B(3)(d) Potential Impacts to Existing Uses and Natural Resources

Introduction

The following subsections present an assessment of potential for impacts to natural resources including forest resources; historic sites; wildlife and plant habitats; scenic resources; water resources; and recreation resources.

A significant component of this discussion is dedicated to surface waters (ponds and streams) and groundwater since these are the resources most vulnerable during the development, operation and closure of the Pickett Mountain mineral deposit. This evaluation discusses the nature of the water resources including the relationships between topography, location of groundwater divides, areas of groundwater recharge and groundwater discharge. An initial estimate of an overall hydrologic water balance for the site is also provided.

The mine development, operation and closure strategy is predicated on protecting these water related resources. Therefore, a discussion of this overarching strategy is presented after discussion of the resources and addresses how these resources will be protected.

This information is followed by a general discussion of the Pickett Mountain mine development, operation and closure strategy and the management of mine-related waters. Those approaches, as well as the physical setting of the mineral deposit provide the means for mitigation of potential impacts to water resources.

Surface Water Resources and Groundwater

The following sections describe the physical setting, surface water, groundwater hydrogeology and groundwater resources.

Physical Setting and Surface Water Resources

The Pickett Mountain Deposit is situated beneath a portion of an approximate 2.7 mile long ridge with moderate elevations ranging from 1,360 to 1,140 feet (west to east). The ridge is bordered to the south by Pickett Mountain Pond, to the east by Tote Road Pond and Grass Pond, and to the north by Pleasant Lake and Mud Lake. Pickett Mountain Pond flows through an unnamed stream to Grass Pond and hence north to Mud Lake and the West Branch of the Mattawamkeag River. Pleasant Pond flows easterly to Mud Lake. Tote Road Pond outlets to a stream that flows easterly to Hale Pond and hence northerly through Green Pond to an unnamed stream that also joins the West Branch of the Mattawamkeag River.

The various lakes and ponds have the approximate following acreages:

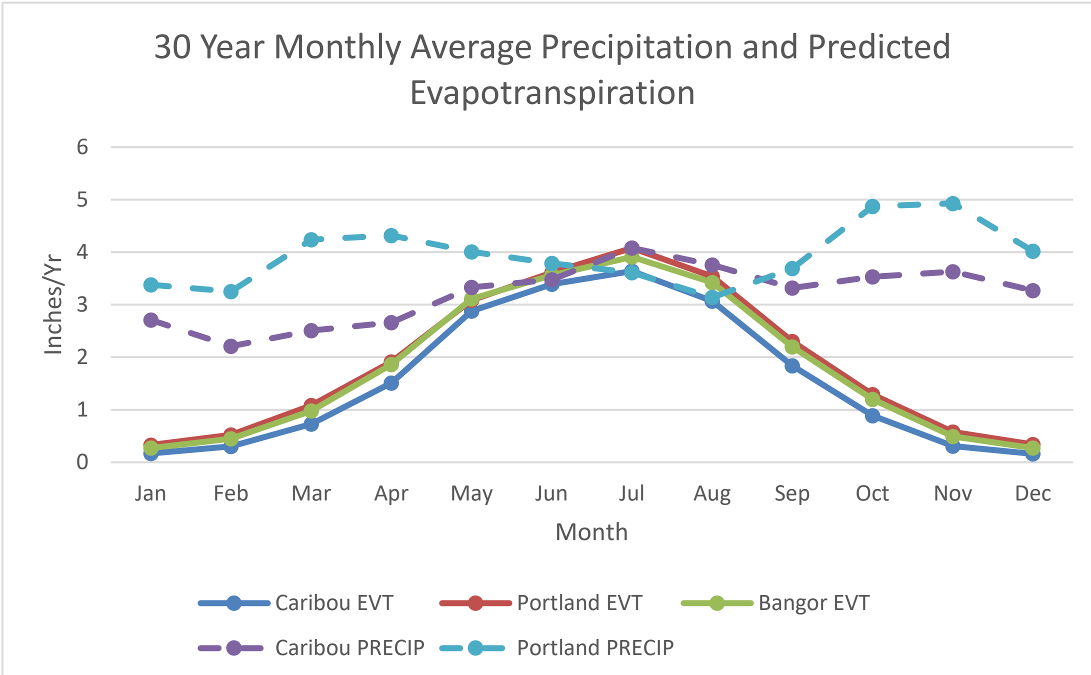
Pickett Pond	173 acres
Grass Pond	42 acres
Pleasant Lake	310 acres

Mud Lake	188 acres
Tote Road Pond	28 acres

The ridge occupying the Pickett Mountain Deposit is bordered by higher elevations to the south including Mount Chase, Long Mountain and Pickett Mountain and to the north by Hay Brook Mountain, Roberts Mountain and Green Mountain. Another intervening ridge of similar elevation is present north of the West Branch of the Mattawamkeag River, where it enters the west side of Pleasant Lake. Surface water drainage and shallow groundwater discharge from the southern slope of this intervening ridge and Green Mountain contribute groundwater and surface water flows along the north side of both Pleasant and Mud Lakes. Prior field observations including surface water temperature measurements indicate the presence of groundwater seeps that flow into Pickett Mountain Pond and the stream flowing from it. Long and Pickett Mountain to the south, also contribute to groundwater and surface water inflows to Pickett Mountain Pond.

Groundwater Hydrogeology

Based on subsurface drilling conducted during mineral exploration activities, the site is characterized by relatively thin glacial deposits which mantle bedrock with moderate to steep slopes. Within margins of intervening valleys stratified glacial deposits are potentially present. Groundwater and surface water divides are expected to be controlled by topography and groundwater flow direction should mimic topography. **Attachment I** provides a depiction of the anticipated groundwater and surface water divides, and indicates anticipated groundwater flow directions. Based on studies of similar geologic and geographic settings (Gerber and Hebson, 1996) and historically averaged precipitation data (http://www.nrcc.cornell.edu/wxstation/pet/pet.html), the site is anticipated to receive approximately 45 inches of total annual precipitation (see figure below). Recharge to groundwater (Net precipitation minus evapotranspiration) will result in overburden groundwater and shallow bedrock groundwater recharge and groundwater flow toward surface water bodies including lakes, ponds and streams.



