# 3.0 PROPOSED ACTION AND ALTERNATIVES

## *3.1 INTRODUCTION*

The NorthMet Project and Land Exchange areas are located in northeastern Minnesota (Figure 1-1). The NorthMet Project area is located in the Mesabi Iron Range mining district in St. Louis County. The Boundary Waters Canoe Area Wilderness (BWCAW) and Voyageurs National Park are approximately 20 miles north and 50 miles northwest, respectively, of the NorthMet Project area. The NorthMet Project area is within the St. Louis River (Lake Superior) Watershed, which ultimately drains to Lake Superior. This area is located on lands acquired by the United States on September 30, 1854, when the Chippewa of Lake Superior ceded ownership of the land to the United States. These lands are often referred to today as 1854 Ceded Territory.

Current land use in the region includes mining, forestry, and recreation on a mixture of private and public land. The NorthMet Project Proposed Action would be the first copper-nickel-PGE mine in Minnesota. However, as shown in Figure 1-2, commercial mining has been undertaken in northeastern Minnesota since the turn of the 20$^{th}$ century when iron ore (hematite and later taconite) was discovered on the Vermilion, Mesabi, and Cuyuna ranges. The development of open pit mines and processing facilities, supported by the development of many small towns, has facilitated continued iron ore/taconite mining over the last century. Today, only the Mesabi Range is actively mined for iron ore/taconite, though several copper/nickel mines are undergoing feasibility studies in this area.

Section 3.1 summarizes the NorthMet Project Proposed Action and alternatives, and the Land Exchange Proposed Action and alternative, which are discussed in detail in Sections 3.2 and 3.3, respectively. The affected environment and the potential environmental consequences are addressed in subsequent chapters in the SDEIS.

### *3.1.1 NorthMet Project Proposed Action Overview*

The NorthMet Project Proposed Action has three major components: a Mine Site, a Transportation and Utility Corridor, and a Plant Site comprising three phases:

- Construction would last for approximately 18 months and would include land clearing, building renovation and construction, and utility upgrades.
- Operations, which would last approximately 20 years, would include ore mining and processing, continued construction, and progressive reclamation.
- Closure and Post-Closure Maintenance would occur after mining and would include infrastructure removal and final land reclamation, maintenance, monitoring, and transitioning from mechanical to passive water treatment.

An overview of the NorthMet Project Proposed Action layout, operations, closure, and alternatives is discussed below.

### 3.1.1.1 Site Preparation and Construction Overview

In preparation, existing vegetation would be cleared from sites where mining would take place and where infrastructure would be built. Overburden (i.e., the soils and rocks overlying bedrock or ore) would be removed from the mine pits and as required for foundations of stockpiles, infrastructure, and haul roads. Buildings and infrastructure would be constructed on site.

Existing facilities at the former LTVSMC processing plant would be refurbished to working order. New processing buildings would also be constructed to further refine the copper-nickel-Au/PGM ores—a process different from that utilized for taconite previously processed at the facility. Construction would begin approximately 18 months prior to the start of mining.

### 3.1.1.2 Mine Site Layout Overview

The NorthMet Project Proposed Action includes several new facilities necessary to manage the material removed from three mine pits: the East Pit, Central Pit, and West Pit. Infrastructure at the Mine Site would include, but would not be limited to, haul roads, a temporary ore storage pile, a rail-loading facility, water-containment systems, a WWTF, and temporary and permanent waste rock stockpiles. Waste rock that has a low potential to contaminate water would be stored mostly in a permanent stockpile, with some being filled into the empty mine pits when available. Waste rock with a high potential to contaminate water would be temporarily stored in lined stockpiles, then moved permanently into the empty pits.

### 3.1.1.3 Mine Operations Overview

The mining operations would involve the use of conventional surface mining methods, such as blasting and excavating rock from the NorthMet Deposit, a low to medium quality copper-nickel-PGE deposit with a low sulfide content. The East Pit and West Pit would be mined simultaneously through the first 11 years of the mine life. Mining would cease at the East Pit at approximately year 11 and continue at the West Pit until year 20. The Central Pit would be mined between mine years 11 and 16 and would ultimately combine with the East Pit. The maximum depths of the pits below the original surface level would be 630 feet (ft) for the East Pit (at year 11), 356 ft for the Central Pit (at year 16), and 696 ft for the West Pit (at year 20).

The ore, waste rock, and overburden would be transported within the Mine Site via a series of haul roads. Ore would be hauled to a rail-loading facility for transport to the Plant Site. The waste rock would be sorted into four categories based on its potential to contaminate water—Category 1 waste rock would have a low potential and Category 4 waste rock would have a high potential.

Until the completion of mining in the East Pit (approximately year 11), waste rock would be hauled to the following stockpiles at the Mine Site:

- Category 1 Stockpile;
- temporary Category 2/3 Stockpile; or
- temporary Category 4 Stockpile.

After year 11, the waste rock in the temporary stockpiles would be moved into the East Pit (mining at the East Pit is planned to end by year 11). Waste rock generated from ongoing mining in the West Pit and Central Pit after year 11 would be directly disposed of in the East Pit. Some Category 1 waste rock would continue to be placed on the Category 1 Stockpile until year 13.

Water control systems would be constructed to capture water that has contacted surfaces disturbed by mining operations, as well as water collected on stockpile liners (i.e., process water). Process water would be treated at a treatment facility located at the Mine Site and either pumped via a Central Pumping Station to the Plant Site for discharge to the Tailings Basin, or used to supplement flooding of the East Pit after year 11.

#### 3.1.1.4 Transportation and Utility Corridor Overview

The Mine Site would be connected to the Plant Site, located approximately 8 miles to the west, by an approximately 8-mile-long Transportation and Utility Corridor that would contain the following:

- a private railroad consisting of new spurs that would connect the Mine Site and Plant Site to the existing Cliffs Erie private railroad and would be used to transport ore from the Mine Site to the Plant Site;
- an existing segment of the private Dunka Road that would provide vehicle access between the Mine Site and the Plant Site;
- new water pipelines that would be constructed along Dunka Road to transport water between the Mine Site and the Plant Site; and
- new transmission lines that would be constructed along a portion of Dunka Road near the Mine Site.

#### 3.1.1.5 Plant Site Layout Overview

Some facilities at the former LTVSMC processing plant would be refurbished and new facilities would be added for the NorthMet Plant Site. The existing infrastructure at the Plant Site includes roads, railroads, electrical transmission lines, sanitary and potable water treatment facilities, coarse and fine crusher buildings, and a concentrator building. New construction would include the Hydrometallurgical Plant, oxygen plant, flotation buildings, and a WWTP.

The existing LTVSMC Tailings Basin would be used as the base for a new Tailings Basin for disposal of tailings from the NorthMet Project Proposed Action. The existing LTVSMC Tailings Basin consists of three areas: Cell 1E, Cell 2E, and Cell 2W. Cell 2W, the most built-up cell, is located on the western half of the existing LTVSMC Tailings Basin and is not proposed for use as part of the NorthMet Project Proposed Action. A groundwater containment system would be installed around the northern and western sides of the Tailings Basin, around Cells 2W and 2E. Additionally, the northern and southern embankments of the existing LTVSMC Tailings Basin would be reinforced with a rock buttress to increase stability.

A separate facility would be constructed to contain residue from hydrometallurgical processing at the Hydrometallurgical Residue Facility. This facility would be built at the existing LTVSMC Emergency Basin, immediately southwest of Cell 2W at the Tailings Basin. A double-liner system would be installed, with each layer consisting of a geomembrane layer above a geosynthetic clay liner for leachate control and collection.

### 3.1.1.6 Plant Operations Overview

Once mined, the ore would be shipped to the Plant Site by rail, to be crushed and processed. Processing would involve concentration in a new flotation building to separate metallic sulfide minerals (ore concentrate) from feldspar and other non-ore minerals (tailings).

Then, the ore concentrate either would be dewatered and shipped off-site as copper and nickel concentrate final products, or the nickel concentrate would be processed in an autoclave at the Hydrometallurgical Plant and base/precious metal precipitates would be produced; these precipitates would be shipped off-site as final products. Based on the anticipated rate of mining, annual production post-processing would total about 113,000 short tons of copper concentrate, 18,000 short tons of mixed (nickel/copper) hydroxide, and 500 short tons of platinum group metals (PGM) precipitate.

After passing through a scavenger flotation cycle to remove as many sulfide minerals as possible, the tailings would be transferred as slurry to the Tailings Basin. The NorthMet tailings would be deposited on top of Cells 1E and 2E at the existing LTVSMC Tailings Basin and, at completion, would be approximately the same height as the existing Cell 2W. Bentonite would be incorporated into the exposed outer side-slopes of the Tailings Basin as it is built up to create a barrier that would limit oxidation. This limiting of oxygen transfer would reduce pollutants generated from the Tailings Basin.

Water seepage from the Tailings Basin would be collected by the groundwater containment system and sent to either the Tailings Basin pond or the Plant Site WWTP. Treated water would be used to augment flows in the streams that would be impeded by the Tailings Basin groundwater containment system.

### 3.1.1.7 Project Closure Overview

In general, proposed facilities have been designed and would be operated to allow for concurrent reclamation, which would include backfilling the East Pit once it were exhausted (after year 11 of mining) using waste rock generated through mining beyond year 11 and relocating waste rock from the temporary waste rock stockpiles. Undertaking reclamation concurrent with mining would reduce the effort and cost of final closure. The Category 1 Stockpile would also be covered after it is completed in year 13.

Mining is expected to be completed approximately 20 years after operations begin. In anticipation, PolyMet would prepare a Closure Plan as part of the Permit to Mine application. The Closure Plan would include planned scheduling and costing for closure and post-closure activities. At closure, PolyMet would first remove all redundant infrastructure and facilities, then reclaim disturbed lands. Post-closure activities would include monitoring and maintenance of reclamation and operation of mechanical water-treatment infrastructure until facility features were deemed environmentally acceptable in a self-sustaining and stable condition.

### 3.1.1.8 NorthMet Project Proposed Action Alternatives Overview

The NorthMet Project Proposed Action incorporates activities and environmental impact mitigation measures that have been evaluated and developed through the EIS process. In addition, a number of alternatives and mitigation measures were identified and considered through the EIS process and were either:

- incorporated into the NorthMet Project Proposed Action as they offered benefits to the outcomes of the NorthMet Project Proposed Action; or
- eliminated from detailed evaluation because they did not offer measurable or substantial environmental benefits over other alternatives (including the NorthMet Project Proposed Action), they were not reasonable (i.e., they were not economically or technically feasible in accordance with CEQ guidelines), or would not meet the Purpose and Need.

As a result of screening and analysis, the NorthMet Project No Action Alternative (i.e., the NorthMet Project Proposed Action would not occur) is the only alternative evaluated in detail in the SDEIS.

## *3.1.2 Land Exchange Overview*

The Land Exchange Proposed Action includes undertaking a land exchange of 6,650 (GLO) acres of federal land with up to 6,722 (GLO) acres of privately owned land of a combined equal value, located within the 1854 Ceded Territory in Minnesota.

The federal land for the Land Exchange Proposed Action consists of a single contiguous area of land located within the Laurentian Ranger District approximately 6 miles south of the City of Babbitt in St. Louis County in northeastern Minnesota. It was acquired by the United States under the authority of the Weeks Act of 1911, and is managed by the USFS.

The federal lands are located within the historic Mesabi Iron Range and are surrounded by privately held land used for mining and other industrial purposes. The surface lands are located above the NorthMet Deposit, for which PolyMet leases private subsurface mineral rights. However, under the Weeks Act 1911, the USFS is restricted from allowing, by decision, surface mining on federal land, such as that proposed by PolyMet. The Land Exchange Proposed Action would unite surface and mineral rights in the area and is therefore considered to be a connected action to the NorthMet Project Proposed Action.

The Land Exchange Proposed Action would include five tracts of non-federal lands in St. Louis, Lake, and Cook counties that comprise approximately 6,722 acres (GLO); however, the final exchange, if approved, could include fewer than 6,722 acres (GLO) of non-federal land depending on the results of the environmental analysis and real estate appraisals. All of the lands proposed for exchange are located throughout the 1854 Ceded Territory of northeastern Minnesota.

### 3.1.2.1 Land Exchange Proposed Action Alternatives Overview

Two alternatives to the Land Exchange Proposed Action, the Land Exchange Alternative B and Land Exchange No Action Alternative, are evaluated in detail in the SDEIS. Land Exchange Alternative B would convey fewer acres of federal lands for fewer acres of non-federal land. Other alternatives were considered but eliminated from further analysis because they did not meet the screening criteria. These included a purchase alternative, exchange of a single contiguous federal parcel, exchange of other non-federal lands, exchange of only the federal lands needed for the NorthMet Project Proposed Action, exchange of lands with use restrictions, and underground mining for the NorthMet Project Proposed Action, which would eliminate the need for a land exchange.

# 3.2 NORTHMET PROJECT PROPOSED ACTION DETAILED DESCRIPTION

## 3.2.1 Overview

The NorthMet Project Proposed Action includes three major components: a Mine Site, a Transportation and Utility Corridor, and a Plant Site. These areas are shown in Figure 3.2-1. Figure 3.2-2 shows a schematic diagram of the main activities and flow of material. The NorthMet Project Proposed Action would incorporate activities and environmental impact mitigation measures that have been evaluated through the EIS process with the benefit of stakeholder review and comment. The NorthMet Project Proposed Action would involve the following:

- Development of a 20-year open pit mine at the NorthMet Deposit (Mine Site).
- Copper-nickel-PGE ore processing at an upgraded former LTVSMC processing plant (Plant Site).
- Transportation of ore and other materials using existing rail and road infrastructure and new water pipes between the Mine Site and Plant Site (Transportation and Utility Corridor).
- Construction of permanent features, including the following, described in post-reclamation state:
  - one backfilled pit (filled with the most reactive rock for underwater storage);
  - one flooded mine pit;
  - one capped waste rock stockpile;
  - a reclaimed Hydrometallurgical Residue Facility (over an existing brownfield site); and
  - a bentonite-covered Tailings Basin (over an existing brownfield site).
- Engineered water management controls including:
  - fixed liners on temporary stockpiles;
  - fixed containment systems encompassing a permanent stockpile and Tailings Basin to capture groundwater and surface seepage from those facilities;
  - Mine Site WWTF and Plant Site WWTP to treat contaminated waters; and
  - caps and covers on the permanent stockpile and Tailings Basin applied at reclamation that could be adapted to alter water infiltration as needed.
- Long-term post-closure involving mechanical treatment, which would transition to passive treatment, for affected water from the pits, permanent stockpile, and Tailings Basin.

A number of alternatives have been evaluated and either incorporated into the NorthMet Project Proposed Action by the applicant, or eliminated in accordance with NEPA and MEPA on the basis of not being reasonable or not having the potential to offer substantial environmental benefit. Ultimately, the NorthMet Project No Action Alternative was the only alternative evaluated in detail in this SDEIS. Under the NorthMet Project No Action Alternative:

- no NorthMet Project Proposed Action activities would occur;
- public land would continue to be managed by the USFS and private land would continue to be managed under private ownership; and
- the former LTVSMC processing plant would be managed as required under existing MDNR- and MPCA-approved reclamation program and Consent Decree.

A summary of the NorthMet Project Proposed Action and the NorthMet Project No Action Alternative is provided in Table 3.2-1.

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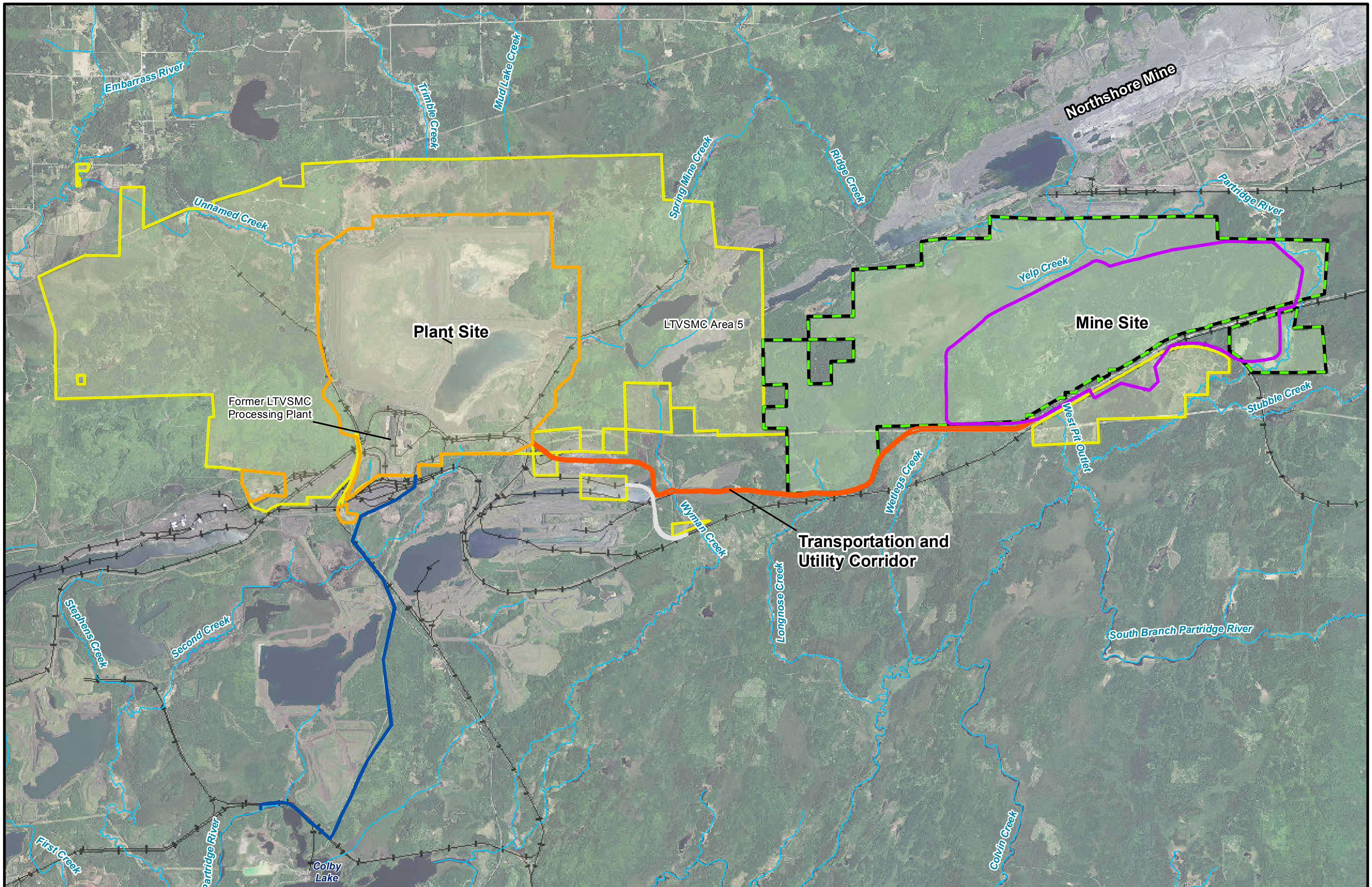


Federal Lands
PolyMet Owned/Leased Area
Mine Site
Plant Site
Colby Lake Water Pipeline Corridor
Transportation and Utility Corridor
Railroad Connection
Stream/River

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N W E S

0 0.5 1 2 Miles

**Figure 3.2-1**
**NorthMet Project Area Surface Rights**
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

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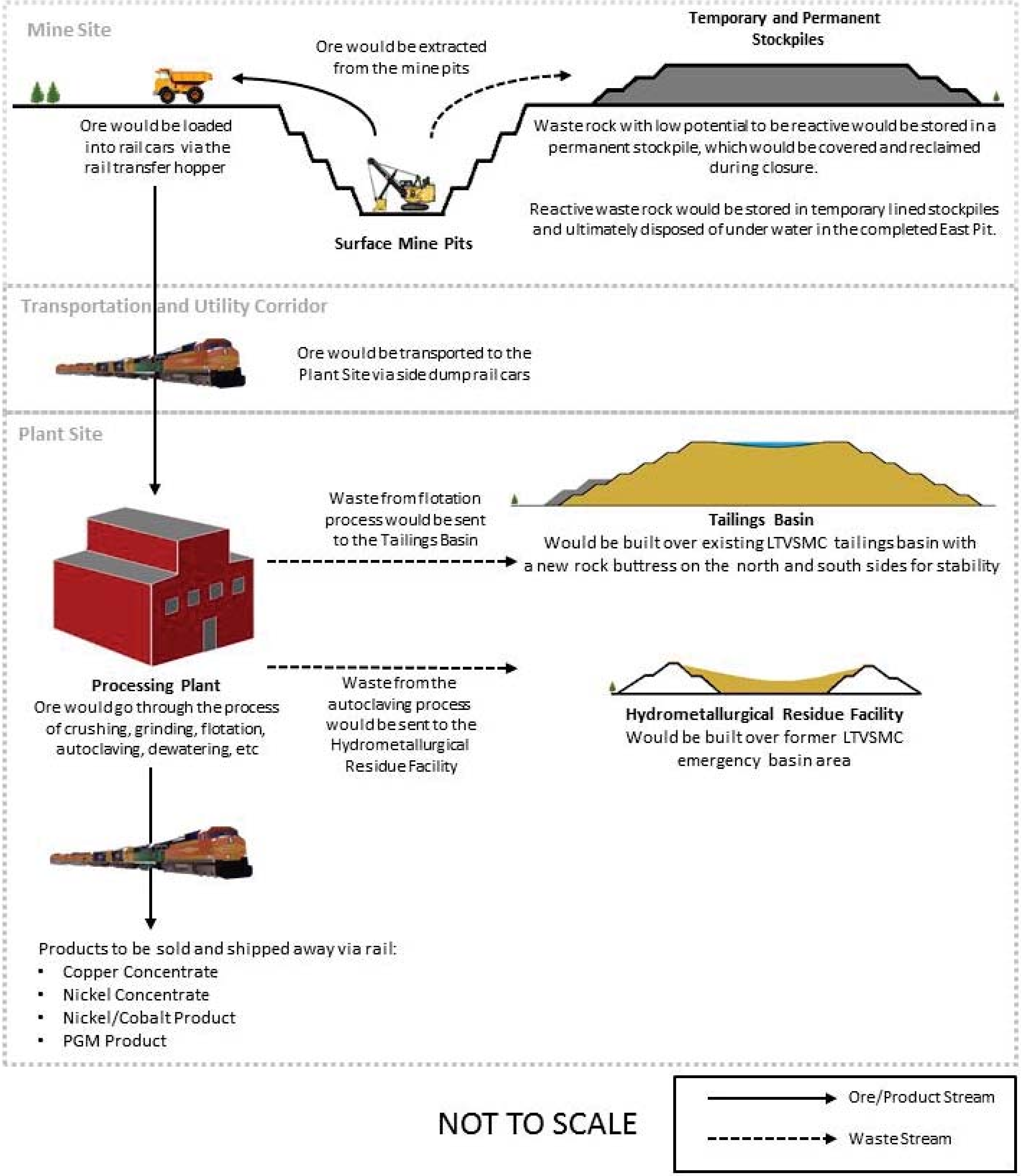


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US Army Corps of Engineers
St. Paul District

**Figure 3.2-2**
**NorthMet Project Material Flow**
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

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### *Table 3.2-1 Summary of the NorthMet Project Proposed Action and the NorthMet Project No Action Alternative*

| **Project Component** | **Location and Existing Land Use** | **NorthMet Project Proposed Action** | **NorthMet Project No Action Alternative** |
|---|---|---|---|
| Mine Site | • Undeveloped federal land located 0.5 mile south of the Northshore Mine and 7 miles east of the former LTVSMC processing plant<br>• Surface lands are publicly owned (USFS)<br>• Mineral rights are privately held | • Development of three open pits that, upon closure, would include one backfilled pit wetland and one flooded pit void<br>• Construction of one permanent and two temporary waste rock stockpiles and a temporary Ore Surge Stockpile<br>• Construction and operation of a WWTF, a Rail Transfer Hopper, and other Mine Site support infrastructure<br>• Mechanical treatment of runoff/seepage water for as long as required in accordance with permit conditions | • No mining<br>• Continued management of public land by USFS or private ownership (Table 3.3-1) |
| Transportation and Utility Corridor | • Privately owned rail and road (Dunka Road) infrastructure<br>• Generally runs east-west from the southern edge of the proposed Mine Site to proposed Plant Site | • Refurbishment and additions to an existing Transportation and Utility Corridor including:<br>– refurbished railway,<br>– refurbished Dunka Road, and<br>– new water pipelines<br>• To be used to transport materials and ore between the Mine Site and the Plant Site | • Continued private ownership and use |
| Plant Site | • Privately owned, unused plant infrastructure (formerly the LTVSMC plant site) and Tailings Basin | • Refurbishment and additions to existing mineral processing facilities at the former LTVSMC processing plant<br>• Tailings disposed of on top of existing Tailings Basin Cells 1E and 2E<br>• Construction of additional dams and seepage/groundwater capture systems<br>• Bentonite layer on top of the Tailings Basin to restrict oxygen and water infiltration<br>• Hydrometallurgical residue disposed of at a new Hydrometallurgical Residue Facility constructed over the existing LTVSMC Emergency Basin<br>• During closure, Hydrometallurgical Residue Facility to be drained, covered, and reclaimed/revegetated<br>• Seeps from the Tailings Basin to be directed back to the Tailings Basin pond or to a new WWTP before discharge to existing discharge locations<br>• Mechanical treatment of water captured from the Tailings Basin to continue as long as required in accordance with permit conditions | • Brownfield site managed as required under existing MDNR- and MPCA-approved reclamation program |

### *3.2.2 NorthMet Project Proposed Action*

The NorthMet Project Proposed Action has been defined by PolyMet Project Description Version 5 (PolyMet 2013c) and includes design elements and mitigation measures identified in management plans described below. These management plans are preliminary in nature and are in development primarily for permitting purposes. However, the mitigation measures contained within them form part of the NorthMet Project Proposed Action and, in most cases, are assumed in the environmental impact analysis.

- Mine Plan (PolyMet 2012t): Describes the site development (infrastructure and facilities), pit development, and mine operations including mining rates and locations to supply ore from the Mine Site to the Plant Site, as well as overburden and waste rock management plans.
- Wetland Management Plan (PolyMet 2013d): Describes the on- and off-site wetland mitigation design, wetland mitigation outcomes, and monitoring and reporting procedures.
- Air Quality Management Plan – Mine (PolyMet 2012b): Describes the emission control systems for point and fugitive sources, air quality modeling outcomes, operating plans for emission controls and fugitive dust control, and air quality monitoring/reporting and adaptive management plans at the Mine Site.
- Air Quality Management Plan – Plant (PolyMet 2012r): Describes the emission control systems for point and fugitive sources, air quality modeling outcomes, operating plans for emission controls and fugitive dust control, and air quality monitoring/reporting and adaptive management plans at the Plant Site.
- Rock and Overburden Management Plan (PolyMet 2012s): Describes baseline data, the design of systems to manage overburden and waste rock (waste characterization, waste classification, and construction uses), outcomes of the design, rock and overburden management operational plans, Category 1 Stockpile groundwater containment system extension design and circumstances that would trigger a design change, water quantity and quality monitoring systems, amount of material in the stockpiles, footprint of the stockpiles, annual reporting requirements, and reclamation plans for next-year closure and forecast of annual estimates for years remaining to end of mining.
- Water Management Plan – Mine (PolyMet 2013e): Describes baseline data and existing conditions, process water management systems (such as the Mine Site WWTF and stormwater management infrastructure), key water quality outcomes, operational water management plans, monitoring and reporting requirements (including comparison to modeled outcomes and compliance), and adaptive management action plans.
- Water Management Plan – Plant (PolyMet 2013f): Describes baseline data and existing conditions, process water management systems (such as the Plant Site WWTP and stormwater management infrastructure), key water quality outcomes, operational water management plans, monitoring and reporting requirements (including comparison to modeled outcomes and compliance), adaptive management action plans, Tailings Basin groundwater containment system design, and Plant Site reclamation plans.
- Adaptive Water Management Plan (AWMP) (PolyMet 2013g): Describes Mine Site and Plant Site water management, Category 1 Stockpile cover system design and circumstances

that would trigger a design change, Category 1 Stockpile water containment non-mechanical treatment system design, West Pit overflow non-mechanical treatment system design, Tailings Basin pond cover system design and circumstances that would trigger a design change, and Tailings Basin non-mechanical treatment system design.

- Flotation Tailings Management Plan (PolyMet 2013m): Describes existing conditions at the existing LTVSMC Tailings Basin, NorthMet Project Tailings Basin design (including tailings geochemical characterization; engineering design of the dams, flotation tailings transport system, and return water system; and seepage and stormwater management), outcomes of modeling, operational plans, monitoring and reporting requirements, and the reclamation plan for the Tailings Basin for next-year closure and forecast of annual estimates for years remaining to end of mining.
- Residue Management Plan (PolyMet 2012e): Describes Hydrometallurgical Residue Facility design, summary of Hydrometallurgical Residue Facility geotechnical analysis outcomes, operational plans (including residue transport and deposition system, return water system, leachate collection system, and general maintenance), monitoring and reporting requirements, and the reclamation plan for the Hydrometallurgical Residue Facility for next-year closure and forecast of annual estimates for years remaining to end of operations.
- Reclamation Plan (PolyMet 2013a): Describes activities associated with demolition of structures and waste disposal, reclamation of the Mine Site (mine pit; stockpile; water management systems, building areas, roads, and parking lots; and removal of railroad tracks and culverts), reclamation of the Plant Site (Tailings Basin; Hydrometallurgical Residue Facility; water management systems, building areas, roads, and parking lots; and removal of railroad tracks and culverts), remediation of legacy Areas of Concern (AOCs) and ongoing mitigation of water quality at the Mining Area 5N and the Tailings Basin, ongoing monitoring and maintenance for the existing solid waste disposal facilities, the methodology for making reclamation estimates and the contingency reclamation estimate, and potential mechanisms for financial assurance.

The description of the NorthMet Project Proposed Action that follows is broken down into the main components: the Mine Site (Section 3.2.2.1), Transportation and Utility Corridor (Section 3.2.2.2), and Plant Site (Section 3.2.2.3). Financial assurance also forms part of the NorthMet Project Proposed Action and is discussed in Section 3.2.2.4.

### 3.2.2.1 Mine Site

This section describes the proposed Mine Site with specific reference to key phases as summarized in Table 3.2-2.

*Table 3.2-2 Key Phases and Activities (Mine Site)*

| Mine Year/Phase | Figure | Key Activities at the Mine Site |
|---|---|---|
| **Construction** | | |
| Prior to mining | Figure 3.2-4 (existing conditions) | • Constructing Mine Site infrastructure<br>• Preparing ground for mine pits and stockpiles |
| **Operations** | | |
| Years 1-11 | Figure 3.2-5 (year 1)<br><br>Figure 3.2-6 (year 2) | • Mining in East Pit and West Pit<br>• Stockpiling non-acid-generating waste rock (Category 1) into a permanent stockpile (Category 1 Stockpile)<br>• Stockpiling rock with the potential to generate acid (Category 2, 3, and 4) into temporary stockpiles (Category 2/3 Stockpile, Category 4 Stockpile) |
| Years 11-16 | Figure 3.2-7 (year 11) | • Moving all of the Category 4 Stockpile into the completed East Pit<br>• Mining in the West Pit and Central Pit (the Central Pit would eventually expand to the completed East Pit)<br>• Backfilling the East Pit with rock from the temporary Category 2/3 Stockpile, and waste rock from ongoing mining in the West Pit and Central Pit |
| Years 16-20 | Figure 3.2-8 (year 20) | • Mining in the West Pit only<br>• Backfilling the combined East Central Pit with waste rock from the temporary Category 2/3 Stockpile, and all waste rock from ongoing mining in the West Pit<br>• Reclaiming the Category 1 Stockpile |
| **Closure and Post-closure Maintenance** | | |
| Reclamation (after year 20) | Figure 3.2-8 (year 20) | • Completing the movement of waste stockpiled in the Category 2/3 Stockpile to the combined East Central Pit<br>• Flooding of the West Pit<br>• Reclaiming remaining disturbed areas |
| Long-term management | Figure 3.2-9 (long-term closure management) | • Monitoring and maintenance<br>• Mechanical water treatment |

### 3.2.2.1.1 Location and Ownership

As shown in Figure 1-1, the NorthMet Deposit is located approximately 6 miles south of the City of Babbitt in St. Louis County, Minnesota. The Mine Site, shown on Figure 3.2-4, comprises 3,014.5 acres. This area represents the boundary within which the proposed mining activity and infrastructure (i.e., surface disturbance) would occur. The Mine Site would include:

- mine pits;
- overburden and waste rock stockpiles; and
- mining infrastructure, haul roads, a rail-loading facility, and a WWTF.

Layout maps of the Mine Site—which include outlines of the mine pit(s) and waste rock stockpile(s), and mining infrastructure for years 1 (the first year that ore would be delivered to the processing plant), 2, 11, and 20—are shown on Figure 3.2-5 through Figure 3.2-8. Mine Site layout for long-term closure management is shown on Figure 3.2.9.

PolyMet leases the mineral rights required for proposed mining at the NorthMet Deposit from mineral rights holders RGGS Inc. (RGGS) and Longyear Mesaba Company (Figure 3.2-3).

The majority of the surface land at the proposed Mine Site is part of a single contiguous area of publically owned land managed by the USFS. Smaller portions of the Mine Site are owned by PolyMet and leased by PolyMet from Cliffs Erie. Lands owned or leased by PolyMet are shown on Figure 3.2-1. Ownership of federal land at the proposed Mine Site is subject to the Land Exchange Proposed Action (Section 3.3).

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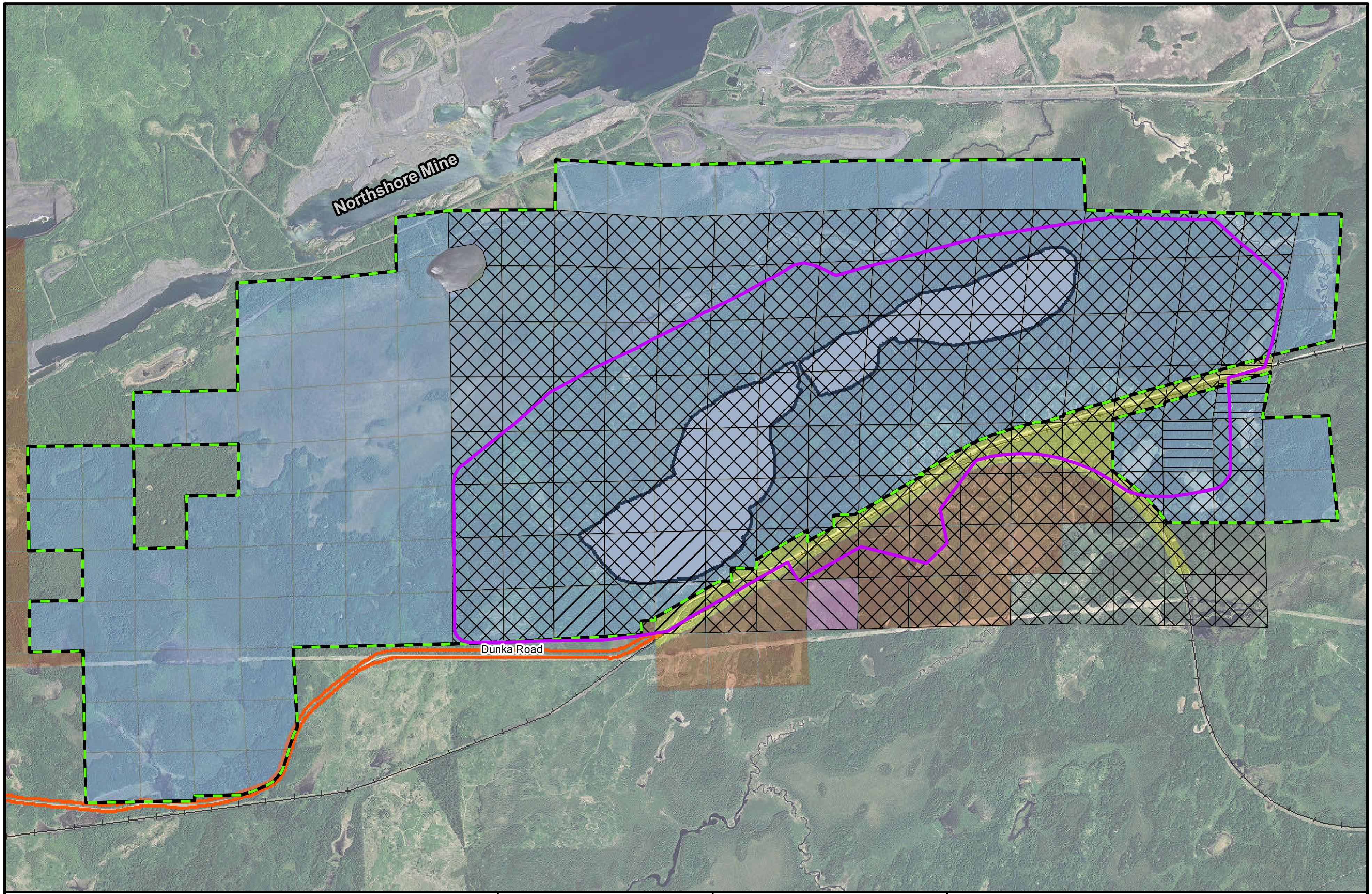


Mine Site
Transportation and Utility Corridor
Federal Lands
Mine Pit
Existing Railroad

**Mineral Ownership**
RGGS
Longyear Mesaba
State of Minnesota
USA

**Surface Ownership**
Cliffs Erie
PolyMet
PolyMet Pursuing Ownership
USA

US Army Corps of Engineers
St. Paul District

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0 1,000 2,000 4,000 Feet

**Figure 3.2-3**
**Mine Site Surface and Subsurface Rights**
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

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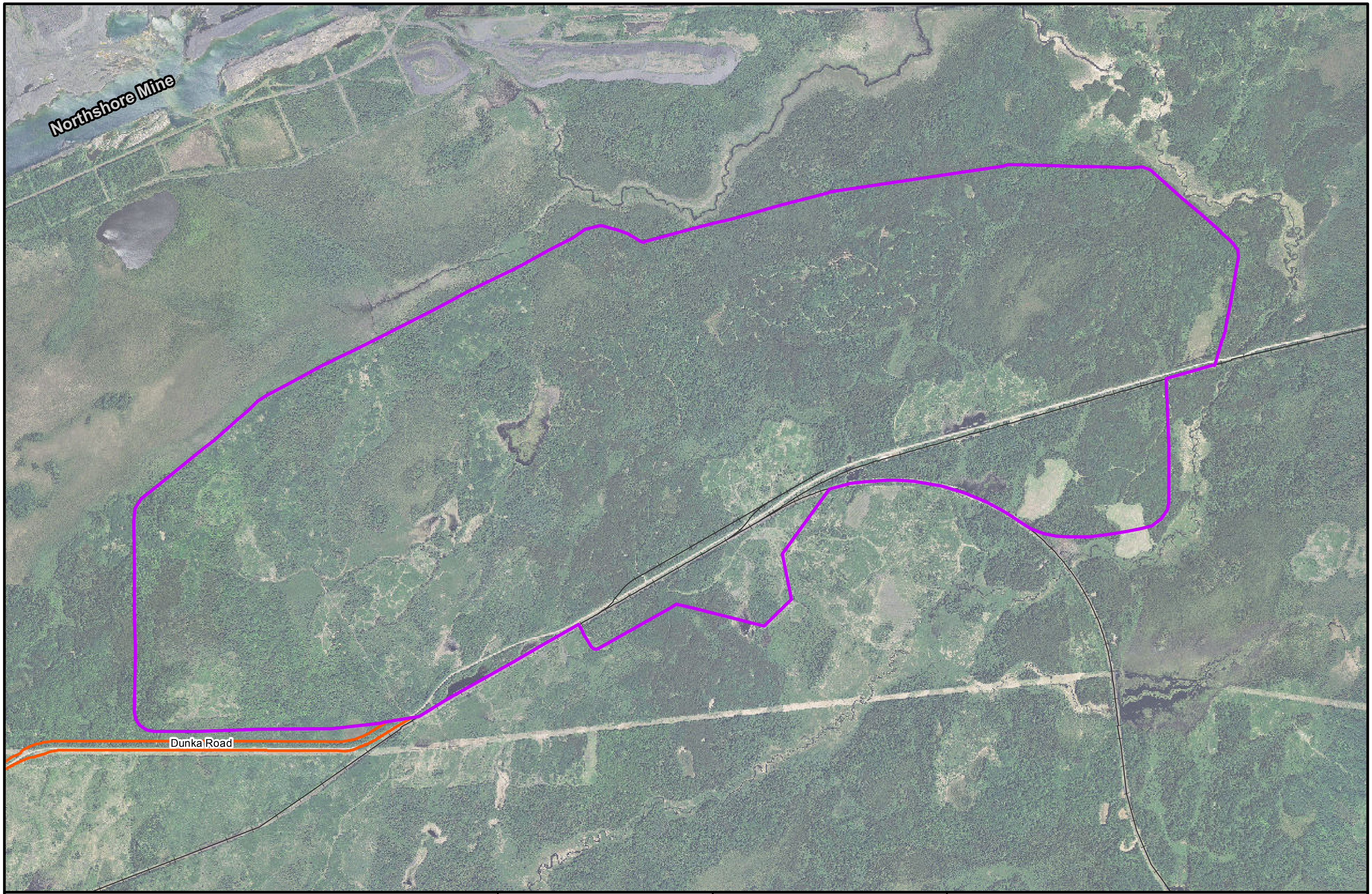


