian and follow the channel of Fly Creek. The proposed road alignment avoids directly disturbing the wetland areas so no primary impacts to wetlands would occur.

4.5.1.4 Alternative Haul Routes

West Alternative

The Highland Road (West) Parallel Route alternative would likely lessen the level or extent of primary impacts to vegetation communities from the impacts anticipated due to the development of the haul route as described under the Proposed Action. Most of this alternative route is next to and parallel to the existing county road and within the current right-of-way for that road. Building the roadway here would not disturb any soil or vegetation that has not been previously disturbed during the construction or ongoing maintenance of the county road. The Highland Road (West) Parallel Route alternative moves the roadway farther from the wetlands and Fly Creek and would decrease the potential for impacts to these areas as well.

North Alternative

The Highland Road (North)/Roosevelt Drive Alternative haul route is an existing road. Use of this haul route will cause fewer primary impacts to vegetation communities than the impacts anticipated due to the construction of the haul route as described under the Proposed Action or the above Highland Road (West) Parallel Route alternative. The existing Highland Road (North)/Roosevelt Drive haul route would require minimal construction activities and only minor potential maintenance to use.

4.5.2 Secondary Impacts

4.5.2.1 No Action Alternative

There would be secondary impacts to vegetation resources through implementation of the No Action Alternative. Approved exploration allows continued use of the facilities area delaying the time that reclamation would begin. Native plant propagates in soil stockpiles would continue to lose viability further reducing the chance of some native species to reestablish on the disturbed areas.

If the mine is not permitted and exploration ends, reclamation would commence. Salvaged soils would be replaced and revegetation would be implemented. It would take up to five years for the revegetated plant communities to develop to a point where the canopy cover and plant productivity equal pre-exploration plant communities. Diversity of the reclaimed plant communities would never achieve pre-exploration levels due to the presence of aggressive introduced invasive species and noxious weeds, and from indirect impacts of the noxious weed control program. The lack of diversity in reclaimed plant communities is an unavoidable impact of soil disturbance.

Continued discharge to the LAD would increase vegetation productivity in the LAD areas and alter the vegetation communities by favoring mesic species tolerant of additional water. After use of the LAD ends, these mesic species may continue to dominate but at reduced productivity.

Primary soil disturbance has disturbed over 20 acres of land, and has provided an increase in potential pathways for spread of noxious weed and other aggressive introduced species. Land clearing has provided disturbed areas that are susceptible to invasion by noxious and other aggressive weeds. Existing weed populations disturbed by the No Action Alternative have an opportunity to spread via vehicular traffic and earth moving activities associated with accessing and maintaining the site during the exploration phase. Increases in abundance and distribution of noxious and other invasive weeds displace native plants, and degrade wildlife habitats. Delaying reclamation increases the potential for weed spread even with aggressive weed control. BHJV has a weed control plan and weeds are sprayed on site and adjacent to the roads in the area. Spot weed spraying destroys some native plant species near the targeted species.

If exploration continues underground, a bulk sample would be removed, and LAD would continue to apply decline water in the three constructed LAD areas. LAD 4 would be modified to allow additional LAD capacity year round. The surface application of mine water could enhance any wetland vegetation species growing in the LAD areas. Subsurface LAD could increase the water table in the LAD areas promoting establishment of wetland species dependent on subsurface irrigation. Application of the water to the LAD areas would limit potential dewatering impacts to wetlands in the area.

4.5.2.2 Proposed Action

The Proposed Action would allow continued and expanded use of the facilities area delaying the time that reclamation would begin. Native plant propagates in soil stockpiles would continue to lose viability further reducing the chance of some native species to reestablish on the reclaimed disturbed areas during closure.

In the Proposed Action, LAD would end as all sources of water on the site would be treated and discharged into the three surrounding drainages. Any vegetation community changes caused by additional water applied in the LAD areas during the exploration program would change. After LAD ends, these mesic species may continue to dominate but at reduced productivity.

Once reclamation commences, impacts on reclaimed vegetation communities would be similar to those listed for the No Action Alternative.

The risk of secondary impacts to special status plants from the Proposed Action near the decline would be minimal. Competition due to introduced noxious weeds and other aggressive introduced species may also hinder native and special status plants.

The Proposed Action would benefit noxious weed populations by producing an additional 12.7 acres of disturbed land that could become populated with new or expanded weed species and provide an increase in potential pathways for dispersal of weed seeds. Existing weed populations and these additional weed sources could disperse to other areas via vehicular traffic or soil transport. Increases in abundance and distribution of noxious weeds have the potential to displace common and rare native plants, and to degrade wildlife habitats.

The Proposed Action has potential to produce secondary impacts to wetlands and riparian vegetation communities adjacent to disturbed areas by altering hydrology or increasing sedimentation. The mine would be dewatered which would lower the regional water table near the decline.

Under the Proposed Action, the LAD system would not be used to distribute mine dewatering output, and water generated from dewatering would be distributed to existing natural drainages after treatment per the MPDES permit. It is unlikely that the water management plan would impact the wetland areas in the mine permit area. This dewatering would persist for the life of the mine project. These discharges would limit any impacts to wetlands from mine dewatering during mine life.

Minor secondary impacts to wetlands near the BHJV Mine site from the Proposed Action may occur after mine closure during groundwater recharge. BHJV proposes to plug the historic Highlands Mine adit and allow the mine workings to flood. The workings would flood to the levels similar to those present before historic mining began in this area. Groundwater recharge is expected to take several years to return to predewatering levels. The proposed mine site is located on the Continental Divide, and once it is flooded, it is unclear how groundwater flow and dispersal among the three watersheds straddling the Continental Divide would be affected. However, given the shallow soils and location of the larger wetland complexes, it is anticipated that any changes to wetland hydrology would be minor.

The wetlands near the proposed private haul route are riparian and follow the channel of Fly Creek. The proposed road alignment avoids the wetland areas and is unlikely to impact them. There is one stream crossing at the eastern end of the proposed route that may be required. The construction of this stream crossing has the potential to introduce sediment into Fly Creek and the associated wetlands. Applying standard BMPs for sediment control during construction such as working during the drier months and using sediment control structures would reduce the potential for impacts. Impacts to the wetlands due to road construction would be short term and localized to the area near the stream crossing. The wetlands are far enough removed from the proposed road alignment to make impacts due to runoff from the new road or accidental spills unlikely.

4.5.2.3 Alternative Haul Routes

West Alternative Route

The Highland Road (West) Parallel Route alternative would reduce the level or extent of secondary impacts to vegetation resources from the impacts anticipated due to the development of the haul route as described under the Proposed Action. The parallel haul route moves the roadway farther from the wetlands and would decrease the potential for impacts to these areas. Moving the haul route away from the relatively undisturbed native range land pasture lands to an area that is set aside as a road right-of-way would decrease the level of disturbance to native vegetation.

Secondary impacts from noxious weeds would be similar to the Proposed Action. Moving the haul route away from the relatively undisturbed native rangeland to an area that is set aside as a road right-of-way would decrease the overall likelihood of weed spread.

Secondary impacts to wetlands would be similar to the Proposed Action. The parallel haul route moves the roadway farther from the wetlands and Fly Creek and would decrease the potential for impacts to these areas as well.

North Alternative Route

The Highland Road (North)/Roosevelt Drive Alternative haul route is an existing road and was in-use prior to the exploration phase of this project. Use of this haul route will cause fewer secondary impacts to wetland resources than the impacts anticipated due to the construction of the haul route as described under the Proposed Action or the above Highland Road (West) Parallel Route alternative. The existing Highland Road (North)/Roosevelt Drive haul route does not involve any construction activities and its associated soil disturbances.

4.5.2.4 Agency Mitigated Alternative

A weed control plan approved by Silver Bow County would be required to establish protocols for monitoring and eradicating noxious weeds during the implementation, operation, and reclamation phases of the Proposed Action. BHJV would develop a weed management control plan with DEQ input and Silver Bow County approval and would perform noxious weed control for three years after completion of reclamation earthwork (BHJV, 2013).

4.5.3 Cumulative Impacts

4.5.3.1 No Action

Under the No Action Alternative, there is increased potential for the spread of noxious weeds from traffic bringing noxious weeds and other invasive weed species to the site. Weed spread would impact plant community diversity after reclamation. Increased use in an area increases weed spread. This weed spread would occur with or without exploration occurring at the site.

4.5.3.2 Proposed Action

The cumulative impacts to vegetation resources would be the same as the No Action Alternative.

4.5.3.3 Alternative Haul Routes

No cumulative impacts to vegetation resources would occur under either alternative haul route.

4.6 Surface Water Resources

The current exploration project uses land application for the disposal of mine water. This system includes underground sumps, surface settling ponds, and three LAD sites. Under the proposed Operating Plan, BHJV would install underground dewatering wells, dewater the mine area ahead of mine development, treat the dewatering water, and discharge it under an MPDES permit. BHJV was issued a Montana Pollution Discharge Elimination System permit number MT0031755 on June 30, 2013 that allows discharge of treated mine water to outfalls located on Fish Creek, the Middle Fork of Moose Creek, and Basin Creek. Water produced from the dewatering wells and any excess water reporting to the underground workings would be treated to meet the non-degradation standards of the MPDES permit.

The existing stream conditions of the mine permit boundary area have been affected by past placer mining disturbances; however, results of field investigations concluded that stream channels within the mine permit boundary areas are identified to be stable or marginally stable under existing natural flow conditions (BHJV, 2013). Potential impacts to surface water resources from mining activities include effects on water quantity, water quality, and on stream channel morphology for portions of Basin Creek, Fish Creek, and Moose Creek watersheds. There would be potential for increased sediment load for Divide Creek, Fly Creek, Climax Gulch, and Curley Gulch. This is due to the proposed haul route and ore load transfer facility.

4.6.1 Primary Impacts

4.6.1.1 No Action Alternative

Under the No Action Alternative there is a potential for temporary reduction in stream flow rates which could also change water quality. Dewatering from the underground workings occurred from April 2010 through October 2011 at a rate ranging from zero to 150 gpm. During this time, a total of 70 million gallons were discharged to LAD areas (BHJV, 2011). Surface water monitoring was conducted during those periods. Water quality from the decline met groundwater quality standards. No noticeable change in flow and quality were noted in surface water and no water quality standards were exceeded during exploration operations.

Under the existing exploration license, dewatering operations could resume while BHJV obtains a bulk sample of ore. This dewatering at an estimated rate of 450 gpm from the decline sumps and dewatering wells may cause a reduction of groundwater discharge to surface water bodies. However, water would be discharged to several LAD areas that drain toward Moose Creek thus offsetting the water quantity impact to Moose Creek during exploration. Monitoring of flow and quality would continue.

Primary surface water impacts from using the Highland Road (North)/Roosevelt Drive route include additional sediment from the increased traffic from exploration. BHJV had a Road Use permit, which has expired, to haul the bulk sample west, towards the Feely interchange (S. Kelley, pers. comm., 2013). The requirements in the Road Use Permit would limit impacts to surface water from exploration traffic to acceptable levels.

4.6.1.2 Proposed Action

The approximately 11 acres associated with an ore transfer facility and a new ore haulage road would create additional disturbance with increased soil erosion possible. This additional disturbance would have the potential to increase sediment load in nearby streams.

Stream flow rates would be altered due to dewatering of the decline. The historic Highland adit discharge to Basin Creek would cease in response to mine dewatering. This would likely occur within a month after dewatering begins (BHJV, 2013). BHJV would treat water to non-degradation standards. After treating water that has been pumped to dewater the mine, BHJV would discharge up to 350 gallons per minute to Basin Creek under its MPDES permit. This flow rate more than offsets the 150 gallons per minute of historic flow from the portal (BHJV, 2013).

Water would also be discharged to two tributaries of the Middle Fork of Moose Creek with proposed flow rates of 60 gallons per minute to one tributary and 140 gallons per minute to the other tributary. The average combined baseline discharge for Moose Creek tributaries is 170 gpm. An average flow of 200 gpm would be discharged to Fish Creek increasing the volume of water flowing in the creek. The outfalls and estimated discharge to each stream reach is shown in Table 4.6-1. Outfall 005 (land application) and Outfall 006 (ground water infiltration) were used during the exploration phase and are being retained as contingency discharge locations in the event that surface water discharge is not feasible (BHJV, 2013).

Table 4.6-1. Mine Dewatering and Storm Water Outfall Volumes (BHJV MPDES, 2013).