Average Precipitation and Evapotranspiration Rates Across Maine

The majority of shallow groundwater recharge is in spring and fall when temperatures are above freezing and evapotranspiration rates are lowest, and precipitation highest as depicted in Exhibit 1. The majority of recharge will be too shallow (possibly perched) and deeper overburden groundwater with a smaller amount of recharge to bedrock groundwater, typically in the range of 2-10% (Gerber and Hebson, 1996). The amount of recharge typically increases toward the top of the topographic highs due to increased vertical gradients, with lower recharge rates down slope toward groundwater discharge areas. This shallow groundwater will form the base flow of groundwater recharge to surface water.

The hydraulic conductivity of silty glacial tills is typically low (< 1ft/day). Therefore, the movement of overburden groundwater at the site is expected to be slow (< 0.2 ft/day) given anticipated hydraulic gradients, which should approximate the slope of the hill slope from the site to Pickett Mountain Pond (0.05 ft/ft). The slow groundwater migration rates and large distances to surface water bodies from the site (3,500 feet to Pickett Pond and 6,500 feet to Pleasant Lake afford a high degree of protection to surface water resources.

Significant Sand and Gravel Deposits

A surficial deposit with good to moderate potential yields is mapped along the northern side of portions of Pleasant and Mud Lakes (**Attachment I**). Based on topography and subsurface drainage basin boundaries indicated on the Significant Sand and Gravel Aquifers Map of the Green Mountain Quadrangle (MGS Open File No. 01-75 2001) surface water divides are generally coincident with groundwater divides. This significant sand and gravel deposits therefore do not receive recharge or run-off from site (i.e., the north facing portion of the ridge that contains the Pickett Mountain Deposit) and would not be affected by the proposed project.

Hydrologic Water Budget - Overburden and Bedrock Groundwater Resources

A surface water and groundwater divide occur along the ridge separating surface water and groundwater flow to Picket Mountain Pond and Pleasant Lake (Attachment I). The drainage sub-basin occupied by this portion of the ridge occupies approximately 3,330 acres (830 acres south of the divide and 2500 acres north of the divide). On average it is expected that 42% of precipitation is lost to evapotranspiration and run-off, with the remaining water budget resulting in recharge to overburden and bedrock groundwater (Gerber and Hebson, 1996). Approximately 5% of precipitation is assumed be to bedrock. This results in the following estimated water balance for the sub-basin provided in the following table. Most of the overburden groundwater would be expected to discharge locally within the local drainage basin (>95%), with the exclusion of recharge to bedrock. Some shallow bedrock groundwater would also be expected to discharge locally to streams in upland mountain areas and deeper sections of ponds, where present.

Estimated Hydrologic Budget

Area	Size (acres)	Net Precipitation (acre/feet/yr)	Evapotranspiration (acre/feet/yr)	Overburden Recharge (acre/feet/yr)	Bedrock Recharge (acre/feet/yr)	Overburden Recharge gallons/year	Bedrock Recharge gallons/year
Total Sub-Basin	3330	11933	5012	6575	346	2,142,548,037	112,765,686
North of Divide	2500	8958	3763	4936	260	1,608,519,547	84,658,924
South of Divide	830	2974	1249	1639	86	534,028,490	28,106,763
Developed Mine Area	49	176	0	-88	-8	(28,608,878)	(2,574,799)
Percent Excluded During Mine Operation	1%	0%	0%	1%	2%	1%	2%

Total Annual Precipitatio	45	
Interception	2	
Net Annual Precipitation	43	inches
Bedrock Net Recharge	5	%
EVT Rate & Run-off	0.42	%

Developed Mine Area = area where precipitation/ runoff is collected.

The total area of land disturbance for mine development (excluding roads) is approximately 105 acres and includes the foot-print of buildings, mine portal, a surface water management facility and a dry TMF (approximately 92 acres). Precipitation over much of this area (approximately 49 acres) will be managed to control run-off of non-contact waters, and water that potentially contact waste materials (waste rock and tailings). Collected waters will be treated as discussed later in this section.

The area of mine development during operations is intentionally limited in size. When the water budget within this area is compared to the drainage basin, it becomes clear that impacts to recharge of groundwater (overburden and bedrock) and run-off of surface water to surface water bodies is negligible, and as a percentage (1-2 %) is within the range of annual variations in precipitation. Even if average annual precipitation varied by as much as 10 % (+/- 5 inches), the percent reduction in recharge remains essentially the same. The immediate reduction in recharge is replaced by re-infiltration of clear treated effluent from the water management system.

Forest Resources

Wolfden currently owns 7,148 acres located in the southeastern corner of Township 6, Range 6 (T6R6). The property is entirely undeveloped and forested, except for six privately owned camps (seasonal residences) and logging/woods roads. The property generates approximately $300k in revenue annually from timber revenue. The timber industry is the primary industry in the area and is the driver of the local economy. The area proposed for rezoning is approximately 528.2 acres which includes approximately 105 acres of land that would be constructed upon or disturbed by construction. The mine is planned to operate for 10 years after which the impacted area would be restored. The mine operations area would be restored as forest and would eventually again be logged/harvested. The dry stacked tailings would be contoured, capped and restored/revegetated. The cap concepts will be developed during the final feasibility designs. The cap is required to achieve the same permeability as the liner system. Several concepts will be evaluated from a dry cap that promotes run-off in a course armored infiltration layer that would discourage large tree growth and protect the underlying low permeability barrier from root damage and wind throw, to a wet cap that mimics local hydrology and is able to sustain a wetland like condition where large tree growth is naturally discouraged. Other alternatives include long term management of vegetative growth on the cap, similar to a conventional landfill cap. There would be no restrictions on current and future timber operations on the remaining 6,947.5 acres of the property while the mine is in operation and being restored. The development associated with the proposed mine would affect less than 3% of the property currently in forest production. Therefore, impacts to the forest resources and timber industry would be negligible.