Mine Site
Transportation and Utility Corridor
Existing Railroad

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0 750 1,500 3,000 Feet

**Figure 3.2-4**

**Existing Conditions at the Mine Site**

NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

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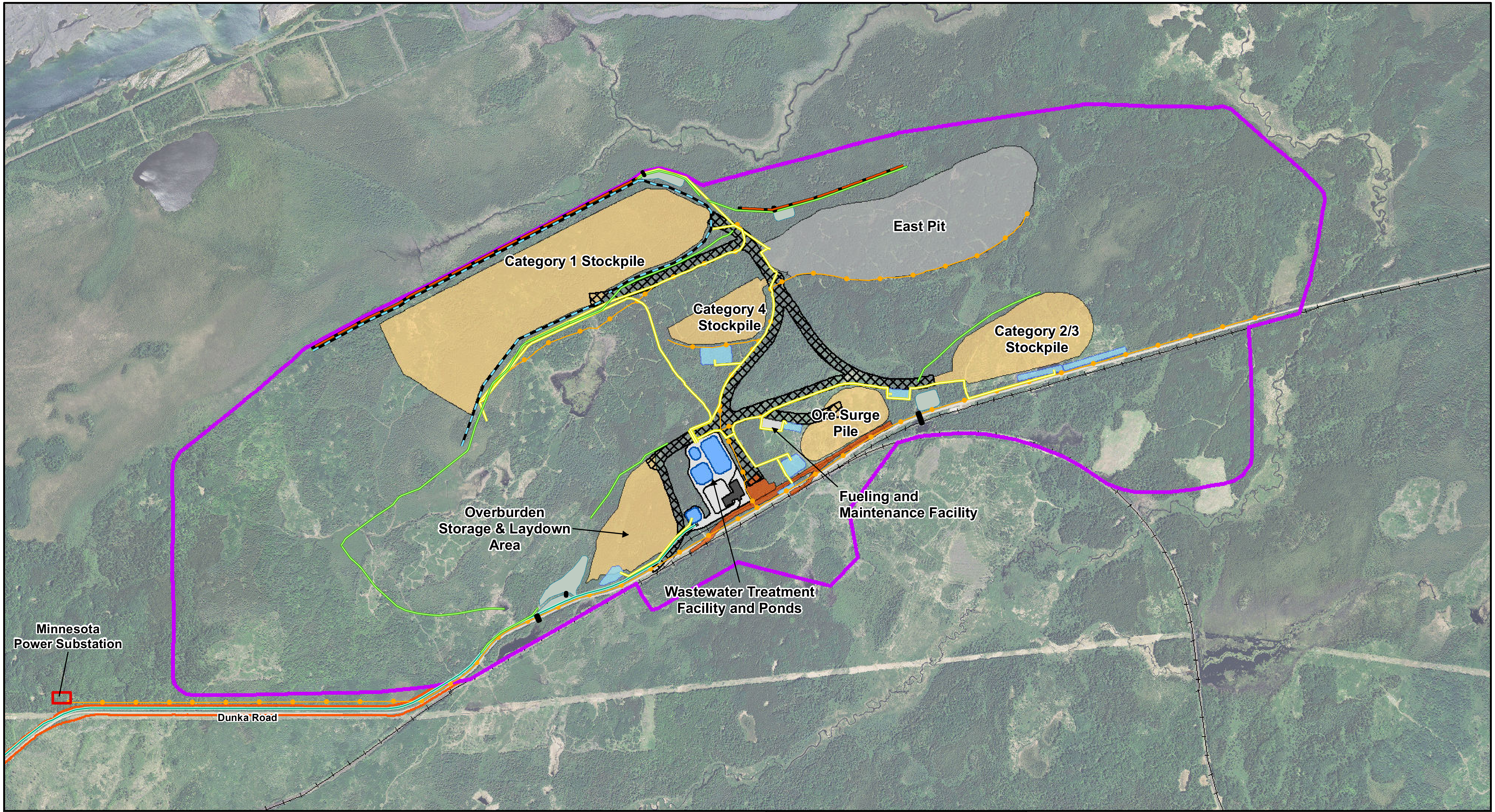


Mine Site
Mine Pit
Active Stockpile
Rail Transfer Hopper and New Railroad Spur
Transportation and Utility Corridor
Groundwater Containment System
Perimeter Dike
Treated Water Pipeline
Stormwater Collection Ditch
Transmission Line
Process Water Pipes
Culvert
Ponds and Sumps
Stormwater Pond
Haul Road

Minnesota Department of Natural Resources
US Army Corps of Engineers
St. Paul District
Forest Service US Department of Agriculture

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N W E S

0 750 1,500 3,000 Feet

**Figure 3.2-5**

**Mine Site Plan - Year 1**

NorthMet Mining Project and Land Exchange PSDEIS

Minnesota

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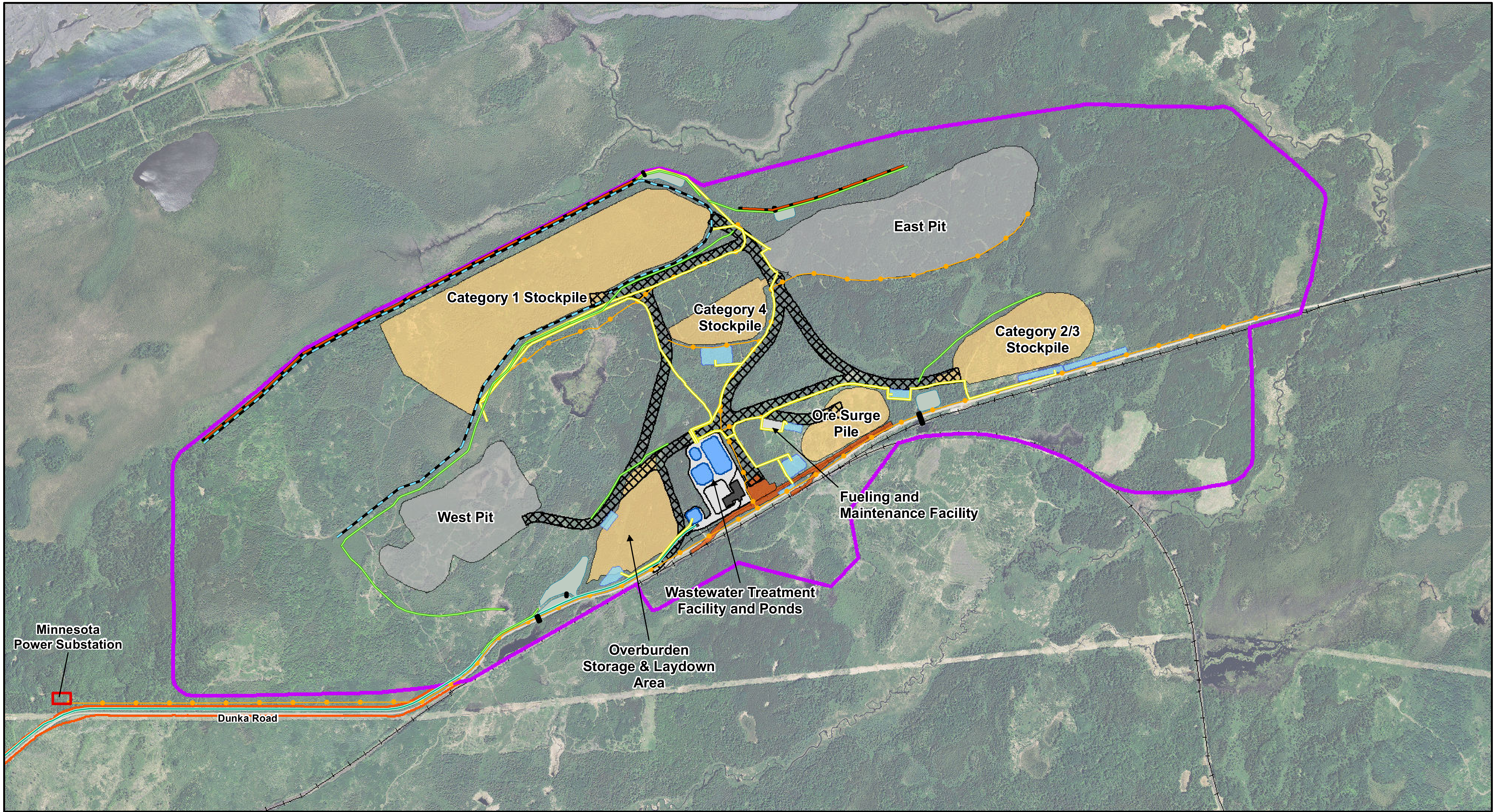


Mine Site
Mine Pit
Active Stockpile
Rail Transfer Hopper and New Railroad Spur
Transportation and Utility Corridor
Groundwater Containment System
Perimeter Dike
Treated Water Pipeline
Stormwater Collection Ditch
Transmission Line
Process Water Pipes
Culvert
Ponds and Sumps
Stormwater Pond
Haul Road

Minnesota DEPARTMENT OF NATURAL RESOURCES

US Army Corps of Engineers St. Paul District

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

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N W E S

0 750 1,500 3,000 Feet

**Figure 3.2-6**
**Mine Site Plan - Year 2**
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

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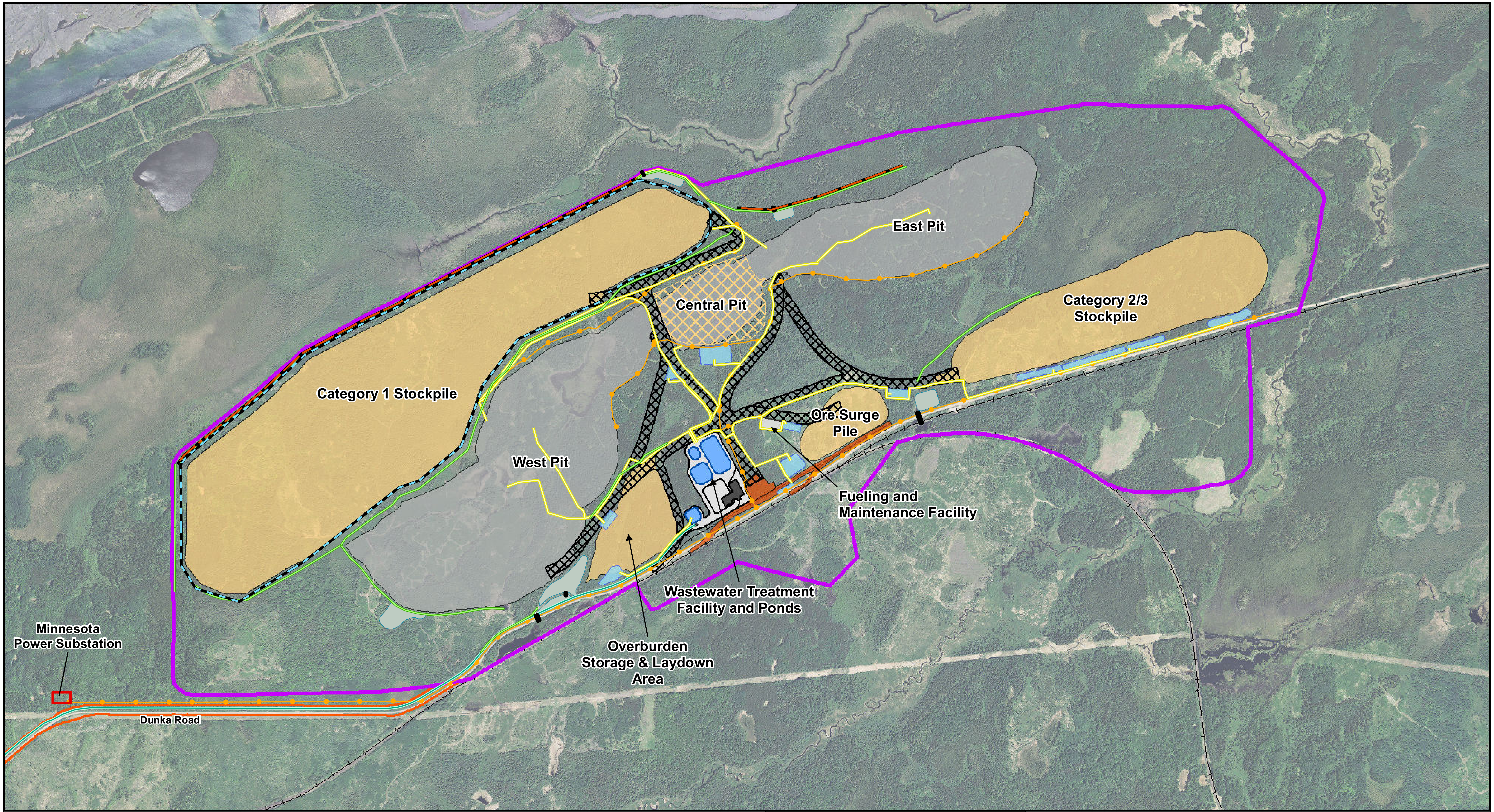


Mine Site
Active Stockpile
Category 4 Stockpile Removed
Mine Pit
Haul Road
Transportation and Utility Corridor
Rail Transfer Hopper and New Railroad Spur
Groundwater Containment System
Perimeter Dike
Transmission Line
Culvert
Stormwater Collection Ditch
Process Water Pipes
Treated Water Pipeline
Ponds and Sumps
Stormwater Pond

Minnesota Department of Natural Resources
US Army Corps of Engineers St. Paul District
Forest Service U.S. Department of Agriculture

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N W E S

0 750 1,500 3,000 Feet

**Figure 3.2-7**
**Mine Site Plan - Year 11**
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

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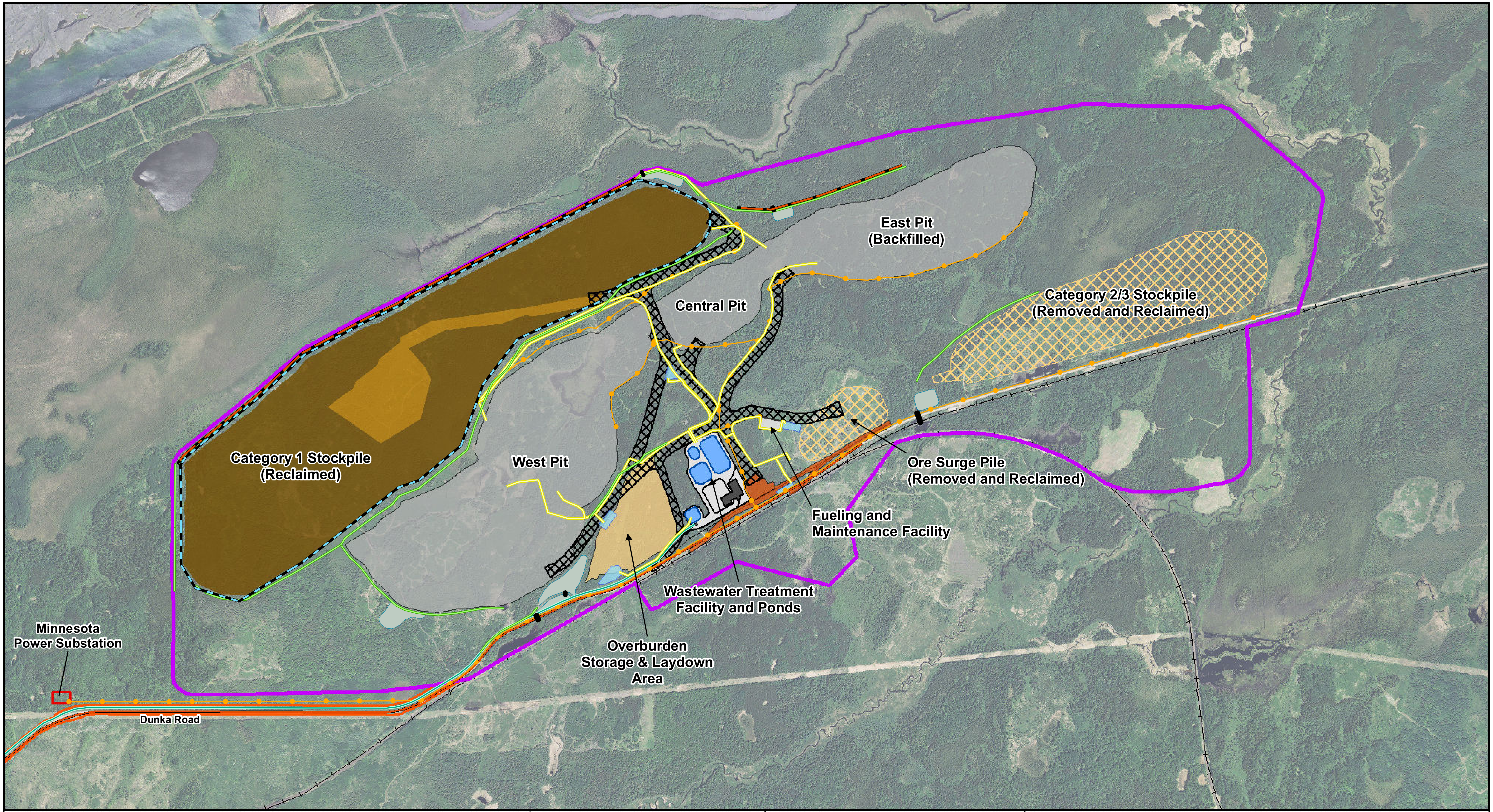


- Mine Site
- Mine Pit
- Covered in Previous Years
- Covered Upon Mine Closure
- Active Stockpile
- Removed and Reclaimed Stockpile
- Haul Road
- Transportation and Utility Corridor
- Rail Transfer Hopper and New Railroad Spur
- Groundwater Containment System
- Perimeter Dike
- Transmission Line
- Culvert
- Stormwater Collection Ditch
- Process Water Pipes
- Treated Water Pipeline
- Ponds and Sumps
- Stormwater Pond

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N W E S

0 750 1,500 3,000 Feet

**Figure 3.2-8**

**Mine Site Plan - Year 20**

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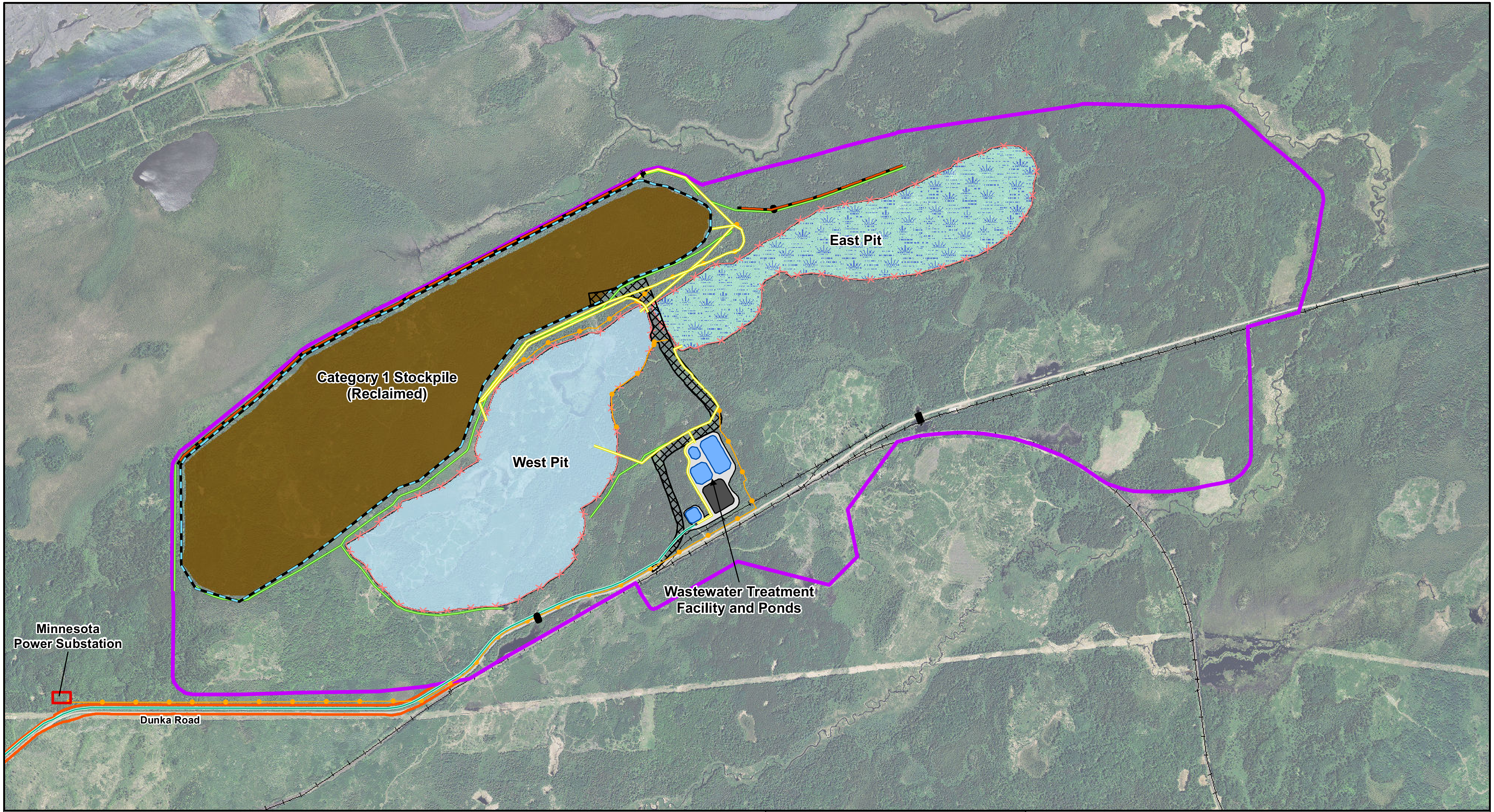


Mine Site
Pit with Backfill and Surface Wetland
Pit Lake
Covered in Previous Years
Haul Road
Transportation and Utility Corridor
Groundwater Containment System
Transmission Line
Stormwater Collection Ditch
Perimeter Dike
Process Water Pipes
Treated Water Pipeline
Fence
Culvert

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St. Paul District

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N
W E
S

0 750 1,500 3,000 Feet

**Figure 3.2-9**

**Mine Site Plan - Long Term Closure**

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Minnesota

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#### 3.2.2.1.2 Existing Conditions

The Mine Site is mostly located on undeveloped federal land within the western/central part of the Superior National Forest (Figure 1-1). As can be seen on Figure 3.2-4, existing disturbance includes some minor access tracks used for mineral exploration, as well as the existing railway line and Dunka Road that run east-west in the southern part of the Mine Site. Both the rail line and road would be refurbished as part of the NorthMet Project Proposed Action and would be used to transport ore and other material, as required, between the Mine Site and the Plant Site (Section 3.2.2.2).

Section 4.2 provides additional information on the affected environment at the Mine Site.

***NorthMet Deposit Geology***

The NorthMet Deposit is one of 10 known significant mineral deposits that have been identified within the 30-mile length of the Duluth Complex and just south of the eastern end of the Mesabi Iron Range. The complex is a well-known geological formation containing large quantities of copper, nickel, cobalt, platinum, palladium, and gold. The MDNR has estimated that the entire complex contains as many as 4.4 billion tons of mineral resources grading at 0.66 percent copper and 0.20 percent nickel. The NorthMet Deposit is the second-largest deposit within the Duluth Complex and represents nearly 25 percent of the known mineral resources in the area.

All of the mineral deposits share a broadly similar geologic setting to the NorthMet Deposit. They are disseminated sulfides with minor, local, massive sulfides hosted in grossly layered heterogeneous troctolitic rocks forming the basal unit of the Duluth Complex. The majority of the metals are concentrated in, or associated with, four sulfide minerals: chalcopyrite, cubanite, pentlandite, and pyrrhotite, with platinum, palladium, and gold also found as elements and in bismuthides, tellurides, and alloys.

There have been many major drilling programs at the NorthMet Deposit since its discovery in 1969, and numerous bulk metallurgical samples have been collected. The general structure of the NorthMet Deposit, including individual beds within the Biwabik Iron Formation and Virginia Formation, is dominated by an overall dip ranging from 15 to 25 degrees to the southeast, and striking about N56 degrees east. The mineralized zone dips to a maximum of 60 degrees in the area of the proposed East Pit, where the Duluth Complex steeply cross-cuts the Virginia Formation footwall rocks. The NorthMet Deposit is a low- to medium-quality copper-nickel-PGE deposit with a low sulfide content.

The lithology of the NorthMet Deposit consists of seven units, as shown on Figure 3.2-10. Further information on the geology and hydrogeology of the Mine Site and Plant Site is provided in Section 4.2.3.

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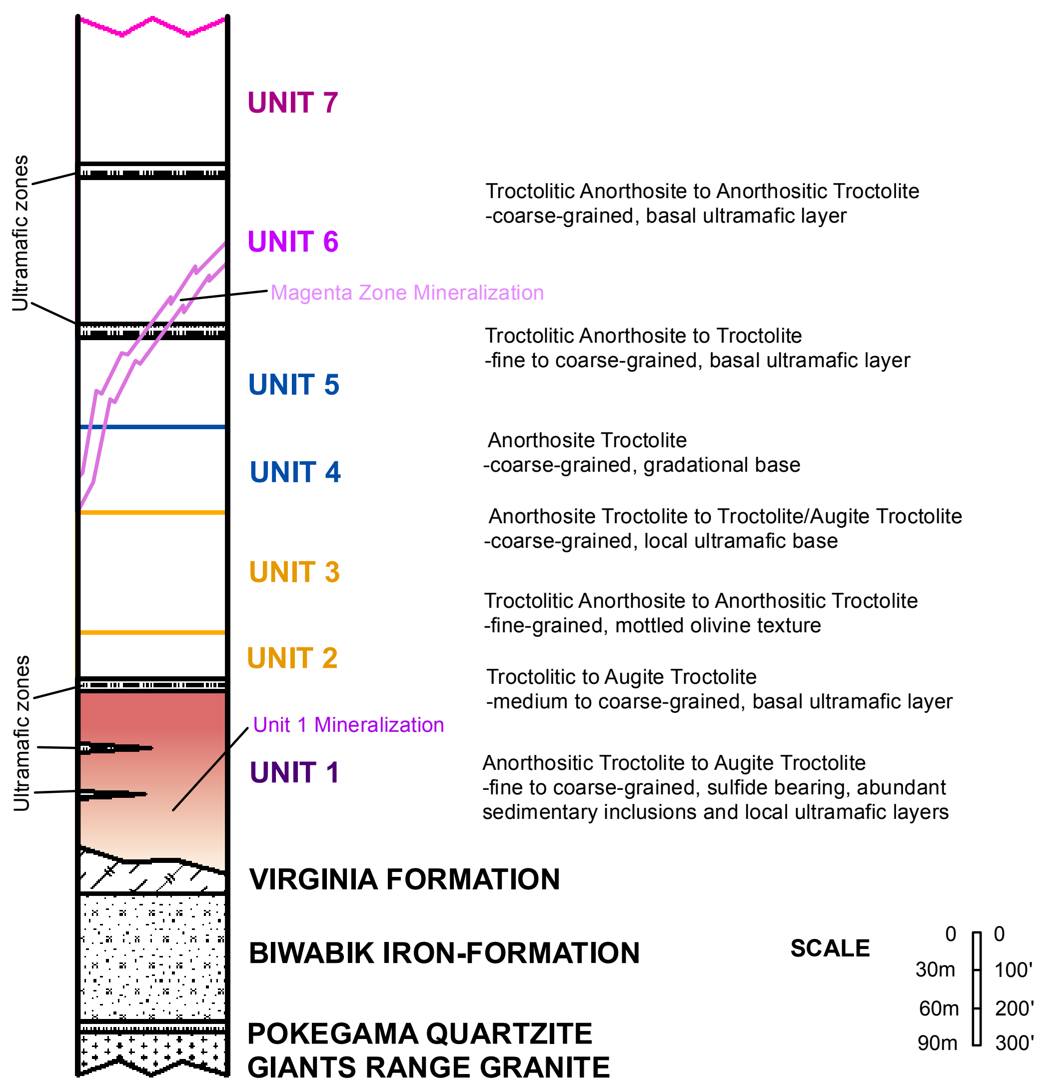
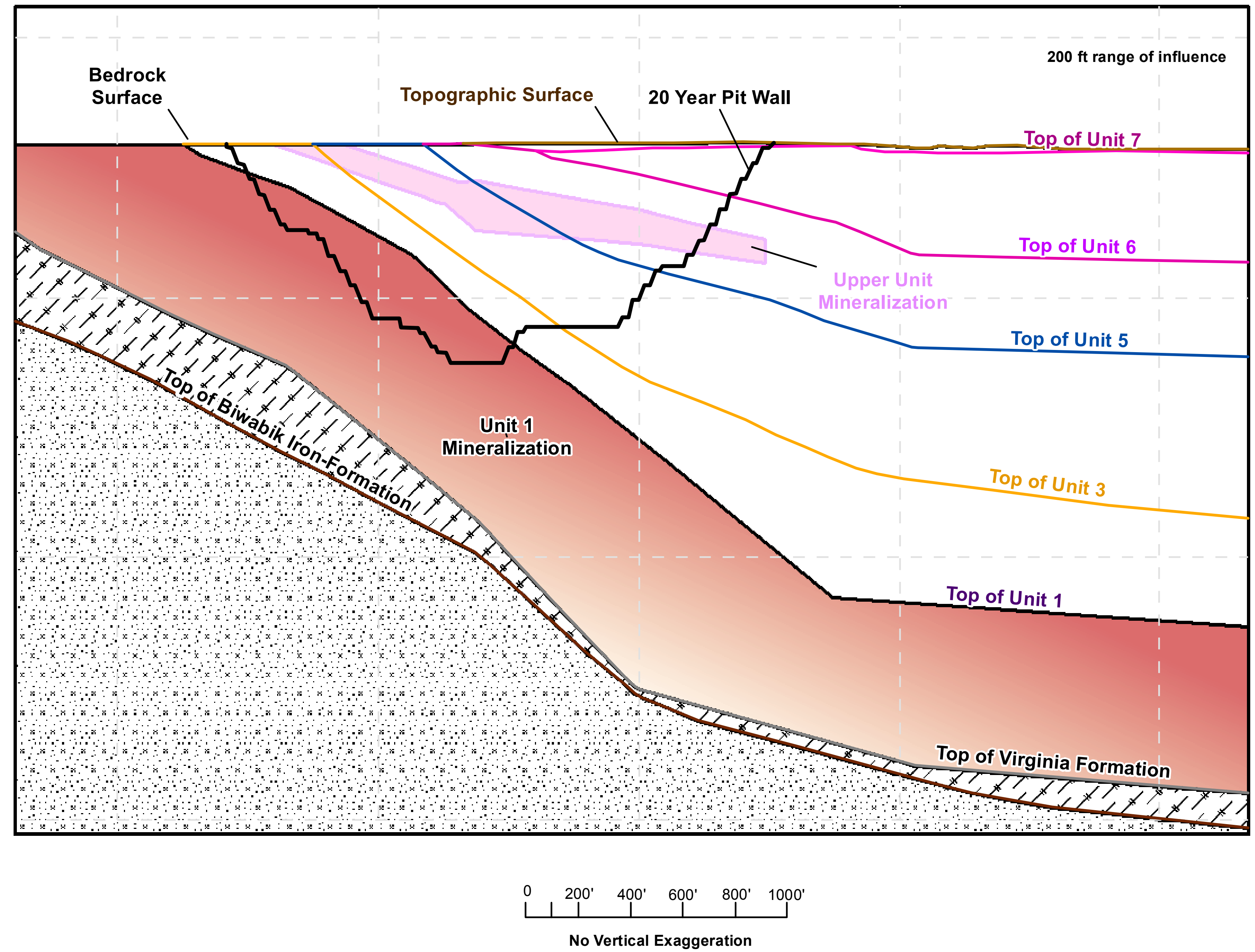
## NORTHMET GENERALIZED STRATIGRAPHIC COLUMN




## NORTHMET TYPICAL CROSS SECTION FACING EAST

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St. Paul District

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**Figure 3.2-10**
**Schematic Geologic Cross-Section and Stratigraphic Column at Mine Site**
NorthMet Mining Project and Land Exchange PSDEIS
Minnesota

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#### 3.2.2.1.3 New Construction and Pre-production Development

Several construction activities would be completed during the estimated 12 to 18 months of pre-production mine development. These activities would include the following:

- clearing timber and biomass from surface footprint areas by contracted logging and biomass services, which would remove forest products from the NorthMet Project area;
- constructing site access and haul roads, upgrading the existing Dunka Road, installing rail connections and spur, and constructing the Mine Site Fueling and Maintenance Facility from existing facilities using standard industrial construction practices and off-site materials;
- removing overburden from the pit areas and other areas on-site, as necessary, using excavation equipment such as backhoes, bulldozers, and standard (non-mining) dump trucks (Section 3.2.2.1.7);
- constructing the Overburden Storage and Laydown Area by compaction to provide space to sort and temporarily store overburden;
- constructing the Rail Transfer Hopper;
- constructing the liners and containment systems for the Ore Surge Pile and waste rock stockpiles (Section 3.2.2.1.8);
- constructing water management features—including dikes, ditches, and ponds—to manage surface water, the Mine Site WWTF, the Central Pumping Station, and the Treated Water Pipeline (Section 3.2.2.1.8); and
- constructing a substation drop from the 138 kV transmission line (by Minnesota Power, which would retain ownership of the line) and installation of power poles and lines that would be owned by PolyMet and would serve as a 13.8 kV Mine Site power distribution system.

The MDNR would need to approve the use of waste rock, overburden, and peat during construction. This material would be supplemented with rock from a state-owned, non-reactive taconite stockpile located approximately 5 miles west of the Mine Site, adjacent to Dunka Road (refer to Section 3.2.2.1.7 for more information on waste rock management).

#### 3.2.2.1.4 Equipment and Services

***Equipment***

A variety of equipment, mostly diesel-powered unless otherwise noted, would be used at the Mine Site. The anticipated fleet of Mine Site equipment is shown in Table 3.2-3.

### *Table 3.2-3 Mine Site Equipment Fleet*

| Typical Machine Type | Power | Number | Duties |
|---|---|---|---|
| Tracked dozer (Cat D10R or equivalent) | 582 hp | 2 | Stockpile maintenance, construction, stockpile reclamation |
| Wheel dozer (Cat 834G or equivalent) | 450 hp | 1 | Clean-up at the pit loading faces and the Rail Transfer Hopper |
| Grader (Cat 16H or equivalent) | 275 hp | 2 | Haul road maintenance |
| Water truck (Cat 777D or equivalent) | 937 hp | 2 | Haul road maintenance, dust suppression, auxiliary firefighting duties |
| Wheel loader (Cat 992G or equivalent) | 800 hp | 1 | Construction, general purpose loading, reclamation |
| Backhoe with hammer (Cat 446D or equivalent) | 110 hp | 1 | Secondary breakage |
| Integrated tool carrier (Cat IT62H or equivalent) | 230 hp | 1 | Miscellaneous tasks (i.e., snow plowing, fork lift, sweeper, etc.) |
| Field service trucks | 114 hp | 6 | Field maintenance flatbed trucks fitted with hydraulic arm lift |
| Fuel truck | 150 hp | 2 | Field fueling of mobile equipment and drills |
| Line truck | 100 hp | 1 | Power line maintenance, excavator and rail transfer hopper service |
| Off-road lowboy trailer and tractor | 200 hp | 1 | Transporting tracked equipment around mine and to service areas and workshops |
| Drills | Electric and/or 1,600 hp | 2 | Blast hole drilling for waste rock and ore |
| Excavators | Electric | 2 | Excavation of ore and waste materials (waste rock and overburden) |
| Haul trucks | 2,500 hp | Up to 9 | Haulage of ore and waste materials (waste rock and overburden) |
| Haul truck retriever | 1,120 hp | 1 | Retrieving and transporting haul trucks unable to move under their own power |
| Light vehicles (pickups and SUVs) | 150-250 hp | Up to 20 | Supervisor transport, general duties |

hp = horsepower

## ***Fuel and Maintenance Facilities***

Equipment fueling and minor service and repair work would be conducted at the Mine Site Fueling and Maintenance Facility located near the Rail Transfer Hopper. This facility would consist of two buildings, one for fueling mobile equipment (fueling station) and the second for mobile equipment maintenance (maintenance building). The fueling station and the maintenance building would be roved structures with enclosed sides, but open at each end to allow equipment to drive through. The structures would have a reinforced concrete floors sloped to drain to a sump to collect any fuel, hydraulic oil, engine oil, and coolant/antifreeze spillage. A licensed disposal contractor would periodically pump out the sumps.

The fueling station would house a fuel-dispensing system, as well as dispensing equipment for lubricating and hydraulic oils, antifreeze/coolant, windshield washer fluid, and compressed air for tires. The building would house storage tanks containing lubricating and hydraulic oils and antifreeze. Two to three 12,000-gallon bulk diesel storage tanks, enclosed within a spill containment system, would be provided. Interior and area lighting would be available to enable safe operation at night. A metering system would record the amount of fuel dispensed to each vehicle. There would be emergency shut-off valves at all necessary locations.

Stationary or slow-moving equipment such as excavators, dozers, drill rigs, and portable light generators would be fueled in the field from mobile fuel tankers specially equipped with pumping and metering devices. The fueling tankers would arrive at the Mine Site with fuel or be replenished at the Fueling Station.

Minor mobile equipment maintenance—such as oil, filter, tire, and lamp changes; maintenance of fluid levels; haul truck box welding; and other short duration maintenance—would be done at the Maintenance Building.

Major scheduled maintenance and repair work on mobile equipment—such as haul trucks, front-end loaders, dozers, and graders—that would last several days would be done in the refurbished and reactivated former LTVSMC Area 1 Shop located about 1 mile west of the former LTVSMC processing plant (Section 3.2.2.3.8). Examples of these types of repairs include engine changes and final drive repairs. Because of the size and weight of the primary excavators and blast hole drill rigs, as well as the distance to the Area 1 Shop, most of their maintenance and repair work would be done at the Mine Site.