Outfall	Description	Existing Average Flow (gpm)	Proposed Average Input (gpm)	Intermittent (Y/N)
001	Basin Creek (near monitoring station WS-1)	105	350	N
002	Tributary to Fish Creek	Unknown	200	N
003	Middle Fork of Moose Creek (near monitoring station WS-6)	34	60	N
004	Tributary to Middle Fork of Moose Creek (near monitoring station WS-9)	126	140	N
005	Middle Fork of Moose Creek (LAD 1)	0	0	Y
006	Middle Fork of Moose Creek (LAD 2) ground water infiltration system)	0	0	Y

BHJV instituted a water monitoring program as part of the approved exploration license. Water monitoring occurs on a monthly basis for both quality and quantity. BHJV currently monitors surface water quality at Basin, Fish, and Middle Fork Moose Creeks. The BHJV Mine discharge is also part of the required monitoring program.

Pump tests and modeling conducted by BHJV predict that sustained pumping of up to 750 gpm of groundwater would be necessary to dewater the bedrock surrounding the ore deposit prior to mining. Once mining reached the maximum planned depth (about 1200 feet below surface), modeling estimated that the dewatering rate could be reduced to 500 gpm to maintain dry conditions within the mine workings.

Upon cessation of mining, dewatering activities would cease and the underground workings and surrounding dewatered bedrock would begin to refill with groundwater. It is estimated that seven to eight years would be required for the water table to recover to pre-mining levels. During this period, groundwater would continue to flow into the cone of depression surrounding the dewatered mine workings (see Figure 4.7-1). Initially this inflow rate would be similar to the 500 gpm pumping rate estimated to be necessary to maintain dewatering of the mine, but the rate of inflow would decrease as the water table rebounds. Groundwater flowing into the mine void and cone of depression would not be available to provide baseflow to surface water resources located above the cone of depression of the groundwater table. Temporary reductions in surface water flow would include the discharge from the historic Highlands Adit which currently contributes an average flow of 105 gpm to Basin Creek. The remaining flow reduction, equivalent to the rate of groundwater flow into the mine area minus the flow that currently discharges from the historic adit, would be distributed among headwaters reaches of Basin, Fish, and Moose Creeks.

Once the water table has fully recovered seven to eight years after mining ceases, flow rates in Fish and Moose Creeks would return to baseline conditions. Because BHJV would install a permanent hydraulic plug within the historic Highlands Adit, discharge from the Adit into Basin Creek would not resume. Instead, the groundwater table above the mine workings would continue to rise until an equilibrium groundwater level similar to that which existed prior to historic mining is achieved. The volume of water which currently discharges via the historic Highlands Adit would instead discharge to the surface in the form of seeps and springs surrounding Nevin Hill. It is not known what fractions of this water volume would discharge into Basin Creek, Fish Creek, and Moose Creek watersheds because streamflow data were not collected prior to development of the historic mine during the 1930s.

In the event that springs develop post-mining after the recovery of the water table and do not meet appropriate water quality criteria, BHJV has proposed to control water levels within the mine workings at an elevation that would prevent discharge from any such springs. This water would be directed into a subsurface LAD system to allow attenuation of any elevated parameters (metals, nitrates, TSS) via flow through soils within the LAD area. Depending upon the location of such an LAD area, a reduction of baseflow may occur to one or more of the three basins, while an increase in flow may occur to the LAD receiving waters.

4.6.1.3 Alternative Haul Routes

West Alternative Route

Moving the haul route to parallel the existing Highland Road (to the Highland Road (West) Parallel Route alternative) would not create a different level or extent of impacts to surface water resources from the impacts anticipated due to the development of the haul route as described under the Proposed Action. Moving the haul route away from the active channel of Fly Creek to an area that is set aside as a road right-of-way would decrease the level of disturbance and may reduce the overall likelihood of sediment or pollutants entering the stream.

North Alternative Route

The Highland Road (North)/Roosevelt Drive Alternative haul route is an existing road and was in-use prior to the exploration phase and during the exploration phase of this project. BHJV had a Road Use Permit from the Forest Service to use the road and the permit listed conditions of use on the road. The permit has expired.

Use of the Roosevelt Drive haul route would have fewer impacts to surface water resources than the impacts anticipated due to the construction of the haul routes as described under the Proposed Action or the Highland Road (West) Parallel Route alternative.

The existing Highland Road (North)/Roosevelt Drive haul route would not require any major construction activities or the associated disturbances with constructing a new road or improving an existing two-track road to a road built to county or Forest Service specifications.

4.6.1.4 Agency-Mitigated Alternative

Under the Agency-Mitigated Alternative DEQ would require BHJV to increase water quality monitoring and develop additional monitoring sites. Additional monitoring would provide information on the effectiveness of the water management plan.

4.6.2 Secondary Impacts

4.6.2.1 No Action Alternative

There would be no secondary impacts to surface water resources through implementation of the No Action Alternative. All previously permitted surface disturbances with the potential to affect surface water resources have already occurred. The surface runoff and erosion rates are likely higher on disturbance areas with potential increased sediment loading to surface water. All water draining off the surface facilities are routed to the settling ponds or through BMPs to limit sediment transport.

4.6.2.2 Proposed Action

The potential for augmented flow conditions to destabilize the stream channels was evaluated as part of a fluvial geomorphology study (BHJV, 2013). Results of this study indicate that the current stability of receiving streams is not likely to change as a result of the increased flow planned as part of the MPDES discharge.

Runoff from the ore transfer facility and ore haulage road could increase the volume of water delivered to stream channels, elevate the peak streamflow rate, and cause accelerated erosion in stream channels. Roads can increase peak flows by routing runoff more directly to stream channels. Increased traffic could result in increased erosion and sediment loading to Divide Creek, Fly Creek, Climax Gulch, and Curly Gulch during the life span of the mine.

Surface water discharges originating from the mine dewatering and road construction would not create a different level or extent of primary impacts to surface water resources than the impacts anticipated due to the development of the haul route as described under the Proposed Action’s primary impacts. BHJV would continue surface water monitoring as outlined in the BHJV exploration license. The parameter list will be similar to that prescribed by the exploration license.

Sedimentation would be controlled with standard BMPs including such methods as reseeding disturbances as soon as the road is completed and installing silt fences, rock check dams, etc. Water produced from the dewatering wells and any excess water reporting to the underground workings would be treated using a Reverse Osmosis (RO) plant or other suitable or appropriate water treatment technology to meet the non-degradation standards of the MPDES permit. Treatment would take place prior to being discharged to the surface water streams.

Although the potential for augmented flow conditions to destabilize the stream channels for Basin Creek, Fish Creek, and Moose Creek was considered unlikely (BHJV, 2013), stream channels would be monitored for any degradation for the duration of active mining operations.

4.6.2.3 Alternative Haul Routes

Neither the Highland Road (West) Parallel Route alternative nor the Highland Road (North)/Roosevelt Drive Alternative haul routes would create a different level or extent of impacts to surface water resources than the impacts anticipated due to the development of the haul route as described under the Proposed Action.

4.6.2.4 Agency-Mitigated Alternative

A potential beneficial secondary impact to surface water from implementation of the Agency-Mitigated Alternative would be protection of water quality after the mine closes and reclamation is completed.

4.6.3 Cumulative Impacts

4.6.3.1 No Action

Existing stream channels within the mine permit boundary areas have been affected by natural causes (climate cycles, beaver activity, etc.), livestock grazing, and human caused modifications including logging, dams, berms, placer mining disturbances, pipelines, and other diversions. Two of the streams in the mine permit area (Fish Creek and Moose Creek) and Divide Creek near the ore haulage route are considered “impaired” by 2008 Section 303(d) list of impaired water bodies in Montana (EPA, 2008). The potential increase in sedimentation from exploration activities combined with existing and future impacts from other causes could result in stream instability. BHJV anticipates retaining the pre-mining land uses after mine operations which included livestock grazing and logging.

4.6.3.2 Proposed Action

There would be no additional cumulative impacts to surface water resources under the Proposed Action. No cumulative impacts to surface water resources were identified as a result of the interaction of related future actions in the project area and the adoption of the Proposed Action under consideration.

4.6.3.3 Alternative Haul Routes

The cumulative impacts expected under either of the haul route alternatives would be less than or the same as expected under those described under the Proposed Action.

4.6.3.4 Agency-Mitigated Alternative

The water quality component of the Agency Mitigated Alternative may contribute to a reduction in cumulative impacts to surface water resources by providing periodic information on water quantity and distribution that could be used to adapt BHJV’s water management plan.

4.7 Groundwater Resources

The current exploration project requires dewatering of the underground workings to a level where the bulk sample can be removed and exploration drilling can continue. Under the proposed operating plan, BHJV would install underground dewatering wells, dewater the mine area ahead of mine development, treat the dewatering water, and discharge it under an MPDES permit. For the first 4.5 years of mine life, approximately 750 gpm of water is expected to be pumped. During the last six months of mining, the pumping rate is expected to be reduced to 500 gpm. Under all alternatives, groundwater levels will be monitored at selected locations throughout the project duration.

4.7.1 Primary Impacts

4.7.1.1 No Action

The primary impact to groundwater under the No Action Alternative would be the lowering of groundwater elevations as a result of dewatering operations at BHJV to ensure dry conditions during underground exploration activities. Where this groundwater currently discharges to the surface, springs and seeps may dry up or flow at reduced rates until dewatering of the exploration workings has ceased and the water table rebounds.

4.7.1.2 Proposed Action

The primary impact to groundwater under the Proposed Action alternative would be similar to the No Action; however, the Proposed Action would have greater geographic extent for a longer duration of time. The Proposed Action dewatering was simulated using a numerical model (BHJV, 2013). The results of the model simulation indicate that dewatering operations would focus on the Meagher Formation, which has the highest hydraulic conductivity as evidenced by aquifer testing. The predicted maximum dewatering rate for the BHJV Mine site is expected to be about 750 gpm throughout the first 4.5 years of mining. At the end of this first mining/dewatering period, the water level is expected to be approximately 6,300 feet NGVD (National Geodetic Vertical Datum of 1929). During the last six months of mining, the model predicts that pumping rates can be reduced to approximately 500 gpm to maintain the 6,300-foot elevation water level. Mine dewatering rates are designed to ensure that a constant drawdown pumping scenario is established to maintain water levels below the target depths for the duration of the mine.

It is also important to note that because the model was developed under base-flow conditions, additional inflow to the mine during late spring/early summer runoff could occur.

4.7.1.3 Alternative Haul Routes

Neither of the alternative haul routes would create a different level or extent of primary impacts to groundwater resources than the impacts anticipated due to the development of the haul route described under the Proposed Action.

4.7.3.4 Agency-Mitigated Alternative

The Agency-Mitigated Alternative would not change the level or extent of primary impacts to groundwater resources from the impacts anticipated under the Proposed Action.

4.7.2 Secondary Impacts

4.7.2.1 No Action

Secondary impacts to groundwater under the No Action Alternative would include any effects from dewatering on groundwater quality via changes in subsurface geochemistry, geotechnical issues such as stability, and effects on wetland vegetation. The area of impact would be less than the Proposed Action due to the limited duration of dewatering during exploration and bulk sampling.

4.7.2.2 Proposed Action

The predicted extent of drawdown in the water table at the end of mining is shown on Figure 4.7-1. The shape of the ten-foot drawdown contour is influenced by the location of the modeled dewatering wells and by the presence of modeled faults and intrusive bodies which are simulated as low hydraulic conductivity features. The ten-foot drawdown contour encompasses surface water monitoring stations WS-1, WS-3, and WS-5 and covers roughly one square mile. Mine dewatering is predicted not to impact baseflow in Moose Creek or the southern tributary to Fish Creek. Flow from the historic Highlands Mine portal (WS-1) is predicted to cease when dewatering begins. Because BHJV proposes to install a permanent hydraulic plug within the historic Highlands Adit, discharge from the portal would not resume after mining is completed and the water table recovers approximately eight years later. Instead, springs and seeps are predicted to develop where they historically existed prior to the construction of the Highlands Adit during the 1930s. A northern tributary to Fish Creek is predicted to have a reduction in baseflow of about 12 gpm, which is less than 10 percent of the flow predicted at WS-3. Flows during spring runoff and precipitation events are not expected to be impacted.

Water from the historic Highlands Mine portal currently (pre-mining) flows at a seasonally variable rate of approximately 80 to 150 gpm into a channel which feeds the Basin Creek Reservoir. Dewatering is expected to stop the outflow of water from the portal after approximately one month of dewatering. A water-tight plug will be placed at closure to prevent flow from the portal following recovery of groundwater levels (approximately eight years) after mining ceases.