Wetland Resources

The U.S. Fish and Wildlife Service has mapped wetlands in T6R6 as a part of the National Wetland Inventory (NWI). The NWI mapped wetlands have been promulgated into LUPC Land Use Guidance Maps. There are NWI mapped wetlands on the property. The mapped wetlands are primarily palustrine forested and palustrine scrub/shrub wetlands, associated with Pleasant Lake and Pickett Mountain Pond. In addition, the West Branch of the Mattawamkeag River flows across the south part of the property. There are no NWI mapped wetlands in the area of the proposed mine development, however due to the scale of NWI mapping, it can't be concluded that there are no wetlands on the site.

A reconnaissance of the area proposed for development was conducted in October 2019. The purpose of this reconnaissance was to preliminarily identify wetland resources including wetlands and potential vernal pools, and the possible presence of small or intermittent streams. During the reconnaissance wetlands, potential vernal pools, and intermittent streams were observed. The results of the reconnaissance suggest that a detailed wetland and vernal pool survey of the proposed development area during the growing season is warranted. In addition, in order to verify the significance of the potential vernal pools, the survey would need to be conducted during the spring amphibian breeding season; for northern Maine, that period typically falls between May 5th and June 5th. Wetlands, streams and potential vernal pools located within the area proposed for development will be avoided to the extent practicable. Wolfden plans to conduct the survey, in consultation with the IF&W, during the Spring of 2020. Any impacts to these areas would be mitigated to the extent practical during the design and permitting phase of the project. With the exception of the planned dry TMF, current depicted locations of proposed facilities have been placed outside of the area anticipated to contain wetlands. An approximate 4.25 acre area is present within the area of the planned dry TMF that may contain some wetlands, however this area is heavily rutted from prior logging (skidder ruts) and the surface expression of groundwater here is likely due largely to these former ground disturbances rather than natural wetland hydrology. The areas of potential wetlands in addition to potential intermittent streams are depicted in Attachment F1.

Wolfden's goal is to conserve and protect the wetlands and their ecological functions by avoiding impacts to the extent practical, minimizing impacts where they cannot be avoided, and compensating impacts that are not avoidable.

At the completion of the mining project, the site will be reclaimed removing all buildings and structures except the dry TMF. The final grading plan for this final phase of the project can be designed in a manner to enhance and create forested wetlands and associated vernal pool habitats in areas with appropriate hydrology within the footprint of the mine operational area.

Based on our current understanding of wetlands present at the site, the project will meet the goal of protecting the ecological functions of wetland resources, including vernal pools.

Correspondence with the Maine Department of Inland Fisheries and Wildlife is presented in Exhibit N.

Other Water Resources (surface water, streams, shallow groundwater)

The property includes lakes, ponds, and streams, including Pleasant Lake, Pickett Mountain Pond, Mud Pond, west branch of the Mattawamkeag River. The area proposed for development however does not include any mapped streams or surface water bodies based on the USGS topographic map (i.e., Green Mountain, Maine). Although there are no USGS mapped streams within the area proposed for development, the area may include intermittent streams, too small to be picked up at the scale of the USGS maps. As noted in the Wetlands section, intermittent streams and shallow groundwater were observed during the October 2019 reconnaissance of the property and therefore a detailed delineation of intermittent streams is warranted and would be required as a part of the rezoning process. Impacts to water resources would be avoided to the extent practicable and any impacts would be mitigated through restoration activities. In general impacts to water resources would be negligible based on the proposed treatment and discharge of water generated during mine operations, as discussed in the preceding sections. The water generated by mine operations will be treated and released back into the environment following all rules and best management practices.

Wildlife Resources and Habitats

The property contains a mix of terrestrial and aquatic habitats, including forested uplands, forested and scrub shrub wetlands, rivers, streams, ponds and lakes. The majority of the property is forested composed of a mix of deciduous and evergreen trees. Wildlife common to the Northwoods include deer, moose, bobcats, fishers, as well as a number of small mammal species. Avian species including passerine birds, accipiters and buteos, and piscivorous birds such as kingfishers and herons are also common, as are waterfowl including ducks, geese, and loons. The area proposed for development is primarily upland forested habitat, co-dominated by deciduous trees (i.e., beech, birch, and red maple trees) and coniferous trees (i.e., spruce, fir, cedar and hemlock). The area has been logged in the past and is currently in re-growth. Evidence of past logging operations in the form of skidder trails and logging roads are common throughout the area proposed for rezoning and development. The forest understory is relatively open and lacks dense growth commonly found in recently cut forest. Wildlife are accustomed to logging activities in the Northwoods and based on the current mine plan the mine operation would have less impacts to wildlife than common logging operations.

Correspondence has been sent to the Inland Fish and Wildlife Service (November 6, 2019) to obtain a list of Rare, Threatened, or Endangered species that could potentially be found in the area. The IF&W provided a preliminary response to this request on November 25, 2019 which indicated there were no known occurrences of endangered, threatened of special concern species within the project area (Exhibit N). The IF&W also has not mapped any significant wildlife habitats within the project area. The IF&W did identify Great Blue Heron colonies as species of concern and noted the special protection afforded to eight species of bats and concern for habitat protection. The preliminary screening survey conducted to date did not identify habitat that would support Great Blue Heron colonies or bats, the latter due principally to very limited and small exposures of bedrock outcrop and lack of any talus slopes. When the detailed mapping of wetlands, intermittent streams and vernal pools is conducted in the spring it will include a final species assessment encompassing a survey of the area proposed for development individual species and or suitable habitat for the species identified. Impacts to rare, threatened or endangered wildlife are not known or expected and if identified will be avoided and minimized.