### 3.2.2.1.5 Mining

The key characteristics of proposed mining are summarized in Table 3.2-4 and are discussed further below.

***Table 3.2-4 Key Characteristics of Proposed Mining***

| Aspect/ Feature | Characteristic | Proposed Description |
|---|---|---|
| Mining | Life of Mine | 20 years |
| | Method | Surface blast (Ammonium Nitrate Fuel Oil [ANFO]) and haul from three open pits (West Pit, East Pit, and Central Pit) |
| | Total material removed | 533 million tons of waste rock and ore |
| | Average ore rate | Up to 32,000 tpd |
| | Total ore (Life of Mine) | 225 million tons |
| | Total waste rock (Life of Mine) | 308 million tons |
| West Pit | Phases of development | Years 1-20: Mining<br>Year 20+ : Flooding |
| | Waste rock management | Years 1-11: Stockpiled in respective stockpiles<br>Years 11-13: Some stockpiled, some disposed of in the East Pit and combined East Central Pit<br>Years 14-20: Disposed of in the combined East Central Pit |
| | Maximum depth | 696 ft below original surface (year 20) |
| | Maximum surface footprint | 321 acres |

| Aspect/ Feature | Characteristic | Proposed Description |
|---|---|---|
| East Pit | Phases of development | Years 1-11: Mining<br>Years 11-16: Backfilled with waste rock<br>Years 16+: Refer to combined East Central Pit below |
| | Waste rock management | Years 1-11: Stockpiled in respective stockpiles |
| | Maximum depth | 630 ft below original surface (year 11) |
| | Maximum surface footprint | 155 acres |
| Central Pit | Phases of development | Years 11-16: Mining<br>Years 16+: Refer to combined East Central Pit below |
| | Waste rock management | Years 11-16: Disposed of in the East Pit |
| | Maximum depth | 356 ft below original surface (year 16) |
| | Maximum surface footprint | 52 acres (year 16) |
| Combined East Central Pit | Phases of development | Year 16 (end of mining at the Central Pit): The Central Pit would have been expanded into the East Pit, forming a combined pit<br>Years 16-20: Backfilled with waste rock and saturated<br>Years 20+: Reclamation (constructed wetlands) and maintenance |

The pre-production mine development would be followed by a gradual ramp-up of mining and ore output over 6 to 12 months to reach the planned rate of mining, which would be an annual average of 32,000 standard tpd. Because the processing plant feed rate would progressively increase as plant operations ramped up, mining would be scheduled so that the excavated area in the mine pits would also increase to provide an adequate supply of ore and ensure continuity of plant feed.

The NorthMet Project Proposed Action has been designed based on a 20-year mine plan. While mineralization is known to extend beyond the proposed pit outline, the economic feasibility for mining this material has not been assessed. There is no mine plan for any material that lies outside of the proposed open pit; as such, mining this material is not part of the NorthMet Project Proposed Action. Mining of material located beyond the proposed pit outline would be evaluated as appropriate if proposed in the future.

The NorthMet Project Proposed Action would use open-pit mining methods, similar to those currently in use at nearby ferrous metallic (iron) mining operations on the Mesabi Iron Range. The mine would consist of three open pits (East Pit, Central Pit, and West Pit). The development and configuration of these pits are summarized and shown in Tables 3.2-2 and 3.2-4 and on Figures 3.2-5 through 3.2-6. Ore would be hauled to a Rail Transfer Hopper for transportation to the Plant Site (Sections 3.2.2.1.6 and 3.2.2.2, respectively) and waste rock would be categorized and disposed of as discussed in Section 3.2.2.1.7.

The northwest edge of the mine pits would be constrained by the northward extent of the Duluth Complex, which hosts the mineral deposit. The pits follow the mineralization, which dips southeast at about 25 percent and roughly parallels the top of the Virginia Formation (Figure 3.2-9). The mine pits would be developed in a series of benches that would be approximately 40 ft high. These benches would be accessed by ramps with a driving surface approximately 85 ft wide to accommodate mine traffic, with additional width for safety berms and ditches, power lines and cables, and pipes on an as-required basis. The pit slope design has an overall pit slope angle of approximately 51 percent. This would be continuously monitored and refined throughout the life of the mine.

It would be necessary to dewater the pits during mining to remove groundwater and precipitation runoff. These waters would be directed to low areas in the pits, collected in sumps, and pumped to the WWTF. The mine pit sump areas and pump capacities would be designed to minimize delay to mining operations during the typical spring snowmelt or major precipitation events. Water management at the Mine Site is addressed in Sections 3.2.2.1.8 and 3.2.2.1.9.

### ***Drilling and Blasting***

The drilling and blasting plan has been prepared based on standard design, with consideration of specific aspects of the NorthMet Deposit. The general parameters are presented in Table 3.2-5. PolyMet would conduct blasting in accordance with *Minnesota Rules*, part 6132.2900, Air Overpressure and Ground Vibrations from Blasting.

***Table 3.2-5 Blasting Parameters***

| Blasting Parameter | Specifications |
|---|---|
| Blast hole diameter (range) | 10-16 inches |
| Explosive type/blasting agent | ANFO, emulsion and emulsion blends (ANFO and emulsions) |
| Burden (distance from free face) and spacing (distance between holes) | Approximately 25 ft x 28 ft with 5 ft of subdrilling for ore and 29 ft x 33 ft with 6 ft of subdrilling for waste rock, based on a 12 ¼-inch diameter blasthole. |
| Powder factor | Approximately 0.69 pound per ton for ore and 0.45 pound per ton for waste rock, based on a 12¼-inch diameter blasthole. |
| Drilling rate – approximate (Assumed drilling time/rig 24 hours/day) | 50 to 70 ft per hour based on a 12¼-inch diameter drill bit. |
| Average ft drilled per month | 34,425 |

Drilling and blasting would share a common drilling fleet and have similar blast design specifications for the ore and waste rock. Based on a planned annual ore movement rate of 26.7 million tons and a blast design as shown in Table 3.2-5, it is estimated that the total annual amount of blasting agent used for breaking ore would be 15.3 million pounds, not including initiators and blasting accessories. Secondary breaking of oversize pieces would be done using a wheel loader or excavator-mounted, drop-weight hammer. Blasting of ore and waste rock is anticipated to take place approximately every 2 to 3 days. This would typically include separate blasts of ore and waste rock benches totaling about 200,000 to 300,000 tons of broken rock per blast.

### ***Excavation***

After being drilled and blasted, the ore would be loaded by excavators into haul trucks that would transport the rock to the Rail Transfer Hopper or Ore Surge Pile. Electric-hydraulic excavators with an approximate capacity of 31 cubic yards would be the primary rock-loading tools in the mining fleet, with a large, diesel front-end loader (approximately 21.5-cubic-yard capacity) available to provide operational flexibility and additional loading capacity.

### 3.2.2.1.6 Haulage, Storage, and Transport of Ore

***Haulage***

Haul trucks would transport the ore to the Rail Transfer Hopper for transportation to the processing plant (Section 3.2.2.2). Should a delay or shutdown of any part of the rail haulage system occur, the ore would be temporarily stored on the lined Ore Surge Pile. A list of the equipment, including trucks, to be used at the Mine Site is provided in Table 3.2-3.

The haul truck fleet would initially consist of five conventional 240-ton diesel-powered rear dump trucks and increase to a maximum of nine trucks as hauls became longer and temporary stockpiles were relocated to the East Pit. Haul trucks could be reassigned between excavators loading ore, waste rock, and overburden. PolyMet intends to use only private roads that they manage and would not use or intersect any public roads.

***Ore Surge Pile***

An Ore Surge Pile would be constructed near the Rail Transfer Hopper to allow for temporary storage of ore until it could be processed, or as required by rail haulage delays. Use of the Ore Surge Pile would allow for a steady annual flow of rock and would assist in providing a uniform grade of ore to the processing plant. Ore would flow into and out of this pile as needed to meet mine and plant operating conditions. The footprint would have a capacity of 2.5 million tons in one 40-ft lift, with side slopes at the angle of repose; additional lifts could be added to increase storage capacity. A summary of the key characteristics of the Ore Surge Pile is provided in Table 3.2-6.

A lined foundation would be constructed (Section 3.2.2.1.8) and drainage from the Ore Surge Pile would be collected on the liner and routed to a sump for pumping to the Mine Site WWTF (Section 3.2.2.1.8.). The Ore Surge Pile would be removed at the completion of mining activities.

***Table 3.2-6 Key Characteristics of the Ore Surge Pile***

| Characteristic | Proposed Description |
|---|---|
| Purpose | To temporarily store and mix ore to allow for a steady annual flow of uniform grade ore to the processing plant |
| Phases of Development | Pre-mining: Ground preparation (including lining)<br>Years 1-20: Temporary storage of ore until it could fit into the rail haul and/or plant processing schedule<br>Year 20+: Reclaimed |
| Capacity | 2.5 million tons in one 40-ft lift. Additional lifts could be added to increase storage capacity. |
| Maximum surface footprint | 31 acres |
| Maximum height | 120 ft |

***Rail Transfer Hopper***

The Rail Transfer Hopper would consist of a raised platform from which haul trucks would dump into a hopper over a pan feeder. The pan feeder would pass through an opening in a retaining wall and discharge into a rail car positioned under the feeder outlet. The pan feeder and the control gate would be hydraulically powered and could be controlled by the locomotive operator using controls in the operator's cab of the Rail Transfer Hopper. The locomotive would be controlled by the locomotive operator using remote controls. Loading time would be approximately 1 minute per 100-ton rail car, or about 20 to 30 minutes to load a 16-car train, allowing for car-spotting and the operator to move between the locomotive and the Rail Transfer Hopper operator's cab.

The Rail Transfer Hopper would be located to the south of the mine pits and would be connected to the existing Cliffs Erie main line track by a new spur line. The rail track in the area of the Rail Transfer Hopper would be designed to allow rail cars to be loaded directly by front-end loader at the Ore Surge Pile should the Rail Transfer Hopper break down or be unavailable due to maintenance.

### 3.2.2.1.7 Overburden and Waste Rock Management

Overburden, the surficial material that lies on top of the mineral resource and infrastructure footprints, would be stripped prior to mining and as required prior to construction of facilities and infrastructure at the Mine Site. All overburden would be removed by the end of year 11. Waste rock would be generated throughout mining. A summary of the key waste management features is provided in Table 3.2-7 and discussed further below.

***Table 3.2-7 Key Characteristics of Overburden and Waste Rock Management***

| Aspect/ Feature | Characteristic | Proposed Description |
|---|---|---|
| Category 1 Stockpile | Phases of development | Pre-mining: Ground preparation and construction of water engineering controls<br>Years 1-13: Stockpiling<br>Years 14-20: Capping and reclamation<br>Years 20+: Maintenance |
| | Maximum surface footprint | 526 acres (reached at year 6) |
| | Maximum volume | 167,922,000 tons (reached at year 13) |
| | Maximum height | 240 ft above ground level<br>1,840 ft above sea level |
| Category 2/3 Stockpile | Phases of development | Pre-mining: Ground preparation (including lining)<br>Years 1-11: Stockpiling<br>Years 11-20: Transferring waste from stockpile to the East Pit<br>Years 20+: Completion of transfer to East Pit and Central Pit and reclamation |
| | Maximum surface footprint | 180 acres (reached at year 6) |
| | Maximum volume | 44,021,200 tons (reached at year 11 and subsequently removed) |
| | Maximum height | 200 ft above ground level<br>1,770 ft above sea level |
| Category 4 Stockpile | Phases of development | Pre-mining: Ground preparation (including lining)<br>Years 1-11: Stockpiling<br>Year 11: Transferring waste from stockpile to the East Pit<br>Years 20+: Completion of transfer to East Pit and Central Pit and reclamation |
| | Maximum surface footprint | 57 acres (reached at year 11) |

| Aspect/ Feature | Characteristic | Proposed Description |
|---|---|---|
| | Maximum volume | 6,206,700 (reached at year 11 and subsequently removed) |
| | Maximum height | 180 ft above ground level<br>1,790 ft above sea level |

### ***Overburden***

Three types of overburden are present at the site: unsaturated overburden, saturated overburden, and peat. Each type of overburden would be managed according to its potential to be reactive (i.e., acid-producing through oxidization of iron sulfides).

Unsaturated overburden is the material that has been above the natural water table and exposed to air long enough for chemical reactions to have taken place. This material would be used for construction, as approved by the MDNR. Peat (organic soils) and unsaturated overburden that cannot be used in immediate construction and reclamation would be stored in unlined overburden stockpiles at the Overburden Storage and Laydown Area.

Saturated overburden is material that has been below the natural water table. Because it has not been exposed to air, this material has the potential to be reactive. Saturated overburden would be used only for specific on-site construction applications, as approved by the MDNR. Applications for saturated overburden would include those where water contacting the construction material would be collected or drained to the mine pits, where it would be placed back below the water table, above a membrane liner system. Other applications where modeling has demonstrated that applicable surface and groundwater standards would be met would also be options. Saturated overburden not used for construction would be commingled in the temporary Category 2/3 Stockpile or Category 4 Stockpile, which have membrane liners, until final backfilling into the East Pit.

### ***Waste Rock Categorization and Management***

Geochemical characterization has identified four types of waste rock that would be managed, based on their potential to oxidize. The four categories of waste rock and the proposed management of each are summarized in Table 3.2-8. The geochemistry of the material is discussed further in Section 5.2.2.

Waste rock would be disposed of in a combination of permanent and temporary stockpiles, with material in the temporary stockpiles ultimately moved into the East Pit and Central Pit after completion of mining in those areas. Before construction of the stockpiles, overburden would be removed, if necessary, and foundations would be built with suitable overburden material or waste rock from the state taconite mining waste rock stockpile located approximately 5 miles west of the Mine Site, or with Category 1 waste rock. Proposed engineered water management controls such as liners, caps, and containment systems are described in Section 3.2.2.1.8.

*Table 3.2-8 Waste Rock Categorization Properties*

| Categorization | Sulfur Content (%S)[1] | % of Total Waste Rock Mass | Management |
|---|---|---|---|
| Category 1 | %S ≤ 0.12<br><br>Low potential to generate acid, but may leach heavy metals | 70% | Used for construction material at the Mine Site (subject to approval by MDNR during permitting). The Category 1 waste rock not used as construction material would be placed on the permanent Category 1 Stockpile during years 1-13 and in the East Pit following year 11. |
| Category 2 | 0.12 < %S ≤ 0.31<br><br>Low to medium potential to generate acid and would leach heavy metals | 24% | Temporarily stored in the lined Category 2/3 Stockpile (years 1-11). New and stockpiled material would be moved to the East Pit (years 11-16) and the combined East Central Pit (years 16-20). |
| Category 3 | 0.31 < %S ≤ 0.6<br><br>Medium potential to generate acid and would leach heavy metals | 3% | Temporarily stored in the lined Category 2/3 Stockpile (years 1-11). New and stockpiled material would be moved to the East Pit (years 11-16) and the combined East Central Pit (years 16-20). |
| Category 4[(2)] | 0.6 < %S<br><br>High potential to generate acid and would leach heavy metals | 3% | Temporarily stored in the lined Category 4 Stockpile (years 1-11). Stockpiled material would be moved to the East Pit (year 11). New material would be disposed of in the East Pit (year 11-16) and the combined East Central Pit (years 16-20). |

1 In general, the higher the rock's sulfur content, the higher its potential for generating acid rock drainage or leaching heavy metals.
2 Includes all Virginia Formation rock.

During years 1 through 11, all waste rock would be placed in stockpiles, segregated based on its categorized sulfur content (Table 3.2-8). Category 1 waste rock would be placed on the permanent Category 1 Stockpile located north of the West Pit. Category 2 and 3 waste rock would be placed on the lined, temporary Category 2/3 Stockpile located to the southeast of the mine pits. Category 4 waste rock would be placed on the lined, temporary Category 4 Stockpile located over the top of the future Central Pit, which is proposed to be mined starting in year 11 (Figures 3.2-7 through 3.2-10).

The East Pit is anticipated to be exhausted in year 11 of mining. During this year, all of the Category 4 waste rock, stored in a lined stockpile over the future Central Pit until this time, would be backfilled into the East Pit. All new Category 2, 3, and 4 waste rock would be disposed of in the East Pit between years 11 and 16, and the Category 2/3 Stockpile would begin to be moved into the East Pit. New Category 1 waste rock would continue to be placed on the Category 1 Stockpile until year 13, when it would be placed in the East Pit until year 16.

It is anticipated that mining in the Central Pit would cease at year 16. At this time, the Central Pit would have been built into the East Pit, forming a combined pit. From year 16 to 20, all waste rock generated from ongoing mining at the West Pit, as well as the remaining material in the Category 2/3 Stockpile, would be placed into the combined East Central Pit. The East Pit and combined East Central Pit would be flooded (using groundwater, in-pit runoff, direct precipitation, and treated process water from the WWTF) at approximately the same rate of backfilling to ensure that backfilled material would remain saturated (Section 2.2.2.1.10).

The Category 1 Stockpile that was created in years 1 to 13 would be covered and would remain in perpetuity. Reclamation of the Category 1 Stockpile would start in year 14 and would continue until year 22, two years after the completion of mining (Section 2.2.2.1.10).

The geotechnical stability section in Chapter 5 presents more detail on the proposed construction of the stockpiles.

### 3.2.2.1.8 Engineered Water Controls

The Mine Site would include water management features designed to control water potentially affected by sulfides and metal leachates from oxidized rock exposed through mining. This process water would be directed to a Mine Site WWTF and non-contact stormwater would be directed off-site.

The following section describes the engineered controls that would be used for water management. The flow and management of water is discussed in Section 3.2.2.1.9. Figures 3.2-5 through 3.2-8 show the water management features and infrastructure.

***Category 1 Stockpile Water Containment System and Cover***

The permanent Category 1 Stockpile, which has a low reactivity potential, would be constructed with a water containment system to collect drainage from the stockpile. A cover system would be added when placement of rock into the stockpile is complete after year 13.

Figure 3.2-11 shows the containment system that would consist of a cutoff wall (a low-permeability compacted soil hydraulic barrier) combined with a drainage collection system surrounding the perimeter of the stockpile near its toe.

The cutoff wall would be constructed by excavating a trench down to bedrock and backfilling it with a compacted soil material or by placing a manufactured geosynthetic clay barrier in the trench. Compacted soil material would have a hydraulic conductivity specification of no more than $1x10^{-6}$ cm/sec. The drainage collection system would collect stockpile drainage and draw down the water table on the stockpile side of the cutoff wall, thereby maintaining an inward gradient along the cutoff wall and minimizing the potential for drainage passing through the cutoff wall.

The drainage collection component of the containment system would consist of a slotted or perforated horizontal drain pipe surrounded by aggregate (coarse rock) within the trench, excavated to bedrock and backfilled with granular, free-draining material. The horizontal pipe would have vertical risers extending upward into a process water ditch to collect surficial seeps and surface runoff. The trench would intercept stockpile drainage, collect it in the drain pipe, and convey it by gravity flow to sumps that have emergency gravity overflows to the East Pit or West Pit. Stockpile drainage collected in the sumps would be conveyed to a low point near the northeast corner of the stockpile. From there, a non-perforated pipe would convey the drainage to a collection sump where it would be pumped to the WWTF described in Section 2.2.2.1.10.

Reclamation of the Category 1 Stockpile would begin in mine year 14, with progressive installation of an engineered geomembrane cover system to limit water percolation into the stockpile. The cover would be completed by year 22. The design of this cover system is discussed in Section 3.2.2.1.10.

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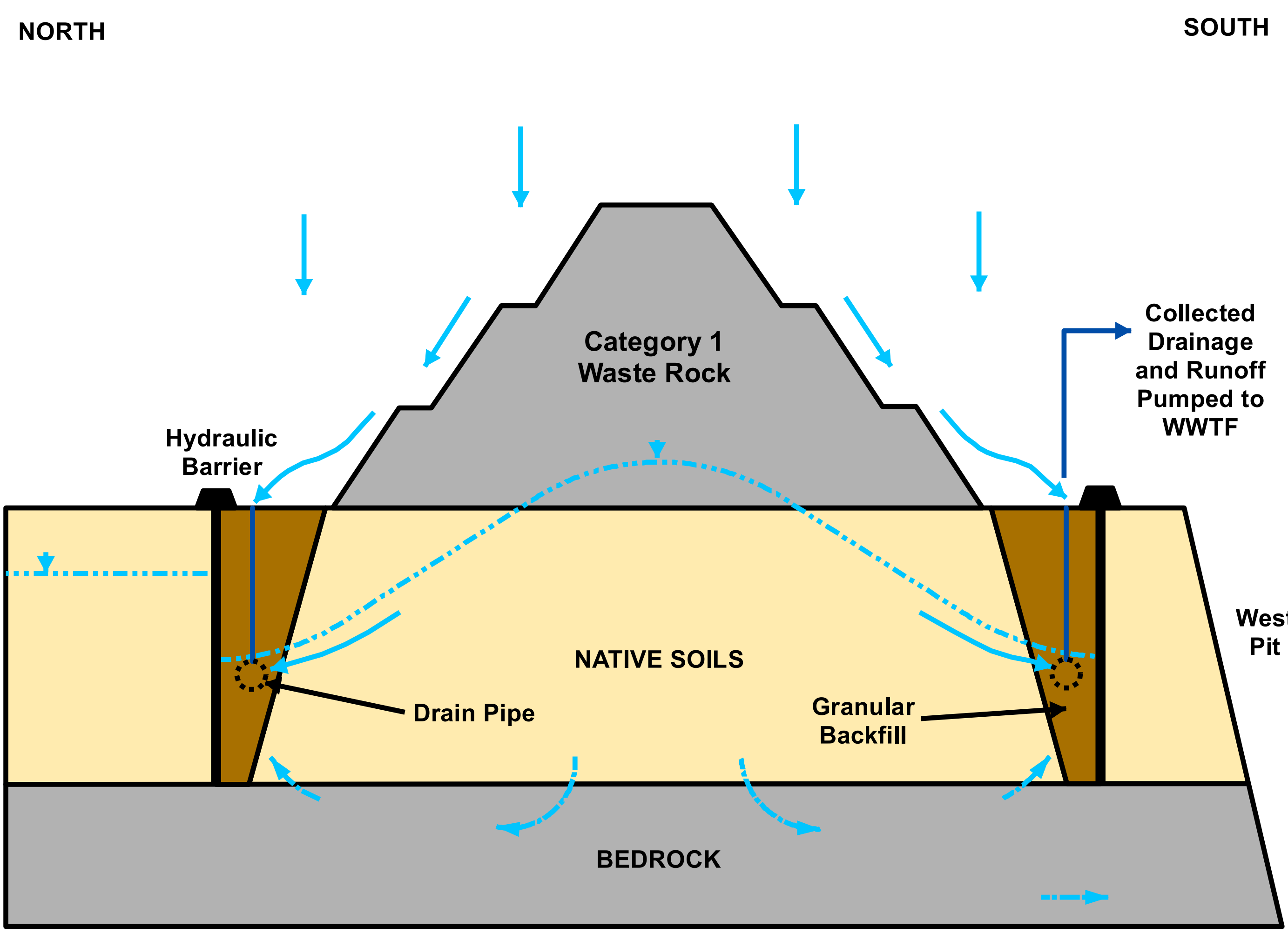




Water Flow

Not To Scale

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St. Paul District

**Figure 3.2-11**
**Conceptual Representation of the Category 1 Stockpile Containment System - Years 1-13**
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## ***Category 2/3 and 4 Stockpiles and Ore Surge Pile Liners***

The temporary Category 2/3 Stockpile and Category 4 Stockpile, which have the potential to generate acid and metal leachate, would have liner systems to capture water penetrating through the stockpiles (Table 3.2-9).

The liner systems would consist of an impermeable barrier layer (to limit the downward infiltration of water through the liner system) and an overlying drainage layer (to promote the conveyance, via gravity, of water that may reach the barrier layer to a collection removal point along the barrier layer). Foundation underdrains would be used, if necessary, to provide gravity drainage should elevated groundwater be encountered, to prevent or minimize the potential for excess pore pressures as the stockpile is loaded. These three design details (impermeable barrier, overliner drainage layer, and underdrains) would enhance liner effectiveness and integrity.

***Table 3.2-9 Summary of the Stockpile Liners and Covers***

| Stockpiles | Stockpile Duration | Liner System | Long-term Management |
|---|---|---|---|
| Category 1 | Permanent (constructed in years 1-13) | No liner system; a containment system would collect seeped groundwater water for pumping to the WWTF | 3-ft engineered cover with a 40-mil geomembrane barrier (applied progressively during years 14-22) |
| Category 2/3 | Temporary (constructed in years 1-11 and removed in years 11-20) | 12-inch compacted ($1x10^{-5}$ cm/s) subgrade overlaid by 80-mil LLDPE geomembrane, covered by a 24-inch overliner drainage layer | Stockpile and liner to be completely removed and reclaimed (year 11-20) |
| Category 4 | Temporary (constructed in years 1-11 and removed in year 11) | 12-inch compacted ($1x10^{-6}$ cm/s) subgrade overlaid by 80 mil LLDPE geomembrane, covered by a 24-inch overliner drainage layer | Stockpile and liner to be completely removed (year 11) to allow mining in the Central Pit |
| Ore Surge Pile | Temporary (used as required in years 1-20) | 12-inch compacted ($1x10^{-6}$ cm/s) subgrade overlaid by 80 mil LLDPE geomembrane, covered by a 24-inch overliner drainage layer | Stockpile and liner to be completely removed and reclaimed (Closure) |

LLDPE = Linear low-density polyethylene

## ***Mine Site Perimeter and Pit Rim Dike and Ditch Systems***

Stormwater would be managed with a system of dikes and ditches constructed at the Mine Site perimeter. The layout of drainage ditches is illustrated on Figures 3.2-5, 3.2-7, and 3.2-8 for mine years 1, 11, and 20, respectively. The dikes and ditches would minimize the amount of surface water flowing onto the site, minimize the amount of surface runoff flowing into the mine pits, manage the amount of process water collected, and control non-contact stormwater flowing off the site.

Dikes would be constructed of silty sands or glacial till material that would be excavated during construction of ditches and removal of overburden. Side slopes would be vegetated to control erosion. Small dikes would be constructed at the rims of the mine pits in all areas where the existing ground surface does not naturally drain surface runoff away from the pit, and would be rebuilt as the pit perimeter expands. Small dikes would also be constructed, as needed, along interior stormwater ditches and around stockpile construction areas to separate stormwater and process water. In some areas along the site perimeter, the existing ground is already relatively high so that a ditch would be able to capture the site surface runoff without a dike.

Ditches would be constructed along the interior of most of the perimeter dike system and throughout the interior of the Mine Site in order to:

- convey non-contact stormwater adjacent to the dikes,
- prevent surface runoff from entering the mine pits,
- intercept stormwater prior to reaching process water areas, and
- prevent water from pooling in areas where the dikes cut across low areas.

Dike design could be modified for shallow groundwater control if needed. Where peat or high-permeability glacial till is present in the dike foundation zone below the water table, seepage control measures would be installed to restrict groundwater movement. Seepage control measure design would depend on soil type and depth to bedrock. In areas where peat is present, seepage would be prevented by compressing the peat with earthen dike materials to create a low-permeability layer. If a sand seam or other high-permeability material were found in the dike foundation zone below the peat deposit, a soil cutoff trench, slurry wall, or sheetpile wall would be installed (depending on depth to bedrock) to cut off seepage. In areas where glacial till is present, seepage control measures would include soil cut-off trenches constructed of compacted silty sand or compacted glacial till, or slurry trenches. Seepage cutoffs are generally not planned to be used in areas of silty sand soils, as geotechnical testing of these soils at the Mine Site indicates these are materials with relatively low permeability in their natural state.

***Wastewater Treatment Facility***

A WWTF would be constructed to treat affected water at the Mine Site and also treat the reject concentrate from the Plant Site WWTP (Section 3.2.2.3.10). The WWTF would be constructed on approximately 40 acres and would include equalization and treatment basins and a building that would house the treatment equipment. Water treatment would include chemical precipitation and ultrafiltration/nanofiltration treatment methodologies. The design of the WWTF is based on the predicted water loads and constituents modeling (Section 5.2.3). However, should water monitoring undertaken during or following operations indicate a need to do so, the WWTF could be expanded or treatment capabilities modified to meet water quality standards.

A Central Pumping Station would be constructed to pump water to the respective management areas as needed.

### 3.2.2.1.9 Water Management

During mining operations, non-contact stormwater captured by the ditches would be directed to sedimentation ponds and then routed into a natural drainage system off-site.

The water from Mine Site project features (waste rock stockpiles, Ore Surge Pile, ancillary mine features, and mine pits) would be collected and treated at the WWTF. Treated water would be pumped to the Tailings Basin at the Plant Site. The sludge waste would be disposed of off-site in a solid waste landfill until the Hydrometallurgical Plant became operational (Section 3.2.2.3). When available, sludge waste would be piped along the Transportation and Utility Corridor and introduced to the autoclave in the Hydrometallurgical Plant to recover metals, or placed directly into the Hydrometallurgical Residue Facility (Section 3.2.2.3.7).

Starting in year 11, some water from the WWTF would be sent to the East Pit to help manage the water level in the pit as it is being backfilled. Covering of the Category 1 Stockpile would begin in year 14 and would be completed in year 22. Once covered, stormwater from the Category 1 Stockpile would be considered non-contact water and would not require treatment. A flow diagram of the proposed water management at the Mine Site for the initial and later years of mining is shown on Figures 3.2-12 and 3.2-13, respectively.

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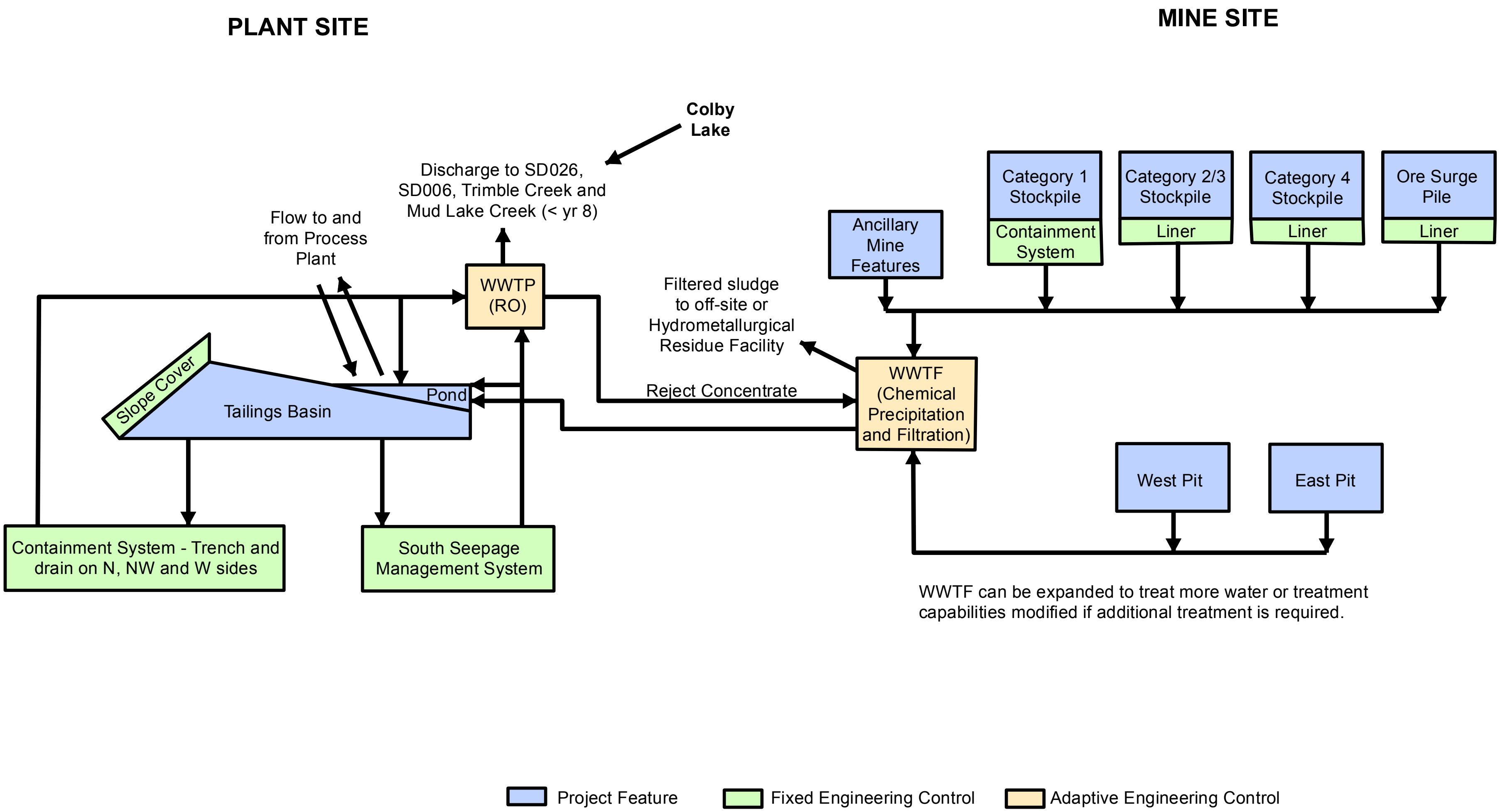


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**Figure 3.2-12**
**Water Management Schematic - Initial Years of Operations - Approximately Years 1-11**
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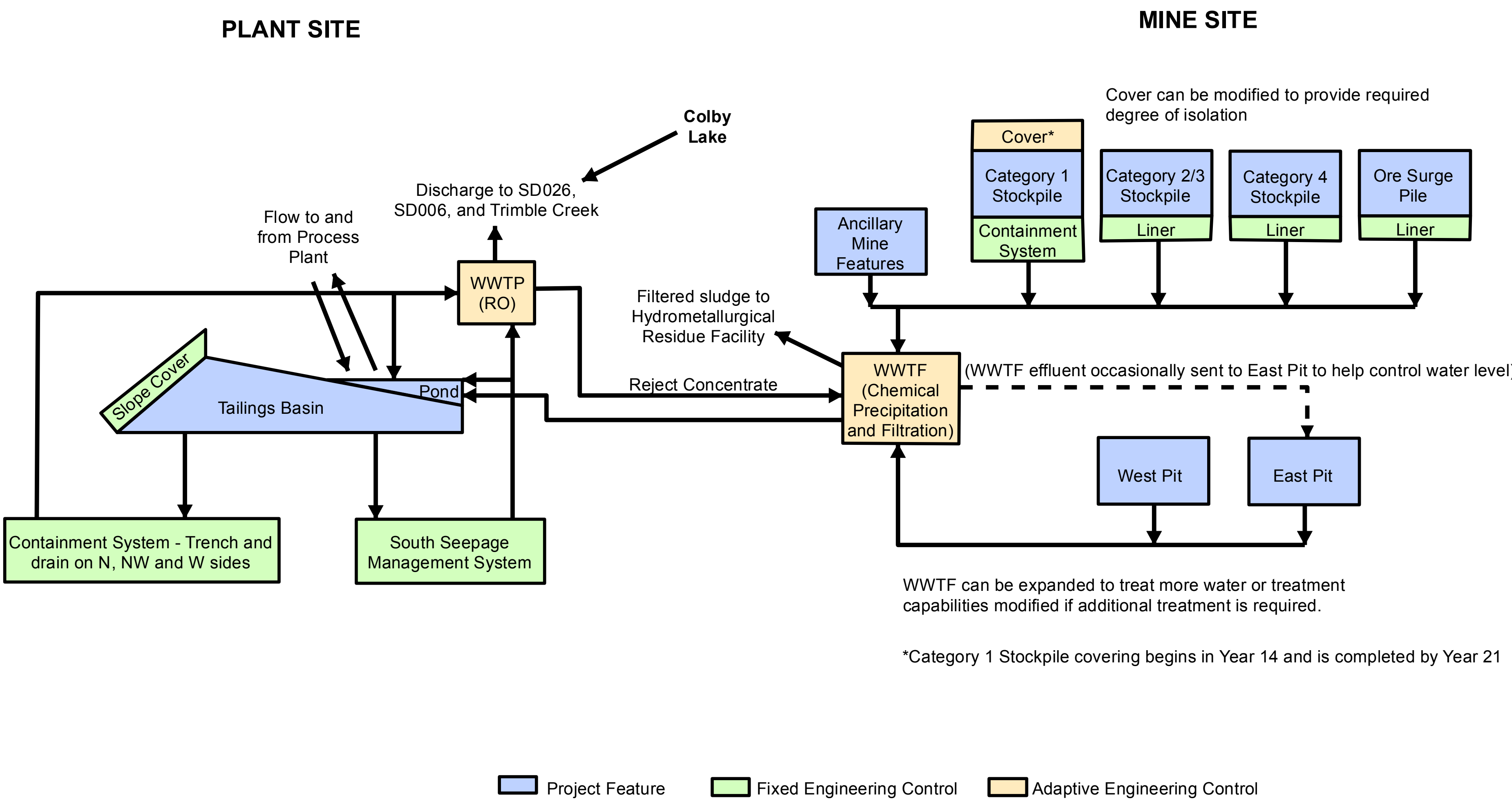




**Figure 3.2-13**
**Water Management Schematic - Later Years of Operations - Approximately Years 11-20**
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### 3.2.2.1.10 Reclamation and Long-term Closure Management

In general, NorthMet Project area facilities have been designed and would be operated to allow for concurrent reclamation, or “mining in a manner that creates areas that can be reclaimed as soon after initiation of the operation as practical and as continuously as practical throughout the life of operation” (*Minnesota Rules*, part 6132.0100). This would leave a smaller portion of the NorthMet Project area needing to be reclaimed at the end of mining. Under the NorthMet Project Proposed Action, concurrent reclamation at the Mine Site would include backfilling the East Pit once it were exhausted (from year 11 of mining) using waste rock generated through mining following this time and relocating waste rock from the temporary Category 2/3 Stockpile and Category 4 Stockpile. This would mean that at the end of mining, the majority of temporary Category 2/3 Stockpile and Category 4 Stockpile would have been removed, and the combined East Central Pit would be mostly, if not completely, backfilled.

At the end of mining, PolyMet would first remove all infrastructure and facilities not approved for potential future use, followed by reclamation of disturbed lands. Post-reclamation activities would include monitoring and maintenance of reclamation and water quality until the various facility features were deemed environmentally acceptable, in a self-sustaining and stable condition. These activities are discussed below.

A schematic cross-section showing the evolution of the geotechnical features at the Mine Site from year 11 to post-closure is provided on Figure 3.2-14.