Plugging of the historic Highlands adit may result in the formation of seeps or springs as water currently discharging from the adit is redirected into fractures and pre-mining flow paths. There is insufficient data to allow predictions of changes in water discharged from these springs and seeps. Rates of flow from these potential new water sources would depend on their number and elevation relative to the ultimate post-mining water level (i.e. reduced head if they form above the level of the Historic adit).

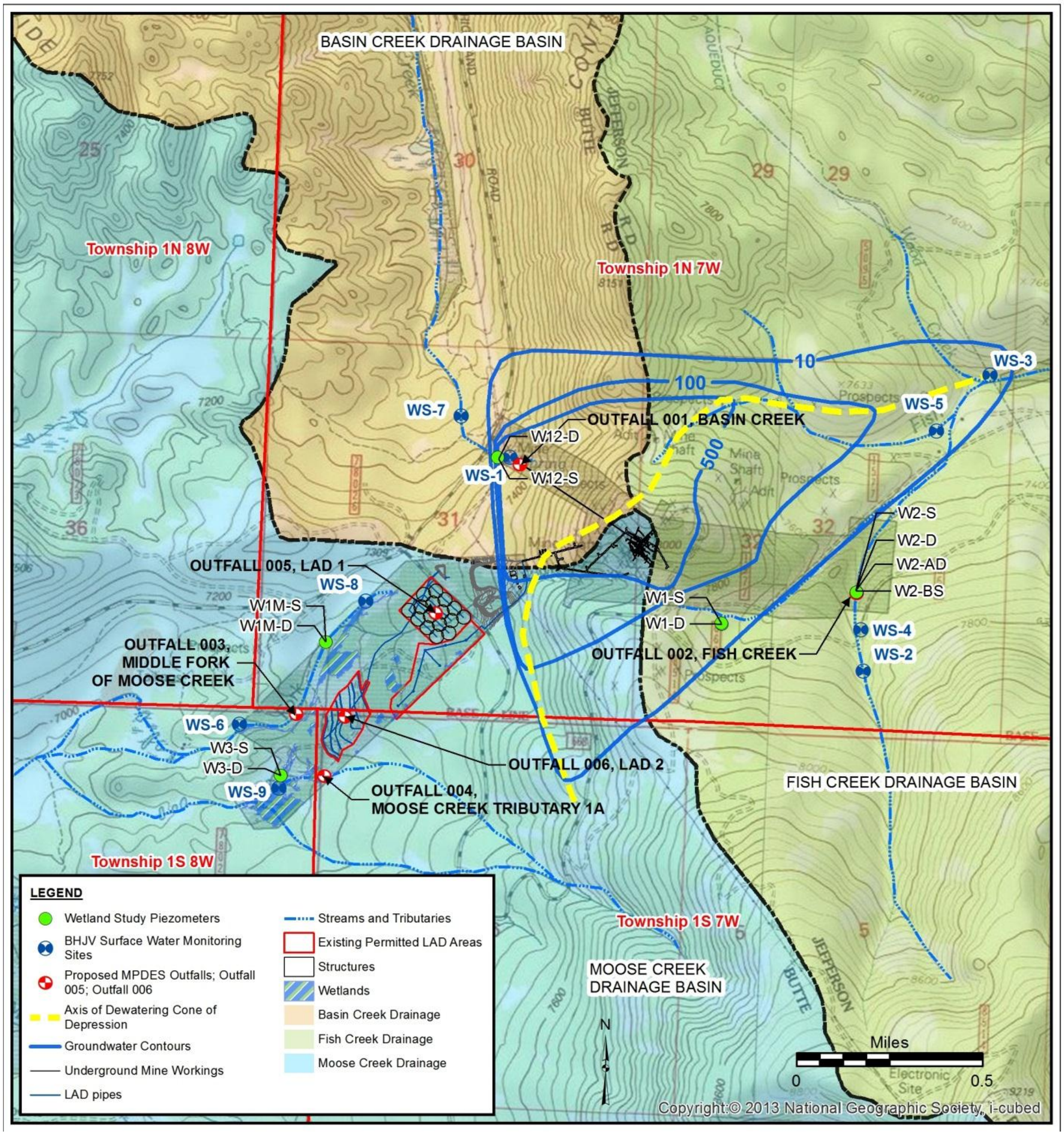

Figure 4.7-1. Project Area Map Showing the Cone of Depression Anticipated due to Dewatering, Water Monitoring Sites, Wetlands, and LAD Areas, BHJV Mine Site, Silver Bow County, Montana.

4.7.2.1 Impacts to Wetlands Hydrology

BHJV initiated a pre-mining groundwater investigation to characterize fluctuations in groundwater levels in area wetlands and evaluated lateral and vertical gradients in bedrock and colluvium. Five sets of paired piezometers were constructed in different wetland areas located in the Basin, Fish, and Moose Creek drainages. BHJV would maintain groundwater levels in existing wetlands within the range of elevations established in the baseline study period using treated or collected water provided to the wetlands, until such time as the regional groundwater table has rebounded to near current levels. Ultimately in closure when the adits are plugged, groundwater levels should rise to levels above the historic Highlands adit (BHJV, 2013).

Basin Creek Wetlands

Because mine dewatering activities would cause flow from the historic Highlands adit to end, it is possible that the Basin Creek wetlands located downslope from the historic Highlands Mine adit would receive less water during the active period of mining. However, discharges into MPDES outfall 001 would provide water to help maintain these wetlands at current conditions. Post mining plugging of the historic Highland Mine adit would eliminate flow from the adit and promote return of the groundwater system to pre-mining conditions and fracture flow pathways. To evaluate the potential that these changes would affect wetlands, or Waters of the U.S., the Army Corps of Engineers (ACOE) was contacted on October 23rd, 2012 and has provided a written response indicating that no permitting would be required by the ACOE for these potential wetland impacts (BHJV, 2013, Appendix AI).

Fish Creek Wetlands

Data from Fish Creek Wetland 1 piezometers (W1-S and -D) suggest a relatively small negative (downward) hydraulic gradient during mid- to late-October that became increasingly negative in early November. These data also imply a disconnect between local and regional groundwater as the groundwater level monitored by the deeper (regional groundwater) piezometer increased in depth while the shallow piezometer groundwater level (local) remained fairly constant. Given the depth to the water table (greater than 12 feet), it is unlikely that the deeper regional groundwater system sustains the wetland vegetation in Wetland 1.

Moose Creek Wetlands

Data from piezometers installed in Wetland 1 and 3 in the headwaters of the Moose Creek drainage suggest a negative (downward) hydraulic gradient in both wetland areas; however, the difference in groundwater elevations between both shallow and deep piezometers is sufficiently small (one-foot or less) to make it difficult to draw any conclusions at this point as to the nature of groundwater in either wetland.

The field data are preliminary and ongoing for Fish Creek and Moose Creek Wetlands and the potential for wetland dewatering due to mine dewatering exists. There are limited data collected from the wetlands piezometers at this time to estimate the potential effects of dewatering. Dewatering would potentially have effects on existing wetlands even though hydrologic modeling suggests that the cone of depression of the regional groundwater table will not extend to the Moose Creek Wetlands. The groundwater model was based on very limited field data and the results may not accurately quantify the actual effects of dewatering.

Water Quality

Several samples collected from groundwater monitoring wells exceeded groundwater quality standards for arsenic and antimony. No groundwater baseline data for BHJV was collected prior to historic mining (1930 and earlier); therefore, potential changes in groundwater quality cannot be compared to what existed at the site under background, pre-mining conditions. BHJV would treat mine water prior to discharge and must meet non-degradation standards. Therefore, secondary impacts to water quality from mine discharge water are not expected.

Alternative Haul Routes

Neither of the alternative haul routes would create a different level or extent of secondary impacts to groundwater resources from the impacts anticipated due to the development of the haul route described under the Proposed Action.

4.7.3 Cumulative Impacts

4.7.3.1 No Action

Cumulative impacts associated with the permitted current and anticipated exploration activities are expected to be minimal with regard to groundwater. There would be few anticipated groundwater impacts associated with any of the alternatives when combined with potential effects from past, present, or related future actions.

4.7.3.2 Proposed Action

The potential for cumulative impacts to groundwater under the Proposed Action would be the same as for the No Action Alternative.

4.7.3.3 Alternative Haul Routes

Neither of the alternative haul routes would create a different level or extent of secondary impacts to groundwater resources from the impacts anticipated due to the development of the haul route described under the Proposed Action.

4.7.3.4 Agency-Mitigated Alternative

The potential for cumulative impacts to groundwater under the Agency-Mitigated Alternative would be the same as for the Proposed Action.

4.8 Hazardous Materials

Hazardous material at the current mine would be mainly associated with operation and maintenance of equipment and septic waste from site personnel. The proposed site would have the addition of an assay lab that may generate some hazardous wastes.

4.8.1 Primary Impacts

4.8.1.1 No Action Alternative

Materials which may be hazardous are currently present on site and include motor oil/lubricants, diesel fuel, septic waste, and wastewater from the truck wash pad containing sediment, metals, and oil and grease. These materials would be hauled to the site using Roosevelt Drive under BHJV's Road Use Permit from the Forest Service and upon approval from Butte-Silver Bow County.

The wash pad water is treated through the wash pad water recycle system for cleaning and reuse. The recycled water will be either used for wash pad water or included in to the mine wide recycle system. Wash pad sediments and oil skimming residues will be disposed of in accordance with environmental regulations. All fuel, oils, lubricants and truck wash operations are located on a 50-foot by 80-foot concrete pad covered by a fabric roof and building. The concrete pad provides secondary containment of the materials to meet the requirements of the SWPPP and SPCC plans and includes hydrocarbon skimming and a sediment settling sump. Used oil would be either used on-site as fuel for onsite heaters or sent to an appropriate facility off site for reuse.

Each material if released could be potentially hazardous and may impact soils and or surface and groundwater in the immediate area. BHJV has a SWPPP and coverage under an industrial storm water permit implemented to minimize impacts to storm water runoff or surface water as required by ARM Title 17.30.1101 or the SPCC plan. The SWPPP outlines measures to be implemented to reduce impacts to water quality as a result of construction or industrial activities. The SPCC plan requires implementation of measures for oil spill prevention, preparedness, and response to prevent oil discharge to navigable waters. It is required for sites storing petroleum greater than a 1,350 gallons in containers holding 55 gallons or larger threshold as required by 40 CFR Part 112.2 (DEQ, 2012) as required by 40 CFR Part 112.2 (Tetra Tech, 2013).

Hazardous materials are hauled to and from the site by a licensed hazardous waste hauler who is subject to Montana Department of Transportation (MDT) requirements under Title 49 CFR and RCRA (MDT, 2011) and RCRA for transportation, handling and disposal of hazardous materials. Fuels, motor oils/lubricants and other hazardous materials hauled by truck must be transported to and from the site via public roads under the Department of Transportation requirements which include driver training and registration, inspections, manifesting (shipping papers), approved containers, with labeling and placarding requirements primarily under Title 49 CFR (MDT, 2011). Based on this, the primary impacts of the No Action Alternative appear to be minor.

Septic effluent may also exhibit hazardous characteristics and is disposed through a septic system permitted through the Butte-Silver Bow County which was designed and installed to serve up to 49 people in a 24-hour period. According to the operating permit application, the total work force at the site would not exceed 49 people on site within a 24-hour period and no septic system expansion is planned (BHJV, 2013). The septic system permit assures that the septic design has met county requirements for the disposal of septic wastes as outlined in Code of Ordinances 13.04.470 – Design Requirements. Based on the county requirements and permit approval, primary impacts from the septic system from the No Action Alternative appear to be minor.

4.8.1.2 Proposed Action

The Proposed Action would result in a slight increase in hazardous materials on-site due to the increased site activity. These materials may potentially be hazardous and include motor oil/lubricants, diesel fuel, septic waste, assay waste and wastewater from the truck wash pad containing sediment, metals, and oil and grease. These materials would be hauled to the site using Roosevelt Drive if BHJV's Plan of Operations is approved by the Forest Service and permission from Butte-Silver Bow County. Primary impacts from these potentially hazardous wastes would be the same as the No Action Alternative except for the assay lab wastes.