Plant Habitats

The area proposed for development includes upland forested habitat and as noted has been logged in the past. The forest habitat includes a relatively open understory dominated by saplings of the dominant tree species. Shrubs are also present in the forested. The herbaceous growth in the forest habitat includes moss, ferns, grasses, and sedges.

Correspondence with the MNAP was submitted to request a list of known or suspect rare, threatened or endangered plants occurring in the area. Exhibit N contains the MNAP response which indicates that there are no rare botanical features documented specifically within the project area. Impacts to rare, threatened or endangered plants are therefore unlikely but if such botanical features are identified they will be avoided and minimized. Unavoidable impacts will be mitigated through moving/transplanting rare, threatened or endangered species when impacts are unavoidable. Based on discussions on MNAP correspondence lakeside graminoid/shrub fen is located between Pleasant and Mud Lakes. These would not be affected by proposed activities and are outside the area to be re-zoned. The MNAP did indicate this as a priority area on the Wolfden property for a botanical survey.

Historical Sites

The Maine State Historic Preservation Office has been consulted to identify any known or suspected historical sites on the property. A stone tool archeological habitation site is known near the headwater of Pickett Pond. A Phase 0 archeological survey will be conducted within the area proposed for rezoning and development to verify that there are no historical resources present. The scope of the survey has been developed in consultation with Maine State Historic Preservation Office and discussed previously in Exhibit M. The survey will be conducted by a State certified archeologist following an approved work plan. If historical sites are identified within the proposed development the area will be investigated, cataloged and mapped. Any pre-historic or other artifacts discovered will be recovered in consultation with Maine State Historic Preservation Office.

Scenic Resources

The project has been designed to limit impacts to scenic resources. The "below ground" mine operation limits the footprint of mine requiring a relatively small area for mine operations (approximately 16 acres) and dry stack tailings pile (approximately 42 acres), thus impacting approximately 58 acres). In addition, the dry stacked tailings will match base line contours, to not protrude from the surrounding topography. The overall elevation increase in the footprint of the tailings is expected to be approximately 10 feet higher than the original ground surface. Once the mine operations end the impacted area will be restored and will be allowed to reestablish as forest.

Recreational Resources

The area proposed for development does not include any snowmobile trails, hiking trails, or camping areas nor does it include any aquatic resources suitable for fishing. The area proposed for rezoning makes up only 2.8% of the total property. It is unlikely that the proposed mine would impact recreation resources. Once the mine is closed there would be no impacts to recreational resources.

Mine Development, Operation and Closure Strategy

The following section provides a general overview of how mine and process waters will be managed. The strategy for mine development, processing of mineralized rock, and management of tailings is discussed. Each of these processes have a water management component. Additional Information is provided in **Appendix M**.

Overview - Management of Mine Waters, Process Waters and Septic Waters

Proper planning, management and treatment of site impacted waters can avert impacts to natural water resources including groundwater, run-off, and surface water. Elements of water management designed to alleviate the potential for adverse impacts are described in the following subsections.

Development of the Pickett Mountain mineral deposit will require collection of groundwater seepage for subsurface dewatering during underground mining operations and collection of surface water run-off from within the footprint of the developed property. These waters will be used in the beneficiation of the economically valuable minerals which includes milling and flotation to separate valuable from non-valuable minerals and create a concentrate that will be shipped off-site for further refinement (smelting) as well as tailings that will be stored on a lined tailings facility located onsite. Waters impacted by these processes will be treated and re-used to the maximum extent possible. It will be the intention of the concentrator/tailings design to have a net negative water balance that will require makeup water.

Water from the mine (seepage and process water) will be collected and treated to within water discharge guidelines and rules that include at or better than background quality. A portion of the treated water will be reused at mining process water and concentrator process water make up. Sewage from the mine will be contained to Portable Toilets (Porta Potties). These will be on contract basis and managed through replacement of filled facilities with clean facilities by the supplier. Sewage from all surface structures will drain to a septic system located on the site down gradient of the building infrastructure and potable water supply. Any excess treated water will be returned to the environment as recharge via system of underground diffusers, similar to a septic system leach field. Water from the TMF will be managed separately. As a result of the water management strategy and the water balance required to sustainably operate the mine, impacts to water resources are expected to be negligible.

The estimated water balance from the milling/tailings facility is as follows resulting in a process water make up requirement of 68.4 cubic meters per day or 12.3 USgpm.

Overall Water Balance				
Water Product	**Solids**		**Water t/d or m^3/d**	**Comments**
	%	**t/d**		
Plant Feed (flotation feed)	30	1000	2333.3	Need per day
Cu Conc.	80	15.5	3.87	Lost in concentrate
Pb Conc.	80	10.6	2.65	Lost in concentrate
Zn Conc.	80	49.5	12.4	Lost in concentrate
Tailing	80	807.4	49.5	Lost in concentrate
Process Water Recycle	-	-	2264.88	Amount recovered
Need Process water	-	-	68.42	

Mine Development Strategy

The strategy for mine development is to conduct underground mining using a long hole stoping method with a decline, to allow underground haulage trucks to carry mineralize rock (mill feed) to a surface staging pad, where waste rock will be segregated from Mineralize Rock. Waste rock would be staged until it can be returned underground for backfill. Waste rock that is placed underground as backfill is not treated or neutralized, rather is simply placed as broken rock. Typically, waste rock outside of the Pickett Mountain deposit is non-acid generating and in fact carries significant neutralizing potential. In addition, after waste rock is deposited underground, it is in a low oxygen environment and therefore will not react with ground water if portions of the rock do contain acid generating potential. Seepage of bedrock water as well as injection of mine process water into the underground workings, necessitates a program of mine dewatering. Although engineering/hydrologic studies have not been conducted to quantify flow rates required to keep the working areas of the mine in a dewatered state, it is currently estimated based on similar site experience and the likelihood of low transmissivity bedrock at depth, that these “seepage“ flows are likely to be on the order of 30 gallons per minute (gpm) long term.