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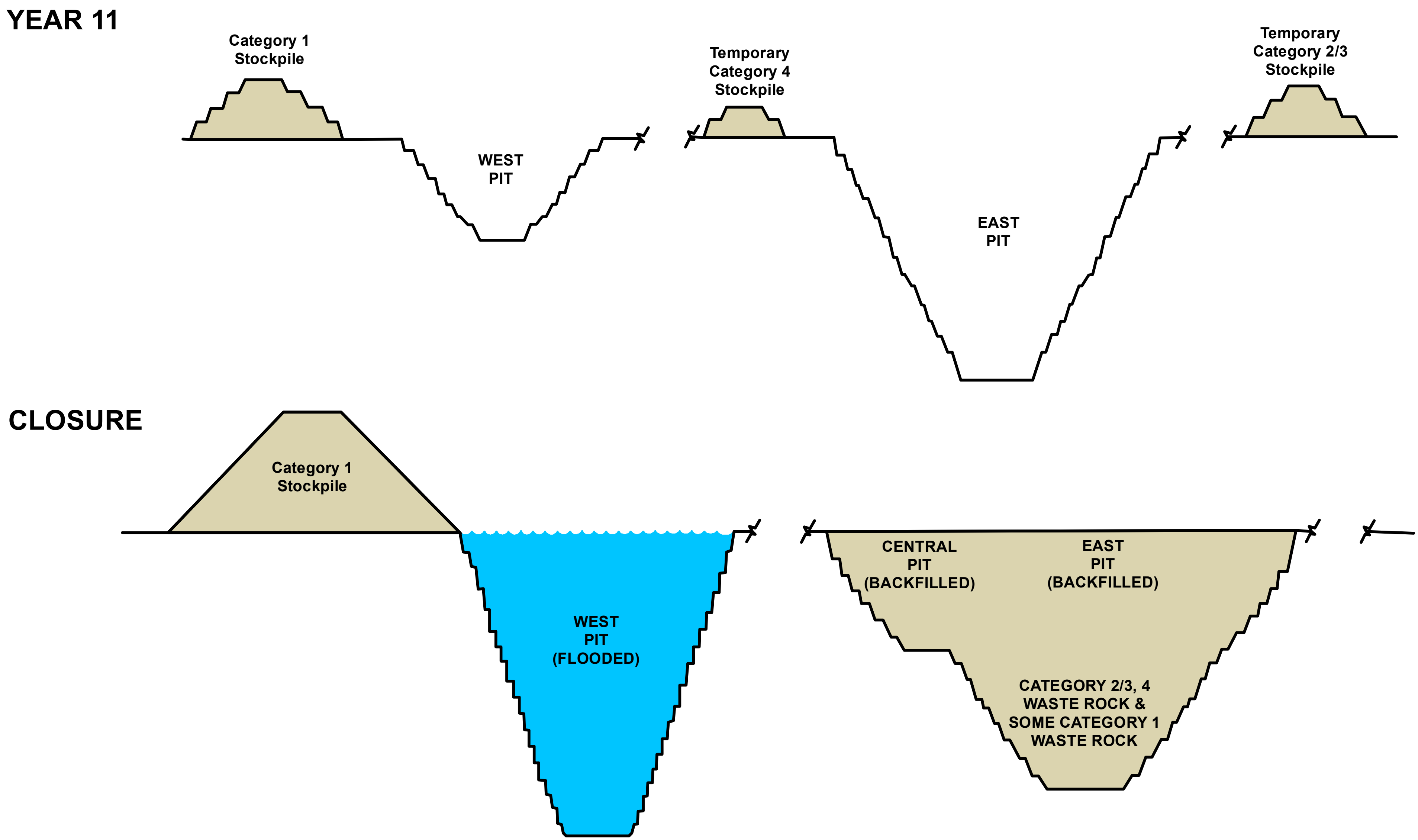


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**Figure 3.2-14**
**Schematic Cross Sections of the Geotechnical Features at the Mine Site (Year 11 and Closure)**
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***Reclamation Planning***

Mining is expected to be completed approximately 20 years after operations begin. PolyMet has developed a Reclamation Plan as part of its application for the Permit to Mine. The Reclamation Plan would be finalized to provide details and schedule for the final reclamation of the actual as-built facilities. In addition, PolyMet would submit an annual Contingency Reclamation Plan, per *Minnesota Rules*, part 6132.1300, subpart 4, to identify activities that would be implemented if operations were to cease in that upcoming year.

***Building and Structure Demolition and Equipment Removal***

All buildings and structures would be removed and foundations razed and covered with a minimum of 2 ft of soil and vegetated according to *Minnesota Rules*, parts 6132.2700 and 6132.3200. Demolition waste from structure removal would be disposed in the existing on-site demolition landfill (SW-619) located northwest of the Area 1 Shops at the Plant Site. Concrete from demolition would be placed in the basements of the coarse crusher, fine crusher and concentrator, and the plant reservoir, or placed in landfills as required.

Most roads, parking areas, or storage pads built to access these facilities would be demolished according to the planned schedule or as approved by the MDNR Commissioner. Utility tunnels would be sealed and closed in place. Asphalt from paved surfaces would be removed and recycled and the disturbed areas reclaimed and vegetated according to *Minnesota Rules*, part 6132.2700. Railroad track and ties that were not used by common carriers would be removed and recycled. Any roads, including mine pit access roads (*Minnesota Rules*, part 6132.3200), that may develop into unofficial off-road vehicle trails would require a variance from MDNR reclamation rules to allow a 15-ft-wide unpaved, unvegetated track down the centerline of the road. Such approvals would also be coordinated with the St. Louis County Mine Inspector’s Office.

All mine, railroad, service, and electrical equipment would be moved from the pit to ensure it would be above pit water elevations until it could be scrapped, decommissioned, or sold. Debris and equipment would be removed from the Mine Site.

Any special materials would be disposed of as discussed in Section 3.2.2.3.12.

***Rail Transfer Hopper Demolition and Reclamation***

During reclamation, aboveground concrete and steel structures would be razed and the area covered with at least 2 ft of soil and vegetated according to *Minnesota Rules*, parts 6132.2700 and 6132.3200. If constructed with Category 1 waste rock, the rock platform from which trucks dumped into the hopper would be sloped and covered in the same manner as the Category 1 Stockpile. If constructed of inert material, the platform would be sloped and vegetated according to *Minnesota Rules*, parts 6132.2700 and 6132.3200.

It is possible that the Rail Transfer Hopper could contain ore residuals, which would have the potential to generate acid and metal leachates. Any ore remaining in the Rail Transfer Hopper, Ore Surge Pile, or anywhere else in the vicinity of the Rail Transfer Hopper, as well as sediment removed from ditches and process water ponds, would be placed in the West Pit. Any remaining material located at the top of the rail-loading platform would be tested and placed in an appropriate waste disposal location (i.e., the West Pit or covered with at least 2 ft of soil and vegetated according to *Minnesota Rules*, parts 6132.2700 and 6132.3200).

### ***Mine Pit Reclamation***

Mining is anticipated to be completed in the East Pit, Central Pit, and West Pit in mine years 11, 16, and 20, respectively. Ultimately, the combined East Central Pit would be backfilled with waste rock and flooded to form wetlands. The West Pit would be flooded to form a pit lake.

At the end of mining in each respective pit, the walls would be sloped and graded in accordance with *Minnesota Rules*, part 6132.2300. The toe of the overburden portion of all pit walls would be set back at least 20 ft from the crest of the rock portion of the pit wall. Lift heights would be no higher than 60 ft and would be selected based on the need to protect public safety, the location of the pit wall in relation to the surrounding land uses, the soil types and their erosion characteristics, the variability of overburden thickness, and the potential uses of the pit following mining. The overburden portions of the pit walls would be sloped and graded at no steeper than a height-to-vertical ratio of 2.5:1 and would be vegetated to conform to *Minnesota Rules*, part 6132.2700. Safe access would be provided to the bottom of each mine pit (*Minnesota Rules*, part 6132.3200) via selected original haul roads built during pit development. The access road would be selected such that, as the pits flood, there would always be a clear path to the water surface.

The dewatering systems—including power lines, substations, pumps, hoses, pipes, and appurtenances—would be removed. All areas disturbed during pipe removal would be graded and revegetated. Some piping and temporary pumps may remain in the pits for selected dewatering that would be performed during reclamation.

Pit perimeter fencing systems would be installed and consist of fences, rock barricades, ditches, stockpiles, and berms. A gated entrance would be placed at each pit access location. The fencing system plan would be submitted to the St. Louis County mine inspector for review and approval before installation. As required by the St. Louis County mine inspector and in accordance with *Minnesota Statutes*, chapter 180.03, fencing would consist of five strands of barbed wire in most locations and 5-ft, non-climbable mesh fencing with two strands of barbed wire at the top in areas where roads would remain adjacent to the fences unless other means were agreed to with the mine inspector.

### ***East Pit and Central Pit***

As previously noted, waste rock would be placed into the East Pit at the completion of mining at year 11, and in the combined East Central Pit beginning in year 16. It is anticipated that the combined East Central Pit would be completely backfilled with waste rock shortly after year 20.

While being backfilled with waste rock, the pits would be flooded with water to minimize the amount of pit wall and backfilled waste rock exposed to the atmosphere, thus limiting the oxidation of the sulfide minerals and reducing the amount of metals leaching to the pit water. Water used to flood the pits would come from groundwater, in-pit runoff, direct precipitation, and treated process water from the WWTF. During backfilling, the water elevation would be maintained below the surface of the waste rock to safely avoid equipment working in the water and to maximize the amount of material used to fill the pit. During periods of high precipitation or during spring snowmelt, dewatering (to the WWTF and ultimately to the Tailings Basin) may be required to allow placement of the waste rock. Lime could be added to the East Pit during East Pit backfilling, as needed, in order to maintain circumneutral pH in the pit pore water

Once backfilling of the East Pit is complete, a wetland would be constructed over the backfilled material (Figures 3.2-10 and 3.2-14). The water depth in the backfilled, combined East Central Pit would be maintained within the wetland by a gravity overflow structure to the West Pit. The East Pit overflow structure would be formed out of bedrock or a cast-in-place, reinforced concrete weir.

***West Pit***

West Pit reclamation would commence when mining activity ceases, expected in year 20. Primary dewatering systems would no longer be operated, and the West Pit would begin to flood naturally with groundwater, precipitation, and surface runoff from the tributary watershed. Flooding would also be accelerated with treated water from the Plant Site. With the addition of water pumped from the Plant Site to the West Pit, flooding of the West Pit is projected to be completed in approximately year 40. When the West Pit is full, the discharge would be controlled via a lift station and pumped to the WWTF for treatment. The WWTF would be upgraded to include reverse osmosis (RO) treatment to achieve an effluent with a sulfate concentration of less than 10 mg/L; this effluent would be discharged into an existing wetland that flows toward Dunka Road at Outlet Structure OS-5 and eventually into the Partridge River through an existing tributary channel. The reject concentrate from the RO unit would be treated at the existing Mine Site WWTF (Section 3.2.2.1.8).

***Stockpile Reclamation***

As described above, material in the temporary Category 2/3 Stockpile and Category 4 Stockpile would be moved to the East Pit from year 11, and the combined East Central Pit from year 16. The Category 4 Stockpile would be completely removed by year 12, to allow mining to begin in the Central Pit.

***Category 2/3 and 4 Stockpiles and the Ore Surge Pile***

At year 20, any material remaining in the Category 2/3 Stockpile would be moved to the combined East Central Pit. The disturbed areas would be reclaimed.

The ore in the Ore Surge Pile would be processed as operations wind down, and any remaining material would be relocated to the West Pit after operations cease. Material may still remain in the Overburden Storage and Laydown Area, but the area would be graded to stable conditions and reclaimed.

Infrastructure (pipes, pumps, liners, etc.) associated with the temporary Category 2/3 Stockpile and Category 4 Stockpiles and the Ore Surge Pile would be removed and the footprint of each area would be reclaimed to mitigation wetlands where practical.

***Category 1 Stockpile***

Following completion of its construction in year 13, a cover would be installed incrementally over the permanent Category 1 Stockpile. This cover would include an engineered geomembrane system that would be vegetated to meet the requirements of *Minnesota Rules*, part 6132.2200, subpart 2, item B. As shown in Figure 3.2-15, this cover system would consist of, from top to bottom: 18 inches of rooting zone soil consisting of on-site unsaturated overburden mixed with peat as needed to provide organic matter, 12 inches of granular drainage material with drain pipes to facilitate lateral drainage of infiltrating precipitation and snowmelt off the stockpile cover, the 40-mil geomembrane barrier layer, and a 6-inch soil bedding layer below the geomembrane

The soils at the Mine Site are anticipated to be used for cover material. The cover would be designed to promote runoff with minimal erosion. To provide an adequate base for sloping of cover materials, Category 1 Stockpile side slopes would be re-shaped to no steeper than a height-to-vertical ratio of 3.75:1, with the cover system placed on top of the re-shaped waste rock. The outermost layer would consist of local till soils (also known as "overburden" per *Minnesota Rules*, part 6132.0100, subpart 32) adequate for vegetation growth. To provide further erosion control, catch benches at least 30 ft in width would remain on the stockpile.

Stockpile tops and benches would be seeded with a certain selection of grasses/forbs and a potentially different group of species for the slopes. The three groups of species designated for the top and benches would include a group of native species, a group of non-native species, and a mixed group. The species mix for the stockpile slopes would contain the same native species as the stockpile bench and flats, and a slightly modified group of non-native species.

Upon full reclamation of the Category 1 Stockpile, runoff from the top and sides of the stockpile would be classified as non-contact stormwater and would be routed through a system of ditches prior to being discharged into the natural drainage system. Ditches on the reclaimed stockpile surface would direct stormwater flows into channels that would route flows down the sides of the stockpile. The Category 1 Stockpile water containment system would continue to collect drainage from the stockpile during reclamation, with drainage treated at the WWTF. The general flow of water on the reclaimed stockpile is shown in Figure 3.2-16.

Long-term maintenance of the Category 1 Stockpile would include repairing erosion and removal of woody species and trees from the stockpile cover system.

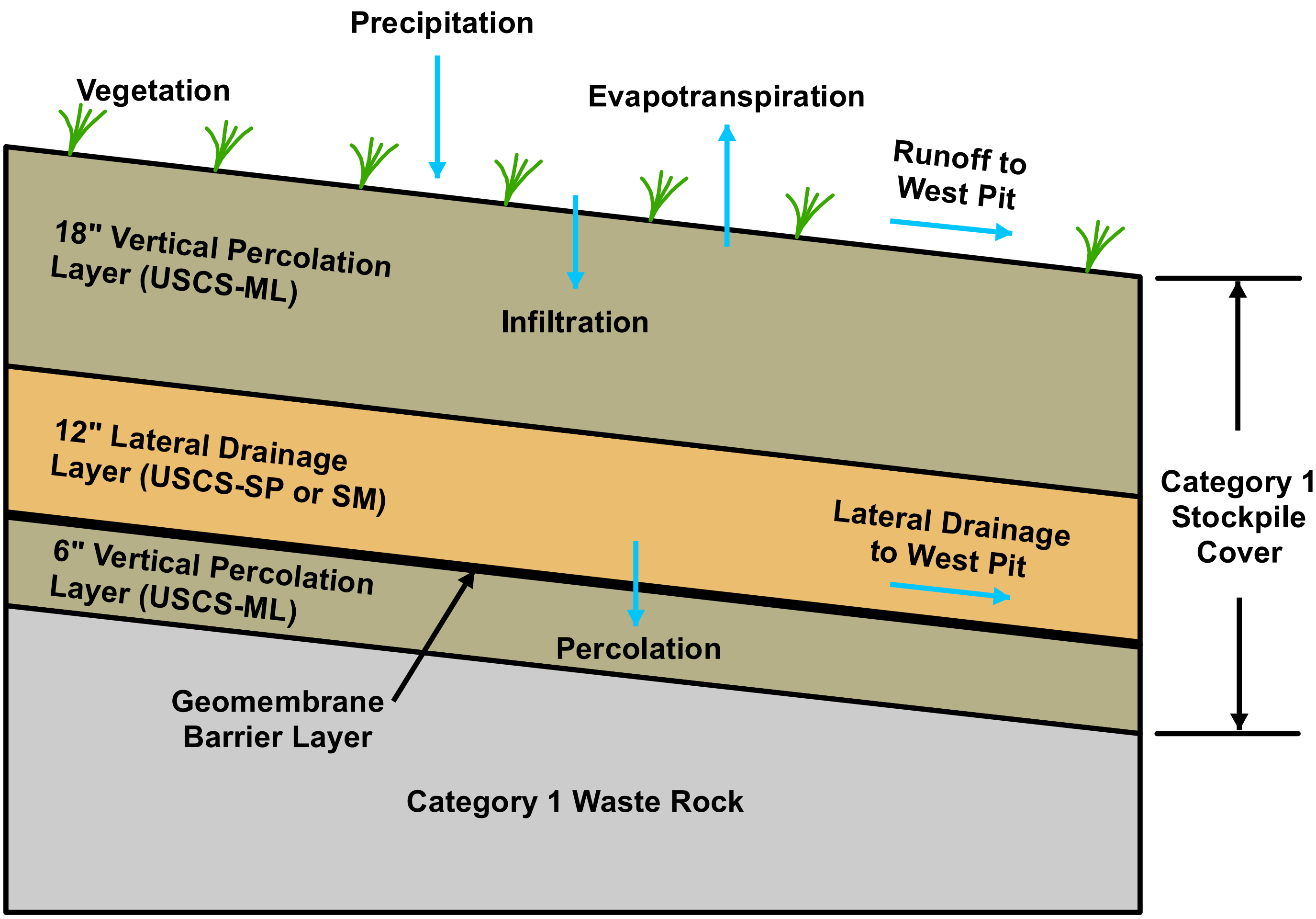




**Figure 3.2-15**
**Conceptual Cross Section - Category 1 Stockpile Cover System**
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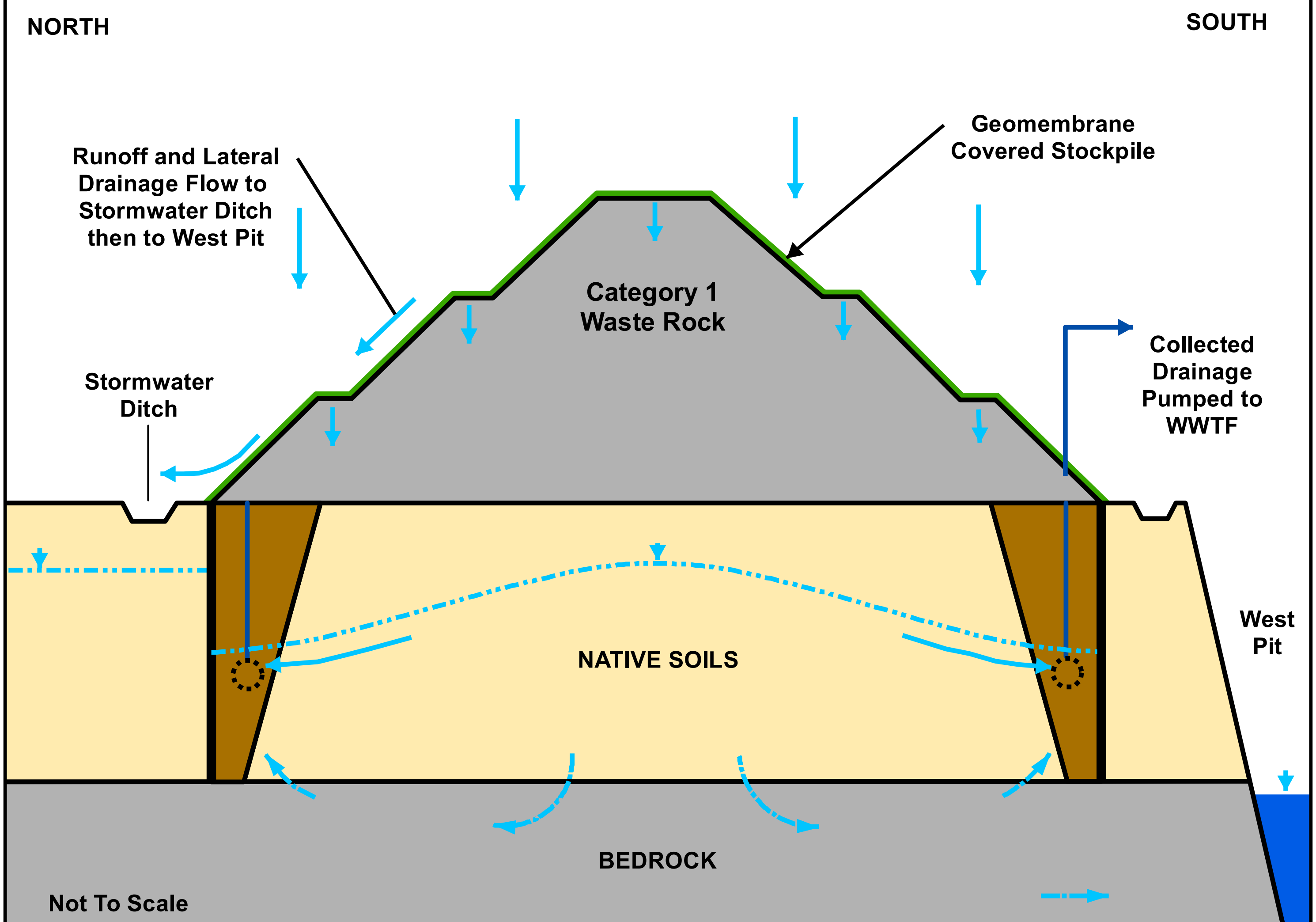


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Water Flow

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US Army Corps of Engineers
St. Paul District

**Figure 3.2-16**
**Conceptual Cross Section - Category 1 Stockpile Containment System - Long Term Closure Conditions**
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### ***Watershed Restoration***

During mining operations, stormwater runoff from reclaimed stockpile areas and natural (undisturbed) areas would be routed via dikes and ditches to stormwater sedimentation ponds. Upon completion of stockpile reclamation, these water management systems would be modified. Perimeter dikes that would no longer be needed to provide access or separation from the areas outside the Mine Site would be removed. The dike located north of the East Pit would remain in place to minimize mixing of the Partridge River flows with the East Pit water and prevent gully development on the northern side of the pit in the segments not protected by ditches. In addition, the dike located north of the Category 1 Stockpile would remain in place to allow access to groundwater monitoring locations.

Surface runoff would be routed to the mine pits using a combination of existing and new ditches. Some portions of the pit rim dikes may be left in place, if needed to prevent an uncontrolled flow to or from the pits and potential erosion (head cutting) of the pits walls.

In all cases of dike removal, material from the main body of the dikes would be removed and used at the site for restoration of disturbed surfaces. To minimize disturbance of subsurface soils, any subsurface seepage control components of the dikes would remain in place. As part of the dike removal work, typical construction erosion-control measures would be used. These could include installing silt fencing on the down-slope side of disturbed areas and controlling surface water runoff. The reclaimed surface would then be scarified, topsoil would be placed, and the area would be revegetated with native species.

Ditches would be filled or rerouted during reclamation to direct non-contact stormwater into the West Pit for flooding. Use of existing ditches would be maximized, but some new ditches may need to be constructed to direct stormwater runoff from the Mine Site into the East Pit or West Pit.

All ponds—including the five stormwater ponds, the Overburden Storage and Laydown Area process water pond, the four haul road process water ponds, and all stockpile sumps and overflow ponds—would either be filled or converted into wetlands. Once filled, the ponds would be covered with topsoil and revegetated to restore these areas. If the process water ponds were converted into wetlands, any sedimentation that occurred within the pond would be evaluated to determine if removal or covering would be necessary to prevent adverse effects to wetlands during restoration.

Stormwater pond outlet control structures would remain in place as necessary to manage water resource effects. The outlet control structure on the stormwater pond located immediately north of the East Pit and the Category 1 Stockpile (and associated dike) would remain in place to minimize the mixing of the Partridge River flows with the East Pit water and prevent gully development on the northern side of the pit. The outlet control structures on the two stormwater ponds next to Dunka Road would remain in place to direct water under the road and the railroad to a tributary to the Partridge River along natural drainage paths. As a requirement of the NPDES stormwater permit and/or reclamation plan for the facility, discharges from these outlet control structures would be monitored as necessary to ensure that runoff to the Partridge River meets water quality discharge limits.

***Water Management***

During the reclamation phase (while the West Pit is flooding), the water from the Category 1 Stockpile groundwater containment system would be pumped to the WWTF and treated. Water from the East Pit would also be pumped to the WWTF and treated. The effluent from the WWTF would be sent to the East Pit and West Pit. Treatment of the East Pit water would include removing the flushing load of constituents added as waste rock is backfilled to the East Pit, and the pit walls would be inundated. In addition, water from the Tailings Basin would be pumped to the West Pit to flood the pit faster and allow the Tailings Basin to be reclaimed. In the final years of the reclamation phase, water from the West Pit would be pumped to the WWTF, treated, and returned to the West Pit. The objective of treating the West Pit water would be to manage water quality within the pit prior to groundwater outflow from the pit lake via the surficial aquifer. Reject concentrate from the Plant Site WWTP would continue to be sent to the Mine Site WWTF during this period. The WWTF could be expanded or treatment capabilities modified if required to meet water resource objectives during this time.

Once the West Pit is full (approximately year 40), discharge of treated water from the WWTP and the WWTF would be terminated. The WWTF would be upgraded to RO and include evaporator/crystalizers to convert the RO reject concentrate to residual solids, which would be disposed of at appropriate off-site facilities. The WWTF would continue to treat water collected by the Category 1 Stockpile Groundwater containment system, as well as water from the West Pit, to ensure that the discharge met applicable water quality discharge limits.

Inspection, water treatment maintenance and reporting activities would continue while the mechanical treatment systems operate during long-term closure. Surface water and groundwater would be monitored as required by relevant permits.

These long-term closure activities would be ongoing until the various facility features were deemed environmentally acceptable, in a self -sustaining and stable condition, and until it were shown that water quality standards were being met. The ultimate objective of long-term closure would be to transition from the mechanical treatment provided by the WWTF and WWTP to non-mechanical treatment, if proven to be successful through demonstration projects within the NorthMet Project area.

When all reclamation activities required by the Permit to Mine are completed, a Request for Release per *Minnesota Rules*, part 6132.1400, would be submitted. This request would provide the Commissioner of the MDNR with detailed information on the final reclamation status of the NorthMet Project area.

A summary of the water management during reclamation and long-term management is provided on Figures 3.2-17 and 3.2-18, respectively.

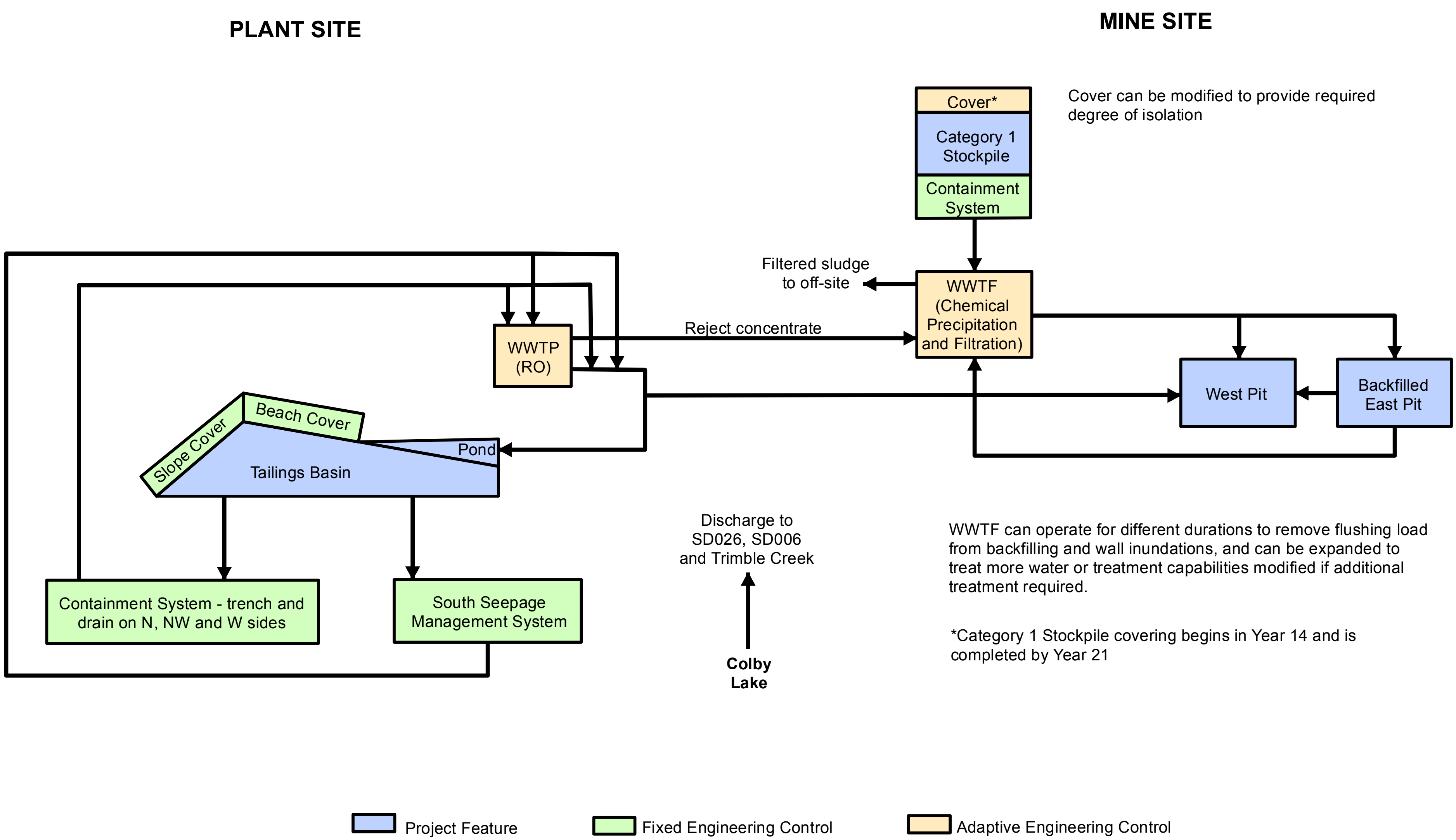


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**Figure 3.2-17**
**Water Management Schematic - Reclamation - Approximate Years 21-30**
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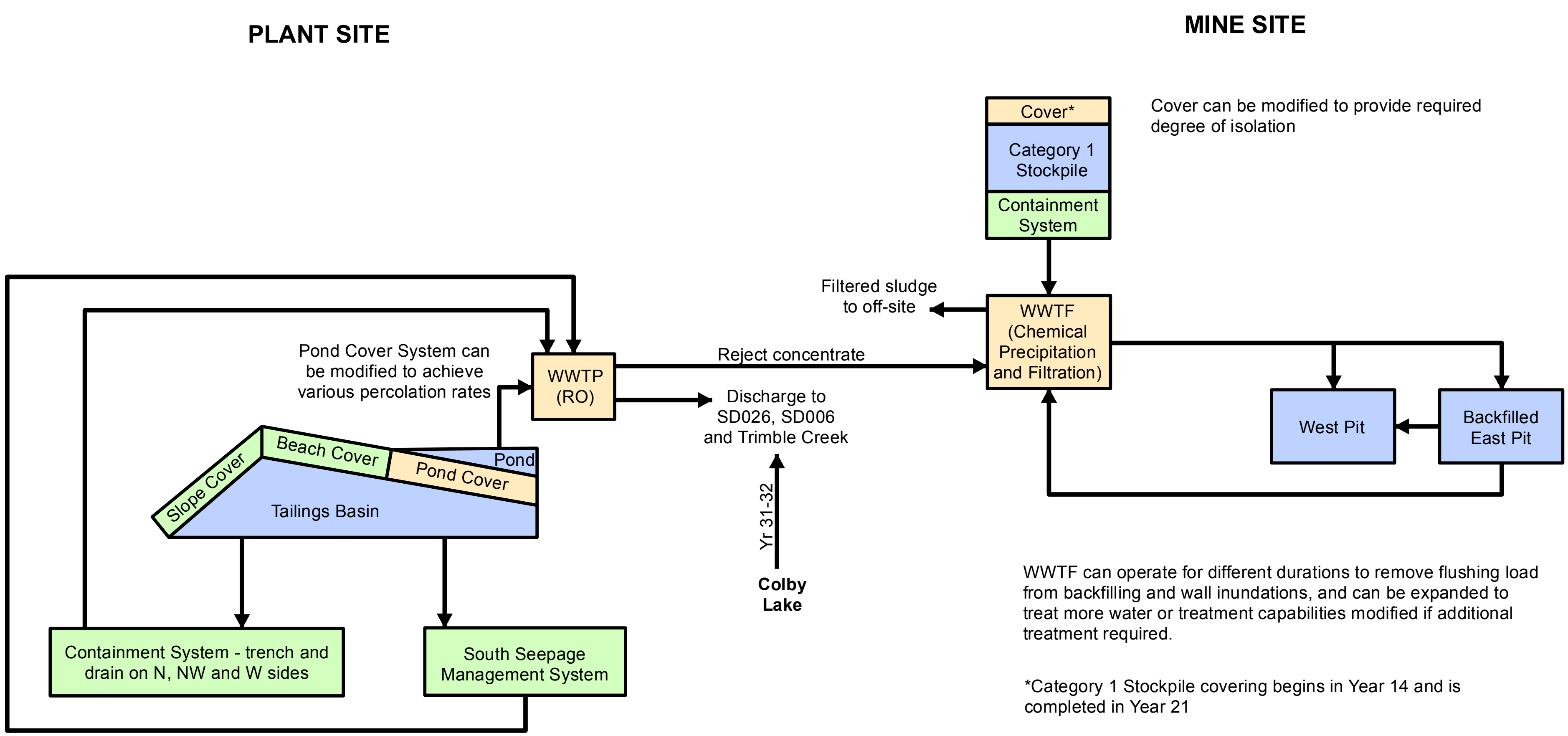


Project Feature | Fixed Engineering Control | Adaptive Engineering Control

US Army Corps of Engineers St. Paul District

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**Figure 3.2-18**
**Water Management Schematic - Reclamation - Approximate Years 31-40**
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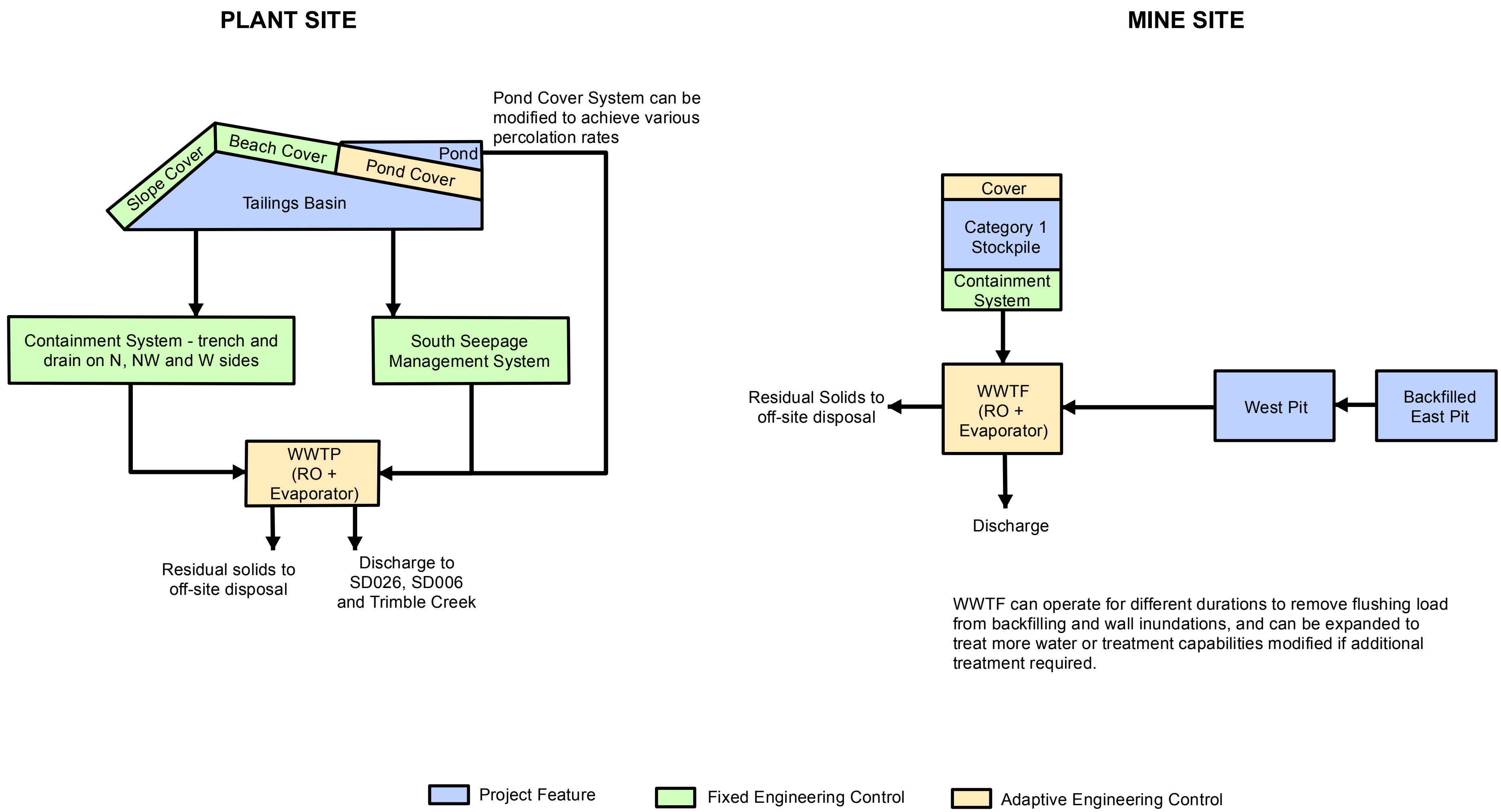




**Figure 3.2-19**
**Water Management Schematic - Long Term Mechanical Treatment**
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***Post-reclamation Activities***

Maintenance activities that would continue throughout reclamation and post-reclamation include erosion repair, woody species and tree removal on the Category 1 Stockpile cover system, and ongoing operation and maintenance of the Category 1 Stockpile groundwater containment system and WWTF. PolyMet has committed to conduct demonstration projects during the Life of Mine and reclamation to establish non-mechanical water treatment systems to be used at the Mine Site. The WWTF would remain operational until water quality monitoring results meet permit requirements without the need for mechanical treatment.

### 3.2.2.2 Transportation and Utility Corridor

The Mine Site and Plant Site would be connected by a Transportation and Utility Corridor that would contain refurbished and new infrastructure proposed to transport goods, including ore, between the Mine Site and Plant Site.

#### 3.2.2.2.1 Location and Ownership

The Transportation and Utility Corridor would be approximately 8 miles in length, generally consisting of two easements (Railway and Dunka Road) that deviate from one another at various points along the corridor (Figure 3.2-20).

PolyMet has acquired ownership of, or the rights to use, the land and existing infrastructure required within the Transportation and Utility Corridor. Surface owners of land intersected by the existing Dunka Road and existing and new sections of railway are listed in Table 3.2-10.