The Proposed Action would include an on-site assay lab. The lab would generate assay waste which may exhibit hazardous characteristics. Unlike the exempted mine waste, assay waste of this type would likely be regulated under RCRA which requires specific handling and disposal (Tetra Tech, 2013). The disposal of assay waste falling under the RCRA requirements would utilize a licensed hazardous waste hauler contractor to remove and dispose of the waste to a licensed hazardous waste treatment facility in accordance with Department of Transportation and RCRA requirements. Specific requirements exist for handling, transportation, disposal, and recordkeeping. The disposal of assay waste falling under the RCRA requirements will utilize a licensed hazardous waste hauler contractor to remove and dispose of the waste to a licensed hazardous waste treatment facility in accordance with RCRA requirements. These requirements specify specific requirements for handling, disposal, and recordkeeping. Based on this, the primary impacts from the Proposed Action are expected to be minor.

4.8.1.3 Alternative Haul Routes

Moving the haul route to the Highland Road (West) Parallel haul route or using the Highland Road (North)/Roosevelt Road would not change the level or extent of impacts due to hazardous materials than the development of the haul route described under the Proposed Action. This is because potentially hazardous materials would be hauled to/from the site via Roosevelt Road under any alternative.

4.8.2 Secondary Impacts

4.8.2.1 No Action Alternative

Deposition of pollutants from potentially hazardous wastes on water, soil, vegetation, and impacts to unique, endangered, fragile, or limited environmental resources, terrestrial and aquatic life appear to be minor as a result of current activities. There is a possibility of impacts to water quality downstream which may affect vegetation or aquatic life, mainly from a potential spill along Roosevelt Drive, where it parallels or crosses surface water. This assumes BHJV obtains a permit from the Forest Service to use Roosevelt Drive. A spill would be handled according to the approved SPCC. The secondary impacts from the No Action Alternative on the physical and biological environment in the immediate area appear to be minor.

4.8.2.2 Proposed Action

Deposition of pollutants from potentially hazardous wastes would be the same as the No Action Alternative.

4.8.2.3 Alternative Haul Routes

Moving the haul route to parallel the existing Highland Road (to the Highland Road (West) Parallel Route alternative) would not create a different level or extent of impacts resulting from pollution transport or deposition than the impacts anticipated due to the development of the haul route as described under the Proposed Action. Moving the haul route away from the active channel of Fly Creek to an area that is set aside as a road right-of-way would reduce the overall likelihood of pollutants reaching the stream or other sensitive environment in the event of a spill or pollutant release.

The Highland Road (North)/Roosevelt Drive Alternative haul route is an existing road and was in-use prior to the exploration phase of this project. Use of this haul route will cause fewer secondary impacts to sensitive resources than the impacts anticipated due to the construction of the haul route as described under the Proposed Action or the above Highland Road (West) Parallel Route alternative. The existing Highland Road (North)/Roosevelt Drive haul route does not require any construction or other new activities, or any increased transport of polluting materials through sensitive areas.

4.8.3 Cumulative Impacts

4.8.3.1 No Action Alternative

There are no other significant sources of potentially hazardous materials in the area. The cumulative impacts from the No Action Alternative on the physical and biological environment in the area appear to be minor.

4.8.3.2 Proposed Action

Cumulative impacts from the Proposed Action would be the same as the No Action Alternative.

4.8.3.3 Alternative Haul Routes

No cumulative impacts are expected with these alternatives.

4.9 Air Quality

The air quality of a region is primarily controlled by the type, magnitude and distribution of pollutants and may be affected by regional climate. Transport of pollutants from their source areas are affected by topography and meteorology. BHJV may be restricted on annual throughput by other governmental agencies which would limit ore production to a level less than that described in the current permit.

4.9.1 Primary Impacts

4.9.1.1 No Action

The current permit covers the equipment and operation needed for the current operation (No Action). The DEQ believed that BHJV would be expected to operate in compliance with all applicable rules and regulations outlined in the current permit (DEQ, 2011).

According to the current air permit (MDEQ ARMB #4449-03), there were no projected impacts to ambient air quality above the NAAQS or MAAQS. This was based on dispersion modeling of the new sources in the revised permit, and DEQ indicated that expected impacts will be minor.

4.9.1.2 Proposed Action

The current permit revision (MDEQ ARMB #4449-03) includes new equipment needed for the Proposed Action. The Proposed Action will result in the facility's potential to emit greater than 100 tons per year of NOx and CO. This level of emissions requires a major source Title V operating permit application. BHJV will be required to submit an application for a Title V operating permit application within 12 months of startup of the new equipment identified in the current permit. The operating permit application would be a result of NOx and CO primarily from operating the diesel generators. DEQ's analysis found that BHJV would be expected to operate in compliance with all applicable rules and regulations outlined in the current permit (DEQ, 2011).

Pollutant deposition from the facility is expected to be minimal because the pollutants are widely dispersed (from factors such as wind speed and wind direction) and exhibit minimal deposition on the surrounding areas. Therefore, air quality impacts in this area as a result of the Proposed Action are expected to be minor (DEQ, 2011).

4.9.2 Secondary Impacts

4.9.2.1 No Action

DEQ indicated that secondary impacts from the actions in the current permit would result in a slight increase in industrial process in the area (DEQ, 2009). The potential for deposition of pollutants on water, soil, vegetation, and impacts to unique, endangered, fragile, or limited environmental resources, terrestrial and aquatic life as a result of the No Action Alternative appears to be minor (DEQ, 2011).

4.9.2.2 Proposed Action

DEQ indicated that secondary impacts from the actions in the current permit would result in a slight increase in industrial process in the area. Overall, any secondary impacts to the physical and biological aspects of the human environment as a result of the Proposed Action are expected to be minor.

Deposition of pollutants on water, soil, vegetation, and impacts to unique, endangered, fragile, or limited environmental resources, terrestrial and aquatic life as a result of the Proposed Action are expected to be minor (DEQ, 2011).

4.9.2.3 Alternative Haul Routes

Neither haul route alternative would change the level nor extent of secondary impacts to air quality from those anticipated due to the development of the haul route as described under the Proposed Action.

4.9.3 Cumulative Impacts

4.9.3.1 No Action

There are no major sources of air pollutants in the area. Cumulative impacts to physical and biological aspects on the physical and biological environment in the immediate area as a result of the No Action Alternative appear to be minor (DEQ, 2011).

4.9.3.2 Proposed Action

There are no other major sources of air pollutants in the area. Cumulative impacts to physical and biological aspects on the physical and biological environment in the immediate area as a result of the Proposed Action are expected to be minor (DEQ, 2011).

4.9.3.3 Alternative Haul Routes

Neither haul route alternative would change the level or extent of cumulative impacts to air quality from those anticipated due to the development of the haul route described under the Proposed Action.

4.9.4 Prescribed Best Available Control Technologies

A best available control technology (BACT) analysis was completed as part of the current air quality permit. The analysis examined control options for emissions based on technical and environmental feasibility, and economics of each option to select the option that would be considered the best available control technology.

The use of low sulfur diesel fuel (less than 15 parts per million sulfur) for the diesel engines was selected as BACT for SO_2 emissions. Proper engine design and operations in accordance with the manufacturer's operation and maintenance is considered BACT by DEQ for controlling PM, VOC, and CO.

Water or chemical dust suppressant was determined by DEQ to be BACT for fugitive emissions which would include PM from activities outlined in the current permit to include haul road traffic, increases in aggregate throughput, and additional crushing and screening.

MDEQ ARMB #4449-03 includes conditions limiting the facility's opacity and requiring water and spray bars to be available on the site to ensure compliance with opacity standards. These conditions would limit fugitive emissions (DEQ, 2011).

As part of the submittal for the major source Title V permit application process, impacts to ambient air quality (NAAQS and MAAQS) may have to be quantified. Impacts would then be analyzed by DEQ to determine if the resultant concentrations are significant in accordance with the Prevention of Significant Deterioration (PDS) increment evaluation. The evaluation must show that combined impacts from all PSD sources would not exceed the allowable increments in air quality for NO_2, SO_2, and PM.

4.10 Power Supply

4.10.1 No Action Alternative

There would be no discernible impacts to the overall power system due to electrical use by the mine facilities. The powerline that BHJV uses has sufficient capacity to accommodate the electrical needs of the office and dry building. There would be no primary, secondary, or cumulative impacts to the power supply due to implementation of the No Action Alternative.

4.10.2 Proposed Action

Activities and the potential for impacts related to the power supply under the Proposed Action would not differ appreciably from those under the No Action Alternative. The primary, secondary or cumulative impacts to the power supply due to implementation of the Proposed Action would be the same as the No Action Alternative.

4.10.3 Alternative Haul Routes

No aspect of the Agency-Mitigated Alternative Haul Routes would affect the power supply. There would not be any additional primary, secondary, or cumulative impacts to/from the power supply due to implementation, or under the Agency-Mitigated Alternative than those described under the Proposed Action.

4.11 Noise

The remote location of the proposed BHJV Mine reduces its potential to generate impacts due to noise on humans. Noise may be noticed by recreational users in the area.

4.11.1 Primary Impacts

The BHJV Mine would potentially operate 24 hours per day 7 days per week and elimination of industrial noise from the operation is not possible. There are unavoidable noises associated with mining operations, many of which are due to backup alarms required of Mine Safety and Health Administration (MSHA). The primary mining activities at the BHJV Mine would be located underground. It would be possible for equipment operating on the surface to be heard by the public.

4.11.1.1 No Action Alternative

The noise study conducted in 2010 found measurable levels of noise at the permit boundary (48 to 70 dBA) and levels as high as 78.4 dBA close to the operating generators (BHJV, 2013). The lowest levels measured near the permit boundary are comparable to normal conversation noise (50 dBA) or noise perceived in a “quiet suburb”, while the upper end is comparable to a vacuum cleaner (INC, 2010). The highest levels of noise measured, near the generators, are comparable to a garbage disposal (80 dBA) or a passenger car at 65 mph at 25 feet (77 dBA) (INC, 2010). The levels most likely to be experienced by a passing hiker or other person nearby would be those near the permit boundary since access to the facility is restricted. The level of direct impacts due to noise from exploration operations is likely to be minimal and sporadic.

Noise levels from trucks along the bulk sample haul route would be the same as levels measured at the mine site and primary impacts would be the same. Noise generated by the truck traffic on the haul route would be likely to be noticeable to the residents' homes along that route. Disturbance or disruption due to truck noise would be sporadic but may have the potential to disrupt residents' activities.

4.11.1.2 Proposed Action

Most of the infrastructure would remain from exploration activities, and little construction activity would occur during the production phase of mining. For this reason, noise levels during pre-production and production phases of the Project would not be considerably different than they would be during exploration. Primary impacts would be similar to those outlined under the No Action Alternative.

Developing the new portion and improving the existing portions of the haul route may increase the level or extent of impacts due to noise. The number of trucks and the intermittency of their use of the road would decrease the likelihood that the noise would be considered disruptive by residents.

Under the Proposed Action the largest source of noise at the transfer station would be generated when the haul trucks were emptied into the highway-legal vehicles. The noise generated by this activity would be sporadic, short in duration, and would occur inside a covered building. The ore transfer facility would include a 120 foot by 100 foot covered structure, with the entire unloading and reloading process taking place under the covered structure (BHJV, 2013). These factors when coupled with the rural nature of the area surrounding the transfer station would lessen the overall likelihood of the noise being perceived by anyone in the area.

Noise generated by the truck traffic on the proposed private haul (west along the county road - Highland Road) route may be noticeable to nearby residents. Disturbance due to truck noise would be sporadic and would not likely disrupt residents' activities.

4.11.1.3 Alternative Haul Routes

West Alternative Route

Moving the haul route to parallel the existing Highland Road (to the Highland Road (West) Parallel Route alternative) would not create a significantly different level or extent of impacts from noise than the impacts anticipated due to the development of the haul route as described under the Proposed Action. This alternative haul route is closer the existing county Highland Road, so it passes closer to the single resident living in proximity to that road. The local residence north of the county road may be able to hear the truck traffic, but the noise from these trucks would be transient and probably not significant.

North Alternative Route

The Highland Road (North)/Roosevelt Drive Alternative haul route would create an increased level or extent of primary impacts from noise than the impacts due to the development of the haul route as described under the Proposed Action or the alternate route described above. This would be a product of the number of trucks passing through the diffuse residential development of Thompson Park. It is very likely that some of these residents will be able to hear the trucks as they pass through this area and would be disturbed by the noise.