Initial dewatering is usually conducted through use of bedrock extraction wells (dewatering wells) to reduce the bedrock potentiometric surface prior to and during development of the decline. This water will be used for storage and recycled for underground diamond drilling for blastholes. As underground workings are advanced, and seepage into these openings will occur, and that seepage will be pumped out eventually replacing the dewatering wells and establishing a network of water conveyance pipes within the developing mine infrastructure During mine operation, seepage waters will continue to be collected underground through a series of temporary sumps and pumps and treated at the water management facility prior to being re-used for underground process water with excess discharged to the environment. Waters used underground for drilling and wetting down rock surfaces to eliminate dust when mucking rock outwill be pumped through a connected network of pipes that can be modified and extended as the underground workings are developed.

When sulfide mineralized rock is mined and processed, the surface area of exposed sulfides increases along with the potential for acid generation. Exposure of these sulfide minerals to oxygen and water results in weathering and oxidation producing acidity (hydrogen ions), dissolved sulfate, dissolved metals and soluble acid-sulfate minerals. Undisturbed sulfide mineral deposits have limited exposed surfaces, and therefore pose little threat to groundwater under natural, oxygen-limited conditions. Since this weathering process requires presence of both oxygen and water, as well as time, effective strategies to prevent acid generation are incorporated into the design and operation of the mine. In the short term, these strategies rely on limiting exposure of these materials to water in the presence of oxygen as well as water collection and treatment. In the long term, strategies rely on isolating materials from water (infiltration), intrusion of atmospheric oxygen.

The waste rock will be mined separately and segregated from the mill feed, temporarily staged and then returned underground as backfill on an on-going basis. This manages and mitigates potential leaching and environmental release of metals from this waste rock material.

Mineralized Rock Milling and Flotation Strategy

Mineralized Rock (mill feed) will be crushed on-site and finely ground to a powder utilizing a comminution (Grinding) circuit. The finely ground rock is the feed stock for the flotation circuits, where the valuable sulfide minerals (Zn, Cu, Pb, and associated precious metals Au and Ag) are sequentially segregated from gangue minerals of no economic value and into a series of Copper, Lead and Zinc concentrates. This flotation process is done with a series of chemicals and reagents that are used to treat the minerals to optimize recoveries. Chemicals that are used within the process typically remain in the process water and are broken down over time. However, since majority of the water is reclaimed into the process, this material is reused. Any potential waste chemicals or spillage, are collected and pumped to the TMF. These are then broken down over time or gathered through precipitation and ultimately gathered back into the process. Any stored chemicals that are expired or unusable for other reasons are repackaged and shipped back to the supplier or to a qualified management facility for appropriate disposal during operations and mine closure. The non-valuable or gangue minerals which will constitute approximately 80% of the mill feed result in the production of tailings requiring management. A conceptual flow diagram of the milling process is shown below.