***Table 3.2-10 Surface Owners Along the Transportation and Utility Corridor.***

| Easements | Land Surface Owner | Township and Section |
|---|---|---|
| Dunka Road and/or Treated Water Pipeline | State of Minnesota | Township 59 N, Range 13 W, Section 16 |
| | | Township 59N, Range 14W, Sections 13, 14, 15 |
| | Cliffs Mining Services | Township 59N, Range 13W, Sections 1, 10, 11, 15, 18 |
| | | Township 59N, Range 14W, Section 13 |
| | United States of America | Township 59N, Range 13W, Sections 12, 17, 18 |
| | Allete, Inc. | Township 59N, Range 13W, Section 17 |
| Railroad Corridor | State of Minnesota | Township 59N, Range 13W, Section 16 |
| | | Township 59N, Range 14W, Sections 14, 23 |
| | Cliffs Mining Services | Township 59N, Range 13W, Sections 1, 10, 11, 12, 15, 17, 18 |
| | | Township 59N, Range 14W, Sections 13, 24 |

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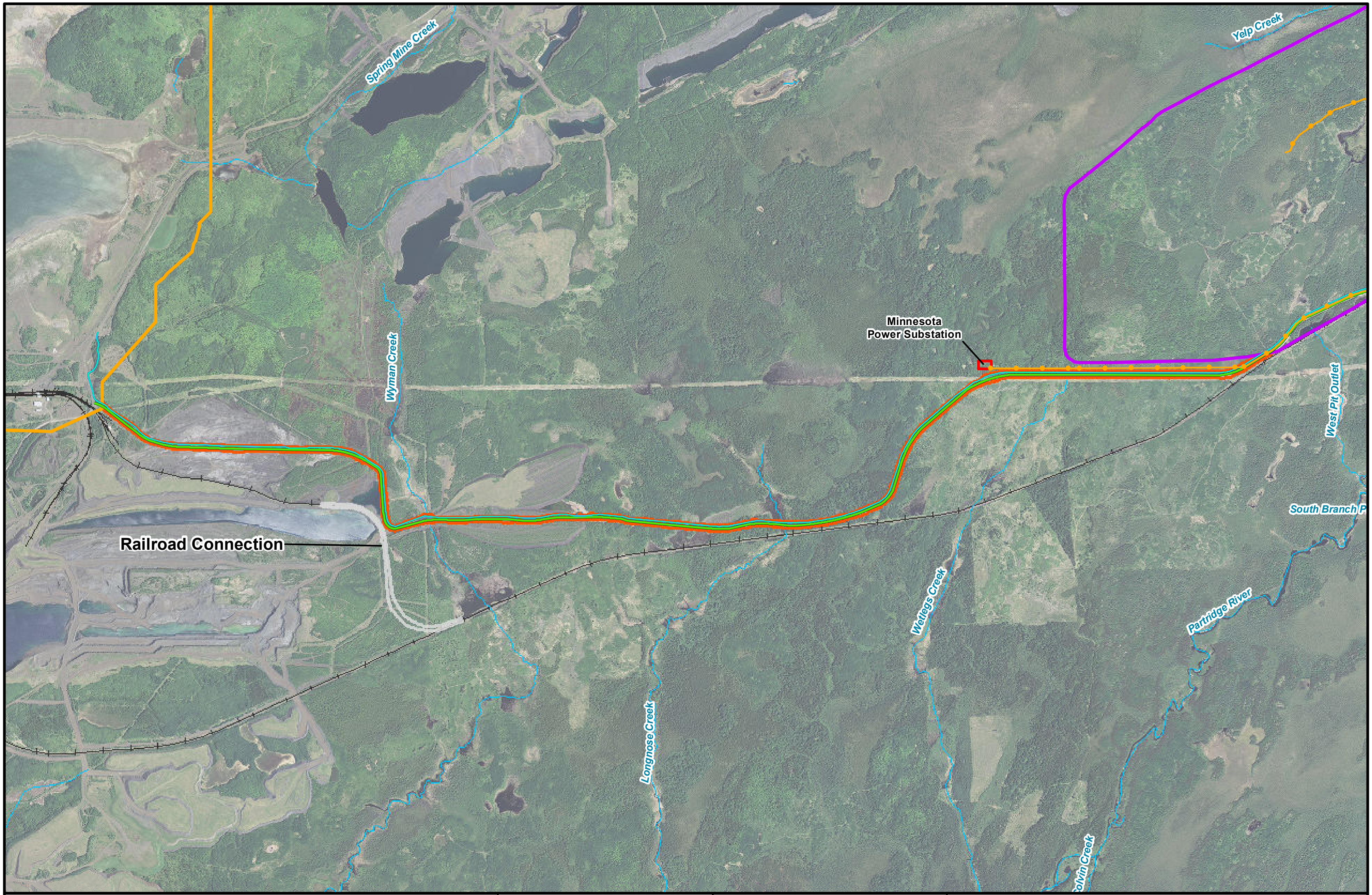


Transmission Line
Treated Water Pipeline
Dunka Road
Minnesota Power Substation
Transportation and Utility Corridor
Railroad Connection
Plant Site
Mine Site
Stream/River
Existing Railroad

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**Figure 3.2-20**

**Transportation and Utility Corridor**

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#### 3.2.2.2.2 Existing Conditions

The existing Cliffs Erie private railroad and Dunka Road are located within the Transportation and Utility Corridor (Figure 3.2-20), and both would be refurbished for use as part of the NorthMet Project Proposed Action.

#### 3.2.2.2.3 New Construction and Pre-production Development

Pre-production development along the Transportation and Utility Corridor would include the following:

- refurbishing the existing 8-mile portion of the Cliffs Erie private railroad located between the Mine Site and Plant Site;
- constructing a new rail spur (less than 1 mile in length) to connect the existing Cliffs Erie private railroad to the Rail Transfer Hopper at the Mine Site;
- constructing a new rail spur (approximately 1 mile in length) connecting the existing Cliffs Erie private railroad to existing railroad infrastructure at the Plant Site;
- upgrading an existing 7-mile segment of the private Dunka Road located between the Mine Site and Plant Site;
- constructing a new water pipeline(s) approximately 7.5 miles in length along Dunka Road, to connect the Mine Site with the Plant Site; and
- constructing a new 2.5-mile 13.8 kV transmission line along a portion of Dunka Road to connect the Mine Site to a new Minnesota Power electrical substation.

#### 3.2.2.2.4 Use During Operations

Dunka Road would be used to transport various materials and personnel between the Mine Site and Plant Site. The water pipeline would be used to transport treated water from the Mine Site WWTF to the Tailings Basin at the Plant Site.

The railway would generally be used to transport ore from the Mine Site to the Plant Site using three to four trains, each consisting of sixteen to twenty 100-ton, side-dumping ore cars and one 2,100-hp (approximate) six-axle diesel-electric “Gen-Set” or “Multi-Engine” locomotive.

The side-dump cars have two hinged doors that act as the sides of the car and drop down when the cars are tipped at the coarse-crusher for unloading. Figure 3.2-21 shows the configuration of the ore cars. These cars would result in less spillage than from bottom-dump cars previously used as part of the former LTVSMC taconite mining operations.

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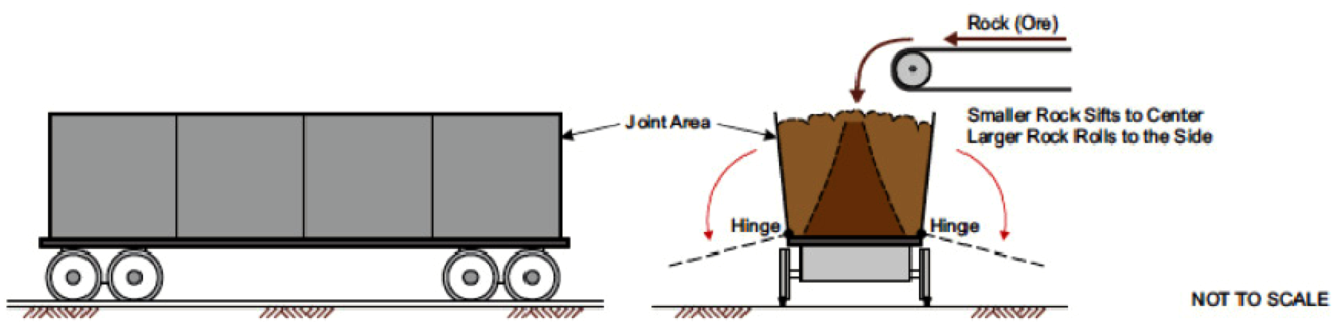




US Army Corps of Engineers
St. Paul District

**Figure 3.2-21**

**Side Dump Railroad Cars**

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#### 3.2.2.2.5 Reclamation and Long-term Closure

At closure, infrastructure along the Transportation and Utility Corridor would be managed in accordance with the respective usage agreements.

### 3.2.2.3 Plant Site

The NorthMet Project Proposed Action would include the development and operation of a Plant Site, an area located at the former LTVSMC processing plant. The Plant Site would include infrastructure required to process ore received from the Mine Site in order to recover base and Au/PGM metals, and to manage associated wastes.

Operating at the average mining rate (Section 3.2.2.1), annual production would yield about 113,000 short tons of copper concentrate, 18,000 short tons of mixed nickel/cobalt hydroxide, and 500 short tons of PGM precipitate. Tailings and hydrometallurgical residue would be stored in new facilities that would be progressively constructed throughout operations.

The required infrastructure and the steps undertaken during processing, including the inputs and outputs, are discussed below.

#### 3.2.2.3.1 Location and Ownership

The Plant Site is located at the site of the former LTVSMC processing plant, approximately 6 miles north of the City of Hoyt Lakes (Figure 1-1).

PolyMet has surface ownership of the lands encompassing the Plant Site, including the existing infrastructure and tailings facilities (Figure 3.2-1).

#### 3.2.2.3.2 Existing Facilities

The Plant Site was previously used for the former LTVSMC taconite processing operations that ended in 2001. As shown in Figure 3.2-22, existing infrastructure at the site includes a Beneficiation Plant, access roads, railway infrastructure, and a process waste facility (Tailings Basin), as well as ancillary and support infrastructure and buildings such as administration, warehouse, and storage facilities. A pump station and pipeline also connect the Plant Site to Colby Lake, located to the south.

The existing LTVSMC Tailings Basin is unlined and was constructed in stages beginning in the 1950s. It was configured as a combination of three adjacent cells, identified as Cell 1E, Cell 2E, and Cell 2W, and was developed by first constructing perimeter starter dams and placing tailings from the iron-ore process directly on native material. Perimeter dams were initially constructed from rock and subsequent perimeter dams were constructed of coarse tailings using upstream construction methods. The Tailings Basin operations were shut down in January 2001 and have been inactive since then except for reclamation activities consistent with an MDNR-approved closure plan.

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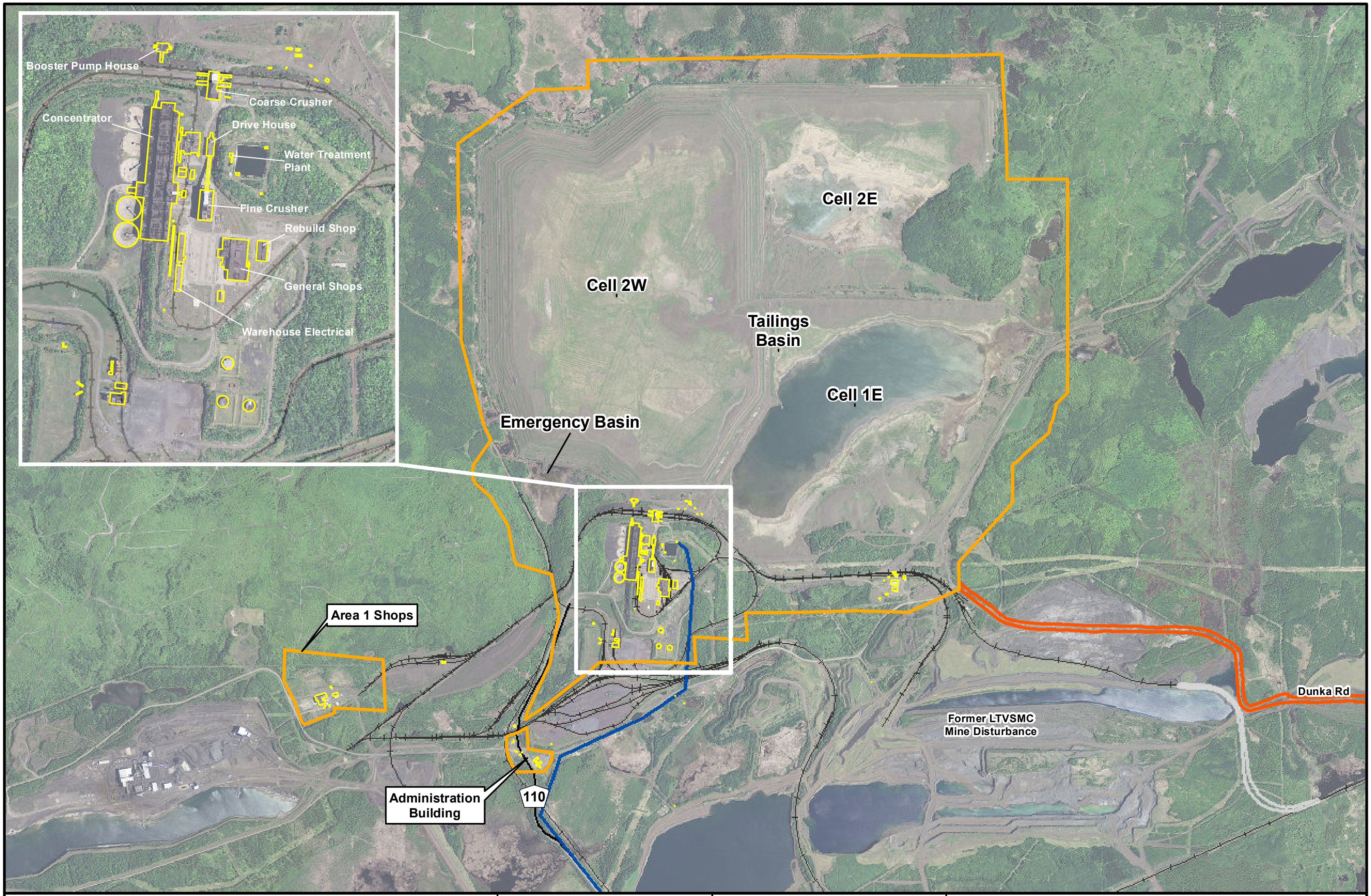


Plant Site
Existing Building
Colby Lake Water Pipeline Corridor
Transportation and Utility Corridor
Railroad Connection
Existing Railroad

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**Figure 3.2-22**
**Existing Conditions at the Plant Site**
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#### 3.2.2.3.3 New Construction and Pre-production Development

PolyMet proposes to use some of the existing infrastructure at the Plant Site. The existing infrastructure would be refurbished and supplemented with new facilities that would be constructed and operated as part of the NorthMet Project Proposed Action.

Existing infrastructure at the Plant Site that would be refurbished and used includes:

- Beneficiation Plant facilities such as:
  - coarse-crusher building,
  - fine-crusher building, and
  - concentration building;
- a rail car maintenance shop;
- Area 1 Shops; and
- a pump station and pipeline connecting the Plant Site to Colby Lake, located approximately 4 miles to the south of the Plant Site.

Flotation in the beneficiation process would occur in a new flotation building located on disturbed ground immediately to the west of the concentration building. Dewatering, storage, and shipping would occur in a new concentrate dewatering and storage building located on disturbed ground near an existing heating and additive plant, which would be demolished.

All equipment used in the hydrometallurgical process would be located in a new Hydrometallurgical Plant building.

New tailings would be placed within new dams on top of the existing LTVSMC Tailings Basin. Hydrometallurgical residue would be placed within new dams built on top of the existing LTVSMC Emergency Basin adjacent to the existing tailings facility. Refer to the geotechnical stability section in Chapter 4.0 for more information on the existing geotechnical conditions at the Tailings Basin and Hydrometallurgical Residue Facility.

A new WWTP would be built at the Plant Site to treat intercepted seepage from the Tailings Basin.

The layout of existing and proposed buildings and infrastructure at the Plant Site is shown on Figure 3.2-23.

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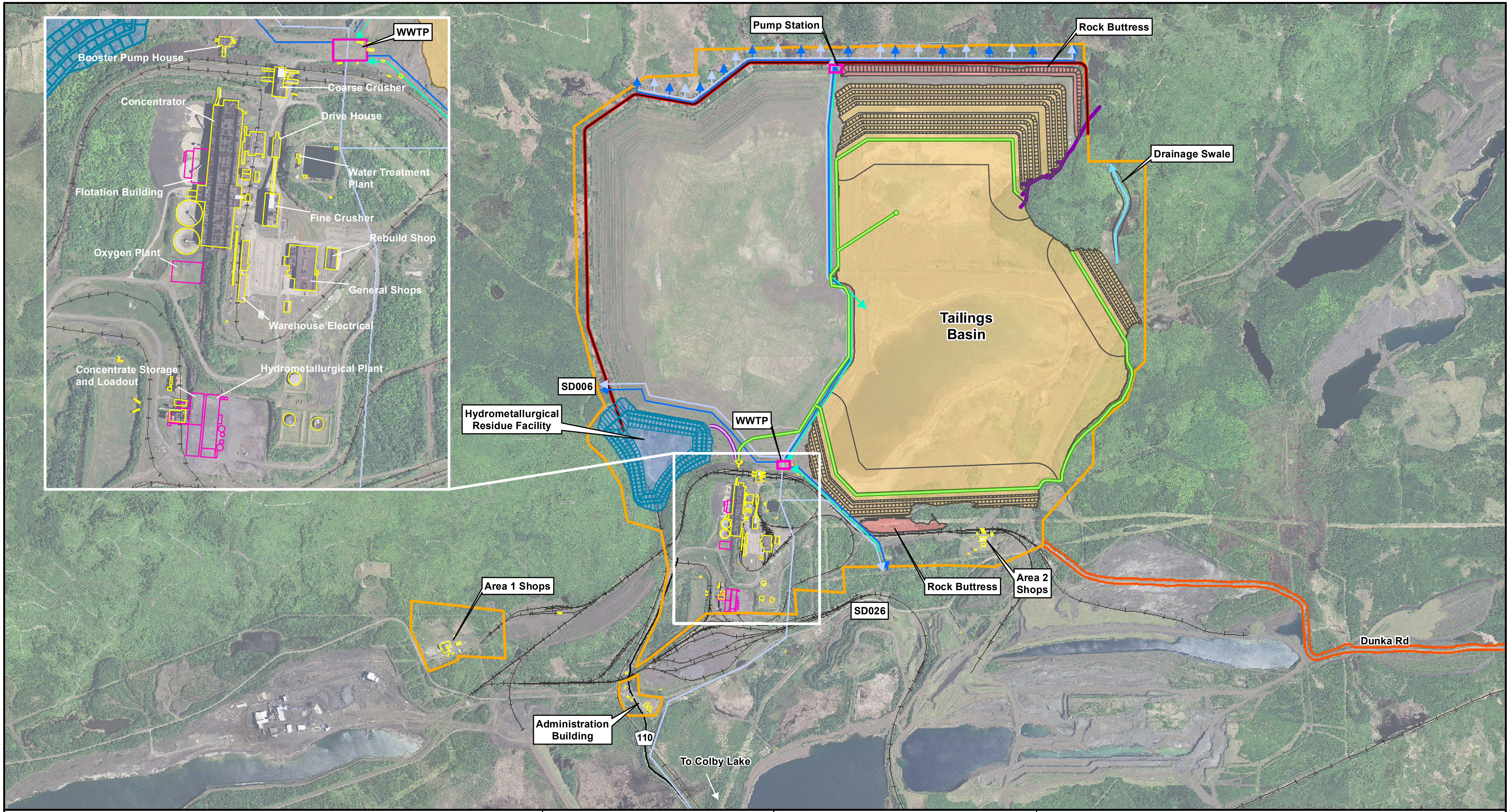


Plant Site
Tailings Basin
Proposed Building
Existing Building
Hydrometallurgical Residue Facility
Transportation and Utility Corridor
Rock Buttress
Containment System
Treated Water Discharge Pipe
Seepage Water Pipe
Colby Lake Transfer
Drainage Flow Direction
Hydrometallurgical Residue Pipeline
Flotation Tailings Pipeline
Tailings Basin Emergency Overflow
Existing Railroad

US Army Corps of Engineers
St. Paul District

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**Figure 3.2-23**
**Plant Site Layout**
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#### 3.2.2.3.4 Beneficiation Process

Mined ore would be processed using beneficiation and hydrometallurgical technologies. The purpose of the beneficiation process would be to produce final separate concentrates of copper and differing grades of nickel. The concentrates could be shipped to customers, used as a feedstock to the hydrometallurgical process, or divided for both uses. PolyMet expects that the Beneficiation Plant would be operational 2 years before the Hydrometallurgical Plant and that, during that period; all concentrates would be shipped to customers. Once the Hydrometallurgical Plant becomes operational, some or all of the nickel concentrates would be feedstock to the hydrometallurgical process. The decision to ship or process concentrates would be based on equipment maintenance schedules, customer requirements, and overall project economics.

Processes at the Beneficiation Plant would include ore crushing, grinding, flotation, dewatering, storage, and shipping. Crushing and grinding would occur at the existing coarse-crusher building, fine-crusher building, and concentration building, all of which remain from operations of the former LTVSMC taconite processing plant. Flotation would occur at a new flotation building located on disturbed ground immediately to the west of the concentrator building. Dewatering, storage, and shipping would occur at a new concentrate dewatering and storage building located on disturbed ground near the Heating and Additive Plant, which would be demolished. A simplified process flow diagram for the beneficiation process is shown on Figure 3.2-24.

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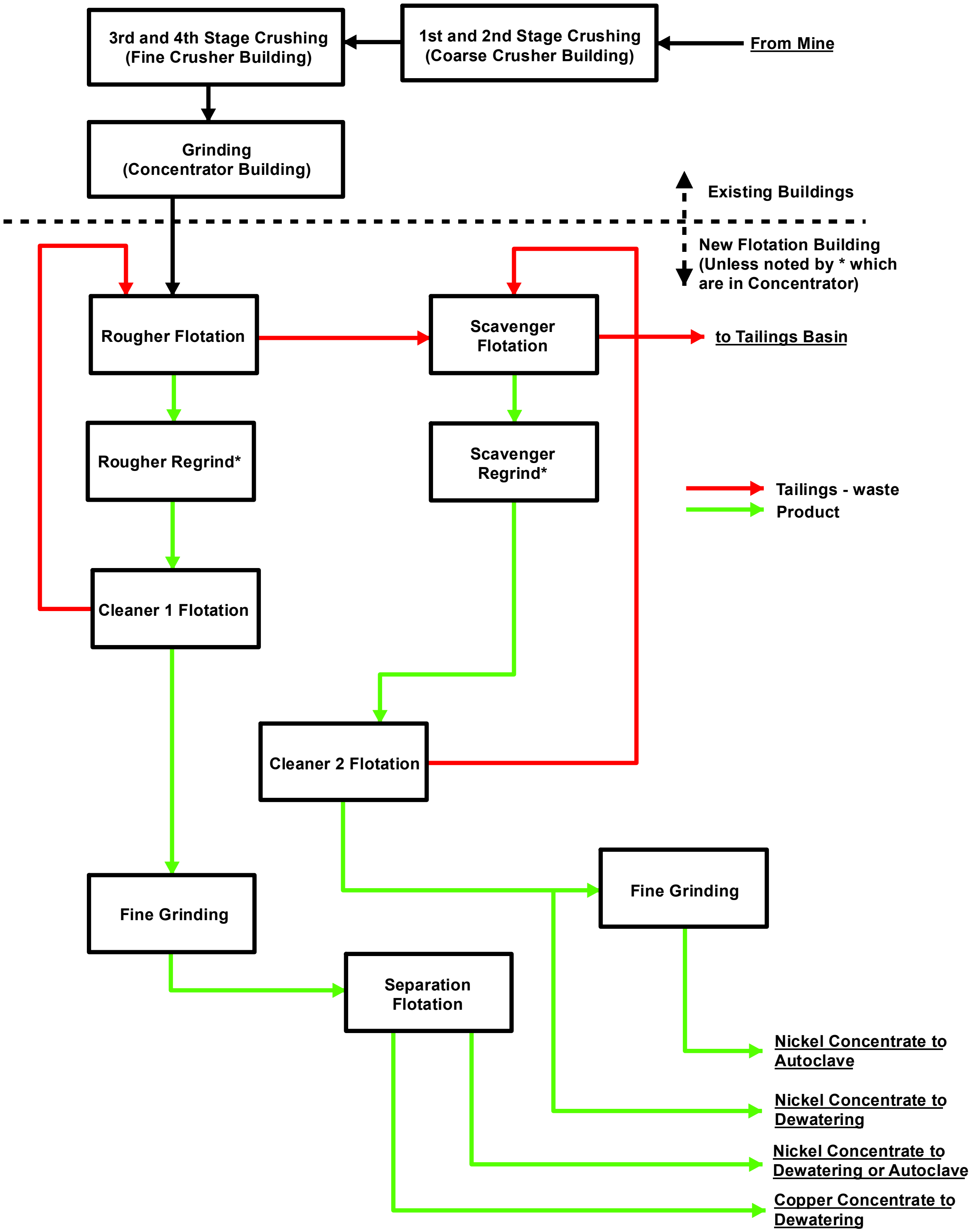




**Figure 3.2-24**
**Beneficiation Plant Process Flow Diagram**
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### ***Ore Crushing***

In ore crushing, ore as large as 48 inches in diameter would be delivered by rail from the mine to the existing coarse-crusher building, where each car would be emptied into a primary crusher at an average (calculated using the hours the primary crusher would be actually running, as it would not run continuously) feed rate of 1,667 tons per hour. From the primary crusher, ore would move by gravity to four parallel secondary crushers. A conveyor system would move the ore, 80 percent of which would now be smaller than 2.5 inches, to the coarse-ore bin located in the fine-crusher building.

The coarse, crushed ore would be fed into parallel fine-crushing lines. Each line would consist of a tertiary crusher, two quaternary screens, and two quaternary crushers. The crushed ore would be transferred to the fine-ore bin located in the existing concentrator building. At this stage, approximately 80 percent of the ore in the fine ore bin would be smaller than 0.315 inch.

The existing coarse- and fine-crushing building emission control systems would be replaced with components that meet or exceed the particulate emission standard required of new sources at taconite plants. To reduce space-heating requirements, emission control system exhaust would be recycled to the buildings. The material collected would be mixed with water and added to the milling circuit. This means that the solids removed from the air stream would be recycled to the process and no solid waste management would be required and no water would be lost.

### ***Ore Grinding***

Ore grinding, which would occur at the existing concentrator building, would reduce the ore particle size to the point at which 80 percent would be less than 120 microns (4.7 x $10^{-3}$ inches). In ore grinding, the fine-ore bin would feed into parallel mill lines. Each line would consist of a rod mill in series with a ball mill. The ore would pass through the rod mill once and the ground ore would be delivered to the ball mill. The ground ore would re-circulate through the ball mill until the particle size is small enough for flotation.

The existing ore-grinding emission control systems would be replaced with components that meet or exceeded the particulate emission standard required of new sources at taconite plants. To reduce space-heating requirements, emission control system exhaust would be recycled to the buildings. The material collected would be mixed with water and added to the milling circuit. Solids removed from the air stream would therefore be recycled to the process and no solid waste management would be required and no water would be lost. Because water would be added to the mill lines and the beneficiation process would be wet from that point on, there would be no need for particulate emission control systems downstream of the fine-ore bin.

In the event of a power failure, all process fluids would be contained within the concentrator building and recycled to the process when power is restored. This same containment and recycle system would contain and control any minor spills.

### ***Flotation***

Once at a size of 120 microns, the ore would be processed in flotation to recover the base and precious metal sulfide minerals. Flotation would consist of rougher and scavenger flotation lines followed by cleaner stages in a new flotation building and would produce separate nickel and copper concentrates.

In flotation, separation of the sulfide minerals would be achieved using a collector and frother combination. Air would be injected into each flotation cell and the cell would be mechanically agitated to create air bubbles that would pass upward through the slurry in the cell. The frother (methyl isobutyl carbinol and polyglycol ether, or MIBC/DF250), would provide strength to the bubbles, and the collector (potassium amyl xanthate, or PAX) would cause the sulfide minerals to attach to the air bubbles. The material attached to the bubbles would be concentrated and the material remaining in the slurry would be tailings.

The rougher tailings would go to scavenger flotation, where collector and frother would be added, along with copper sulfate as a flotation activator. The activator would ensure that the particles that would be difficult to float (i.e., contain minor amounts of sulfide) would be recovered in the concentrate, which would reduce the total sulfur content of the tailings. The concentrate from scavenger flotation would go through scavenger regrind to cleaner 2 flotation. Cleaner 2 tailings would go back to the scavenger flotation feed, while the nickel-rich cleaner 2 flotation concentrate would be sent through fine grinding 2 to the Hydrometallurgical Plant or directly to concentrate dewatering. The tailings from scavenger flotation would be sent to the Tailings Basin. Rougher flotation concentrate would be fed through rougher regrind to cleaner 1 flotation. Cleaner 1 flotation tailings would go back to the rougher flotation feed, while the concentrate would be sent through fine grinding 1 to separation flotation. Separation flotation would produce a copper concentrate and two nickel concentrates. The copper concentrate would go to concentrate dewatering. The nickel concentrates would go to concentrate dewatering or to the Hydrometallurgical Plant.

Lime would be added in separation flotation, which would result in a highly basic process water stream. Because this stream would be combined with other process water streams and makeup water, buildup of basicity is not expected. If there were a buildup of basicity, the basicity could be neutralized before it was combined with other process water streams.

The scavenger tailings would be pumped to the Tailings Basin, where the solids would settle and be stored permanently (refer to the tailings section below). The clear water would be re-circulated to the mill process water system.

In the event of a power failure, all process fluids would be contained within the flotation building and recycled to the process when power is restored. This same containment and recycle system would contain and control any minor spills.

### ***Concentrate Dewatering and Storage – Concentrate Mode***

Concentrate dewatering and storage would be used to dewater and store copper and nickel concentrates and to load those concentrates into covered rail cars. Concentrate dewatering and storage would be within the new concentrate dewatering and storage building.

The copper and nickel concentrates would be delivered to separate dewatering lines, each with a filter that would reduce concentrate moisture content to approximately 8 to 10 percent. The water removed by the filter would be returned to the Beneficiation Plant.

Each filtered concentrate would be conveyed to separate stockpiles within an enclosed 10,000-ton storage facility for loading into covered rail cars. The storage facility would contain about 15 days of production capacity. The storage facility would have a concrete floor and provisions to wash wheeled equipment leaving the facility to prevent concentrates from being tracked out of the facility.

In the event of a power failure, all process fluids would be contained within the concentrate dewatering and storage building and recycled to the process when power is restored. This same containment and recycle system would contain and control any minor spills.

### ***Processing Parameters***

Table 3.2-11 shows PolyMet's estimates for daily production rates and size reduction through the processing steps in the beneficiation process. The rates and sizes provided are the values PolyMet intends to use to design plant piping and equipment.

***Table 3.2-11 Design Processing Parameters***

| **Process** | **Input** | | | **Output** | | |
|---|---|---|---|---|---|---|
| | **Material** | **Rate (stpd)** | **Size (inches)** | **Material** | **Rate (stpd)** | **Size (inches)** |
| Ore crushing | Ore | 32,000 | 48 | Ore | 32,000 | 0.315 |
| Ore grinding | Ore | 32,000 | 0.315 | Ore | 32,000 | $4.7 \times 10^{-3}$ |
| Flotation | Ore | 32,000 | $4.7 \times 10^{-3}$ | Concentrate | 374 to Hydrometallurgical Plant and 286 to concentrate dewatering or 660 to concentrate dewatering | Varies depending on concentrate stream and next process step |
| | | | | Tailings | 31,340 | $4.7 \times 10^{-3}$ |
| Concentrate dewatering | Concentrate | 660 | Varies depending on concentrate stream | Dried nickel and copper concentrates | 286 copper and 374 nickel | Same as input[1] |

[1] Flotation step has two fine grinding stages that produce a defined size. One nickel concentrate stream to Concentrate Dewatering does not pass through a fine grinding stage, but all concentrates to the Hydrometallurgical Plant pass through a fine grinding stage. Therefore the average output for Flotation does not coincide with the average input for Concentrate Dewatering.

### ***Process Consumables***

PolyMet anticipates the raw materials shown in Table 3.2-12 would be consumed by the Beneficiation Plant processes.

***Table 3.2-12 Materials Consumed by the Beneficiation Plant Process***

| Consumable | Quantity | Mode of Delivery | Delivery Condition | Storage Location | Containment |
|---|---|---|---|---|---|
| Grinding Media (metal alloy grinding rods and balls) | 15,600 tpy | Rail (13 rail cars/ mo) | Bulk | Concentrator Building | None required |
| Flotation Collector (PAX) | 1,171 tpy | Truck (2-3 trucks/mo) | Bulk bags | Reagents Building | None required |
| Flotation Frother (MIBC and DF250) | 1,007 tpy | Tank truck (2-3 trucks/mo)[1] | Bulk | Reagents Building | Separate 13,200-gallon storage tanks |
| +Flotation Activators (copper sulfate) | 592 tpy | Truck (1-2 trucks/mo) | Bulk bags | Reagents Building | 9,200-gallon activator storage tank |
| Flocculant (MagnaFlox 10) | 16.5 tpy | Truck (1 truck/2 mo) | 1,875-lb bulk bags | Reagents Building | None required |
| Gangue Depressant (CMC) | 1,073 tpy | Truck (2-3 trucks/mo) | Bulk bags | Reagents Building | None required |
| pH Modifier (hydrated lime) | 10,279 tpy | Tank Truck (1-2 trucks/day) | Bulk | Reagents Building | Storage silo |

***Beneficiation Process Water***

Water needed for the milling and flotation circuits would primarily be return water from the Tailings Basin, which would include treated Mine Site process water. As a contingency measure, any shortfall in water requirements would be made up by raw water from Colby Lake using an existing pump station and pipeline. Throughout operations, the average annual makeup water drawn from Colby Lake would vary between 20 and 810 gpm, with an average annual demand of 275 gpm. This would be the total potential raw water demand from both the Beneficiation Plant and the Hydrometallurgical Plant.

Water collection at the Tailings Basin and Plant Site water management are discussed further in Sections 3.2.2.3.10 and 3.2.2.3.11 below.

#### 3.2.2.3.5 Tailings Management

Flotation tailings would be placed on top of part of the unlined existing LTVSMC Tailings Basin. For the first 7 years of operation, tailings would be placed on top of Cell 2E (currently approximately 1,595 ft amsl) or until it reaches the same height as the existing Cell 1E (approximately 1,660 ft amsl). After that, tailings would go on top of both Cells 1E and 2E (forming a single cell) up to the same height of Cell 1W (approximately 1,735 ft amsl). A schematic cross section of the Tailings Basin at its maximum height is provided on Figure 3.2-25.

The future perimeter dams of the Tailings Basin would be raised in an upstream construction method using compacted LTVSMC bulk tailings that consist primarily of coarse tailings with limited amounts of LTVSMC fines and slimes mixed in. This material would be sourced from the existing LTVSMC Tailings Basin dams to the north and east of Cell 2W, from the southeast dam of Cell 1E, and from the south dam of Cell 2E. Upon exhaustion of LTVSMC tailings available for dam construction, off-site borrow from MDNR-approved sources would be utilized.

To increase geotechnical stability, a rock buttress would be constructed around the northern and southern dams of the existing LTVSMC Tailings Basin. Rock buttress material would be from MDNR-approved sources. Material from former LTVSMC Area 5 would be a likely source for the rock buttress and fill material, but other sources could also be considered.

A bentonite-amended oxygen barrier layer (at a depth of 30 inches from the surface of the dams) on exterior sides of dams would be added as part of construction. The design also includes a mid-slope setback and construction of buttresses along the northern foot of existing LTVSMC Tailings Basin Cell 2E and southern foot of Cell 1E, using material from former LTVSMC Area 5. Refer to Section 5.2.14 for more information on the proposed construction of the Tailings Basin.

The NorthMet tailings would be deposited in slurry form through a system of pumps and moveable pipelines. Tailings would be deposited over discharge beaches or underwater in the Tailings Basin pond using movable diffusers. The small and fairly uniform grind size of the tailings would allow for a fairly consistent particle-size distribution, minimizing segregation of coarse and fine portions.

Tailings beaches would exist along the northern and northeastern dams of Cell 2E and the southern and eastern dams of Cell 1E, where the natural landscape is higher, thus bounding the material.

The tailings would settle out of the slurry and the decanted water would be allowed to pond and would be collected using a barge pump-back system that would pump the water back for use at the Beneficiation Plant. The barge system would consist of a primary pump barge in Cell 1E, an auxiliary pump barge in Cell 2E, piping from the primary pump barge to the Beneficiation Plant and piping from the auxiliary pump barge to Cell 1E. The auxiliary pump barge would not be needed once the cells combine to form one cell. The return water pipelines would be moved as dams are raised (up to the maximum of 1,732 ft amsl), to keep the pipeline at or near the top of the dam. The return water pipes would be fitted with a relief drain valve to allow for water to be drained back to ponds in case of shutdown during winter operations to avoid damage to the pipes from freezing or suction. Pumps would also be fitted with deicing mechanisms to avoid freezing.

Plant Site water management, including management at the Tailings Basin, is discussed further in Sections 3.2.2.3.10 and 3.2.2.3.11 below.

Stability modeling and the rationale for the design are discussed in Section 5.2.14. Final design is subject to permitting under the requirements of the MDNR Dam Safety Permit, Mine Permit, and MPCA SDS Permit.

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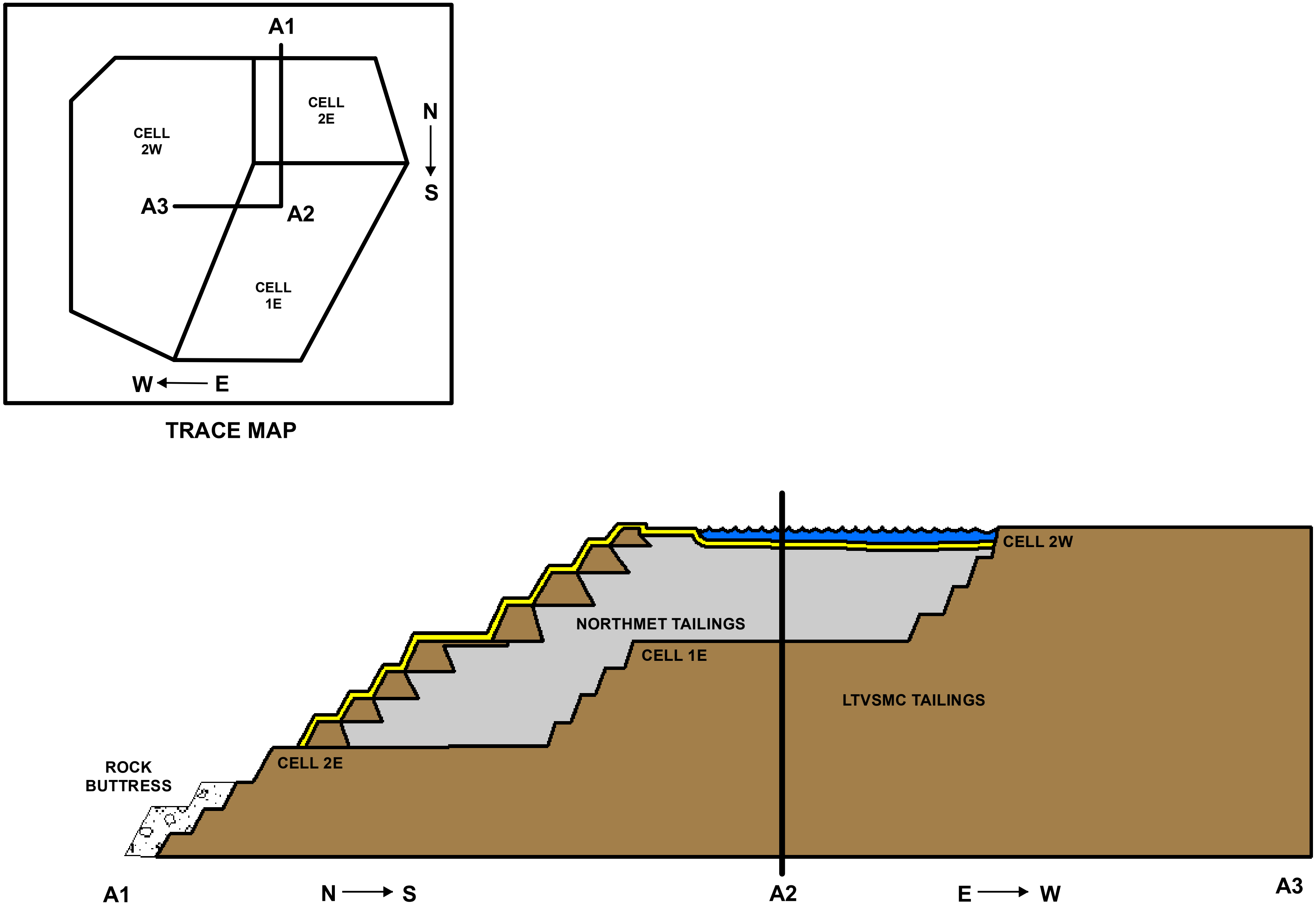


- LTVSMC Tailings
- NorthMet Tailings
- Bentonite
- Rock Buttress

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**Figure 3.2-25**
**Schematic Cross Section of the Tailings Basin - Post Closure**
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Minnesota

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### 3.2.2.3.6 Hydrometallurgical Process

Hydrometallurgical processing technology would be used for the treatment of concentrates. This process would involve high-pressure and high-temperature autoclave leaching followed by solution purification steps to extract and isolate platinum group, precious metals, and base metals. All equipment used in the hydrometallurgical process would be located in a new Hydrometallurgical Plant. Should spillage of process fluids occur, it would remain within the Hydrometallurgical Plant buildings and be returned to the appropriate process streams.