4.11.2 Secondary Impacts

Secondary impacts due to noise include sounds discernible at areas removed from the proposed project area. It is unlikely that secondary impacts due to noise within the BHJV Mine permit areas would be discernible under any alternative under consideration. Noise levels measured at the permit boundary are only minimally distinguishable from background ambient noise such as bird calls (44 dBA) (INC, 2010). Noise levels at distances removed from the permit boundary would not be affected by activities in and around the facilities. The projected and measured noise levels at the permit boundary are low enough as to not disturb wildlife in the vicinity.

Noise generated by the trucks at the proposed transfer facility would also be unlikely to be discernible by anyone near the transfer site. The transfer facility is adjacent to Interstate-15, which would reduce the likelihood that noise generated at the transfer facility would be distinguishable from the ambient noise of the highway.

4.11.3 Cumulative Impacts

No cumulative impacts due to noise were identified as a result of the interaction of related future actions in the project area the adoption of any alternative under consideration.

4.12 Cultural Resources

This section discusses the potential impacts to known cultural resources located within the proposed BHJV mine permit boundaries and includes proposed disturbance areas associated with the transport of the ore to a transfer facility as described in Chapter 2. Although the cultural resource study area encompasses approximately 211 acres and a surrounding buffer of one mile, existing disturbances are limited to 68.1 acres that were previously approved for exploration under Exploration License No. 00680. New disturbances under the Proposed Action include 0.5 acres for a laydown area, 0.5 acres for the ore transfer facility, and 11 acres for the proposed private haul route permit area (Figure 2.4-1 and Figure 2.5-2).

Based on the location data and SHPO searches presented, there would be no potential adverse effects to known historic properties within the proposed transfer facility. However, there would be potential for adverse effects to known historic properties within the proposed mine site.

Cultural resources, which are protected under the National Historic Preservation Act of 1966 (NHPA) as amended, are defined as the nonrenewable, physical remains of past human activity more than 50 years old. Cultural resources are considered archaeological, historic, or architectural properties, buildings, structures, objects, and districts, as well as properties of traditional cultural importance to living communities. Cultural properties can be prehistoric, historic, or both prehistoric and historic in age. Historic properties are those cultural properties which meet both the criteria for significance and for integrity established by the Secretary of the Interior and are therefore eligible for listing on the National Register of Historic Places (NRHP).

As a result of the literature review and field survey, 23 cultural resource sites were identified within the study area, of which four sites are located within the 68.1-acre proposed area of disturbance within the 310-acre Project area and one newly recorded site (24SB958) is located within the proposed private haul route permit area (Barnett, 2013). No prehistoric resources were identified. Based on recent cultural resource inventories and site evaluations, no Native American heritage, traditional cultural, special interest, or sacred sites have been formally identified and recorded to date within the proposed Project area.

4.12.1 Primary Impacts

4.12.1.1 No Action Alternative

Existing disturbances include 68.1 acres that were previously approved for exploration facilities under Exploration License No. 00680. No cultural mitigations were proposed by the mining companies on the private property. No cultural inventory and mitigations to historic features are required by Montana law. No cultural features were noted by the company during land clearing and soil salvage operations. The landscape in the historic mining district has been altered by the exploration program.

Under the No Action Alternative there would be no additional ground disturbance with the potential to disturb cultural resources. The No Action Alternative would have no additional primary, secondary or cumulative impacts on previously recorded cultural resources within the Project area. Existing resources will continue to degrade over time.

4.12.1.2 Proposed Action

Potential primary impacts to known cultural resources include impacts to four previously recorded sites and one newly recorded site. All five cultural resource sites are located within the proposed BHJV mine site and proposed private haul route permit area. Four sites are situated within the Northern Claims area of which two (24SB0064 and 24SB0066) are listed as undetermined. Sites that are listed as undetermined are treated as if they are eligible when determining affects. There is one site (24SB0187) that is determined to be eligible for listing on the NRHP as a historic district and one (24SB0589) is listed as not eligible (Mehls & Lemmon, 2010). Site (24SB958) is recommended as not eligible for listing; however, SHPO concurrence is necessary to determine this recommendation. The discussion below addresses primary impacts to these five sites.

Northern Claims Area

Site 24SB0064 (also known as Red Mountain City) consists of the structural remains of eight log buildings associated with historic mining. The site is situated along Fish Creek Road within the Northern Claims area. The site that was recorded in 1977 by James D. Wilde and listed as being in fair to poor condition during the time it was initially surveyed. The site was relocated by Moore and Fredlund in 1988 who reported that Wilde's location may have been inaccurate as local informants identified Red Mountain City farther east (outside the proposed permit boundaries), blending into Highland City (24SB0067). Due to location discrepancies and lack of survey for the BHJV mine permit, it is not possible to accurately locate and determine the potential impacts to the site. Eligibility for listing on the NRHP is undetermined according to documentation received by SHPO during the January 2013 literature review (Barnett, 2013).

If the site is located within the areas where the 2.2 acres of disturbance would take place the overall long-term impacts to site 24SB0064 associated with pre-production and operational development activities (construction of a laydown area) would potentially occur. Avoidance can minimize direct impacts to historic features.

Underground decline and access ramp construction, cut and fill mining methods and the associated underground blasting could compromise the integrity of the structures from vibrations associated with blasting.

Site 24SB0066 consists of two log cabins and a shed. The site recorded by Wilde was described as a log house built over a shaft with nearby prospect pits (Wilde, 1977). Moore and Fredlund (1988) attempted to relocate the site and found a deteriorated cabin within the described site location; however, the cabin they observed did not match Wilde's survey description. Moore and Fredlund suggested that Wilde's site location may not be accurate. As a result, eligibility of 24SB0066 to the NRHP is currently undetermined.

Site 24SB0187 is defined as the Highland Historic Mining District related to the historic mining boom of 1865 to 1870 and a subsequent revival period from 1930 to 1942. The boundaries of the site have been defined as an area that covers approximately 900 acres. A large portion of the current proposed permit boundary lies within the Highland Mining District boundary. The district is listed as eligible for listing on the NRHP.

Disturbance could potentially impact the integrity of contributing or eligible sites or features. Historic mining activity associated with the Highland Historic Mining District is an important component of not only Montana's mining heritage, but national heritage. Any moderate to major disturbances to the district could have adverse effect on the district. There are no elements contributing to the NRHP eligibility of the district in the constructed LAD areas and proposed laydown area.

Site 24SB0589 consists of the historic Highland Mine and Mill site that includes 32 industrial and domestic features largely associated with operation of the Highland Mine by the Butte Highlands Mining Company from the early 1930s to 1942. The major industrial features include the collapsed portal to the Highland Mine adit, the structural remnants of a flotation mill, and the probable remains of a cyanide plant that was likely never put into operation. The site is located within the boundary of the Highland Mining District (24SB187). However, this site was determined on April 15, 2010, by Josef Warhank of SHPO as not eligible for individual listing on the NHRP or as contributing to a historic district (Mehls & Lemmon, 2010). Therefore there are no adverse effects to the site or district.

Proposed Private Haul Route Permit Area

Site 24SB958 represents a historic homestead and includes several historic features including a corral and loading chute, two log barns, and the remains of a third log structure that most likely represents the homestead residence (Barnett, 2013). This site has been recommended as not eligible for listing on the NRHP, contingent on SHPO concurrence.

Potential Adverse Effects

Construction of the 2.2 acre laydown area could bury, remove, or damage historic properties, including historical structures, districts, and landscapes. The structures can be avoided. Vibrations from underground blasting and drilling may damage historical structures in the immediate and adjacent areas. This may also result in the loss of or reduction in the future research and public interpretation potential of known and yet-to-be-discovered sites.

Currently only one site (24SB0187, Historic Mining District) is associated with the proposed permit is determined as eligible for listing on the NRHP. The district is associated with an area that encompasses a large portion of the Northern Claims area. Disturbances to unknown cultural resources, though not likely, are also possible due to the mining history of the region.

4.12.1.3 Alternative Haul Routes

West Alternative Route

Moving the haul route to parallel the existing Highland Road could reduce impacts to cultural resources. This alternative haul route is adjacent to the existing county Highland Road, primarily within the existing right-of-way for that county road. This right-of-way has previously been disturbed and construction of the new sub-parallel road would be unlikely to encounter cultural resources that were not previously detected during construction or the ongoing maintenance of the county road. The short sections where the route deviates outside of the existing right-of-way are placed to avoid exposed bedrock or private property where an easement couldn’t be secured. Where this occurs, BHJV should conduct a survey prior to road construction to determine if cultural resources are present. Any cultural resources discovered during surveys should be reported to SHPO.

North Alternative Route

The Highland Road (North)/Roosevelt Drive Alternative haul route would have fewer impacts to cultural resources than the impacts due to the development of the haul route as described under the Proposed Action or the west alternative route described above. The Highland Road (North)/Roosevelt Drive Alternative haul route comprises sections of existing Forest Service and county road and little to no new construction activity is planned. No new areas of surface disturbance will occur unless these are stipulated by the county or the Forest Service on the roads within their jurisdiction.

4.12.2 Secondary Impacts

Potential secondary impacts for the Project would include any future disturbances to known cultural resources within the current Project area. Secondary impacts to the sites could also include site disturbance due to increased public access to site areas.

4.12.2.1 No Action Alternative

Under the No Action Alternative, secondary impacts to cultural resources would be minimal.

4.12.2.2 Proposed Action

Based on the proposed operating permit application there would be potential for secondary impacts to cultural resources within the mine claims permit boundaries and the proposed private haul route permit area.

4.12.2.3 Alternative Haul Routes

It is unlikely that either alternative haul route would have any secondary impacts to cultural resources.

4.12.3 Cumulative Impacts

There would be no known cumulative impacts to cultural resources based on activities associated with all alternatives under consideration for the Butte Highlands Project.

4.13 Socioeconomics

Impacts to socioeconomics include those impacts from a change in available work in a community, the likelihood that new people will move into or out of an area to fill open jobs, the additional people (families) that may accompany them, and services that these people are likely to need in the context of the community as it exists now. Mining related jobs are some of the highest paying jobs in Silver-Bow County.

4.13.1 Primary Impacts

4.13.1.1 No Action Alternative

Impacts to socioeconomic conditions in the area would be minimal and short term under the No Action Alternative. Most of the exploration surface disturbance activity required to prepare for exploration has already occurred, and the number of employees needed for exploration would be less than that described under the Proposed Action, although the types of jobs would be similar. Socioeconomic impacts would be small and generally beneficial.

4.13.1.2 Proposed Action

To determine the appropriate level of analysis, the planned total number of personnel (54) was obtained from the operating permit application (BHJV, 2013). It was conservatively assumed that all personnel would be new to the area and that all would bring their families. The number of accompanying family members was calculated using the average family size (2.19) for Silver

Bow County (U.S. Census Bureau, 2012a). This yielded a total of 119 persons, representing a 0.4 percent increase in the area's 2011 population. This small potential impact would be further reduced by the fact that not all personnel would be employed at the same time. Therefore, it was considered unnecessary to include details about housing vacancy rates, or school and infrastructure capacity in the description of the existing environment or in the analysis of potential impacts (Tetra Tech, 2013).

4.13.1.3 Alternate Haul Routes

Potential socioeconomic impacts due to construction and use of either alternate haul route would be inconsequential.

4.13.2 Secondary Impacts

Secondary impacts due to the alternatives under consideration would include potential job creation due to increased needs for services related to the mine activity or to the influx of new persons. The types of secondary impacts to socioeconomic conditions would be the same under all alternatives, but the number of employees directly employed by BHJV would have the potential to affect the number of jobs indirectly generated. The overall beneficial secondary impacts would be greater under the Proposed Action than under the No Action Alternative. The number of employees expected would not be large enough to create a discernible impact to schools, housing, or social services under any alternative under consideration.

4.13.3 Cumulative Impacts

The predicted change in population (0.4%) is not large enough to generate a perceptible cumulative impact to the socioeconomic conditions in Butte-Silver Bow County for any alternative under consideration. The overall impact of the Proposed Action would be beneficial, but the effects would be localized and would not affect the economic climate in the community.

4.14 Transportation

This section characterizes the access corridors and identifies potential impacts to these resources and to the public living along the haul routes under the Proposed Action and alternatives. The No Action Alternative, Proposed Action, and Alternative Haul Routes, and the Agency-Mitigated Alternative have been evaluated to determine their potential impacts on the transportation system within the analysis area. During scoping and at other public meetings the largest issue raised related to impacts of vehicles using the access corridors to residents living along the roads. The issues considered include:

- Vehicle use and required roadway improvements,
- New road construction,
- Road maintenance,
- Effects on recreational access, and
- Traffic effects to residents along haul routes (noise, lights, dust, considerations).