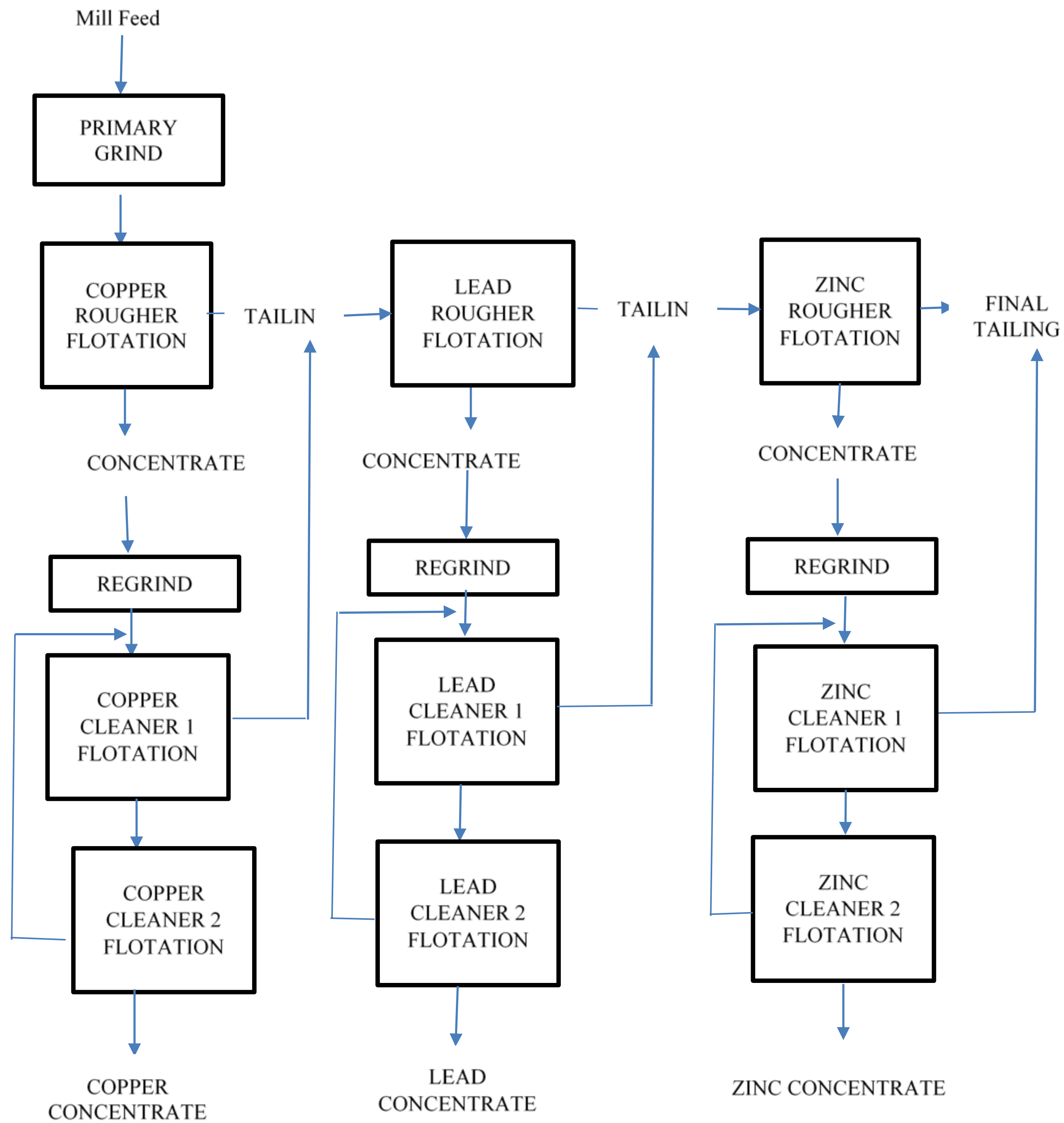


FIGURE: CONCEPTUAL PROCESS FLOWSHEET

Tailings Treatment and Management Strategy

The tailings, will contain some iron sulfides as well as other metallic sulfide minerals and are managed accordingly to mitigate acid generation and leaching. When tailings are first produced, they are oversaturated with respect to water content and are pumped in a slurry.

All tailings will be deposited on a dry stack tailings management facility (TMF). The cleaned and filtered tailings will be dewatered and transported by truck or conveyor belt to the TMF where they are spread, stacked and compacted by a dozer. All water generated by the dewatering process is recycled and pumped back to the concentrator for reuse in the process circuit. The dewatered tailings have a low moisture content and is expected that no supernatant pond will form as they are compacted in the TMF. Rainfall on the TMF is expected and run-off collection is required. All water will be collected from the TMF in a lined collection pond at the south edge of the TMF. Water from the lined TMF collection pond will be pumped back to the concentrator for reuse in the processing circuit. The dewatered tailings will exit the concentrator plant via conveyor onto a storage pad with 24 hours of capacity. The tailings will be loaded and hauled via 35 or 40 tonne articulated trucks to the TMF. With an expected 800 tonnes per day of tailings, this will result in 1.5 or 1.0 trucks per hour depending on the size of the truck. Once or twice per shift, the truck operator will spent up to one hour with a dozer and roller compactor to grade and compact the tailings. The expected cycle time to the farthest area of the TMF is under 7 hours while the closest will be 4 hours. This allows more than sufficient time for haulage, grading and compacting in a 10-hour work shift.

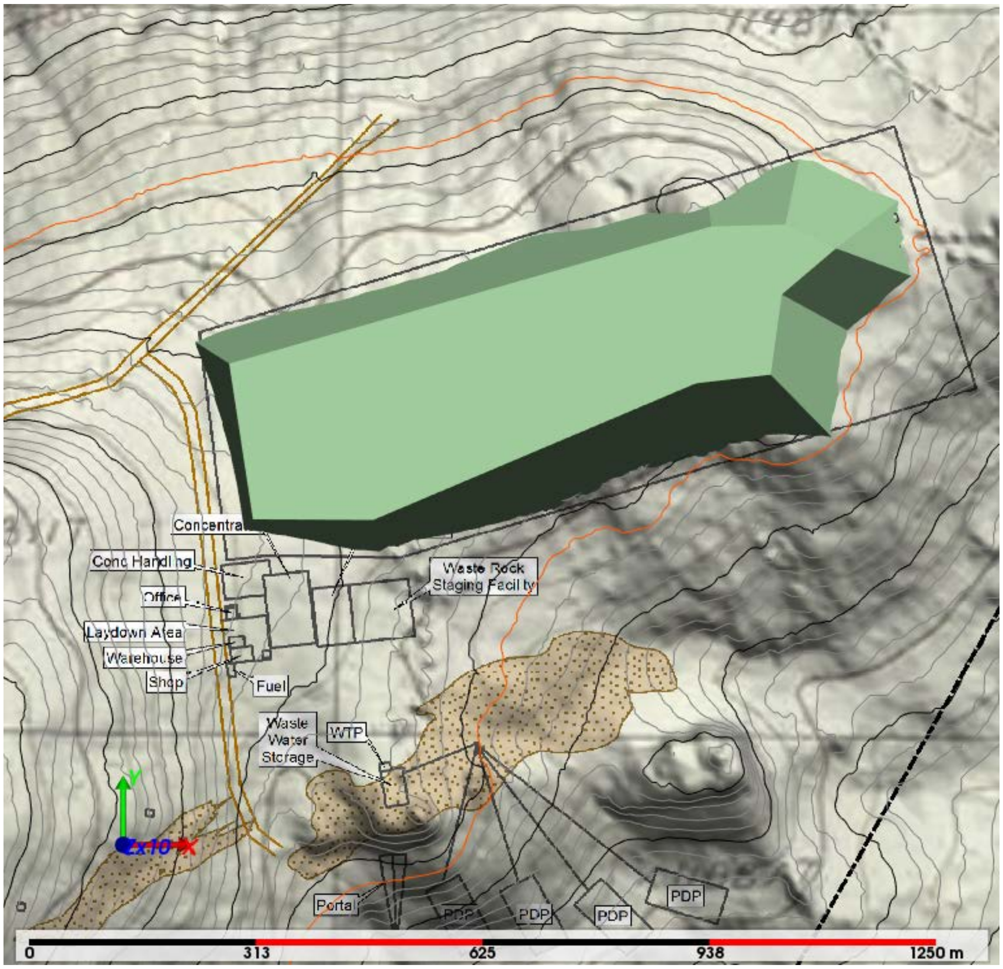
Sub-aerial (dry stacked) tailings are the only above ground tailings management method allowed under the DEP Chapter 200 rules for Group A and Group B mine waste. The sub-aerial TMF will be designed in accordance with requirements (including a composite liner and leachate collection) of Chapter 200 Subchapter 5 Section 21 Mine Waste Unit Design Standards. Leachate ponds that collect water that encounters tailings are also governed by these standards. TMF ground slopes of 20% to 30% may be used for dry stack tailings. The maximum height of the TMF cells when completed at Pickett Mt. are not expected to exceed 20 feet and may average less than 15 feet.