Once the Hydrometallurgical Plant becomes operational, some of the concentrates produced in the Beneficiation Plant would be feedstock to the hydrometallurgical process. The feedstock would be a combination of the separate nickel concentrates produced by the Beneficiation Plant. The decision to ship or process concentrates would be based on equipment maintenance schedules, customer requirements, and overall project economics.

PolyMet expects that the autoclave would be operational 2 years after the Beneficiation Plant becomes operational. A simplified process-flow diagram for the hydrometallurgical process is shown on Figure 3.2-26.

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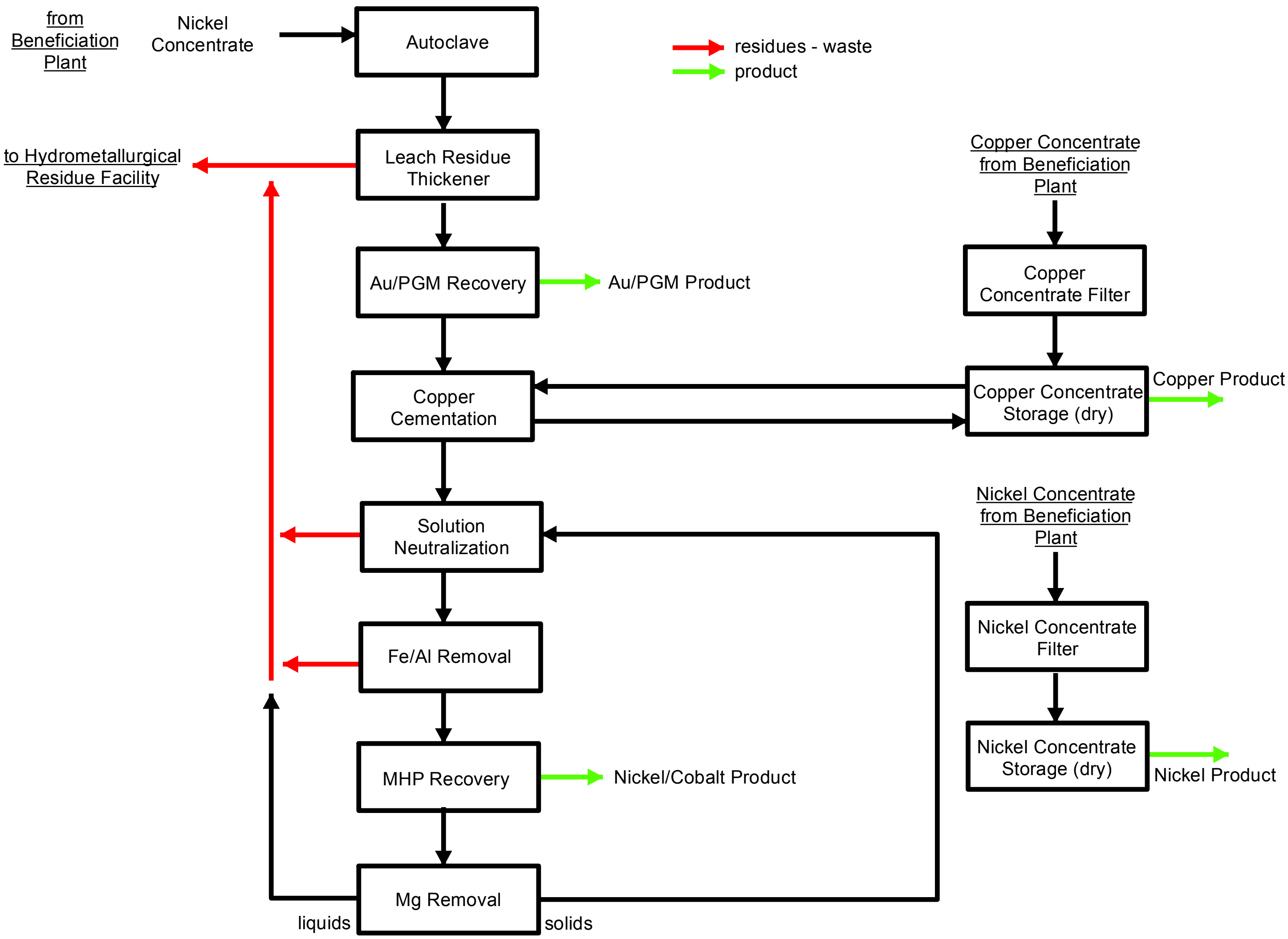




**Figure 3.2-26**
**Hydrometallurgical Plant Process Flow Diagram**
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### ***Autoclave***

In the autoclave, the sulfide minerals in the concentrate would be oxidized and dissolved in a solution. Gold and platinum group metals (Au/PGM) would dissolve as soluble chloride salts. The solid residue produced would contain iron oxide, jarosite (potassium-iron sulfate), and any insoluble gangue (non-ore silicate and oxide minerals) from the concentrate. Generation of acid from the oxidation of major sulfide minerals would result in leaching of the silicate, hydroxide, and carbonate minerals present in the concentrate.

Mine Site WWTF sludge (to recover metals and provide disposal of remaining solids) and hydrochloric acid (to maintain the proper chloride concentration in the solution to enable leaching of the Au/PGM) would be added to the concentrate before the autoclave. The autoclave would be injected with oxygen gas supplied by a cryogenic oxygen plant at a rate that would be controlled to ensure complete oxidation of all sulfide sulfur in the concentrate.

Slurry discharging from the autoclave would be sent to the leach residue thickener where solids would be settled with the aid of a flocculent. The leach residue thickener underflow would be filtered to produce a filter cake, which would be washed, re-pulped, combined with other hydrometallurgical residues, and pumped to the Hydrometallurgical Residue Facility. The leach residue thickener overflow would go to Au/PGM precipitation.

### ***Gold and Platinum Group Metals Recovery***

The product produced by Au/PGM recovery would be a filter cake made up of a mixed Au/PGM sulfide precipitate. The filter cake would be put into either bulk bags or drums for sale to a third-party refinery. The remaining solution would go to copper cementation.

### ***Copper Cementation***

Copper concentrate from dry concentrate storage would be re-pulped and the solution from Au/PGM recovery would be combined with the re-pulped copper concentrate. Copper would precipitate mostly in the form of copper sulfide. The enriched copper concentrate would be filtered and placed back into dry concentrate storage. The remaining solution would then go to solution neutralization.

### ***Solution Neutralization***

Solution neutralization would be used to neutralize acids formed as a result of the upstream process. Solution from copper cementation would go to solution neutralization. Calcium, in the form of either limestone or lime, would be added. The result of the calcium addition would be the formation of gypsum that would be filtered to produce a gypsum filter cake. This filter cake would be washed, re-pulped, combined with other hydrometallurgical residues, and pumped to the Hydrometallurgical Residue Facility. The solution remaining after neutralization would go to iron and aluminum removal.

### ***Iron and Aluminum Removal***

Solution neutralization would feed iron and aluminum removal. Limestone, steam, and air would be added to cause the aluminum and iron to precipitate. The precipitated metals would be filtered to produce a filter cake, which would be washed, re-pulped, combined with other hydrometallurgical residues, and pumped to the Hydrometallurgical Residue Facility. The remaining solution would be sent to mixed hydroxide precipitation.

***Nickel Recovery (Mixed Hydroxide Product)***

Copper-free solution from iron and aluminum removal would be reacted with magnesium hydroxide to produce nickel and cobalt precipitate. The precipitated metals would be filtered to produce a filter cake that would have an approximate composition of 97 percent nickel and cobalt hydroxides, with the remainder as magnesium hydroxide. The high-quality mixed hydroxide filter cake would be packaged for shipment to a third-party refiner. The remaining solution would go to magnesium removal.

***Magnesium Removal***

Lime slurry would be added to the solution from the mixed hydroxide product recovery (above) to facilitate magnesium precipitation. The resulting slurry would be pumped to the Hydrometallurgical Residue Facility along with other residues. The solids would settle in the Hydrometallurgical Residue Facility, to be stored permanently, while the clear water would be reclaimed continuously to the Hydrometallurgical Plant process water system.

***Process Consumables***

The raw materials described below, and those summarized in Table 3.2-13, would be consumed by the Hydrometallurgical Plant processes.

***Table 3.2-13 Materials Consumed by the Hydrometallurgical Plant Process***

| Consumable | Quantity | Mode of Delivery | Delivery Condition | Storage Location | Containment |
|---|---|---|---|---|---|
| Sulfuric acid | 1,500 tpy | Tanker truck (2 tank cars/ mo) | Bulk | Adjacent to General Shop Building | 31,965-gallon storage tank with secondary containment |
| Hydrochloric acid | 3,590 tpy | Tanker truck (3 tank cars/mo) | Bulk | Adjacent to General Shop Building | 36,120-gallon storage tank with secondary containment |
| Liquid sulfur dioxide | 1,433 tpy | Tanker truck (2 tank cars/mo) | Bulk | Adjacent to General Shop Building | 30,000-gallon pressurized storage tank with secondary containment |
| Sodium hydrosulfide | 513 tpy | Tanker truck (2-3 tankers/mo) | Bulk as a 45% solution with water | Adjacent to General Shop Building | 25,750-gallon storage tank |
| Limestone | 125,000 tpy | Rail (one 100-car train/week from April to October) | Bulk | Stockpiled on site | Berms/ditches around outdoor stockpile with water that has contacted limestone collected and added to the plant process water |
| Lime | 4,344 tpy | Freight truck (75 loads/mo) | Bulk | Adjacent to General Shop Building | Lime silo and 21,000-gallon storage tank |

| Consumable | Quantity | Mode of Delivery | Delivery Condition | Storage Location | Containment |
|---|---|---|---|---|---|
| Magnesium hydroxide | 4,866 tpy | Tanker truck (7 tank cars/mo) | 60% w/w magnesium hydroxide slurry | Adjacent to General Shop Building | Magnesium hydroxide 270,000-gallon storage tank |
| Caustic (NaOH) | 33 tpy | Tanker truck (1 load/mo) | 50% w/w solution | General Shop Building | 1,300-gallon storage tank |
| Flocculant (MagnaFloc 342) | 14 tpy | Freight truck | 1,543 lb bulk bags of powder | Main Warehouse | In bags and batch mixed regularly as 0.3% w/w solution |
| Flocculant (MagnaFloc 351) | 90 tpy | Freight truck | 1,543 lb bulk bags of powder | Main Warehouse | In bags and batch mixed regularly as 0.3% w/w solution |
| Nitrogen (used in Hydrometallurgical Plant)[1] | 19,113 tpy | NA | NA | NA | NA |

[1] Nitrogen used in the Hydrometallurgical Plant would be produced as a byproduct in the Oxygen Plant and no shipping or storage would be required.
mo = month

### ***Hydrometallurgical Process Water***

The Hydrometallurgical Plant would require separate water than the Beneficiation Plant due to the different nature of the solutions involved in the two processes. Hydrometallurgical process water would contain substantial levels of chloride relative to the water in the milling and flotation circuits.

The hydrometallurgical system would receive recycled water collected at the Hydrometallurgical Residue Facility (discharged water used to transport hydrometallurgical residue to the facility) and would distribute it to various water addition points throughout the Hydrometallurgical Plant. Makeup water would come from flotation concentrate water and raw water. Raw water demand for ore processing is described in Table 3.2.14.

Water collection at the Hydrometallurgical Residue Facility and Plant Site water management are discussed further in Sections 3.2.2.3.10 and 3.2.2.3.11 below.

***Table 3.2-14 Plant Site Services***

| Service | Source | Source Location | Needed for |
|---|---|---|---|
| Compressed air | Duty and standby arrangement of rotary screw-type compressors | General Shop Building | Provide air at a pressure of 100 psig for plant services |
| Instrument air | Air withdrawn from the plant air receiver to an instrument air accumulator and dried in a duty and standby arrangement of driers and air filters | General Shop Building | Provide air for instruments |
| Steam | Natural gas-fired boiler | Hydrometallurgical Plant | Generates heat needed for startup of the autoclaves |
| Diesel fuel storage | Existing Locomotive Fuel Oil facility | Area 2 Shop | Diesel for locomotives |
| Gasoline storage | Existing storage facility – two 6,000-gallon tanks | Adjacent to the Main Gate | Gasoline for vehicles |

| Service | Source | Source Location | Needed for |
|---|---|---|---|
| Raw water | Water from Colby Lake via an existing pumping station and pipeline | Stored in the existing water reservoir at the Plant Site (Plant Reservoir) | Plant fire protections systems, plant potable water systems, make up water for grinding and flotation process water and Hydrometallurgical Plant process water |
| Potable water | Existing processing plant potable water treatment plant would be refurbished and reactivated | Near the Plant Reservoir | Potable water distribution system includes the Area 1 and Area 2 Shops |
| Fire protection | Existing fire protection system would be refurbished, reactivated, and extended to new buildings | Plant Reservoir | Area 1 and Area 2 Shops have independent fire protection systems |
| Oxygen | 770 tpd Oxygen Plant. Plant process takes in ambient air, compresses it and separates the oxygen from nitrogen and other trace atmospheric gases. Oxygen would be transported via pipeline to plant processes and nitrogen and trace gases would be returned to the atmosphere. | Adjacent to Concentrator | Plant processes |

#### 3.2.2.3.7 Hydrometallurgical Residue Management

The hydrometallurgical process would generate residues from five sources:

- autoclave residue from the leach residue filter;
- high-purity gypsum from the solution-neutralizing filter (depending on the market, this could become a saleable product, but is currently planned to be managed as a waste);
- gypsum, iron, and aluminum hydroxide from the iron and aluminum filter;
- magnesium hydroxide precipitate from the magnesium removal tank; and
- other minor plant spillage sources.

In addition to the above-listed sources, solid wastes from the Mine Site WWTF would be recycled directly into the Hydrometallurgical Plant to recover metals, creating additional waste. The Mine Site WWTF solids would be similar to the hydrometallurgical residue, consisting primarily of gypsum, metal hydroxides, and calcite.

If all flotation concentrate were used as feedstock, the projected hydrometallurgical residue generation rate would be 313,000 tons annually and up to 2,000,000 tons during 6 years of operation. This includes 168,000 tons of high-quality gypsum filter cake (gypsum), which would be produced in the solution neutralization circuit. If some flotation concentrate were sold, the annual hydrometallurgical residue generation would be less.

These wastes would be combined and disposed of in the Hydrometallurgical Residue Facility that would be located at the existing LTVSMC Emergency Basin, adjacent to the southern edge of the existing tailings Cell 2W. The Hydrometallurgical Residue Facility would consist of a single lined cell, developed incrementally as needed, expanding vertically and horizontally from the initial construction, and would initially be designed to accommodate approximately 2,000,000 tons through 6 years of operation.

The first increment would be constructed over two to three construction seasons. Most of the site-preparation activities and major earthwork would occur in the first two construction seasons. Placing the geosynthetic clay liner would occur in the third year of construction. The remaining earthwork and completion of the geomembrane liner installation for the upper elevations of the facility would occur as needed to maintain adequate capacity.

The Hydrometallurgical Residue Facility would be filled by pumping the combined hydrometallurgical residue as slurry from the Hydrometallurgical Plant. A pond would be maintained within the Hydrometallurgical Residue Facility so that the solids in the slurry would settle out, while the majority of the liquid would be recovered by a pump system and returned to the plant for reuse. The residue discharge point would be relocated as needed to distribute the residue evenly throughout the Hydrometallurgical Residue Facility.

Plant Site water management, including management at the Hydrometallurgical Residue Facility, is discussed further in Sections 3.2.2.3.10 and 3.2.2.3.11 below.

Stability modeling and rationale for the design are discussed in 5.2.14. Final design is subject to permitting under the requirements of the MDNR Dam Safety Permit, Mine Permit, and MPCA SDS Permit.

#### 3.2.2.3.8 Required Process Services

The NorthMet Project Proposed Action would utilize two existing service facilities: the Area 1 Shop and the Area 2 Shop.

The Area 1 Shop is an existing fully enclosed maintenance facility built specifically to handle maintenance and repair work on large mining equipment. A heavy-duty, low-bed transporter and tractor would be used to transport some equipment (e.g., dozers and front-end loaders) to the Area 1 Shop from the Mine Site. A haul truck retriever (large-scale tow-truck) would tow haul trucks that would be unable to move on their own; otherwise, haul trucks would be driven to Area 1 Shop. It is estimated that each haul truck would be moved to the Area 1 Shop two times per year for major repairs. To access the Area 1 Shop, mine vehicles would follow an established route utilizing existing gravel and blacktopped roads through parts of the former LTVSMC taconite mine area.

Used oils and antifreeze/coolant, as well as residue from steam-cleaning equipment, would be collected and stored at the Area 1 Shop. Used oils, antifreeze/coolant, and solvents would be collected by a specialist contractor for recycling, while used filters, oily rags, and other oil-contaminated waste would be collected for proper off-site disposal in suitably licensed disposal facilities.

The former LTVSMC Area 2 Shop, located about 7 miles west of the Mine Site, would be reactivated to provide office space for mining and railroad operations supervision and management, as well as change house facilities, toilets, lunch rooms, first aid facility, emergency response center and training, and meeting rooms for mining and railroad crews. The Area 2 Shop facilities would include a Locomotive Fueling Station, Locomotive Service Building, and Mine Reporting Building. The Locomotive Fueling Station, where locomotives would be fueled and lubricated, would have a roof and sides, but would be open at the ends to allow access. The concrete floor, equipped with drip trays, would collect any spilled fuel and route it to a collection sump for proper disposal in the Plant Site area. It also has a 15,000-gallon bulk fuel storage tank with containment systems.

Other process inputs and services required for the Plant Site operations are summarized in Table 3.2-14.

#### 3.2.2.3.9 Transport of Consumables and Products

A 1,500- to 2,000-hp GenSet locomotive, similar to the locomotives that would be hauling ore from the Mine Site to the Plant Site, would transfer loaded and empty cars carrying process consumables and concentrates to and from the interchange location with the Canadian National Railroad and the Plant Site. Cars carrying process consumables and concentrate would meet rail common carrier requirements.

Nickel and cobalt hydroxide and precious metal precipitate products would be shipped in sealed bulk bags or sealed containers. Copper and nickel concentrates would be shipped in solid-bottom rail cars with weather-tight covers. Cars would be checked before loading and any debris would be removed and holes plugged. Loading operations would be conducted in a building via a conveyor system. Car exteriors would be inspected before leaving the buildings and any concentrate on the car exterior would be recovered and returned to storage. The concentrate is expected to be 8 percent to 10 percent moisture, which is not expected to generate dust during loading.

The NorthMet Project Proposed Action would utilize the existing general shop facility previously used by LTVSMC for re-fueling, routine inspection, and maintenance of locomotives and ore cars. Locomotives needing major repair would either be sent off site or repaired by a contractor in the general shop facility.

#### 3.2.2.3.10 Engineered Water Controls

The Plant Site would include water management features designed to control water potentially affected by sulfides and metal leachates from tailings and hydrometallurgical residue. Water contaminated with these materials would be sent to the Plant Site WWTP. Non-contact stormwater would be directed off site.

The following section describes the engineered controls. The flow and management of water is discussed in Section 3.2.2.3.11. Figures 3.2-5 through Figure 3.2-8 show the water management features and infrastructure.

***Tailings Basin***

The Tailings Basin would collect process water that flows through the Beneficiation Plant and process water pumped from the Mine Site. Direct precipitation and runoff from the process areas at the Plant Site would also be directed to the Tailings Basin. Tailings water is expected to seep downward, with some emerging as surface seepage near the toe of the Tailings Basin and some remaining in the ground but flowing away from the Tailings Basin.

As shown in Figure 3.2-27, water containment systems would be installed around the northern, western, and southern Tailings Basin dams to intercept the seepage that emerges as surface water near the toe (within several hundred ft) and virtually all of the seepage that remains in the ground as groundwater.

The system would be similar to the Category 1 Stockpile groundwater containment system described in Section 3.2.2.1.8 and would be designed and constructed in accordance with applicable requirements of *Minnesota Rules*, part 6132.2500, subpart 2. It would consist of a cutoff wall placed into existing surficial deposits, with a collection trench and drain pipe installed on the upgradient side on the cutoff wall. Figure 3.2-28 shows a schematic cross section of the containment system.

Along the eastern side of the Tailing Basin, high bedrock eliminates groundwater seepage. Along the southern side, surface features result in all seepage emerging at a surface seep. A cutoff berm and trench placed approximately 200 to 250 ft downstream of the seepage face would collect this seepage.

An emergency overflow channel for operations would be constructed to carry stormwater from Cell 1E or Cell 2E in case of an extreme rainfall storm or rapid snowmelt event. The channel would consist of a precast concrete channel constructed in the northeast corner of the Tailings Basin and would be raised incrementally with the dam raises. A separate overflow channel would be constructed during reclamation,

All groundwater and surface water seepage collected in the containment system around the Tailings Basin and all seepage from the overflow system would be pumped back into the Tailings Basin pond or to the WWTP.

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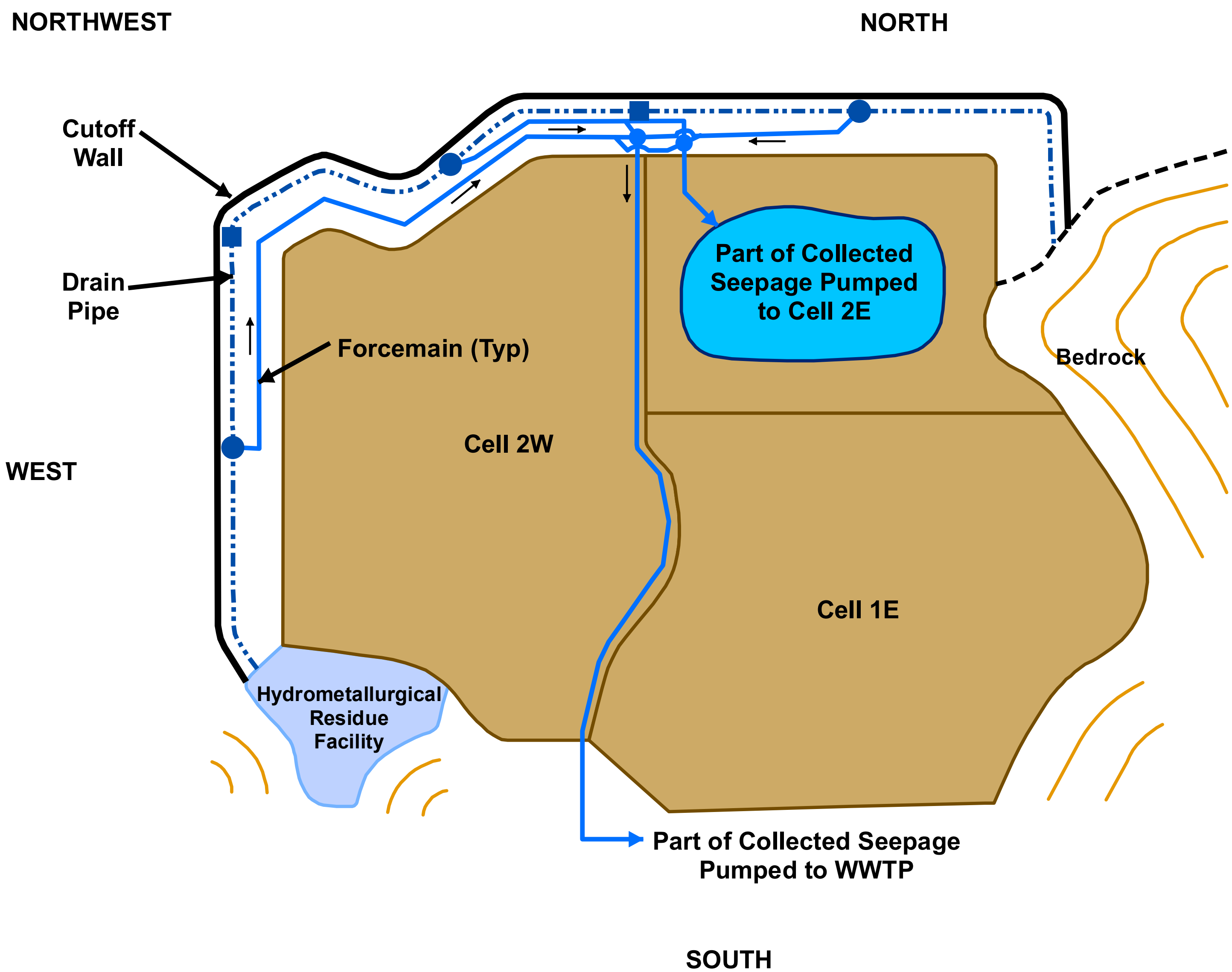


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Minnesota Department of Natural Resources | US Army Corps of Engineers St. Paul District | Forest Service U.S. Department of Agriculture

**Figure 3.2-27**
**Conceptual Plan View - Tailings Basin Groundwater Containment System**
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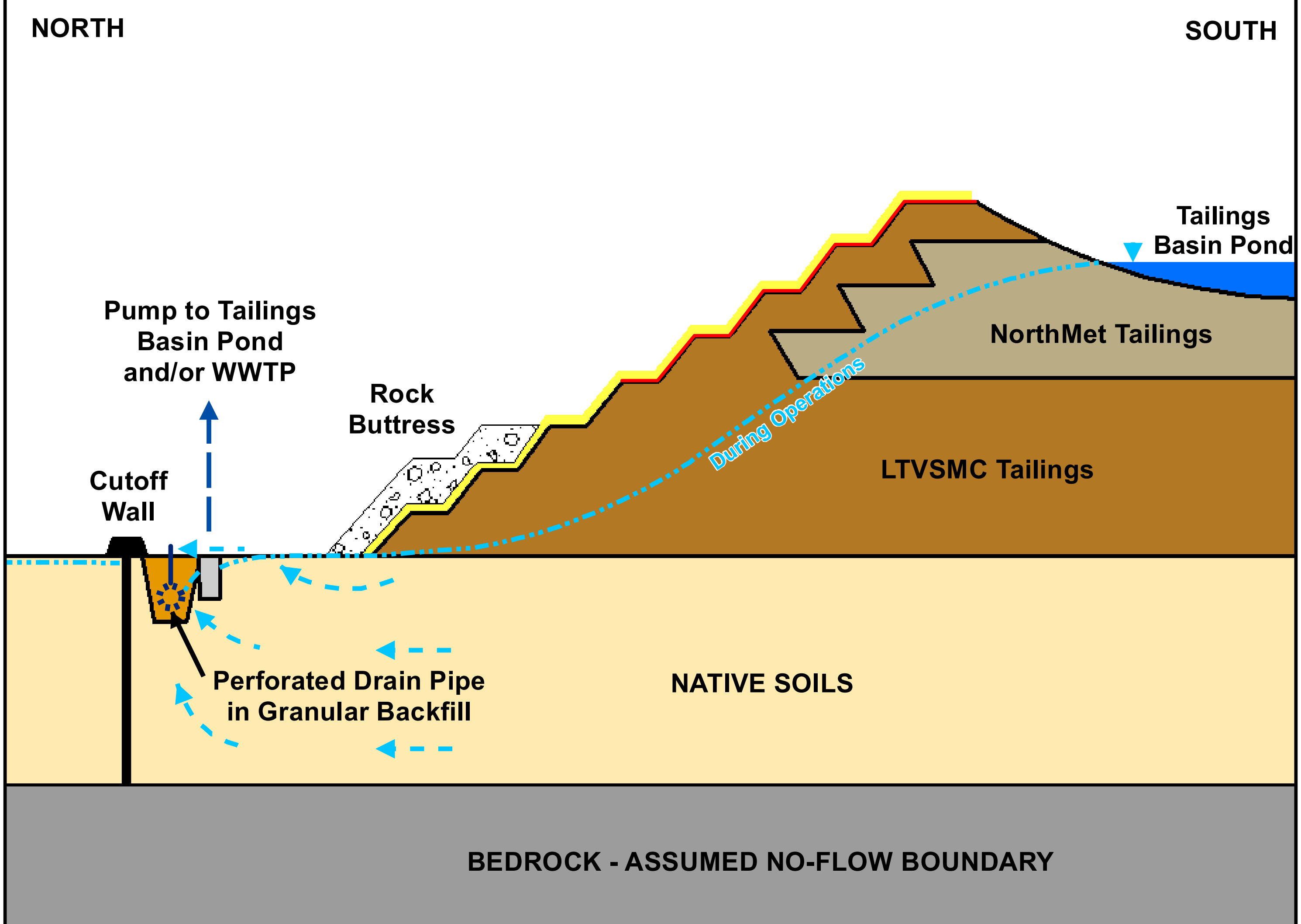




Not to Scale

US Army Corps of Engineers
St. Paul District

**Figure 3.2-28**
**Conceptual Cross-Section - Tailings Basin Groundwater Containment System**
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***Hydrometallurgical Residue Facility***

The Hydrometallurgical Residue Facility would be double-lined to minimize release of the residue. The double liner would consist of a composite liner system utilizing a geomembrane liner above a geosynthetic clay liner, with a second liner placed above the first, separated by a leakage collection system. This would substantially remove hydraulic head from the lower liner and thereby virtually eliminate leakage from the Hydrometallurgical Residue Facility.

***Wastewater Treatment Plant***

A WWTP would treat runoff, Tailings Basin seepage, and process water that could not be stored in the Tailings Basin. The WWTP would be constructed south of the Tailings Basin near the coarse crusher and would include a RO unit designed to achieve a sulfate concentration of 10 mg/L in effluent. The design of the WWTP can be adjusted to accommodate varying influent streams and discharge requirements.

The reject concentrate stream from the WWTP would be transported to the WWTF at the Mine Site via rail tank cars, which is described in more detail below.

#### 3.2.2.3.11 Water Management

During operations, the Tailings Basin would be the primary collection and distribution point for water used in the beneficiation process. The primary sources of water to the Tailings Basin would include direct precipitation, runoff, snowmelt, treated process water from the Mine Site WWTF, and seepage water collected by the Tailings Basin groundwater containment system. Any excess water from the containment system would be treated at the WWTP.

Treated water from the WWTP would be discharged to four tributaries around the Tailings Basin to augment a reduction in flows as a result of the containment system that would be built around the Tailings Basin. The tributaries that would receive water augmentation are Unnamed Creek, Second Creek, Trimble Creek, and Mud Lake Creek. If the volume of treated water from the WWTP does not provide adequate stream flow, water would be transferred from Colby Lake to augment the flow and meet the target annual average flow. The average annual make-up water drawn from Colby Lake would vary throughout operations and reclamation between 350 and 2,030 gpm, with an average annual demand of 1,170 gpm.

To the extent possible, water ponded at the Hydrometallurgical Residue Facility would be returned to the Hydrometallurgical Plant; however, some losses would occur through evaporation or storage within the pores of the deposited residue. The double-liner system described above would virtually eliminate liner leakage to groundwater. Leakage collected by the double-liner system would be recycled to the process.

For the most part, water management within the Hydrometallurgical Plant would operate independently of water management within the Beneficiation Plant. The only exceptions would be the transfer of flotation concentrate from the Beneficiation Plant to the Hydrometallurgical Plant and the combining of filtered copper concentrate and solution from Au/PGM recovery in the copper cementation process step.

The flow and management of water at the Plant Site during operation is summarized on Figure 3.2-12 and Figure 3.2-13 in Section 3.2.2.1.

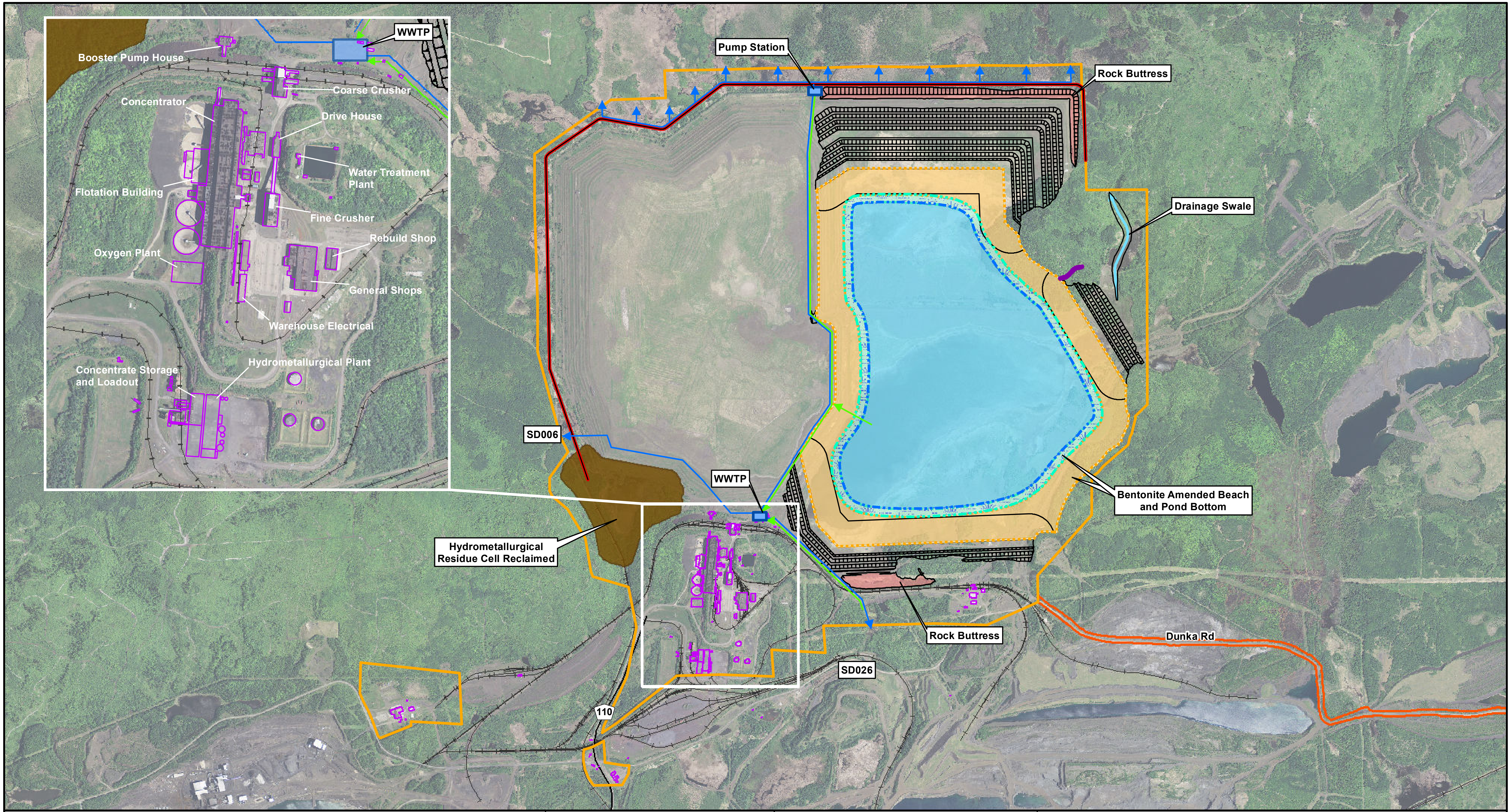
#### 3.2.2.3.12 Reclamation and Long-term Closure Management

PolyMet has developed a Reclamation Plan, which will be submitted to the MDNR as part of its application for the Permit to Mine. Reclamation Plans are also required for the Tailings Basin and the Hydrometallurgical Reside Facility. The Reclamation Plans would be finalized to provide details and a schedule for the final closure of the as-built facilities. In addition, PolyMet would also submit an annual contingency reclamation plan per *Minnesota Rules*, part 6132.1300, subpart 4, to identify activities that would be implemented if operations were to cease in that upcoming year.

Similar to the Mine Site (Section 3.2.2.1.10), where possible, the Plant Site facilities have been designed and would be operated to allow for concurrent reclamation. This would leave a smaller portion of the disturbed area requiring reclamation at closure. Under the NorthMet Project Proposed Action, concurrent reclamation at the Plant Site would include designing and constructing the dams for the Tailings Basin and Hydrometallurgical Residue Facility for long-term management of those wastes and covering the dams of the Tailings Basin with bentonite as they are constructed.

At closure, PolyMet would first remove all infrastructure and facilities not approved for potential future use, followed by reclamation of disturbed lands. Post-reclamation activities would include monitoring and maintenance of reclamation and water quality until the various facility features were deemed environmentally acceptable, in a self-sustaining and stable condition. These activities are discussed below.

Features that would remain at the Plant Site during the post-reclamation period are shown on Figure 3.2-29.




Plant Site
Wastewater Treatment Plant and Pump Station
Building
Transportation and Utility Corridor
Hydrometallurgical Residue Cell Reclaimed
Rock Buttress
Approximate Pond Area
Approximate Wetland Area
Approximate Upland Area
Containment System
Drainage Flow Direction
Tailings Basin Closure Overflow
Pipe to Treatment Plant
Treated Water Discharge Pipe
Existing Railroad

Minnesota Department of Natural Resources

US Army Corps of Engineers St. Paul District

Forest Service U.S. Department of Agriculture

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N W E S

0 1,000 2,000 4,000 Feet

**Figure 3.2-29**
**Plant Site Layout - Long Term Closure**
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### ***Building and Structure Demolition and Equipment Removal***

All buildings and structures not approved for potential future use would be removed and foundations would be razed and covered with a minimum of 2 ft of soil and vegetated according to *Minnesota Rules*, parts 6132.2700 and 6132.3200. Demolition waste from structure removal would be disposed of in the existing on-site demolition landfill (SW-619) located northwest of the Area 1 Shops at the Plant Site. Concrete from demolition would be placed in the basements of the coarse crusher, fine crusher and concentrator, and the plant reservoir, or placed in landfills as required.

Most roads, parking areas, or storage pads built to access these facilities would be demolished according to the planned schedule or as approved by the MDNR Commissioner. Utility tunnels would be sealed and closed in place. Asphalt from paved surfaces would be removed and recycled and the disturbed areas would be reclaimed and vegetated according to *Minnesota Rules*, part 6132.2700. Railroad track and ties that were not used by common carriers would be removed and recycled. Any roads, including mine pit access roads (*Minnesota Rules*, part 6132.3200), that may develop into unofficial off-road vehicle trails would require a variance from MDNR reclamation rules to allow a 15-ft-wide unpaved, unvegetated track down the centerline of the road. Such approvals would also be coordinated with the St. Louis County Mine Inspector's Office.

All plant, railroad, service, and electrical equipment would be scrapped, decommissioned, or sold. PolyMet would also close on-site sewer and water systems, power lines, pipelines (including hydrometallurgical residue pipelines), and culverts according to proper regulatory requirements.

### ***Special Material Disposal***

Special materials on-site at the time of reclamation would be disposed of as follows:

- ACMs – a detailed survey of ACMs (i.e., pipe and electrical insulation in former LTVSMC utility tunnels, siding, water-heating system insulation, lube system insulation, floor tile) would be conducted prior to demolition. Appropriate controls would be put in place or ACMs would be removed intact, properly packaged, and disposed of in the on-site demolition landfill. ACM locations in the landfill would be noted on the property deed. Any ACMs found in utility tunnels would be sealed before the utility tunnel is closed.
- Nuclear sources (i.e., nuclear-density gauges used to measure slurry density during processing) – these sources would be removed and properly disposed of.
- Partially used paint, chemical, and petroleum products – these materials would be collected and properly recycled or disposed of.
- Fluorescent and sodium halide bulbs – these would be removed from fixtures, collected, and properly disposed of.
- Stained concrete – this material would be removed and properly disposed of.