Transportation impacts have been identified using information provided in the Hard Rock Operating Permit Application (BHJV, 2013), the Project Description and Existing Conditions

Report (Tetra Tech, 2013), and the Plan of Operations for Mining Activities on National Forest System Lands (USDA FS, 2013). Potential effects on recreational access, primarily related to area mountain bike routes, are based on information obtained from the Adventure Cycling Association (Adventure Cycling Association, 2011) and the Butte 100 Mountain Bike Race website (Butte 100, 2011). As noted earlier, the Forest Service is evaluating the potential impacts of the proposed BHJV Mine on the roads and lands under their jurisdiction. DEQ's impacts analysis is restricted to the areas where the agency has regulatory authority. Under MEPA, DEQ has to disclose impacts for resources which they do not have regulatory authority.

No Action Alternative

The analysis of impacts under the No Action Alternative assumes that BHJV would continue activities approved under the existing exploration license. BHJV personnel would use Roosevelt Drive as the primary access route to and from the mine. The 10,000 bulk sample would be hauled down Roosevelt Drive using highway-legal trucks.

Proposed Action

The Proposed Action consists of BHJV's mine and reclamation plan as outlined in their operating permit application. The analysis of impacts under the Proposed Action assumes that the mine site would be accessed by two routes, one is the primary route that would be used by workers, general deliveries, and site visits. The second route would be used to haul ore from the mine to the transfer facility near the Feely exit on Interstate-15. See Figure 2.5.2 for an overview of the road system and analysis areas for the Proposed Action.

4.14.1 Primary Impacts

4.14.1.1 No Action Alternative

Under the No Action Alternative, it is anticipated that vehicle use on Roosevelt Drive would remain at approximately the same level as conditions while the decline was being constructed, except for the potential addition of highway-legal trucks used to haul the bulk sample allowed under the exploration license. This is estimated to be 10,000 tons, requiring 22-ton highway-legal dump trucks to haul approximately 450 truckloads.

It is anticipated that only minor surface upgrades may be needed to the Roosevelt Drive route for the No Action Alternative. As the road exists, it should have adequate width, curve radii, and surface conditions for highway-legal trucks to operate.

Specific improvements for use of this road segment are being analyzed by the Forest Service and would be stipulated in the approved Plan of Operations (POO) that the Forest Service would issue once the analysis is complete. The No Action Alternative would not include construction of any new roadways.

The Great Divide Mountain Bike Trail coincides with the Roosevelt Drive access route, so the No Action Alternative would have some minor effects on recreational access. This would be a lesser impact than that associated with the conflict between mountain bikes and haul vehicles under the Proposed Action. The No Action Alternative may also have an indirect impact on hunting access to the area.

4.14.1.2 Proposed Action

Under the Proposed Action, vehicle use on the Roosevelt Drive route would include the following:

- Flatbed, van, and tank tractor trailers for equipment and supplies delivery estimated at approximately three loads per week to and from the mine.
- Approximately two personnel vans, making approximately one trip per day to and from the mine. This is based on the assumption that one van would be required for the day shift and a second van would be required for the night shift.
- Approximately five material delivery trucks making approximately one trip per week to and from the mine. This is based on five different vendors making one trip per week.

The total of these trips and other anticipated miscellaneous trips are summarized below:

Vehicle Type	Trips/Day	Trips/Week
Passenger/Light Vehicles	10-15	60-90
Vendor Trucks/Trailers	1	5
Weekly Fuel/Lubricants		3
Miscellaneous (All Types)	4	24
Total	15-20	92-122

Vehicle use on the Proposed Action ore haulage route west across the private property permit area toward Feely Interchange on Interstate-15 is anticipated to include the following:

- Ore would be hauled in 30-ton articulated off-highway dump trucks (Komatsu HM300-1). Approximately four of these trucks would be used, each hauling approximately five loads per day from the mine to the ore transfer facility during two daytime shifts.
- The total of these vehicle trips would be on the order of 20 trips per day to and from the mine, five days per week.
- Ore hauling would not occur on weekends or holidays.
- Additional trips would be required for snow removal and road maintenance and would likely occur during a third night shift.

The proposed Highland Road improvements include widening narrow areas to 16 feet, adding 22-foot wide pullouts at regular intervals and where visibility requires, installing ditches and culverts, and rebuilding soft spots (BHJV, 2013). The road would also be capped with gravel. Specific improvements are being determined by the Forest Service and would be stipulated in the final Plan of Operations that BHJV has submitted to the Forest Service for use of this road segment. About three miles of private road would be constructed with a 24-foot wide road surface, culverts, ditches, gravel, and gates on each end. About 750 feet of County Road adjacent to old US Highway 91 would be widened to 36 feet, and the bridge and culvert at Divide Creek would be replaced. BHJV has held leases since July 2011 with the land owners on whose land the ore transfer facility and the private haul road would be built (BHJV, 2013).

According to Forest Service Manual 2800 (FS-2800), which regulates geologic and mineral activities on Forest Service lands, as soon as site conditions allow safe access to the project area, a site-specific safety plan would be developed. The safety plan would be submitted to the Forest Service for their review and approval prior to any hauling activities. Some of the many considerations would include: safe operation of the haul trucks along Highland Road, the potential necessity of road widening, traffic control measures, use of radio communication equipment, haul truck speed limits, signage along Highland Road and mitigation of potential interference with public access along the Continental Divide Trail.

BHJV would also be required to evaluate impacts to the Montana Department of Transportation (MDT) system related to the tracking of material onto roadways, sight distance, truck signage, and pavement analysis. MDT would require the information needed to determine the potential impact on their roadways (travel routes, types of vehicles, turning movements, truck trips per day, etc.) and BHJV would be required to complete MDT's review process and be responsible for any mitigation concerning potential safety impacts. Additional mitigation measures may be required by Forest Service, Butte-Silver Bow County, or MDT.

As shown by Figure 2.5-1, the haul route would include a three-mile segment of new roadway that would be constructed on private property. It would essentially follow Highland Road from the Forest Service boundary to Interstate-15. This route would terminate at an ore transfer facility adjacent to Interstate-15 at the Feely Interchange. The new roadway would likely consist of a 24-foot wide gravel surface with roadside drainage ditches. The extent of additional improvements is still to be determined, but would likely include pull-outs, signage, and other improvements.

Under the Proposed Action, BHJV would perform snow removal on Highland Road beginning where the County plowing for school bus access ends and on Forest Service Road 8520 between Highland Road and the mine site. BHJV would perform dust suppression on all mine access roads. Dust control on roads would consist of water application using water trucks or magnesium chloride, if necessary. Maintenance of private road segments is described in lease agreements with private landowners and includes provisions for noxious weed control, erosion control, and culvert and ditch maintenance. Maintenance agreements would also be developed with Butte-Silver Bow County.

According to FS-2800, Forest Service and BHJV would enter into a Memorandum of Understanding for the Forest Service to conduct weed control whereby BHJV would make a monetary contribution to the annual weed control program. Alternatively, subcontractors would be used to implement weed control in accordance with a Forest Service approved weed control plan. The details of such an agreement would be discussed at a later date. In regards to snow removal from the access roads, a snow removal plan would be developed and subsequently submitted to the Forest Service.

The Great Divide Mountain Bike Trail coincides with both the Roosevelt Drive access route and the proposed haul route to the transfer station at Interstate-15. The Butte 100 Mountain Bike Race takes place on a Saturday. It is not anticipated that there would be any conflict with haul trucks. The Great Divide Mountain Bike Trail riders may ride this route any day of the week at any time of day. Haul trucks and bicycles would be able to safely share this route by carefully checking sight distance around horizontal and vertical curves, providing adequate warning signage, and by using targeted education of truck drivers on how to safely share the road with bicycles. BHJV has not proposed measures to limit impacts to bicyclists along the trail.

There is some concern about how haul traffic may affect hunting access in the fall, especially along Highland Road where the private road merges with Forest Service Road 84. This is a high traffic area for recreational use and the Proposed Action may have an indirect effect on hunters. The lack of ore hauling on the weekends would reduce the potential for impacts to hunters.

4.14.1.3 Alternative Haul Routes

West Alternative Route

Moving the haul route to parallel the existing Highland Road (to the Highland Road (West) Parallel Route alternative) would not create a different level or extent of primary impacts than the impacts anticipated due to the development of the haul route as described under the Proposed Action. This alternative haul route is adjacent to the existing county Highland Road. The number and type of ore haul trucks would be the same as that under the Proposed Action: 20 round trips per day on this route during mining.

North Alternative Route

The Highland Road (North)/Roosevelt Drive Alternative haul route would have fewer impacts than the impacts due to the development of the haul route as described under the Proposed Action or the alternate route described above. The Highland Road (North)/Roosevelt Drive Alternative haul route is an existing Forest Service or county road and little to no new construction activity is planned. Because of the lower hauling capacity of the highway legal trucks necessary, the number of ore haul trucks would increase from 20 round trips per day to 30 round trips per day on this route during the Proposed Action mining.

4.14.2 Secondary Impacts

4.14.2.1 No Action Alternative

No secondary impacts to transportation have been identified under the No Action Alternative.

4.14.2.2 Proposed Action

No secondary impacts have been identified. The increased noise, dust, vehicle lights would have a minimal secondary impact due to the lack of nearby residences.

4.14.2.3 Alternative Haul Routes

West Alternative Route

Moving the haul route to parallel the existing Highland Road (to the Highland Road (West) Parallel Route alternative) would not create a different level or extent of secondary impacts than the impacts anticipated due to the development of the haul route as described under the Proposed Action. This alternative haul route is adjacent to the existing county Highland Road.

North Alternative Route

The Highland Road (North)/Roosevelt Drive Alternative haul route would have greater secondary impacts than the impacts due to the development of the haul route as described under the Proposed Action or the West alternative route described above. These impacts would include increased noise, lights, and some dust generated by the larger number of vehicles required to move the ore (see Table 2.1-1). The Highland Road (North)/Roosevelt Drive Alternative haul route includes portions of existing Forest Service and county roads and little to no new construction activity is planned. Because of the lower hauling capacity of the highway legal trucks necessary, the number of ore haul truck trips would increase from 20 round trips per day to 30 round trips per day on this route during the Proposed Action mining.

4.14.3 Cumulative Impacts

No cumulative impacts to transportation have been identified under any alternative under consideration. There are no related future actions under consideration with the potential to impact transportation in the vicinity of the proposed BHJV Mine or the proposed haul route alternatives.

4.15 Land Use and Recreation

Under the Proposed Action, surface disturbance would be limited to existing disturbance associated with the approved exploration plan with an additional disturbance of 12.7 acres required to expand the laydown area, construct the private section of the ore haulage route, and the ore transfer facility. Other land uses in the vicinity of the project include grazing allotments, timber stands, the Basin Creek Management Area, and several recreational use areas with differing use emphasis (motorized, non-motorized, wildlife conservation, etc.).

4.15.1 Primary Impacts

4.15.1.1 No Action Alternative

The area currently in use by BHJV is privately-owned, although it is surrounded by public lands. Land use within the existing permit area boundary would not change under the No Action Alternative. A portion of the Continental Divide Trail crosses the northern portion of BHJV's patented lands.

4.15.1.2 Proposed Action

Under the Proposed Action there would be no additional changes to land use within the mine permit boundary beyond surface disturbances that have been described in previous sections. The lands encompassed by the BHJV permit area would continue to be used as they are being used currently.

The lands leased to accommodate the proposed haul route that would divert the trucks away from the Highland Road would be removed from use as pasture for the duration of the project. These lands are privately-owned; therefore, the change in their use would not affect other land users in the area.

4.15.1.3 Alternative Haul Routes

West Alternative Route

Moving the haul route to parallel the existing Highland Road (to the Highland Road (West) Parallel Route alternative) would create a reduced level or extent of primary impacts to land use than the impacts anticipated due to the development of the haul route as described under the Proposed Action. This alternative haul route is adjacent to the existing county Highland Road and is primarily within the existing right of way. The construction of this haul route would reduce impacts to the wetlands, Fly Creek, and the pasture lands used by the local landowners. The fields would not be bisected by the haul road and truck traffic would be a significantly lower hazard to livestock.

North Alternative Route

The Highland Road (North)/Roosevelt Drive Alternative haul route would have significantly fewer impacts to transportation resources than the impacts due to the development of the haul route as described under the Proposed Action or the alternate route described above. The Highland Road (North)/Roosevelt Drive Alternative haul route is an existing Forest Service or county road and little to no new construction activity is planned.