Once compacted, these tailings will not be subject to infiltration of water and intrusion of atmospheric oxygen which will mitigate the oxidation of sulfide minerals. Management of dry stacked tailings placed within a lined containment facility, that is progressively closed during mine operation will control leaching of metals and provide long-term protection to water resources (groundwater and surface water). The TMF would be designed with run-on controls to prevent contact with surface water run-off. During the operating period of the dry stacked tailings facility, contact water (precipitation) is actively managed.

An example of similar tailings deposition is Cerro Lindo (Peru) show in the following collection of images. Although the climate in Peru is drier than in Maine, the concept is the same. Sub-aerial tailings are currently used in other cold regions including Alaska, Minnesota and Canada.

In most cases in cold weather climates, the tailings are progressively covered to optimize water treatment and reduce the remaining area requiring closure during final reclamation. The DEP regulations require a cover system of permeability equal to the liner system which has specific maximum permeability requirements.

Cerro Lindo Moist Cake Disposal (1:2 Slope)

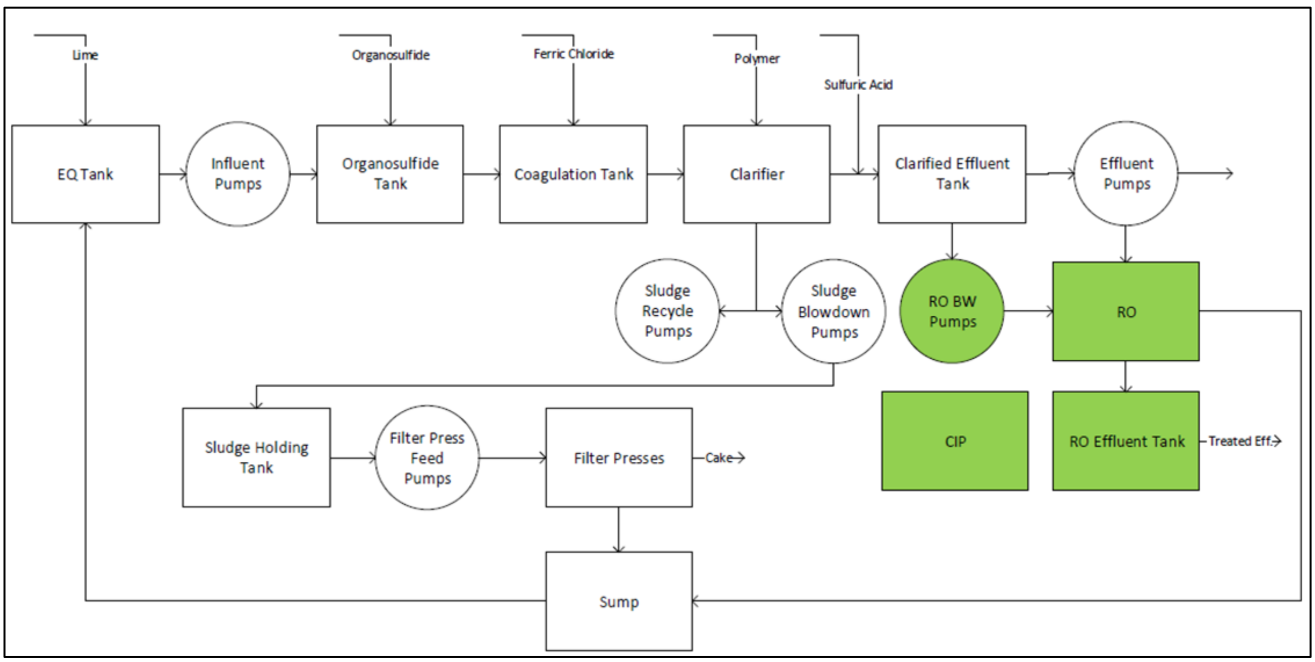


Conceptual Tailings Facility at Pickett Mountain

The figure above illustrates a dry stack tailings facility. The tailings stack features an outer side slope of 20% raised to a maximum height of about 22ft (7 m). The volume of tailings in this model is approximately (1,400,000 m3), equivalent to about 2.6 Mt when fully consolidated or compacted to 88 wt% solids.

Mine Water Management and Treatment

All process and seepage water into the mine as well as precipitation landing outside of the tailings facility footprint are collected via run off ditching and routed to the south eastern (down gradient) corner of the project site into a lined raw water pond in order to contain all water collected on the project site. Seepage water from tailings as well as precipitation water onto the TMF are collected separately and pumped into the mill as recycled water. A series of berms will be designed to re-route precipitation water outside of project footprint in order to reduce contact with site and minimize potential impact. Once the water is collected in the raw water pond, it is pumped to the water treatment facility. The technological state of mine water treatment is very advanced as a form of waste water treatment with processes designed to adjust pH, remove sulfates and metals producing a high quality effluent and a high density solids waste stream (sludge) the latter of which is thickened by a conventional filter press to produce a sulfate filter cake. The solid filter cake will be placed underground in the mine. Excess water from the filter press is returned to the influent equalization tank for treatment. The conceptual treatment train is show in the following figure. The treated effluent may then be recharged to groundwater with no chemical impacts via underground infiltration structures. Recharge of treated water to groundwater is also protective of surface water that eventually receives groundwater.



Mine Water Treatment Process Flow Diagram

Notes:

EQ= Equalization (Tank); RO= Reverse Osmosis, BW= Backwash, CIP=Clean in Place (Tank)

The treatment plant will be operated in accordance with an operations and maintenance plan that will specify storage and management of chemical reagents and actions to be taken to prevent spills and accidental releases and to address spill clean-up and reporting should an accidental spill occur.