### ***Product and Product Tank Disposal***

The reagent suppliers, which would be under contract to PolyMet, would remove any reagents remaining during reclamation. In many cases, the suppliers of chemicals and equipment would be responsible for furnishing tanks and would therefore be required to remove and dispose of those tanks during reclamation. Those tanks for which PolyMet would be responsible would be processed for demolition as follows:

- The tanks would be cleaned to remove remaining materials and sludge.
- The remaining materials, sludges, and wash materials would be sent to an appropriate recycling or waste-disposal facility.
- Large ASTs would be tested for lead paint prior to demolition and, where found, disposal and recycling would be modified to accommodate the lead content.
- All tanks would be disassembled for disposal or recycling, as appropriate.
- Below-grade foundations would be left in place and buried.
- Smaller ASTs would be cleaned and removed without disassembly.

***Other Reclamation Details***

There would be several places where concentrate having up to 20 percent sulfur could accumulate (i.e., dry-concentrate storage bins, froth launders and sumps, concentrate thickeners, concentrate filters). Because this would be a high-value material, there would be an effort to ship as much as could be recovered. However, material remaining in the equipment and process piping would be properly disposed of in the Hydrometallurgical Residue Facility or other MPCA-approved locations.

***Cover and Revegetation of the Building Area***

After demolition of Plant Site buildings, these areas would be reclaimed and vegetated according to *Minnesota Rules*, part 6132.2700. All areas would be stabilized as required for stormwater management. Roads and parking lots would be reclaimed and vegetated according to *Minnesota Rules*, part 6132.2700. Asphalt pavement would be recycled or properly disposed of.

Disturbed areas on the Plant Site would be seeded with a certain selection of grasses/forbs and a potentially different group of species for the slopes. The three groups of species would include a group of native species, a group of non-native species, and a mixed group.

***Tailings Basin Reclamation***

During reclamation of the Tailings Basin, fugitive dust would be controlled on the upland areas by mulching and permanent vegetation.

Inactive interior beach areas would be temporarily vegetated as necessary for fugitive dust control, using oats, winter wheat, annual ryegrass, white clover, redtop, and alsike clover, or some combination of these species for various times of the year. The exterior dam faces would be permanently vegetated by a qualified reclamation contractor according to requirements of the Reclamation Seeding Plan. Upland areas would be planted with permanent vegetation and mulched to control potential fugitive dust in accordance with requirements in the Fugitive Emissions Control Plan. Upland beach areas would be planted with the same potential three mixes (native, non-native, or mixed) as that mentioned for disturbed areas on the Plant Site, while the dam slopes and benches would be planted with the same mix as that mentioned for the slopes of the Category 1 Stockpile.

Infiltration would be reduced through the dam faces, beaches, and pond bottom of the Tailings Basin by bentonite amendment as follows:

- the exterior face of the dams would be reclaimed progressively, with a bentonite layer added as they are constructed, to limit oxygen diffusion;
- exposed beaches and dam tops would be amended with a bentonite layer to limit oxygen diffusion; and
- the pond bottom would be covered with a bentonite layer to maintain a permanent pond that would limit oxygen diffusion. Water management would include maintenance of a pond and wetland within the reclaimed Tailings Basin, stormwater management, and continued operation of the WWTP and the groundwater containment system.

The pond would remain in the reclaimed Tailings Basin with a wetland around its perimeter. In general, the pond's maximum lateral extent would be maintained to be no closer than 625 ft from the interior edge of the Cell 1E/2E dams. The pond and wetland would receive surface water runoff from the crest and beaches of the basin and natural terrain adjacent to the Tailings Basin. The pond and wetland would continue to lose water via seepage, but at a reduced rate compared to operations, as a result of the bentonite amendment of the tailings surface. Water would be pumped from the Tailings Basin pond to the WWTP prior to discharge.

Stormwater management would include grading to provide a gently sloping surface that would route surface water runoff to the interior of the basin, accommodate future differential settlement of the underlying tailings, and maintaining ponding of water in the reclaimed Tailings Basin pond for the development of constructed wetlands.

An emergency overflow channel would be constructed to carry stormwater from the pond to the adjacent wetland in case of an extreme storm or snowmelt event after reclamation. The channel would be sized and designed to safely discharge at a flow sufficient to protect the Tailings Basin dams and would be constructed into bedrock to protect the channel from erosion and minimize maintenance requirements. A riprap delta would be installed where the channel ends to distribute the stormwater. Additional sediment control and energy dissipation structures would be incorporated at the channel discharge point if needed based on final design determinations. The conceptual location of the spillway from the combined Cell 1E and Cell 2E to the adjoining land is shown on Figure 3.2-29.

The WWTP and the groundwater containment systems would continue to operate during reclamation, although seepage rates would be progressively reduced. Seepage would be treated at the WWTP and pumped to the Mine Site to aid in West Pit flooding or discharged as described in see Sections 3.2.2.3.10 and 3.2.2.3.11. Treated water and make up water from Colby Lake would also be discharged to the tributaries surrounding the Tailings Basin to augment flows reduced by the groundwater containment system. The WWTP and the groundwater containment system would be periodically inspected to ensure continuing integrity.

### ***Hydrometallurgical Residue Facility Reclamation***

Reclamation of the Hydrometallurgical Residue Facility would include removal of ponded water, removal of pore water from the residue, construction of the cover system, and establishment of vegetation and surface water runoff controls. Once the Hydrometallurgical Residue Facility becomes full, it would be dewatered by an initial decanting of ponded water and then drainage from the residue would be collected using a geocomposite drainage net and system of sidewall riser and pump systems.

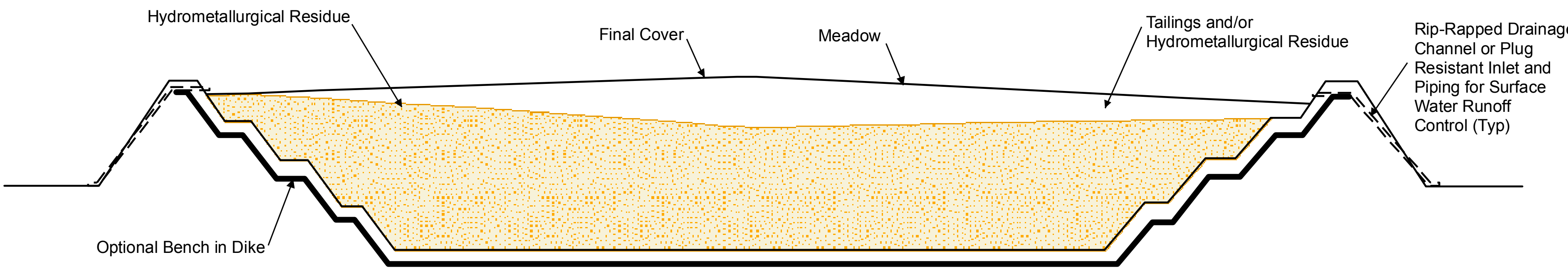
Ponded water remaining in the Hydrometallurgical Residue Facility would be removed and treated at the WWTP. During reclamation, the residue void spaces in the Hydrometallurgical Residue Facility would be full of water; a portion of this would be retained in the residue (stored water) while the other portion would drain from the residue (drainage). Drainage would be collected from the base of the cells at the geocomposite drainage system and managed as described previously for ponded water.

The rate of drainage would decrease over time as the pore water within the hydrometallurgical residue is collected and removed. Once the entire facility is closed, the volume of water from the drainage collection systems would decline. In the long-term, the volume of water requiring treatment would decline to the point that the remaining reclamation activity may consist of periodic pumping of remaining drainage into tank trucks for transportation, treatment, and disposal, as appropriate, and of inspection of the closed cells to verify integrity of the reclamation systems.

The Hydrometallurgical Residue Facility area would be graded to a gently sloping surface. The cover would consist of a layer of NorthMet tailings and/or local till soil layer above the drained hydrometallurgical residue, placed to provide a suitable foundation layer for subsequent reclamation construction activity. This would be topped, if necessary, with a non-woven needle-punched geotextile fabric. Next, a geosynthetic clay barrier layer and 40-mil low-density polyethylene (LDPE) or similar agency-approved barrier layer system would be placed. Finally, additional LTVSMC tailings and/or local till soils would be placed to create a surface capable of sustaining a vegetated cover. The reclaimed Hydrometallurgical Residue Facility would be seeded with a certain selection of grasses/forbs and a potentially different group of species for the slopes. The three groups of species would include a group of native species, a group of non-native species, and a mixed group.

Turf and final cover would be inspected and maintained by mowing once per year or as needed, fertilizing when visual inspection indicates poor vegetation growth, and implementing repairs. A schematic cross section of the Hydrometallurgical Residue Facility post-closure is provided on Figure 3.2-30.

The cover would slope gently toward the site perimeter to accommodate natural drainage of the runoff. Final cover slopes on the Hydrometallurgical Residue Facility interior would be relatively shallow to minimize the velocity of surface water runoff flow and the associated erosion. Runoff channeled along the Hydrometallurgical Residue Facility perimeter would be routed down-slope via rip-rapped drainage swales or plug-resistant inlet structures and piping systems. Runoff from the Hydrometallurgical Residue Facility exterior dam slope (constructed of MDNR-approved material LTVSMC tailings or local till soils) would be routed to the surrounding natural drainage system.

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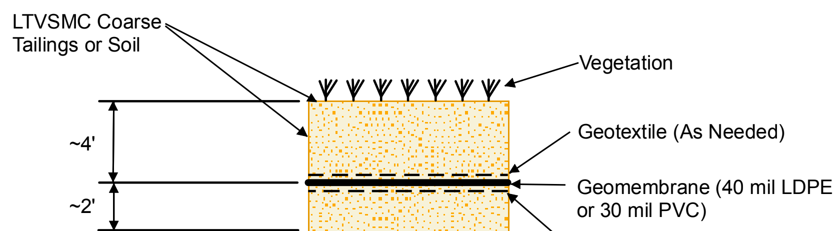


FINAL COVER (TYPICAL)
NOT TO SCALE



**Figure 3.2-30**
**Schematic Cross Section - Hydrometallurgical Residue Facility - Post Closure**
NorthMet Mining Project and Land Exchange PSDEIS
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***Water Management***

During the reclamation phase, while the Tailings Basin is being reclaimed and the West Pit is being flooded (approximately years 21-30), the seepage from the Tailings Basin would continue to be collected. A portion of this water would be sent to the WWTP and treated, and a portion of the water would bypass the WWTP, where it would be blended back with the treated portion and pumped both to the West Pit and the Tailings Basin pond. Several years after the start of reclamation, the bottom of the Tailings Basin pond would be augmented with bentonite (Section 3.2.2.3.12) and the pond water would be pumped to the WWTP, treated, and returned to the pond to the extent possible. The proposed water management for approximate years 31-40 is shown in Figure 3.2-18 in Section 3.2.2.1. Water in the Tailings Basin would be withdrawn, treated, and discharged as required to maintain pond levels.

Reject concentrate from the WWTP would continue to be sent to the Mine Site WWTF for further solute removal. The WWTP could be expanded or treatment capabilities modified if required to meet water resource objectives during this time.

The ultimate objective of long-term closure would be to transition from the mechanical treatment provided by the WWTP to non-mechanical treatment. Because non-mechanical treatment designs are very site-specific and very dependent on the quality of the water to be treated, it is assumed that the WWTP would operate in the long-term and the transition to non-mechanical treatment would be only after the design for a non-mechanical system has been proven and permits issued.

During the long-term phase, after the Tailings Basin has been reclaimed and hydrology has stabilized, the WWTP would be upgraded to include an evaporator, and Tailings Basin seepage would be collected and discharged via the WWTP until non-mechanical treatment has been demonstrated to provide appropriate treatment. The proposed long term water management (year 40 and beyond) is shown in Figure 3.2-19 in Section 3.2.2.1. The objective of the Tailings Basin cover would be to manage the constituent load from the tailings. The objective of the WWTP would be to treat Tailings Basin seepage that upwells as surface water to meet water quality standards. In the long-term, reject concentrate from the WWTP RO unit would be evaporated and the residual solids would be disposed off-site. The WWTP would operate as long as necessary and would be financially assured.

***Post-reclamation Activities***

Maintenance activities that would continue throughout reclamation and post-reclamation include dam slope erosion repair, woody species and tree removal on the Hydrometallurgical Residue Facility cover system, and Tailings Basin seepage management system operation and maintenance. PolyMet has committed to conduct demonstration projects during the Life of Mine and reclamation to establish non-mechanical water treatment systems to be used at the Plant Site. However, the WWTP would remain operational until water quality monitoring results meet permit requirements without the need for mechanical treatment.

### 3.2.2.4 Financial Assurance

*Minnesota Rules*, part 6132.1200, require that before a Permit to Mine can be issued, financial assurance instruments covering the estimated cost of reclamation, should the mine be required to close for any reason at any time, must be submitted and approved by the MDNR. There are no applicable federal financial assurance requirements known at this time that would be incorporated into the Permit to Mine.

Compensatory wetland mitigation is expected to be constructed and approved in-advance of wetland effects and would therefore not require financial assurance.

The level of engineering design and planning required to calculate detailed financial assurance amounts is typically made available during the permitting process and was not available at the time that this SDEIS was prepared. The following sections have been prepared to outline the purpose and requirement of financial assurance, including the rules and criteria that would be used in determining financial assurance and the risk analysis involved, as well as how PolyMet would calculate financial assurance during the permitting process.

#### 3.2.2.4.1 Cost Coverage and Estimation

Financial assurance must cover the reclamation and post-reclamation activities that would incur costs to execute required funding. These activities include (but are not limited to):

- implementation of corrective actions that may become necessary to address any permit non-compliance;
- demolition of all structures;
- remediation of any sites where petroleum products, reagents, additives, or other potential pollutants may have been released;
- implementation of reclamation such as:
  - fencing the perimeters;
  - sloping and seeding the overburden portion of the pit walls;
  - constructing pit outlet structures;
  - shaping and covering the Category 1 Stockpile;
  - removing culverts, dikes, ditches, and ponds, followed by grading and seeding;
  - constructing mitigation wetlands on the vacated stockpile locations;
  - closing and covering the Hydrometallurgical Residue Facility;
  - reseeding all areas; and
  - reclaiming the Tailings Basin.
- long-term post closure monitoring and maintenance including:
  - monitoring and maintenance of the cover and slopes of the Category 1 Stockpile, Hydrometallurgical Residue Facility, and Tailings Basin;
  - treatment of East Pit water and West Pit overflow in the WWTF collecting and pumping water from the Tailings Basin to the WWTP for discharge or transfer to the Mine Site for pit flooding;
  - monitoring and reporting groundwater and surface water quality; and

- developing non-mechanical water treatment systems.

- project management and site security for the above.

Reclamation and post-reclamation costs are required, under the Permit to Mine, to be updated on an annual basis to account for the proceeding year's activities. This requires estimating the contingency funds required for closure and post-closure activities in the event of unplanned closure during the course of the year. Revisions would capture annual changes in contingency reclamation activities and costs such as:

- An annual increase in Mine Site provisions as mining proceeds and the amount of disturbance, size of permanent stockpile, and volume of temporary stockpiles to be backfilled increase.
- An increase in Tailings Basin provisions as the beach and pond areas increase.
- A potential decrease in Mine Site provisions as ongoing reclamation (e.g., backfilling of temporary stockpiles) is completed as contemplated in the Mining and Reclamation Plan. This is expected to occur as the facility nears reclamation.

The final Reclamation Plan (to be applied at the end of mining) and the Contingency Reclamation Cost Estimate (contingency for mine closure prior to the planned 20-year Life of Mine) would be developed by PolyMet and its consultants based on detailed engineering studies that would be finalized through permitting (pursuant to the EIS process). As required, PolyMet would ensure that the financial assurance amount is established as a function of (but not limited to) the following three main variables:

- extent of surface disturbance and potential releases from waste storage facilities,
- reclamation and long-term care standards (including mechanical water treatment), and
- reasonable assessment of the costs to execute the Contingency Reclamation Plan.

PolyMet has developed preliminary cost estimate ranges that address the above items for hypothetical closure at years 1, 11, and 20. These estimates are provided in Table 3.2-15 below. In addition to the cost of physical closure and reclamation activities as shown in Table 3.2-15, annual post closure monitoring and maintenance is estimated to be in the range of $3.5m - $6m per year.

The cost estimates will be finalized by the MDNR during the permitting processes.

***Table 3.2-15 Preliminary Cost Estimate for Closure***

| | Year of Closure (end of year) | | |
|---|---|---|---|
| | **Year 1** | **Year 11** | **Year 20** |
| Estimated Range | $50m - $90m | $160m - $200m | $120m - $170m |

Source: Foth 2013.

### 3.2.2.4.2 Financial Assurance Instruments

The financial instruments must be robust enough to address a wide variety of contingencies such as (but not limited to):

- physical difficulties in implementing reclamation plans;

- escalating standards of closure, reclamation, and long-term monitoring;
- unanticipated liabilities;
- unplanned cessation of mining;
- failure of the mining company; and
- failure or limitations on the ability of third parties to pay reclamation costs.

The financial assurance instruments for the NorthMet Project Proposed Action must:

- be available and made payable to the MDNR when needed;
- be sufficient to cover the costs estimated;
- be fully valid, binding, and enforceable under state and federal law;
- not be dischargeable through bankruptcy; and
- be approved by the MDNR.

PolyMet intends to propose financial instruments based on appropriateness and compatibility with the specific activities for which assurance is being provided. It is likely that different instruments would be proposed to assure different components of the reclamation cost estimate and so would likely use more than one instrument at any point in time. For example, while insurance policies may not be appropriate for primary assurance, they could provide meaningful additional support over and above the expected costs or activities. Commonly accepted financial assurance instruments, such as the following, would be proposed:

- surety bonds,
- irrevocable letters of credit,
- cash and cash equivalents,
- trust funds,
- insurance policies, or
- a combination thereof.

#### 3.2.2.4.3 Cessation of Financial Assurance

PolyMet may cancel financial assurance only upon approval by the MDNR after it is replaced by an alternative mechanism or after being released (in whole or in part) from financial assurance.

MDNR would release PolyMet from the responsibility to maintain financial assurance when the MDNR determines, through inspection of the mining area, that:

- all reclamation activities have been completed in accordance with the Permit to Mine,
- conditions necessitating post-reclamation monitoring and maintenance no longer exist and are not likely to recur, and
- corrective actions have been successfully completed and monitoring of those corrective action is no longer needed.

## *3.2.3 Alternatives*

Both federal and state law require agencies to consider reasonable alternatives as part of their respective responsibilities. The purpose of the alternatives process is to allow for the identification and consideration of other reasonable alternative means to achieve the project purpose and need that could improve environmental and/or socioeconomic benefits. Alternatives offer decision-makers and the public options to the proposal and include a no action alternative that considers the effects that would occur if the project is not approved.

This section describes the process by which the Co-lead Agencies identified, screened, and determined alternatives to the NorthMet Project Proposed Action that would be carried forward for analysis in the SDEIS.

### 3.2.3.1 Process Overview

The NEPA and the CEQ regulations (40 Code of Federal Regulations (CFR) 1500-1508) require that a "range of alternatives" must be considered in the EIS. NEPA does not prescribe any minimum number of alternatives, other than the no action alternative (40 CFR 1502.14) (CEQ 1981).

Under MEPA, the MEQB statutes and rules (Minnesota Statutes, chapter 116D, sections 04 and 045; and Minnesota Rules, part 4410, subpart 0200 through 7500) require that an EIS consider at least one alternative from each of the following categories (State of Minnesota 2009):

- Alternative sites
- Alternative technologies
- Modified designs or layouts
- Modified scale or magnitude
- Alternatives incorporating reasonable mitigation measures

Alternatives may include a number of individual mitigation measures that collectively constitute a major change to the proposed action and would provide decision makers a meaningful choice. Single resource-specific mitigation measures do not normally require a separate alternative to be considered and evaluated in an EIS.

#### 3.2.3.1.1 Identification

Alternatives may be identified at any time throughout the EIS process. They may be identified by the scoping process, which is used to identify issues that trigger the analysis of effects and the development of potential alternatives. Alternatives may also be identified by either the proponent or the Co-lead Agencies at any other time during the process as a result of gaining new information regarding the project's effects or for other reasons.

Alternatives to the NorthMet Project Proposed Action were identified in accordance with the requirements of NEPA and the CEQ regulations and MEQB Rules for MEPA. Alternatives identified and considered for the NorthMet Project Proposed Action are described in Section 3.2.3.2 through Section 3.2.3.5 below.

#### 3.2.3.1.2 Screening

Once identified, alternatives for the NorthMet Project Proposed Action were screened against the following criteria to determine if they warranted further evaluation:

- Purpose and Need – Each alternative was assessed as to whether it would meet the respective Co-lead Agency's Purpose and Need for the project.
- Technical feasibility – Each alternative was assessed as to whether it could be implemented using currently available technology based on the current level of knowledge.
- Economic feasibility – Each alternative was assessed as to whether it could meet economic and financial requirements to construct and operate the proposed project, including whether the cost of implementing the alternative would be economically feasible to meet the Purpose and Need.
- Availability – Each alternative was assessed as to whether surface right, mineral rights, technologies, and other resources required are currently available.
- Environmental or socioeconomic benefits – Each alternative was assessed to determine if it offered substantial environmental or socioeconomic benefits over other alternatives, including the NorthMet Project Proposed Action.

Some alternatives needed to be screened more than others to inform a conclusive decision on whether or not to analyze them in detail in the SDEIS. This process was iterative in that alternatives continued to be screened as they passed through initial filters and as the project evolved.

Alternatives that did not meet the screening criteria were not considered reasonable and were eliminated from detailed analysis in the SDEIS. Alternatives that met the screening criteria were fully analyzed and compared equally in the EIS. The general screening and assessment process applied to alternatives identified for the NorthMet Project Proposed Action is shown in Figure 3.2-31. The process ultimately informs decision makers to identify a preferred alternative. A decision on a preferred alternative is not required under NEPA until the FEIS (40 CFR 1502.14(e)). MEPA does not require identification of a preferred alternative.

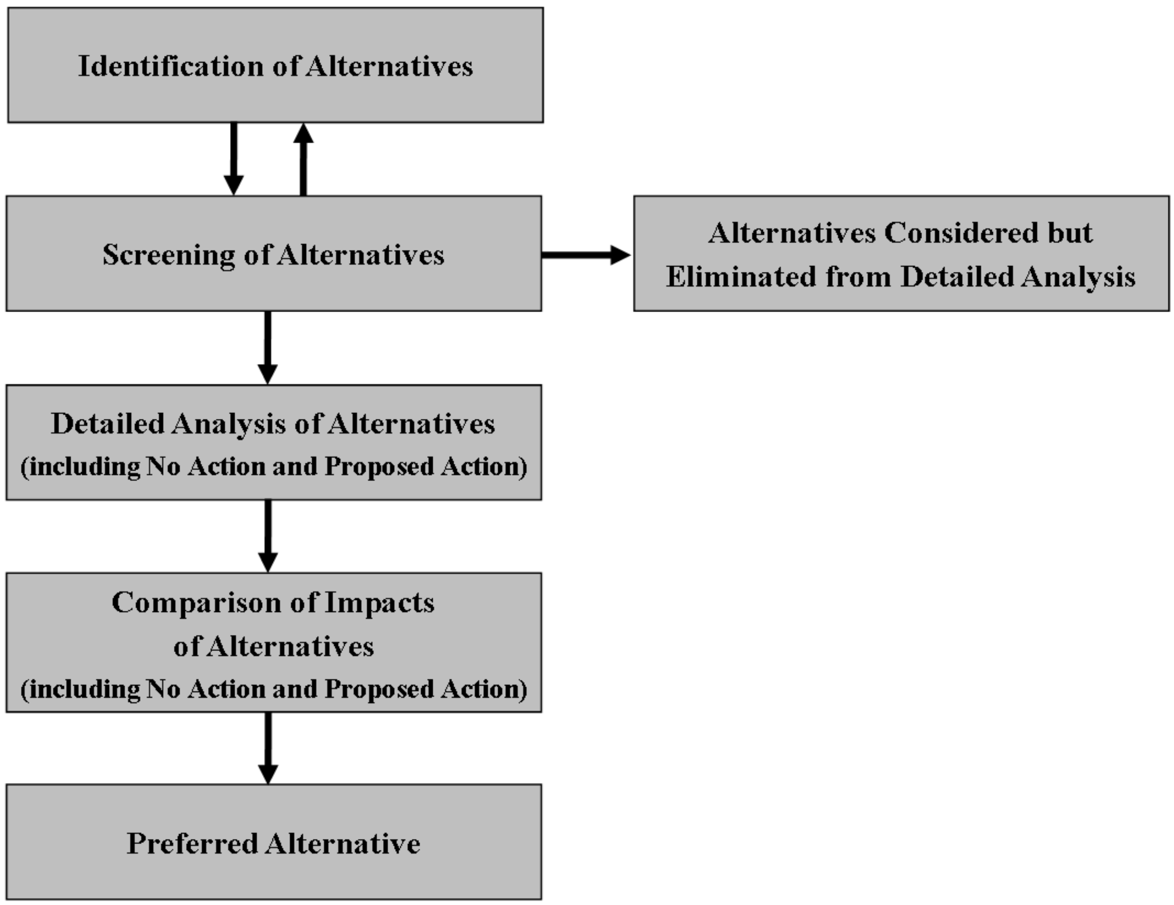


*Figure 3.2-31 Alternative Assessment Process*

#### 3.2.3.1.3 NorthMet Project Alternatives Analyzed in the SDEIS

As discussed in the following sections (after the No Action Alternative section below), the NorthMet Project Proposed Action incorporates activities and environmental impact mitigation measures that have been evaluated and developed through the EIS process.

The alternatives and mitigation measures identified and considered were either incorporated into the NorthMet Project Proposed Action as they offered benefits to the outcomes of the project; or they were eliminated from detailed evaluation because they did not offer measurable or substantial environmental benefits over other alternatives (including the NorthMet Project Proposed Action), they were not reasonable (i.e., weren't economically or technically feasible in accordance with CEQ guidelines), or would not meet the Purpose and Need.

As a result of screening and analysis, the NorthMet Project No Action Alternative (i.e., the NorthMet Project Proposed Action would not occur) is the only alternative to the NorthMet Project Proposed Action evaluated in detail in the SDEIS. Underground Mining, and backfilling the West Pit with Category 1 Waste Rock were considered in more detail but remained eliminated.

### 3.2.3.2 NorthMet Project No Action Alternative

Under the NorthMet Project No Action Alternative, the NorthMet Project Proposed Action would not occur. The NorthMet Project No Action Alternative is required to be evaluated in the SDEIS in accordance with NEPA and MEPA.

At the Mine Site, PolyMet would be required under exploration approvals to reclaim surface disturbance associated with exploratory and development drilling activities. Other existing surface uses would be allowed to continue consistent with the Superior National Forest Plan.

No further upgrades or new segments would be constructed along the existing power transmission line, railroad, or Dunka Road, which would continue to be used by their private owners.

At the brownfield Plant Site, Cliffs Erie would be required to complete closure and reclamation activities required under an existing MDNR- and MPCA-approved reclamation program. This would include completing activities for the localized affected areas under the Minnesota Voluntary Investigation and Cleanup (VIC) Program, removal of the former Plant Site building, and management of seepage at the Tailings Basin embankment.

Local employment and economic revenue would not be affected under this alternative.

### 3.2.3.3 Development of the NorthMet Project Proposed Action

The NorthMet Project Proposed Action and alternatives were developed during project scoping in 2005. Potential effects were analyzed and discussed in the 2009 DEIS (MDNR and USACE 2009). Following public and agency comment on the DEIS, evolving MPCA water quality guidance, project refinements made by PolyMet, and the addition of the Land Exchange Proposed Action, the Co-lead Agencies decided to prepare an SDEIS.

The main refinements to the NorthMet Project Proposed Action from the DEIS and the SDEIS involve improved waste and water management at both the Mine Site and Plant Site. These measures were identified in part in the Mine Site Alternative and Tailings Basin Alternative as described in the DEIS and later combined to form a Co-lead Draft Alternative which PolyMet subsequently incorporated into the NorthMet Project Proposed Action (refer to Section 2.3.2 for more information). Concurrent impact assessment and modeling identified additional project refinements and mitigation measures. PolyMet also incorporated these changes into the NorthMet Project Proposed Action analyzed in the SDEIS.

The development of the NorthMet Project Proposed Action, including consideration and incorporation of alternatives is shown in Figure 3.2-32. The evolution of the NorthMet Project Proposed Action from the DEIS to the SDEIS is summarized in Table 3.2-16. The general method, rate, volume, and duration of mining, transportation, and processing of ore did not change from that proposed in the DEIS. It should be noted that Table 3.2-16 is only for comparison purposes and shows only features that changed from the NorthMet Project Proposed Action as found in the DEIS to the SDEIS NorthMet Project Proposed Action and does not represent a complete summary of the current NorthMet Project Proposed Action.

A number of other alternatives were eliminated from further consideration because they did not meet the screening criteria as discussed above. These alternatives are detailed below in Table 3.2-17.

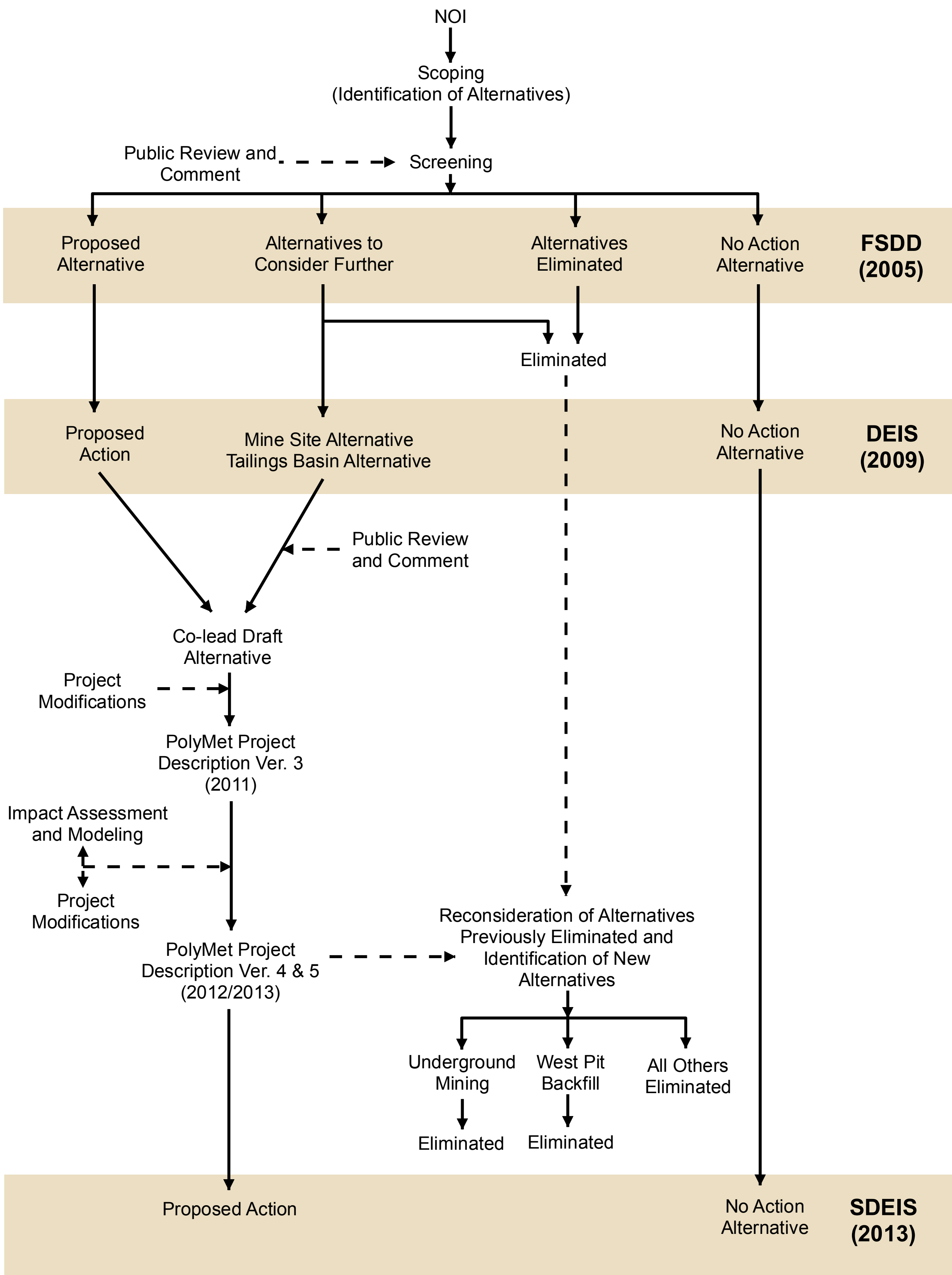




**Figure 3.2-32**
**Development of Proposed Action and Alternatives for the NorthMet Project**
NorthMet Mining Project and Land Exchange PSDEIS
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### *Table 3.2-16 Comparison of DEIS and SDEIS NorthMet Project Proposed Action*

| DEIS Proposed Action | NorthMet Project Proposed Action as Presented in SDEIS Only | Environmental Consequences |
|---|---|---|
| ***Mine Site*** | | |
| • Category 1 and 2 waste rock would be stored in a permanent lined/ covered stockpile (Category 1/2 Stockpile) north of the west pit (years 1-11)<br>• Category 1 and 2 waste rock generated after year 11 would be backfilled to the east pit<br>• Category 3 waste rock would be placed on a permanent lined/covered stockpile (east of the east pit) or Category 3 Lean Ore Stockpile (south east of the east pit)<br>• Category 4 waste rock would be stored on a permanent, lined and covered waste rock stockpile (south of the east pit)<br>• Category 4 lean ore would be hauled to the Rail Transfer Hopper or stored on the Lean Ore Surge Pile<br>• Saturated overburden would be placed in the Category 1/2 Stockpile<br>• A wastewater treatment facility used to treat process water collected from lined stockpiles would be located on the south side of the west pit, west of the overburden storage and laydown area | • Category 1 waste rock mined from years 1 to 13 would be stored in an unlined, permanent stockpile north of the West Pit. The stockpile would have a geomembrane cover system at completion and surface water and groundwater collection system would encompass the entire stockpile and direct water to the Mine Site WWTF<br>• Category 2/3 waste rock mined from years 1 to 11 stored in a temporary stockpile (with a geomembrane liner system) southeast of the mine pits<br>• Category 4 waste rock mined from years 1 to 11 stored in a temporary stockpile (with a geomembrane liner system) on the top of the un-mined Central Pit<br>• The temporary Category 2/3 Stockpile and Category 4 Stockpile and all new waste rock mined in years 11-20 would be backfilled into the east pit and stored subaqueously<br>• Saturated overburden would be used as approved by the MDNR or placed in stockpiles with geomembrane liners (Category 2/3, or 4 Stockpiles)<br>• Wastewater treatment facility located south of the West Pit and Central Pit, east of the Overburden Storage and Laydown Area and immediately adjacent to the Rail Transfer Hopper. It would be upgraded to include RO after closure<br>• Water containment systems enhanced to collect virtually all contact water from within the Mine Site and direct captured water to treatment at the WWTF | • Elimination of three permanent stockpiles and highest sulfur rock backfilled to East Pit<br>• Reduction in wetland effects<br>• Capture and treatment of virtually all groundwater and surface seepage from stockpiles and mine pits<br>• Minimizes the long term water flow through the stockpile |

| DEIS Proposed Action | NorthMet Project Proposed Action as Presented in SDEIS Only | Environmental Consequences |
|---|---|---|
| ***Plant Site*** | | |
| • Upgrading existing and constructing new processing facilities located at the former LTVSMC Plant Site<br>• Seepage from the toe of the tailings basin collected through a series of header pipes, recovery trenches and vertical extraction wells returning seepage to the tailings basin<br>• No tailings basin cover proposed<br>• Hydrometallurgical residue facility located on top of the existing LTVSMC tailings basin cell 2W | • As per the DEIS, with some minor changes to the layout of processing facilities, the addition of a new wastewater treatment plant (RO) and only one autoclave --Copper concentrate would not be further processed.<br>• Added rock buttressing at the Tailings Basin to increase geotechnical stability.<br>• Surface water and groundwater containment system constructed around the north, west and southern Tailings Basin dams capturing all surface and virtually all groundwater seepage which would be directed to a new Plant Site WWTP. Treated water returned to the Tailings Basin or discharged to wetlands north of the Tailings Basin groundwater containment system to supplement a reduction in flow in that area.<br>• During the construction of the Tailings Basin embankments, a bentonite amended oxygen barrier layer (at a depth of 30 inches from the surface of the dams) would be installed on exterior sides of dams.<br>• During closure, bentonite would be incorporated into beach and pond areas of the Tailings Basin to reduce the influx of oxygen and water.<br>• Hydrometallurgical Residue Facility would be located in the footprint of the existing LTVSMC Emergency Basin immediately southwest of the existing LTVSMC Cell 2W of the Tailings Basin. | • New building layout better utilizing disturbed ground meaning reduced wetland effects<br>• Elimination of major air emission sources and electrical users<br>• Capture and treatment of virtually all groundwater and surface seepage from Tailings Basin<br>• Improvement in the foundation stability of the Hydrometallurgical Residue Facility which eliminates concerns about liner failure and provides a virtually zero leakage liner system |

### 3.2.3.4 Reconsideration of Previously Eliminated Alternatives

In response to stakeholder comments and the evolution of the NorthMet Project Proposed Action since the DEIS, the Co-lead Agencies reviewed the alternatives against the SDEIS NorthMet Project Proposed Action to identify whether it was necessary to reconsider any alternatives that had been previously eliminated.

As addressed below, the Underground Mining Alternative and backfilling the West Pit with Category 1 waste rock were considered further in response to stakeholder comments received on the DEIS. However, following further analysis, these remain eliminated from full analysis in the EIS.

Some alternatives considered include various wet and dry cover options for the Tailings Basin at closure. Many specific mitigation measures were identified and considered individually and in combinations thereof. One particular combination of mitigation measures was identified and carried forward in the DEIS as the Tailings Basin Alternative. In preparing the SDEIS, a multidisciplinary Co-lead workgroup evaluated and compared three wet and three dry cover options to address several modified water management and geotechnical stability requirements.. Of these, the recommended option involved a wet cover with bentonite amended beach, side slopes and pond.

PolyMet adopted this recommended wet cap option as part of the NorthMet Project Proposed Action. In response to a change in applicability of water quality impact criteria, PolyMet further revised the NorthMet Project Proposed Action to include collection of substantially all Tailings Basin surface and groundwater seepage from the existing LTVSMC Tailings Basin and the proposed NorthMet Tailings Basin by a vertical hydraulic barrier constructed from the ground surface down to the top of bedrock. PolyMet also proposed enhanced mechanical water treatment using RO which would remove substantially all of the constituents in the captured seepage. This combination of the wet cap option along with collection and treatment engineering controls were shown in modeling to meet water quality criteria (see section 5.2.2). Additionally, PolyMet enhanced the design of the proposed Tailings Basin rock buttress, and it was shown in modeling to provide adequate geotechnical stability (see section 5.2.14). The other wet and dry cap options did not offer meaningful environmental benefits and, in fact seepage from the dry caps was predicted to result in substantially higher concentrations which would make the future transition from mechanical (RO) to non-mechanical (biological) water treatment more difficult during post-closure (ERM 2010).