4.15.2 Secondary Impacts

4.15.2.1 No Action Alternative

There would be no appreciable secondary impacts to land use due to the selection of the No Action Alternative.

4.15.2.2 Proposed Action

Users of the Continental Divide Trail including mountain bikers may notice more frequent truck traffic along the existing portions of the ore haul route. In addition, if road improvements are made to the mine access route, this may increase recreational use of the Highland Mountain area trails and access sites.

4.15.2.3 Alternative Haul Routes

Neither haul route alternative would create a different level or extent of secondary impacts to recreational users from those anticipated due to the development of the haul route as described under the Proposed Action.

4.15.3 Cumulative Impacts

4.15.3.1 No Action Alternative

As there are no potential primary or secondary impacts to land use due to implementation of the No Action Alternative, there is no potential for cumulative impacts for this alternative.

4.15.3.2 Proposed Action

There are no additional projects proposed in the general area surrounding the Proposed Action that would contribute to cumulative impacts to land use in and around the project area. The expected level of impacts related to recreational traffic is low enough that it is unlikely to contribute to a cumulative increase in overall use of the lands in the vicinity of the project area.

4.15.3.3 Alternate Haul Routes

Moving the haul route to parallel the existing Highland Road or using Roosevelt Road as an ore haul route would likely reduce the level or extent of cumulative impacts to recreational users from those anticipated due to the development of the haul route described under the Proposed Action.

4.16 Visual Resources

4.16.1 Primary Impacts

4.16.1.1 No Action Alternative

A visual screen analysis conducted by BHJV as part of their operating permit application indicated that the facilities are not visible to the public from the most likely view point, a rest area near the intersection of Highland Road and Fish Creek Road. A person walking or driving on Forest Service Road 8250 would be able to see the entrance to the mine, but the cleared areas and facilities are uphill from the roadway and would not be visible from any publicly accessible area. Lights from the operation may be visible at night to people driving through the area, but would not be visible to any residences due to the remote location.

4.16.1.2 Proposed Action

Impacts to visual resources under the Proposed Action would be the same as those described under the No Action Alternative for the area near the proposed mine. No additional ground disturbance areas are proposed that would be visible.

Portions of the haul route would be visible to a person driving along the Highland Road near the Interstate-15 intersection. There are other dirt and gravel roads in the vicinity on the north and south sides of Highland Road, and the addition of the proposed haul route roadway would not appear out of place within the scenic context but would appear as a new road in the native rangeland. The proposed 100 foot by 120 foot covered structure at the transfer facility would be painted to blend in with the surrounding landscape.

BHJV has not proposed any lighting modifications.

4.16.1.3 Alternate Haul Routes

West Alternative Route

Placing the haul route adjacent to the existing Highland Road (Highland Road (West)/parallel haul route) would increase the overall width of roadway in the area and would be a noticeable change to the character of the existing road. Building the new section of haul route adjacent to the existing road would limit amount of new disturbance and keep the visual impacts to the existing road corridor. This larger road surface would have less impact than the presence of a new haul road constructed across the middle of the fields on private lands.

North Alternative Route
The use of the Highland Road (North)/Roosevelt Drive Alternative haul route would represent no change in the visual resources of the area as no new roads or disturbances to the area are planned.

4.16.2 Secondary Impacts

There would be no secondary impacts to the visual resources of the areas affected by any of the alternatives under consideration.

4.16.3 Cumulative Impacts

There would be no cumulative impacts to the visual resources of the areas affected by any of the alternatives under consideration. There are no plans for projects that are in the permitting stage that would have the potential to contribute to the cumulative impact of the proposed BHJV mine and the proposed haul routes.

4.17 Wildlife Resources

4.17.1 Primary Impacts

4.17.1.1 No Action Alternative

Impacts to wildlife resources under the No Action Alternative are those that are ongoing from activities approved under the existing exploration license. Primary impacts to wildlife include ongoing risk of roadkill from traffic along Roosevelt Road to and from the proposed exploration project area. This impact is temporary since, under the No Action Alternative, if the mine is not permitted, exploration decline closure would be initiated in less than one year after completion of exploration activities.

Under the No Action Alternative there would be the continued temporary loss of habitat associated with the exploration disturbance, surface facilities, and small portions of the LAD areas (total of 68.1 acres). This temporary loss of habitat would continue until exploration decline closure and completion of reclamation.

4.17.1.2 Proposed Action

Under the Proposed Action, roadkill impacts would increase due to the increase in traffic along Roosevelt Drive (15-20 trips per day, compared to 5-10 trips per day) and along the proposed haul route (20 trips per day compared to none). This impact would be temporary, occurring for the five years of mine operation.

In addition to impacts on roads, there would be another 12.7 acres of temporary habitat loss compared to the No Action Alternative. Most of the habitat loss would be associated with the proposed haul route to be constructed, the haul route permit area, and transfer facility. The haul route and transfer facility would be reclaimed within two years after mine closure per the operating permit application.

4.17.1.3 Alternative Haul Routes

West Alternative Route
Moving the haul route to parallel the existing Highland Road (to the Highland Road (West) Parallel Route alternative) would likely create a reduced level or extent of primary impacts to wildlife than the impacts anticipated due to the development of the haul route as described under the Proposed Action. This alternative haul route would be adjacent to the existing county Highland Road and would be primarily within the existing right of way. The construction of this haul route would potentially reduce impacts to the wetlands, Fly Creek, and the pasture lands used by wildlife and livestock. The fields would not be bisected by the haul road and truck traffic would be a lower hazard to wildlife and livestock, as it would be located adjacent to the county road.

North Alternative Route
The Highland Road (North)/Roosevelt Drive Alternative haul route would have potentially fewer impacts to wildlife resources than the impacts due to the development of the haul route as described under the Proposed Action or the alternate route described above. The Highland Road (North)/Roosevelt Drive Alternative haul route is an existing Forest Service or county road and little to no new construction activity is planned. It is essentially the same impacts that would be seen under the No Action Alternative.

4.17.2 Secondary Impacts

4.17.2.1 No Action Alternative

Wildlife may avoid the BHJV exploration area or portions of the area because of the exploration activity and road traffic associated with the No Action Alternative, causing secondary impacts.

4.17.2.2 Proposed Action

Under the Proposed Action, the work force will increase (up to 54 total employees); therefore, disturbance to wildlife would be greater than under the No Action Alternative. Short-term disturbance to wildlife would occur primarily from traffic on the proposed haul route. Species of concern such as grizzly bears and wolverines may avoid this area. BHJV has identified protection measures for wildlife in its operating permit application. Specifically these measures are:

- BHJV will implement a waste management plan that will minimize refuse that would be an attractant to wildlife. Employees will be discouraged from feeding wildlife in the mine site and strict company policy will be implemented with respect to guns in company vehicles on mine property.
- Employee awareness programs will be implemented into the overall training program of all employees about wildlife issues.

These measures will mitigate impacts to wildlife.

Any groundwater from mine dewatering discharged directly to surface water would be required to meet non-degradation criteria and would therefore not negatively affect amphibian populations. Surface water quantity may change during the life of the mine as a result of the Proposed Action, and could therefore affect habitat for aquatic wildlife, especially the amphibians known to occur in Middle Fork Moose Creek and Fish Creek. The operating permit application includes an Aquatic Monitoring Plan designed to evaluate the mine's effects on water quality and quantity.

4.17.2.3 Alternative Haul Routes

West Alternative Route

Moving the haul route to parallel the existing Highland Road (to the Highland Road (West) Parallel Route alternative) would likely create a reduced level or extent of secondary impacts to wildlife than the impacts anticipated due to the development of the haul route as described under the Proposed Action.

North Alternative Route

The Highland Road (North)/Roosevelt Drive Alternative haul route would have fewer secondary impacts to wildlife resources than the impacts due to the development of the haul route as described under the Proposed Action or the alternate route described above. The Highland Road (North)/Roosevelt Drive Alternative haul route is an existing Forest Service or county road and little to no new construction activity is planned. It is essentially the same impacts that would be seen under the No Action Alternative.

4.17.3 Cumulative Impacts

4.17.3.1 No Action Alternative

There would be no cumulative impacts to wildlife under the No Action Alternative.

4.17.3.2 Proposed Action

Cumulative impacts to wildlife under the Proposed Action would include potential displacement of wildlife due to additional disturbance from the transfer facility and within the proposed haul route permit area.

4.17.3.3 Alternative Haul Routes

West Alternative Route

Moving the haul route to parallel the existing Highland Road (to the Highland Road (West) Parallel Route alternative) would likely cause no cumulative impacts to wildlife.

North Alternative Route

The increase in truck traffic on the Highland Road (North)/Roosevelt Drive Alternative haul route would likely cause no cumulative impacts to wildlife resources.

4.18 Aquatic and Fisheries Resources

Impacts to fisheries and aquatic resources would stem from changes in water availability and water quality and are likely to follow the impacts outlined under Section 4.6 Surface Water Resources. There are populations of westslope cutthroat trout in Basin Creek and Fish Creek (Table 3.18-1) (MFISH, 2013; Spoon, pers. comm., 2013).

4.18.1 Primary Impacts

4.18.1.1 No Action Alternative

Under the No Action Alternative there is a potential for reduction in stream flow rates as described in Section 4.6. Under the existing exploration license, exploration decline dewatering operations may cause a reduction of groundwater discharge to surface water bodies. The extent of this change is not known, but the MPDES permit estimated that groundwater storage would be reduced due to the dewatering (DEQ, 2013a). BHJV would pump the water to LAD areas draining toward Moose Creek offsetting water quantity impacts to Moose Creek. However, any impacts to flow in Fish Creek could be detrimental to the native cutthroat trout population because of the small size of the stream (Spoon, pers. comm., 2013).

4.18.1.2 Proposed Action

Under the Proposed Alternative, stream flow rates would be altered due to mine dewatering. It is not possible to determine the precise extent or duration of the alterations, but the mine plan anticipates dewatering would occur for at least four and one-half years. Dewatering would reduce groundwater input to streams, but BHJV would return substantial amounts of water in excess of average annual flows to Basin Creek, Fish Creek, and tributaries of Moose Creek via pumping and discharge from the LAD system (Table 4.6-1).

An assessment of the ability of these stream channels to manage the increased flows found that the channels of are marginally stable enough to receive the flows, but changes in the hydrograph have the potential to alter habitat such as pools and riffles, and may cause downcutting before the channels are able to accommodate the new flow levels (Cawlfield, 2012).

The water returned to the creeks would be treated, and water quality would meet non-degradation criteria. The uncertainty related to how the creeks and the aquatic ecology would adapt to the change in flows makes assessing potential impacts difficult. Headwater streams generally experience high flows during snowmelt and return to baseflow conditions in summer. Mine dewatering would continue throughout the summer and returned water (treated outflows) would augment baseflows in the creeks. The increased flows would dissipate as they move down the watershed, but some increase in flow may be noticeable downstream during the dewatering.

The proposed haul route bisects an area of ranchland and crosses Fly Creek. Construction of the road would potentially introduce sediment into Fly Creek. Appropriate use of sediment BMPs would minimize the potential for negative impacts to stream habitat from introduced sediment such as increased turbidity and deposition. Stream crossings should be designed using structures (e.g. culverts) capable of passing mean annual flood discharge without compromising existing channel width.

4.18.1.3 Alternative Haul Routes

West Alternative Route

Moving the haul route to closely parallel the existing Highland Road (Highland Road (West) Parallel Route alternative) would potentially decrease the level and extent of impacts to fisheries and aquatic resources from those anticipated due to the development of the haul route described under the Proposed Action. The alignment adjacent to the existing road would keep the road disturbance away from Fly Creek and could reduce the potential for impacts due to sediment input and pollutants to the creek and nearby wetlands.

North Alternative Route

Use of the Highland Road (North)/Roosevelt Road haul route would have no additional impacts to fisheries and aquatic resources.

4.18.1.4 Agency Mitigated Alternatives

The Agency Mitigated Alternative may benefit fisheries if the additional monitoring detects contaminants and allows a clean-up response to prevent damages to water quality and fisheries.

4.18.2 Secondary Impacts

4.18.2.1 No Action Alternative

The dewatering necessary for the No Action Alternative has the potential to temporarily decrease groundwater levels which would impact surface water flows after exploration is complete. Changes to surface water could affect aquatic organisms in wetlands as well as streams. More details about this potential impact are provided in the description of the impacts under the Proposed Action.