The groundwater quality will be monitored quarterly during the life of the mine and for a period of time post-closure that is specified in the mining permit issued by the DEP. Monitoring will occur at locations where mining activities have a reasonable potential for impact to groundwater and surface water. In general, these parameters will be based on baseline background water quality data and consideration of parameters related to mining operations (metals, pH, specific conductance and inorganic parameters such as sulfate). Surface water and sediment quality will also be monitored under an approved program during mine operations and for a post-closure period specified in the mining permit. The department may require additional sampling of aquatic biological resources and monitoring of specific parameters at certain structures including water storage ponds, leachate collection systems and underdrains.

The following tables summarize of ground water variances for a full list of elements and characteristics in ground water surrounding the Halfmile Mine owned by Trevali Mining Corporation located West of Miramichi, NB. It can be noted that certain non-targeted and non-harmful minerals are higher than background. This is the driving factor behind the addition of a reverse osmosis system down stream of the chemical treatment facility proposed for Pickett Mountain. The mechanical type of filtration is able to draw these final minerals from the water and ensure the final treated quality is back to or better than background quality.

Halfmile Mine Analysis of Metals in Water		**Ground Water Well**											
Sample Identification		327776-1	327776-2	327776-3	327776-4	125083-1	125083-3	125083-4	125083-2	Variance	Variance	Variance	Variance
Well Identification		MB-1	MB-3	HB-1	MB-2	MB1	MB3	HB1	MB2	MB1	MB3	HB1	MB2
Date Sampled:		28-Aug-19	28-Aug-19	28-Aug-19	28-Aug-19	7-Sep-11	7-Sep-11	7-Sep-11	7-Sep-11	NA	NA	NA	NA
Analytes	**Units**												
Aluminum	µg/L	3	17	24	27	8	43	56	44	-5	-26	-32	-17
Antimony	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Arsenic	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Barium	µg/L	2	3	3	3	2	2	3	2	0	1	0	1
Beryllium	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Bismuth	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Boron	µg/L	2	0	0	1	1	1	2	1	1	-1	-2	0
Cadmium	µg/L	0.02	0	0	0	0	0	0	0	0.02	0	0	0
Calcium	µg/L	6250	8620	8230	8490	4910	6900	6770	6780	1340	1720	1460	1710
Chromium	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Cobalt	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Copper	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Iron	µg/L	0	20	30	30	0	60	90	60	0	-40	-60	-30
Lead	µg/L	0	0	0	0	0	0.1	0.1	0	0	-0.1	-0.1	0
Lithium	µg/L	0.1	0	0	0	0	0	0	0	0.1	0	0	0
Magnesium	µg/L	840	900	1040	900	630	790	910	780	210	110	130	120
Manganese	µg/L	0	4	10	9	0	5	9	6	0	-1	1	3
Mercury	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Molybdenum	µg/L	0	0.2	0.1	0.1	0.1	0	0	0.1	-0.1	0.2	0.1	0
Nickel	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Potassium	µg/L	430	380	430	380	370	320	350	320	60	60	80	60
Rubidium	µg/L	0.2	0.5	0.4	0.5	0.2	0.3	0.3	0.3	0	0.2	0.1	0.2
Selenium	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Silver	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Sodium	µg/L	2190	1610	1750	1680	1730	1400	1380	1400	460	210	370	280
Strontium	µg/L	22	25	24	25	15	18	18	18	7	7	6	7
Tellurium	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Thallium	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Tin	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Uranium	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Vanadium	µg/L	0	0	0	0	0	0	0	0	0	0	0	0
Zinc	µg/L	3	1	2	1	0	2	0	2	3	-1	2	-1

Halfmile Mine Groundwater Metals Variance September 2011 – August 2019

Halfmile Mine Water Chemistry Analysis		Ground Water Well											
Sample Identification		327776-1	327776-2	327776-3	327776-4	125083-1	125083-3	125083-4	125083-2	na	na	na	na
Well Identification		MB-1	MB-3	HB-1	MB-2	MB1	MB3	HB1	MB2	MB-1	MB-3	HB-1	MB-2
Date Sampled:		28-Aug-19	28-Aug-19	28-Aug-19	28-Aug-19	7-Sep-11	7-Sep-11	7-Sep-11	7-Sep-11	NA	NA	NA	NA
Analytes	**Units**												
Ammonia (as N)	mg/L	0	0	0	0	0	0	0	0	0	0	0	0
pH	units	7.5	7.5	7.5	7.5	7	7.1	7.1	7.1	0.5	0.4	0.4	0.4
Acidity (as $CaCO_3$)	mg/L	0	0	0	0	0	0	0	0	0	0	0	0
Sulfate	mg/L	4	0	0	0	0	0	0	0	4	0	0	0
Solids - Total Suspended	mg/L	0	0	0	0	0	0	0	0	0	0	0	0
Conductivity	µS/cm	54	62	60	60					54	62	60	60
Hardness (as $CaCO_3$)	mg/L	19.1	25.2	24.8	24.9	14.9	20.5	20.6	20.2	4.2	4.7	4.2	4.7

Halfmile Mine Groundwater Chemistry Variance September 2011 – August 2019

The mine water balance will be carefully managed to take advantage of recycling of mine waste contact waters including precipitation run-off and seepage water. These anticipated water streams volumes are evaluated to determine the design capacity of the water treatment system. These water sources will be used in the beneficiation of the mineralize rock (milling and flotation) are compared to those design flows to determine the extent of water recycling and excess treated water requiring recharge back to groundwater.

A preliminary mine water balance has been developed. This preliminary estimate assumes all infiltration /run-off within the footprint of the developed facility will be collected and treated in addition to approximately 30 gpm of seepage water. The annual average precipitation over the facility footprint is equivalent to an average flow of 175 gpm. This results in an average flow of approximately 205 gpm for use by the treatment facility.

The concentrator water balance indicates, after recycle, approximately 68.4 metric tons of make water (or approximately 13 gpm) such that the daily water balance of available water is greater than the water required. Therefore, net recharge of treated effluent back to ground, will be close to the natural recharge that is excluded within the developed facility footprint. Operation of the envisioned facility will therefore not require additional sources of water supply (groundwater or surface water) and the operation of the facility is sustainable with respect to water needs, water use and management.