Other alternatives were either incorporated (at least in part) to the NorthMet Project Proposed Action and are therefore no longer relevant, or remain eliminated as the changes to the NorthMet Project Proposed Action would not affect the rationale previously used to eliminate them.

The outcomes of reconsideration of previously eliminated alternatives are shown in Table 3.2-17. The types of alternatives considered against the MEPA-required alternative types are shown in Table 3.2-18.

#### 3.2.3.4.1 Underground Mining Alternative

The Underground Mining Alternative was considered but eliminated as alternative E7 in Table 3.2-4 of the DEIS (MDNR and USACE 2009). It was eliminated from further consideration in the DEIS as it was determined that it would not offer substantial environmental or socioeconomic benefits compared to the NorthMet Project Proposed Action.

The Underground Mining Alternative was reconsidered for the SDEIS due to a high level of interest from stakeholders and because it was identified in the Land Exchange Scoping Report (ERM 2011a) as requiring further assessment. This alternative would involve mining the NorthMet Deposit as defined by the proposed open pit boundary. While the mineralized zone extends beyond the proposed open pit boundary, the geology outside of the open pit has not been characterized enough to support a mine plan and is beyond the boundaries of the NorthMet Project area, so it is not reasonable to include for consideration for the Underground Mining Alternative.

An underground mine would result in a smaller surface footprint, thus offering environmental benefits over the NorthMet Project Proposed Action through reduced effects on wetlands, vegetation, and wildlife habitat. An underground mine would also have lower production rates compared to the proposed open pit, resulting in less fugitive air emissions, and less waste rock and processing waste (tailings and hydrometallurgical residue), thus reducing the scale and duration of potential water quality effects. However, a smaller mining operation would reduce the scale and duration of mining and the associated socioeconomic benefits.

PolyMet conducted an Economic Assessment of Conceptual Underground Mining Option for the NorthMet Project Proposed Action that concluded underground mining would not be economically feasible given the specific characteristics of the NorthMet Deposit (Foth 2012). That is, the tonnage/volume and grade (amount of metals) of rock would not generate enough revenue to pay for all costs associated with underground mining. The assessment used metal prices calculated in June 2012 that are consistent with the National Instrument 43-101 reporting standard used for public disclosure of information relating to mineral properties on stock exchanges supervised by the Canadian Securities Administrators. Certified mining engineers with the MDNR reviewed PolyMet’s Economic Assessment of Conceptual Underground Mining Option and agreed with the statements made, and agreed that the outcome is consistent with early studies of the NorthMet Deposit, general rules for assessment of economic viability, and similar mining operations elsewhere.

The Co-lead Agencies prepared a position paper that concludes that the Underground Mining Alternative is not considered to be a reasonable alternative because it would not be economically viable and therefore it would also not meet the Purpose and Need (MDNR et al. 2013a). For these reasons, the Underground Mining Alternative remains eliminated from further evaluation in the SDEIS.

The PolyMet Economic Assessment of Conceptual Underground Mining Option is attached to the Co-lead position paper: Underground Mining Alternative Assessment for the NorthMet Mining Project and Land Exchange Environmental Impact Statement (MDNR et al. 2013a) provided in Appendix B.

#### 3.2.3.4.2 West Pit Backfill

The option to utilize the West Pit for mining and processing waste disposal was considered but eliminated as alternative E20 in Table 3.2-4 of the DEIS (MDNR and USACE 2009). It was eliminated from further consideration in the DEIS as it was determined that it would not offer substantial environmental or socioeconomic benefits as compared to the NorthMet Project

Proposed Action (USACE et al. 2013). Furthermore, the DEIS noted that there are additional mineral resources in the West Pit that would effectively be lost if the pit was used for waste rock and/or tailings disposal.

The option to backfill the West Pit with Category 1 waste rock that would otherwise be permanently stored in the Category 1 Stockpile under the SDEIS NorthMet Project Proposed Action was raised by the Bands as a potential mitigation option to minimize surface footprint effects including wetlands, improve surface water and groundwater quality outcomes, potentially eliminate a managed West Pit overflow, and reduce project costs.

In response to the Bands' request, the Co-lead Agencies reconsidered the option to backfill the West Pit against the same screening criteria used for all potential alternatives (Section 3.2.3.1). Further consideration concluded that the West Pit would have sufficient capacity to accept all of the Category 1 Stockpile material, but for safety and operational reasons under the proposed mine plan, the West Pit would not be available for backfilling until the end of mining, still including a pit lake approximately 105 ft deep. Therefore, the full Category 1 Stockpile would still be required for the 20 year Life of Mine. As such, throughout operations of the mine, compared to the NorthMet Project Proposed Action, there would be no change to:

- the temporal surface footprint effects of the Category 1 Stockpile and affected wetlands would require off-site mitigation; and
- water management requirements associated with the Category 1 Stockpile until it is removed and backfilled into the West Pit.

After mining is completed:

- Removal of the Category 1 Stockpile may allow for reclamation of the affected surface footprint, including potential to recreate wetland areas, as noted above, the prior effect would have been offset through mitigation required for the initial effect. The generation of wetland credits in this area has the potential to be used on a contingency basis, but compensatory credit will not be considered up-front.
- The volume of material in the Category 1 Stockpile would not be enough to fill the West Pit so there would still be some pit lake.
- Backfilling would affect the water quality in the West Pit by increasing constituent loads, so additional mechanical treatment of water in the West Pit may be required for a certain timeframe following backfilling. However, there would be no effect on surface water quality discharged to the environment because mechanical treatment of water from the West Pit would still be required in the long term. Potential long-term pit water constituent loading to groundwater, and eventually to the Partridge River, would likely be increased under the backfilled condition.
- Moving the waste rock from the stockpile into the West Pit would result in prolonged dust, air, and noise emissions, but these would be unlikely to exceed the respective maximum years modeled during operations.
- While there may be potential for additional jobs required for backfilling, they would be unlikely to offer substantial socioeconomic benefits.

- Removal of the Category 1 Stockpile may improve visual aesthetics. Backfilling the West Pit would encumber private mineral resources that are deeper than the proposed West Pit. Such an encumbrance is in conflict with the terms of PolyMet's private mineral leases. The PolyMet lease agreements could be renegotiated, which might involve monetary compensation for the mineral owners if minerals are encumbered.
- The cost of physically backfilling the West Pit and other associated costs, including those for additional mechanical water treatment (required to treat increased constituent loads) and financial assurance requirements, could affect the ability of PolyMet to secure financing.

Based on the above, the opportunity to reclaim wetlands and vegetation at the Category 1 Stockpile footprint area would be the only measurable environmental benefit offered by backfilling the Category 1 Stockpile into the West Pit. However, because of the temporal effect that the stockpile would have, those effects would be required to be mitigated regardless of future backfilling or not. Furthermore, the potential environmental benefit is moot or outweighed because encumbrance is not allowed in PolyMet's private mineral leases and because the costs associated with backfilling may affect the ability of PolyMet to secure financing and thus render it economically infeasible (USACE, et al. 2013). As such, the option to backfill the West Pit was eliminated from further consideration in the SDEIS.

### 3.2.3.5 Identification of New Alternatives

Following the receipt of PolyMet's NorthMet Project Proposed Action for the SDEIS, the Co-lead Agencies considered whether there were any new or different alternatives to those previously considered that should be evaluated in the SDEIS. No reasonable alternatives that would potentially offer substantial environmental benefits compared to the NorthMet Project Proposed Action were identified.

***Table 3.2-17 Previous NorthMet Project Alternatives Screened for the SDEIS***

| Reference[1] | Alternative | Previous Screening Outcome | SDEIS Screening Outcome |
|---|---|---|---|
| | DEIS Proposed Action | Analyzed in the DEIS | Partially incorporated into the SDEIS NorthMet Project Proposed Action, with improved waste rock and water management and further refined through identification of improved mitigation measures such as the full bentonite amendment cover for the Tailings Basin |
| | DEIS Mine Site Alternative | | |
| | DEIS Tailings Basin Alternative | | |
| TB1 | Wet Tailings Basin cover at closure using a bentonite beach, side slope and pond amendment | Analyzed since the DEIS | |

| Reference[1] | Alternative | Previous Screening Outcome | SDEIS Screening Outcome |
|---|---|---|---|
| E18 | Use of low sulfur waste rock as construction material | Eliminated in the DEIS | Partially incorporated into the SDEIS NorthMet Project Proposed Action. Category 1 waste rock may be used if approved by the MDNR in circumstances where contact water is controlled and treated. |
| E7 | Underground mining the NorthMet Deposit (Underground Mining Alternative) | Eliminated in the DEIS | Continues to be eliminated. Reconsidered but not economically feasible. Refer to Underground Mining Alternative in Section 3.2.3.4 and Appendix B for more information. |
| E20 | Disposal of waste rock and/or tailings in the West Pit (West Pit Backfill) | Eliminated in the DEIS | Continues to be eliminated. Reconsidered but would not offer substantial environmental benefit. Refer to West Pit Backfill in Section 3.2.3.4. |
| E3 | Alternative mine pit location | Eliminated in Final Scoping Decision Document | Continues to be eliminated. No changes to the project design affect these alternatives. |
| E12, E13 | Alternative ore transport (conveyors vs. trucks) | | |
| E21 | Smaller mine and ore processing facility | | |
| E4 | Alternative Processing Plant site location | | |
| E8 | Other hydrometallurgical technologies | | |
| E10 | Process the Category 3 and 4 lean ore and waste rock through the Processing Plant | | |
| E9 | Concentrate-only operations mode | | |
| E11 | Alternative designs and layouts for the ore processing plant | | |
| E1 | Off-site non-reactive waste rock disposal | Eliminated in the DEIS | |
| E2 | Off-site, subaqueous in-pit disposal of reactive waste rock | | |
| E6 | Off-site subaqueous in-pit co-disposal of reactive waste rock/tailings/ overburden | | |
| E5 | Off-site subaqueous in-pit tailings disposal | | |

| Reference[1] | Alternative | Previous Screening Outcome | SDEIS Screening Outcome |
|---|---|---|---|
| E14 | Co-disposal of reactive waste rock and tailings on a lined tailing basin | | |
| E17 | Use of Mine Site reactive runoff as make-up water for Processing Plant with a single wastewater treatment at the Processing Plant | | |
| E15 | Pretreatment of Mine Site reactive runoff and discharge to Babbitt or Hoyt Lakes POTW | | |
| E16 | Pretreatment of Tailings Basin process water and discharge to the City of Hoyt Lakes POTW | | |
| E19 | Use non-contact stormwater from detention pond at Mine Site as process water | | |
| TB2 | Wet Tailings Basin cover at closure using a bentonite side slope and pond amendment | Analyzed since the DEIS | These alternatives were reconsidered and continue to be eliminated since they do not afford meaningful environmental benefits compared to the enhanced engineering controls (seepage collection and reverse-osmosis mechanical water treatment) built into the NorthMet Project Proposed Action. Further, dry cap seepage is predicted to result in substantially higher concentrations which would make the future transition from mechanical (RO) to non-mechanical (biological) water treatment more difficult during post-closure. |
| TB3 | Wet Tailings Basin cover at closure using a bentonite beach and pond amendment | | |
| TB4 | Dry Tailings Basin cover at closure using a surface bentonite amendment | | |
| TB5 | Dry Tailings Basin cover at closure using a geomembrane | | |
| TB6 | Dry Tailings Basin cover at closure using a geosynthetic clay liner | | |

[1] "E" alternatives are from Table 3.2-4 in the DEIS, "TB" options are from ERM 2010.

Per MEPA rules, projects must consider five types of alternatives and determine which activities would address those alternatives. Table 3.2-18 below identifies which alternatives considered addressed the five MEPA alternative types.

*Table 3.2-18 MEPA Alternatives Types Considered for the NorthMet Project Proposed Action*

| NorthMet Project Activity[1] | Alternative Sites | Alternative Technology | Modified Designs or Layouts | Modified Scale or Magnitude | Alternatives Incorporating Reasonable Mitigation Measures |
|---|---|---|---|---|---|
| Mining | E3 | E7, E13 | | E21 | |
| Waste Rock Management | E1,E2, E6 | | E10, E14, E18, E20 | | DEIS Mine Site Alternative |
| Mine Site Processing Plant Water Management | | | E15, E17, E19 | | |
| Transportation and Utility Corridor | | E12 | | | |
| Processing and Plant Site Water Management | E4 | E8, E9 | E11, E16 | | |
| Tailings Management | E15, E5 | | TB1,TB2, TB3, TB4, TB5, TB6 | | DEIS Tailings Basin Alternative |

[1] For further information see Table 3.2-17.

## 3.3 LAND EXCHANGE PROPOSED ACTION DETAILED DESCRIPTION

### 3.3.1 Overview

The Land Exchange Proposed Action would involve exchange of a single 6,650-acre (GLO) tract of federal land (encompassing most of the NorthMet Project Mine Site) for up to approximately 6,722 acres (GLO) of privately owned, non-federal lands located within five different tracts throughout the proclamation boundary of the Superior National Forest within St. Louis, Lake, and Cook counties of northeastern Minnesota.

Several alternatives to the Land Exchange Proposed Action were identified and screened through scoping in 2010. The following alternatives are evaluated in detail in this SDEIS:

- Land Exchange No Action Alternative, under which no land exchange would occur; and
- Land Exchange Alternative B, under which a smaller amount of federal lands would be exchanged for the NorthMet mine activities instead of the 6,650 acres (GLO) of federal lands proposed.

A summary of the Land Exchange Proposed Action, Land Exchange Alternative B, and the No Action Alternative is provided in Table 3.3-1.

The Land Exchange Proposed Action is a connected action to the NorthMet Project Proposed Action. As such, it is unlikely that the Land Exchange Proposed Action would proceed without the NorthMet Project Proposed Action.

***Table 3.3-1 Summary of the Land Exchange Proposed Action Alternatives***

| Project Component | Location and Existing Land Use | Land Exchange Proposed Action | Land Exchange Alternative B | No Action Alternative |
|---|---|---|---|---|
| Federal land | Undeveloped federal land located 0.5 miles south of the Northshore Mine<br><br>Surface lands are federally owned<br><br>Mineral rights are privately held | Exchange approximately 6,650 acres (GLO) of federal lands to private ownership (PolyMet) | Exchange a smaller amount of federal lands (approximately 4,901 acres (GLO)) | No Land Exchange<br>Current public land would remain under USFS management |
| Non-federal land | Predominantly forest and wetland habitat<br><br>Spread throughout the proclamation boundary of the Superior National Forest<br><br>St. Louis, Lake, and Cook Counties | Exchange consists of up to 6,722 acres (GLO) from private to federal ownership<br><br>Consists of up to five non-federal land tracts of land | Approximately 4,652 acres (GLO) of non-federal lands in one tract (Tract 1) | No Land Exchange<br>Current non-federal lands would remain under private ownership |

## *3.3.2 Land Exchange Proposed Action*

The Land Exchange Proposed Action would occur between the USFS, as the manager of the federal lands, and PolyMet, as the owner of the non-federal lands. The key characteristics of the Land Exchange Proposed Action are highlighted in Table 3.3-2, shown on Figure 3.3-1, and discussed in the following sections.

GLO acres represent the acreages associated with the legal descriptions of the parcels based on original surveys performed by the GLO. As such, GLO acreages are being used as part of the project description and would also be used to define the real estate transaction if the Land Exchange Proposed Action was approved. Analysis of effects presented in the subsequent sections, based upon GIS data, indicates the actual size of the Land Exchange Proposed Action parcels may be different than the GLO acreage.

***Table 3.3-2 Legal Description and Acreage of Parcels Included in the Land Exchange Proposed Action***

| Tract | Parcel Name | Legal Description (4th P.M.) | Total Acres (GLO) | Total Acres (GIS, for Analysis Purposes) |
|---|---|---|---|---|
| **Federal lands** | | T.60N., R13W (Secs. 33-35)<br>T.59N, R.13W (Secs. 1-6)<br>T.59N, R.12W (Sec. 6)<br>T.59N, R.13W (Secs. 7-12)<br>T.59N, R.12W (Sec. 7)<br>T.59N, R.13W (Secs. 17, 18) | 6,650.0 | 6,495.4 |
| **Non-federal lands** | | | 6,722.4 | 7,075.0 |
| Tract 1 | Hay Lake Lands | T.59N, R.16W (Secs. 9, 16, 19, 20-22, 27-33) | 4,651.5 | 4,926.3 |
| Tract 2 | Lake County North | T.57N, R.12W (Secs. 5, 6) | 199.4 | 265.0 |
| | Lake County South | T.56N, R.9W (Sec. 17) | 120.0 | 116.9 |
| Tract 3 | Wolf Lands 1 | T.57N, R.11W (Sec. 8) | 120.0 | 125.8 |
| | Wolf Lands 2 | T.58N, R.10W (Secs. 10, 14, 15, 22, 23) | 760.0 | 767.9 |
| | Wolf Lands 3 | T.59N, R.9W (Secs. 30, 31) | 279.4 | 277.4 |
| | Wolf Lands 4 | T.59N, R.9W (Secs. 7, 8, 17, 18) | 400.0 | 404.7 |
| Tract 4 | Hunting Club Lands | T.66N, R.17W (Sec. 7) | 160.0 | 160.2 |
| Tract 5 | McFarland Lake Lands | T.64N, R.3W (Sec. 9) | 32.1 | 30.8 |

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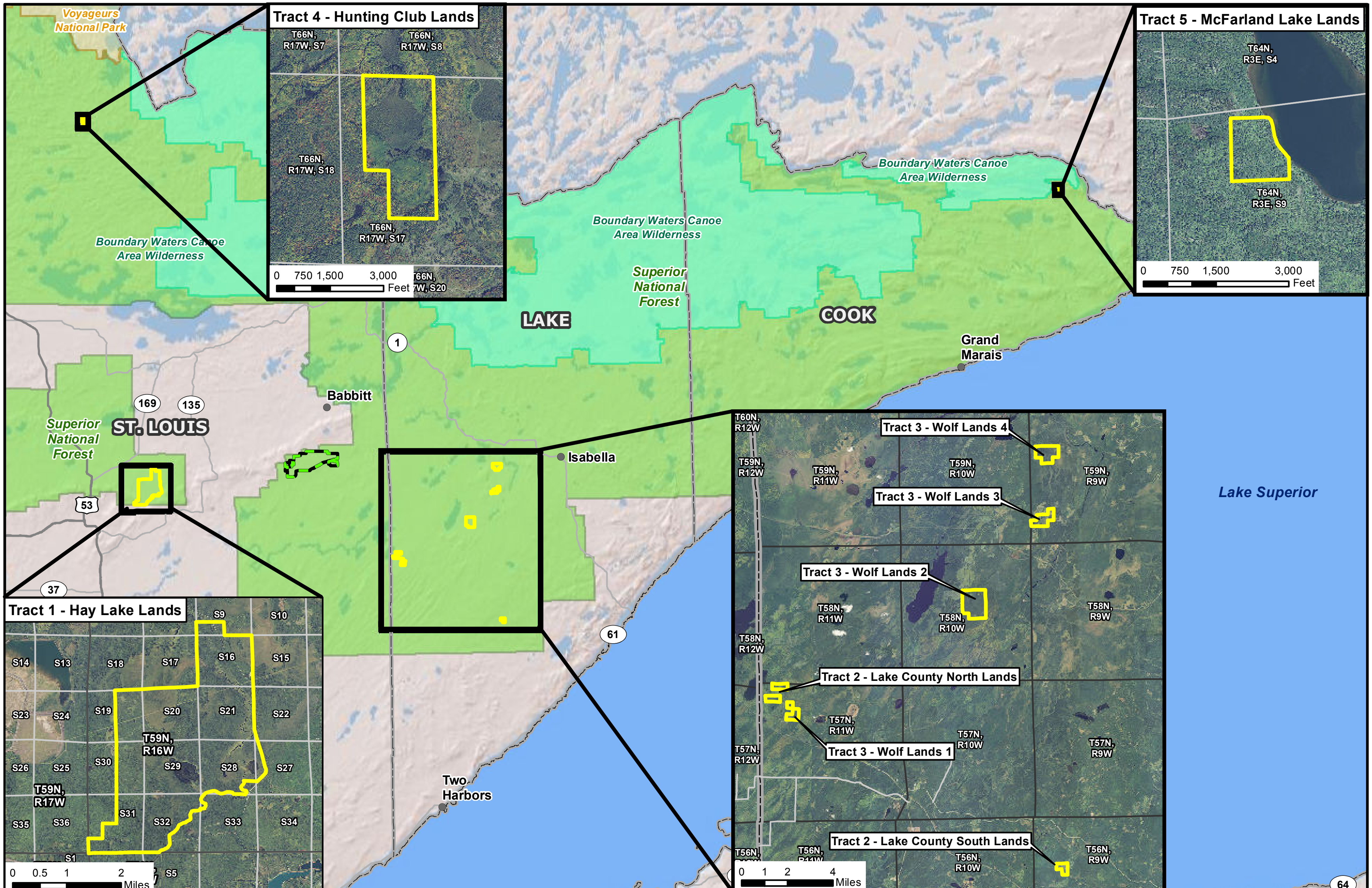


Federal Lands

Non-federal Lands

Boundary Waters Canoe Area Wilderness

National Forest

This PSDEIS document is a Co-lead Agency provisional draft intended for internal review only. Corrections, revisions, and changes will be made prior to the release of the SDEIS for public review and comment.

N W E S

0 2 4 8 Miles

**Figure 3.3-1**

**Land Exchange Proposed Action Parcels**

NorthMet Mining Project and Land Exchange PSDEIS

Minnesota

**DRAFT SUBJECT TO REVISION**

April 2013

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### 3.3.2.1 Federal Lands Proposed for Exchange

The federal lands proposed for the Land Exchange Proposed Action are a single contiguous area of approximately 6,650 acres (GLO) of land located within the western/central part of the Superior National Forest, approximately 6 miles to the south of Babbitt in St. Louis County, Minnesota. The federal lands are located in Township 59 North, Range 12 West, Sections 1-12, 17, and 18; Township 59 North, Range 13 West, Sections 6 and 7; and Township 60 North, Range 13 West, Sections 33, 34, and 35 (Table 3.3-2 and Figure 3.3-1).

The federal lands encompass many acres of the One Hundred Mile Swamp, a large black spruce, tamarack, and cedar wetland, and also contain Mud Lake. Yelp Creek and the Partridge River also flow through the property.

The federal lands are located within the historic Mesabi Iron Range and are surrounded by privately held land used for mining and other industrial purposes. The federal lands lie immediately south of the Superior National Forest proclamation boundary and are bounded on the south by the former LTVSMC railroad and Dunka Road, which are NorthMet Project area roads. Access to the federal lands is primarily via Dunka Road and the former LTVSMC railroad. Privately owned properties to the north and west of the federal lands have been extensively affected over the years by surface mining, including mine pits, waste rock stockpiles, Tailings Basins, processing facilities, railroad grades, and other general mining activities. There is a 115-acre block of privately owned land located within the northwestern portion of the federal lands that is not part of the Land Exchange Proposed Action.

Most mineral rights within the federal lands are privately held apart from 181 acres of mineral rights on scattered parcels located outside and to the southeast of the NorthMet Project Proposed Action mine pits (Figure 3.2-3). The USFS would reserve ownership of these mineral rights.

### 3.3.2.2 Non-federal Lands Proposed for Exchange

The Land Exchange Proposed Action includes five tracts of non-federal lands in St. Louis, Lake, and Cook Counties that contain approximately 6,722 acres (GLO); however, the final exchange, if approved, could include fewer than 6,722 acres (GLO) of non-federal land depending on the results of the environmental analysis and real estate appraisals (Table 3.3-2). As shown in Figure 3.3-1, all of the lands proposed for exchange are located within the 1854 Treaty Ceded Territory of northeastern Minnesota.

PolyMet currently owns a portion of the non-federal lands proposed for exchange; however, all rights, titles, and interests of the remaining non-federal lands proposed for exchange have been assigned to PolyMet.

There are no activities proposed on the non-federal lands as part of the Land Exchange Proposed Action. The non-federal lands would be incorporated with adjacent federal ownership and managed in accordance with the Forest Plan for that particular management area. Management areas provide context within which the USFS makes implementation decisions (described through desired conditions, objectives, standards, and guidelines) for an area of common direction. The majority (86 percent) of the non-federal lands would be allocated to the General Forest Management Area, with the balance of the lands allocated to General Forest – Longer Rotation (7 percent), cRNAs (4 percent), and Riparian Emphasis Areas (3 percent). More information on Management Areas is presented in Chapters 4 and 5. Details of the tracts are summarized below.

#### 3.3.2.2.1 Tract 1 – Hay Lake Lands

Tract 1 – Hay Lake Lands (Tract 1) is the largest tract of non-federal lands consisting of approximately 4,652 acres (GLO) within St. Louis County. Tract 1 consists of a single area of land located within the southeastern portion of the Superior National Forest (Laurentian Ranger District) proclamation boundary west of and adjoining County Road 715 and north of the town of Biwabik (Figure 3.3-1). Access to the tract is available along the eastern edge via Country Road 715, although access to the interior is generally limited by vegetation.

PolyMet is the owner of Tract 1, with the tract subject to a mortgage in favor of Iron Range Resources, which would have to be satisfied at closing of the Land Exchange Proposed Action.

#### 3.3.2.2.2 Tract 2 – Lake County Lands

Tract 2 – Lake County Lands (Tract 2) consists of approximately 319 acres (GLO) of land made up of four distinct parcels of lands within Lake County, Minnesota, formerly owned by Lake County (3.3-1). The three northern parcels are referred to as Lake County North and the southern parcel is referred to as Lake County South. Tract 2 includes various 40-acre parcels within the Superior National Forest (Laurentian and Tofte Ranger Districts) proclamation boundary southeast of Seven Beaver Lake that are mostly surrounded by lands managed by the Superior National Forest and other wetland habitats.

The Tract 2 parcels are tax forfeit lands being purchased in the name of Lake-Forest Enterprise, Inc. on a land contract from Lake County. There is an assignment on file with Andresen and Butterworth, PA which assigns all right, title, and interest in these lands to PolyMet.

#### 3.3.2.2.3 Tract 3 – Wolf Lands

Tract 3 – Wolf Lands (Tract 3) consists of approximately 1,559 acres (GLO) of land made up of four distinct parcels of land within Lake County, Minnesota (Figure 3.3-1). Tract 3 lands are located within the Laurentian and Tofte Ranger Districts, west and southwest of Isabella and are referred to as Wolf Lands 1, Wolf Lands 2, Wolf Lands 3, and Wolf Lands 4. The four parcels would block in or complement Superior National Forest ownership and offer wetland habitat.

The Tract 3 parcels are being purchased in the name of Lake-Forest Enterprise, Inc., through options from Wolf Lands, Inc. There is an assignment on file with Andresen and Butterworth, PA which assigns all right, title, and interest in these lands to PolyMet.

#### 3.3.2.2.4 Tract 4 – Hunting Club Lands

Tract 4 – Hunting Club Lands (Tract 4) is a single parcel of approximately 160 acres (GLO) of land within St. Louis County, surrounded by Superior National Forest-managed lands and is within the LaCroix Ranger District, approximately 5 miles southwest of Crane Lake (Figure 3.3-1). Two small, unnamed lakes are partially included in the tract, as well as a high percentage of wetland habitats.

PolyMet is the owner of Tract 4 and the parcel is not subject to any financing.

#### 3.3.2.2.5 Tract 5 – McFarland Lake Lands

Tract 5 – McFarland Lake Lands (Tract 5) is a single parcel of land, approximately 32 acres (GLO) in size within the Gunflint Ranger District in northeastern Cook County (Figure 3.3-1).

The tract includes blocks in Superior National Forest ownership and includes lakefront property on McFarland Lake, an entry point to the BWCAW. Access to the property is available by water from a landing off County Road 16 (Arrowhead Trail), approximately 10 miles north of Hovland. The tract is not developed apart from a 20- by 40-ft wood-frame bunkhouse and outhouse that would be removed prior to finalizing the real estate transaction of the Land Exchange Proposed Action.

PolyMet is the owner of Tract 5, with the tract subject to a mortgage in favor of the Iron Range Resources, which would have to be satisfied at closing of the Land Exchange Proposed Action.

## *3.3.3 Land Exchange Proposed Action Alternatives*

The Land Exchange Proposed Action and alternatives were developed initially through scoping (refer to Chapter 2 for more information). Public comments received in response to the scoping of the Land Exchange Proposed Action provided suggestions for alternative methods for achieving the Purpose and Need for the Land Exchange Proposed Action. Some of these alternatives may have been outside the scope of eliminating the management conflict between the United States and the private mineral estate. In addition, the alternatives may have been duplicative of the alternatives considered in detail, or may have been determined to be components that would cause unnecessary environmental harm.

Two alternatives to the Land Exchange Proposed Action; the Land Exchange No Action Alternative and Land Exchange Alternative B, are evaluated in detail in the SDEIS. Other alternatives considered were eliminated from further analysis because they did not meet the screening criteria. These are both discussed below.

### 3.3.3.1 Land Exchange No Action Alternative

As stated previously, NEPA requires that the No Action Alternative be evaluated; in this case, this alternative means that the Land Exchange Proposed Action would not take place. Therefore, the environmental effects resulting from taking no action are compared to the effects of permitting the Land Exchange Proposed Action and alternatives to the Land Exchange Proposed Action. Under the Land Exchange No Action Alternative, no lands would be exchanged.

The federal government would not convey federal lands to PolyMet and the USFS would continue managing these lands as has been done in the past. The level of development and acceptable activities would be regulated by USFS and Superior National Forest policies. Management would include vegetation management, mineral exploration, recreation, wildlife, watershed, and other uses identified in the Forest Plan. These lands are in General Forest – Longer Rotation and the General Forest Management Areas. Furthermore, the federal government would not acquire the five tracts of non-federal lands and the lands would remain as private lands under the Land Exchange No Action Alternative.

### 3.3.3.2 Land Exchange Alternative B

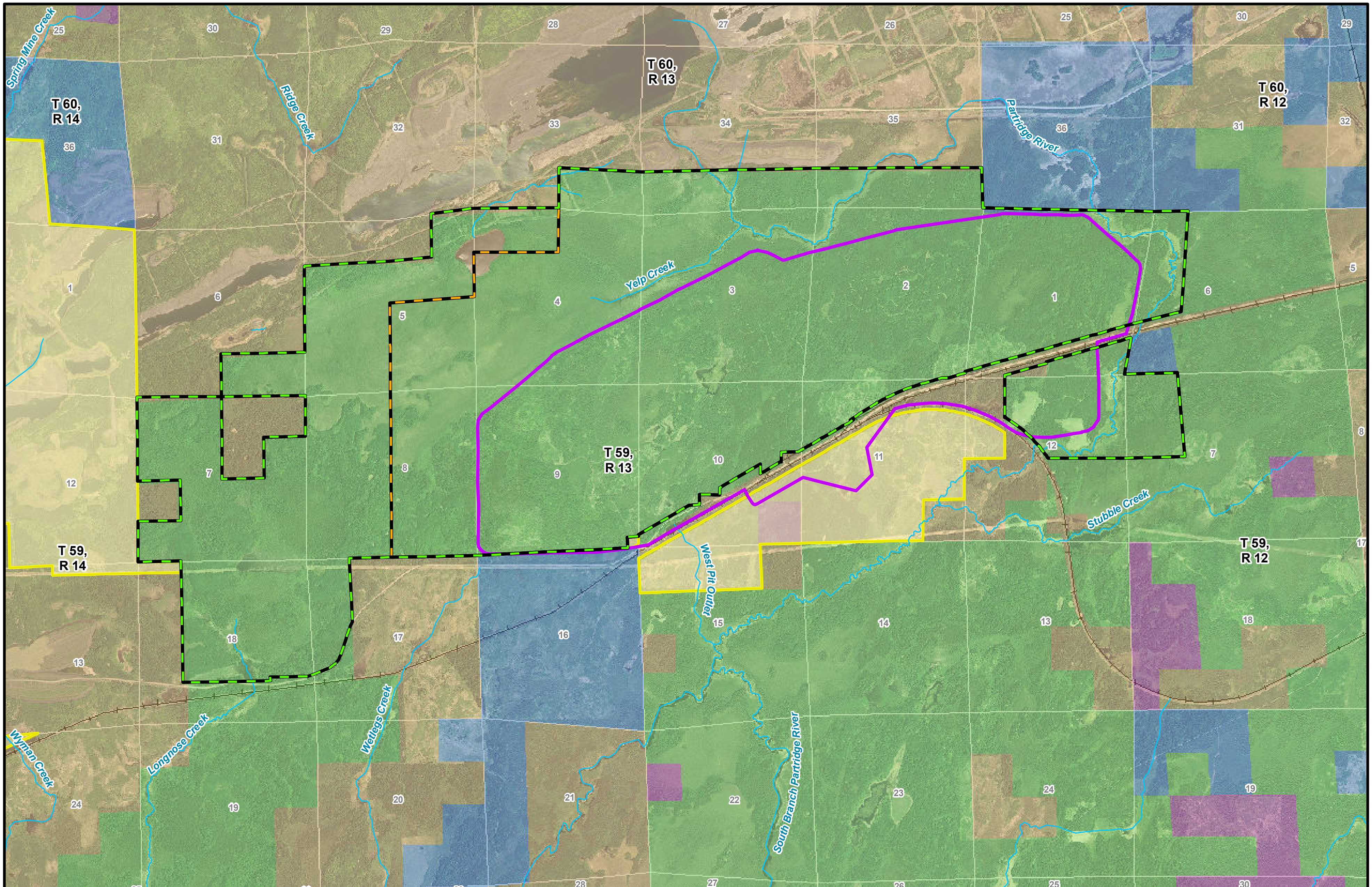
Land Exchange Alternative B was derived from the Mine Site Exchange Only Alternative (refer to Section 3.3.3.3) that was developed to address concerns raised during scoping. This alternative would convey fewer acres of federal lands for fewer acres of non-federal land.

Land exchanges are based on equal value; consequently, because there would be fewer federal acres available to be conveyed, there would likely be fewer acres of private land that would be acquired. The federal government would convey approximately 4,901 acres (GLO) of federal lands to PolyMet, and the USFS would no longer manage these lands. The federal government would acquire approximately 4,652 acres (GLO) of non-federal lands in one parcel, Tract 1. Tract 1 was selected for this alternative for the following reasons:

- it would be almost equal in size to the smaller federal parcel;
- it would provide wetlands; and
- it is likely that Tract 1 would have a higher per-acre value than the smaller federal parcel because of its access to a county road and its potential for riparian lots.

The configuration of the smaller federal parcel is considered the smallest the boundary can be while still meeting the underlying Purpose and Need for the Land Exchange (Figure 3.3-2). Under this alternative, a small parcel to the west of the Mine Site would remain under federal ownership. This remaining federal tract would become an isolated piece of federal land with limited or difficult access through private property (Figure 3.3-2). As for the Land Exchange Proposed Action, the USFS would reserve ownership of 181 acres of mineral rights on scattered parcels in the federal lands. These minerals are located outside of the NorthMet Project Proposed Action mine pits.

The environmental consequences of Land Exchange Alternative B are evaluated throughout the following chapters of this SDEIS.




Federal Lands

Alternative B: Smaller Federal Parcel

Mine Site

Stream/River

Section Label

National Forest Ownership

County Ownership

State of Minnesota Ownership

Other Ownership

PolyMet Owned/Leased Area

This PSDEIS document is a Co-lead Agency provisional draft intended for internal review only. Corrections, revisions, and changes will be made prior to the release of the SDEIS for public review and comment.

N W E S

0 0.25 0.5 1 Miles

US Army Corps of Engineers St. Paul District

**Figure 3.3-2**

**Land Exchange Alternative B: Smaller Federal Parcel**

NorthMet Mining Project and Land Exchange PSDEIS

Minnesota

**DRAFT SUBJECT TO REVISION**

April 2013

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### 3.3.3.3 Alternatives Considered but Eliminated from Detailed Analysis

The following alternatives were considered by the interdisciplinary team, but have been dropped from further consideration because the proposals could not be acted upon at this time, were represented in the alternatives analyzed in detail, or did not meet the Purpose and Need.

#### 3.3.3.3.1 Purchase Alternative

The alternative involving the purchase of the non-federal property in lieu of acquiring the property in a land exchange was evaluated. The purchase of the non-federal property would not meet the Purpose and Need of the NorthMet Project Proposed Action as PolyMet would not be able to obtain the federal property under such a scenario. Therefore this alternative was eliminated from further consideration.

#### 3.3.3.3.2 Single Contiguous Parcel

PolyMet's assemblage of land for the exchange was based on a number of criteria provided by the USFS prior to the development of the feasibility analysis. The acquisition of a single contiguous non-federal parcel was not one of the priority criteria, and PolyMet was not able to identify any single large tracts of land for sale. As such, this alternative was eliminated from further consideration.

#### 3.3.3.3.3 Other Non-federal Lands

The exchange of the federal lands for multiple non-federal parcels that have wetlands and habitat more similar to the federal lands than the proposed non-federal lands was eliminated from detailed consideration for several reasons. The USFS is not required under EO 11990 to exchange habitats and/or wetlands of similar type and/or quality of lands. Since the Land Exchange Proposed Action strove to match like acres with like acres (including similar wetlands and similar habitat types) to the extent possible with lands that were available for acquisition, another alternative that would also strive to match wetlands and habitats, to the extent possible, would not be likely to meaningfully add to the range of alternatives considered. Therefore, this alternative was dismissed from detailed analysis, as the Land Exchange Proposed Action is already striving to be as similar as possible to the federal lands' habitat.

#### 3.3.3.3.4 Mine Site Exchange Only

The Mine Site exchange-only alternative would have conveyed fewer acres of federal lands to address comments raised during the scoping period. Under this alternative, the federal government would have conveyed only the federal land (2,719 of the 3,015 acres) that would actually be used for the NorthMet Project Proposed Action.

Land exchanges are based on equal (monetary) value; consequently, because there would have been fewer federal acres available to be conveyed, there would have likely been fewer acres of private land that could have been acquired. Environmental assessment of the NorthMet Project Proposed Action identified the potential for air quality effects at the indicative Mine Site boundary. As such, this Land Exchange alternative was not considered to offer environmental benefits over the Land Exchange Proposed Action, given the potential for air quality non-compliance at the boundary of the Land Exchange and Mine Site. A larger land exchange area would mitigate potential air quality issues; consequently, this alternative was eliminated from further consideration and modified to Land Exchange Alternative B described in Section 3.3.3.2 and further evaluated in the SDEIS.

#### 3.3.3.3.5 Full Exchange with Restrictions

Consistent with the Land Exchange Proposed Action, under this alternative, the federal government would have conveyed the entire federal tract (6,498 acres); however, use restrictions would have been placed on a portion of the conveyed lands.

This alternative was initially developed by the USFS during the 2009 Feasibility Analysis to compensate for a wetland imbalance when only Tract 1 and Tract 5 were being proposed by the applicant as part of the Land Exchange Proposed Action. This imbalance has since been resolved through the addition of Tracts 2, 3, and 4 to the Land Exchange Proposed Action. Furthermore, this alternative is not substantially different from Alternative B, where the smaller federal parcel exchange would have been protective of the One Hundred Mile Swamp. Therefore, this alternative was eliminated from detailed analysis as it would have had substantially similar effects to alternatives already analyzed.

#### 3.3.3.3.6 Underground Mining Alternative

The potential for an underground mine to be developed on federal lands (through permitting) instead of the proposed surface mining was raised by public comment through both the land exchange scoping process and the DEIS comment period. Commenters suggested that a land exchange would not be needed if underground mining was proposed for the NorthMet Deposit.

Underground mining was eliminated as an alternative to the NorthMet Project Proposed Action (refer to Section 3.2.3.4) because it was found to be economically infeasible. Consequently, it is also not a reasonable alternative to the Land Exchange Proposed Action.