4.18.2.2 Proposed Action

Secondary impacts to aquatic resources and fisheries due to the Proposed Action would include potential reductions in groundwater levels during operations from dewatering. Once BHJV stops actively pumping and redistributing the water from the mine, mine flooding would take up to eight years to fully recharge groundwater levels (BHJV, 2013; DEQ, 2013a). During this recharge period, surface water flows are likely to be reduced and would not be offset by discharge of treated mine water. It is also likely that surface water flows would be reduced, especially after spring runoff when streams are maintained by baseflow during this recharge period. Reduction in flows would decrease available fish habitat and increase potential competition for quality habitat in these small streams. Any stream dewatering could strand and kill individual fish, interrupt reproductive migration (spawning), or cause egg mortality depending upon when the dewatering occurred seasonally and how long the dewatering persists.

Plugging the historic Highland adit would reduce flow to the Basin Creek watershed over the long term. As the mine floods the historic springs and seeps could be reestablished. The position of the mine along the Continental Divide complicates predicting how plugging the adit would ultimately resolve where the water would flow. The interim period between cessation of dewatering and groundwater recharge may affect fish populations.

Creeks may be impacted during road improvements required by the Forest Service and the county along haul routes. These impacts would be mitigated by BMPs required on the roads by the Forest Service and the county. The creeks may also be affected by the new segment of private road construction through native rangeland, particularly at or near proposed culvert and stream crossing sites.

4.18.2.3 Alternative Haul Routes

West Alternative Route

Moving the haul route to closely parallel the existing Highland Road (Highland Road (West) Parallel Route alternative) would potentially decrease the level and extent of secondary impacts to fisheries and aquatic resources from those anticipated due to the development of the haul route described under the Proposed Action. The alignment adjacent to the existing road would keep the road disturbance away from Fly Creek and could reduce the potential for impacts due to sediment input and pollutants to the creek and nearby wetlands.

North Alternative Route

Use of the Highland Road (North)/Roosevelt Road haul route would have no additional impacts.

4.18.2.4 Agency-Mitigated Alternative

Sediment control BMPs would be used during road construction to minimize the amount of material that enters the streams and wetlands in the vicinity. All stream crossings should be designed to pass typical high flow events and not impinge upon the existing channel. Sediment control structures should be maintained in the vicinity of the streams until vegetation is well established to reduce sediment inputs.

4.18.3 Cumulative Impacts

There are no related future actions currently proposed or in the permitting process that would affect fish or aquatic resources in the general vicinity of the proposed BHJV Mine.

4.18.3.1 No Action Alternative

There would be no cumulative impacts to fisheries under the No Action Alternative.

4.18.3.2 Proposed Action

There would be no cumulative impacts to fisheries under the Proposed Action.

4.18.3.3 Alternative Haul Routes

There would be no cumulative impacts to fisheries that result from the construction or use of the Alterative Haul Routes.

4.18.3.4 Agency-Mitigated Alternative

No mitigations are required due to the lack of foreseen cumulative impacts to Aquatic and Fisheries Resources.

4.19 Regulatory Restrictions Analysis

No aspect of the alternatives under consideration would restrict the use of private lands or regulate their use beyond the permitting process prescribed by the MMRA. Approval of BHJV's operating permit application facilitates BHJV's proposed mining for minerals on land that it owns. The conditions imposed by DEQ in issuing the permit are designed to make the project meet minimum environmental standards or have been proposed and/or agreed to by BHJV. Thus, the conditions do not constitute a compensable taking of private property.

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Chapter 7: Comments on the Draft EIS

Comments on the Draft EIS will be compiled and summarized in the Final EIS

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Chapter 8: References Cited

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Appendix: Summary of Reclamation Plans for Individual Facilities and Equipment at Butte Highlands Mine

Table 3.1.1. Summary of Reclamation Plans for Individual Facilities and Equipment at Butte Highlands Mine

Item or Facility	Description	Reclamation Method	Status During Reclamation Phase	
			Temporary Closure	Final Closure
Underground Mine and Pad Area				
Main Access Adit Portal	16' high x 15' wide	Cemented rock fill, cement plug, or locking gates/air doors	Reclaimed (with locking gates)	Reclaimed
Secondary (Ventilation) Adit Portal	16' high x 15' wide			
Laydown/Yard Area	Flat graded area 2.7 acres during exploration, 3.2 acres at full build out	Minor regrading and scarify, spread top soil 12" deep, and reseed.	Reclaimed	Reclaimed
250,000 Ton Waste Rock Dump				
Sediment Ponds				
Sediment Pond	Approximately 120' x 270' rectangular pond, lined with 80 mil liner	Cut and bury liner, backfilled with Recycle Pond dike material.	**Retained**	Reclaimed
Recycle Pond	Approximately 120' x 150' triangular pond lined with 80 mil liner.	Cut and bury liner, push embankments into Sediment Pond	**Retained**	Reclaimed
Culvert	Approximately 60' culvert (8" diameter) connecting Sediment Pond to Recycle Pond	Removal	**Retained**	Reclaimed
Fencing	1,350 feet of "hog wire" fencing around ponds, 8' tall.	Removal	**Retained**	Reclaimed
Soil Stockpiles				
Sediment Pond Spoil/Subsoil Stockpile	12,000 cubic yards	Used for growth media	Reclaimed	Reclaimed
Topsoil Stockpile	35,600 cubic yards	Used for growth media	Reclaimed	Reclaimed
Shotcrete and Slurry Plants				
Mixing Pit Area	35' x 35' x 5' unlined pit	Backfill and revegetate	Reclaimed	Reclaimed
Shotcrete Plant	8' x 16'	Removal	Reclaimed	Reclaimed
Slurry Plant	8' x 20' conex container	Removal	Reclaimed	Reclaimed
Crushing and Screening Plant	Portable equipment	Removal	Reclaimed	Reclaimed

Item or Facility	Description	Reclamation Method	Status During Reclamation Phase	
			Temporary Closure	Final Closure
Power Generation				
Compressor	Skid/trailer mounted equipment	Removal	Reclaimed	Reclaimed
546 HP Compressor	Skid/trailer mounted equipment	Removal	Reclaimed	Reclaimed
563 Compressor	Skid/trailer mounted equipment	Removal	Reclaimed	Reclaimed
Transformer	Skid/trailer mounted equipment	Removal	Reclaimed	Reclaimed
Panel	Skid/trailer mounted equipment	Removal	Reclaimed	Reclaimed
Structures and Associated Infrastructure				
Lamp House	8' x 20' conex container	Removal	Reclaimed	Reclaimed
Wash/Fuel Pad	Quonset tent on 50' x 75' concrete foundation 8" thickness	Tent removed, slab broken and buried (12" cover-soil)	**Retained**	Reclaimed
Surface Shop	Quonset tent on 50' x 75' concrete foundation 8" thickness	Tent removed, slab broken and buried (12" cover-soil)	**Retained**	Reclaimed
Office	Double-wide trailer on level ground at laydown area (no slab)	Removal	**Retained**	Reclaimed
Dry Building	Double-wide trailer on level ground at laydown area (no slab)	Removal	**Retained**	Reclaimed
Core Shed	25' x 45' metal shed on a foundation 6" thickness	Retained in place on private land	**Retained**	**Retained**
Septic Tanks	Two concrete underground septic tanks ~2,200 gallons each	Retained in place on private land	**Retained**	**Retained**
Leach Field	30' x 100' leach field	Retained in place on private land	**Retained**	**Retained**
Potable Water Well	Well located about 150' east of Wash/Fuel Pad	Retained in place on private land	**Retained**	**Retained**
Fencing and Gate	Approximately 4,000' of fence and steel gate	Retained in place on private land	**Retained**	**Retained**
Run-On and Run-Off Control				
Portal Pad Run-On Diversion	Approximately 1,000' ditch on south east of office area 4' wide by 18" deep	Regraded and revegetated once site is stabilized	**Retained**	Reclaimed
Portal Pad Run-Off Diversion	Approximately 900' ditch and collection ponds west of Laydown/Waste Rock area	Regraded and revegetated once site is stabilized	**Retained**	Reclaimed

Item or Facility	Description	Reclamation Method	Status During Reclamation Phase	
			Temporary Closure	Final Closure
LAD 2 Diversion Ditches	Approximately 1,300' of ditches (two ditches) located north and east of LAD 2	Regraded and revegetated once site is stabilized	**Retained**	Reclaimed
Culverts	One approximately 60' culvert and one approximately 100' culvert (15" diameter) emptying into Sediment Pond	Removal	**Retained**	Reclaimed
Land Application Discharge Areas and MPDES Discharge Pipes				
Culvert (leading to to Pump Vault)	Two approximately 135' culverts 8" diameter between Recycle Pond and LAD Pump Vault	Plug and leave buried in place	**Retained**	Reclaimed
Pump Vault	10' diameter by 14'tall steel vault	Removal	**Retained**	Reclaimed
LAD 1 Mainline (6" HDPE)	Approximately 650' of HDPE piping leading to 4" Sprinkler System (40' buried, the rest is on surface)	Removal	**Retained**	Reclaimed
LAD 1 Sprinkler System (4" HDPE) and sprinkler heads	Approximately 2,000' of 6" and 4" HDPE piping on surface	Removal	**Retained**	Reclaimed
LAD 2 Mainline	Approximately 2,850' of buried 6" HDPE	Cut and plug ends, remains buried in place	**Retained**	Reclaimed
LAD 2 Valve Vault	10' diam by 14' tall steel	Removal	**Retained**	Reclaimed
LAD 2 Laterals	Approximately 18,700' of buried 2" HDPE	Remains buried in place	**Retained**	Reclaimed
LAD 4 Mainline	Approximately 2,260' of buried 8.5" steel pipe	Cut and plug ends, remains buried in place	**Retained**	Reclaimed
LAD 4 Pump House	20' x 20' steel building on 4' concrete slab	Remove	**Retained**	Reclaimed
LAD 4 Lateral	Approximately 960' of buried 3.5" steel pipe	Remains buried in place	**Retained**	Reclaimed
LAD 4 Snow Guns and Pads	Seven snow guns each located on separate 4' diameter x 5" deep concrete foundations	Snow guns removed and concrete foundations buried in place	**Retained**	Reclaimed
Reverse Osmosis System	Trailer mounted equipment	Removal	Reclaimed	Reclaimed
MPDES Pipeline	Approximately 9500' of buried 4" and 6" HDPE	Cut and plug ends, remains buried in place	**Retained**	Reclaimed

Item or Facility	Description	Reclamation Method	Status During Reclamation Phase	
			Temporary Closure	Final Closure
Roads				
Main Access Road	Road from north side of Camp Creek Road to office area	Retained in place on private land	**Retained**	**Retained**
Access Roads to LAD 1 and 2	Approximately 2,000' of road from south side of Camp Creek Road to LAD 1 and LAD 2 areas	Lightly scarified and revegetated/reclaimed as 2-track road	**Retained**	Reclaimed
Exploration Drill Roads	Approximately 5,700' of road	Regraded to original contour and revegetated	**Retained**	Reclaimed
Private Ore Haulage Road	Approximately 20,000' (10 acres) of road	Regraded to original contour and revegetated	**Retained**	Reclaimed
Wells and Piezometers				
LAD Monitoring Wells (3)	8" diameter and 65' deep, downgradient of LAD 1, 2, 3, and 4	Plugged and abandoned in accordance with applicable laws	**Retained**	Reclaimed
Exploration Bore Hole (1)	12" diameter boring 540 feet deep drilled from surface into mine workings	Plugged and abandoned in accordance with applicable laws	Reclaimed	Reclaimed
Hydrology Testing Wells (5)	8"diameter and approximately 1,000' deep in vicinity of mine workings	Plugged and abandoned in accordance with applicable laws	**Retained**	Reclaimed
Piezometers (14)	4" diameter and 5' deep PVC at end of LAD 2 laterals	Remove	**Retained**	Reclaimed
Ore Transfer Facility				
Ore Transfer Building	100' x 120' covered structure	Dismantle and remove. Break and bury concrete foundation/pad	**Retained**	Reclaimed
Access Road	Appx 215 lineal feet of 40-foot wide access road leading to and from the Ore Transfer building	Regraded to original contour and revegetated	**Retained**	Reclaimed
Soil Stockpile Area	100' x 120' area for topsoil and subsoil stockpiles	Use for reclamation and revegetate footprint	**Retained**	Reclaimed