ENVIRONMENTAL ASSESSMENT WORKSHEET

The Environmental Assessment Worksheet provides information about a project that may have the potential for significant environmental effects. The EAW is prepared by the Responsible Governmental Unit or its agents to determine whether an Environmental Impact Statement should be prepared. The project proposer must supply any reasonably accessible data for — but should not complete — the final worksheet. If a complete answer does not fit in the space allotted, attach additional sheets as necessary. The complete question as well as the answer must be included if the EAW is prepared electronically.

Note to reviewers: Comments must be submitted to the RGU during the 30-day comment period following notice of the EAW in the *EQB Monitor*. Comments should address the accuracy and completeness of information, potential impacts that warrant further investigation and the need for an EIS.

1. **Project title**: NorthMet Mine and Ore Processing Facilities

2.	**Proposer:**	PolyMet Mining Inc.	3.	**RGU**	**Minnesota Dept. of Natural Resources**
	Contact person:	Jim Scott		**Contact person**	Randall Doneen
	Title:	Assistant Project Manager		**Title**	Principal Planner
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4. **Reason for EAW preparation** (check one)

EIS scoping X Mandatory EAW ___ Citizen petition ___ RGU discretion ___ Proposer volunteered ___

If EAW or EIS is mandatory give EQB rule category subpart number and subpart name.

4410.4400 Subpart 8b. Subpart Name: Construction of a new facility for mining metallic minerals.

5. **Project location**

County: St. Louis

City/Township: Mining Area: Approx. 6 mi. south of Babbitt
Ore Processing Facility and Shops: Approx. 5 mi. north of Hoyt Lakes

Mining Area:

Parts of Sections 1, 2, 3, 4, 9, 10, 11, and 12, Township 59 North, Range 13 West

Railroad:

Parts of Sections 10, 16, 17, and 18, Township 59 North, Range 13 West

Parts of Sections 9, 13, 14, 15, 16, 23, and 24, Township 59 North, Range 14 West

Ore Processing Facility and Shops:

Parts of Sections 3, 4, 5, 8, 9, 10, and 16, Township 59 North, Range 14 West

Tailings Basin:

Parts of Sections 3, 4, 5, 8, 9, 10, and 16, Township 59 North, Range 14 West

Parts of Sections 32, 33, and 34, Township 60 North, Range 14 West

Attach each of the following to the EAW:

- County map showing the general location of the project; - See Figure 5-1
- U.S. Geological Survey 7.5 minute, 1:24,000 scale map indicating project boundaries (photocopy acceptable); - See Figure 5-2
- Site plan showing all significant project and natural features. See Figure 5-3 (Mine and Stockpiles), Figure 5-4 (Plant Site Layout), Figure 5-5 (Tailings Basin Modifications), Figure 5-6 (Area 1 Shops) and Figure 5-7 (Railroad Modifications)

6. **Description**

a. **Provide a project summary of 50 words or less to be published in the *EQB Monitor.***

PolyMet Mining Inc. proposes an open pit mine to extract a low-grade mineral deposit near Babbitt MN. An existing railroad will be used to haul ore to the existing Cliffs Erie processing facility (currently idled) where it will be crushed and concentrated to extract copper, nickel, cobalt and precious metals by dissolution and precipitation.

b. Give a complete description of the proposed project and related new construction. Attach additional sheets as necessary. Emphasize construction, operation methods and features that will cause physical manipulation of the environment or will produce wastes. Include modifications to existing equipment or industrial processes and significant demolition, removal or remodeling of existing structures. Indicate the timing and duration of construction activities.

PROJECT OVERVIEW

This section provides a project overview provided by PolyMet Mining Inc. (PolyMet). It is a plan that will be modified as information from various studies is developed during the EIS. For the EAW, PolyMet used a conservative approach in sizing the operation. As the ore body and mine model are refined, new estimates will be available and incorporated into the EIS. By using maximum values for the evaluation, the maximum impacts can be addressed.

PolyMet plans to excavate and process the low-grade disseminated sulfide mineral deposit (NorthMet deposit) in northeastern Minnesota. The NorthMet deposit is approximately 6 miles south of the town of Babbitt and about 2 miles south of the operating Northshore Mining Company (NMC) taconite open pit. Ore processing and tailings disposal would occur at the currently inactive Cliffs Erie taconite processing facility and the adjoining tailings basin, which are situated about 8 miles west of the NorthMet deposit and about 5 miles north of the town of Hoyt Lakes. This mining and processing effort, designated the NorthMet Project, would utilize a hydrometallurgical process for extracting copper, nickel, palladium, platinum, cobalt and gold from the ore.

Project plans call for the excavation of up to 32,000 tons of ore per day, using open-pit mining methods after overburden and waste rock stripping and stockpiling. Ore would be transported from the mine site to the processing plant on a largely existing railroad. A refurbished and modified Cliffs Erie processing plant is proposed to process the ore. Flotation tailings and reactive residue from ore processing would be disposed of on top of the existing Cliffs Erie taconite tailings basin. The idled processing plant and existing tailings basin where owned and operated by L-T-V Steel Mining Company (LTVSMC) prior to being purchased by Cliffs Erie. Mining operations - including stripping and stockpiling, drilling, blasting, loading, hauling, and processing of the ore – are expected to be conducted 24 hours per day, 365 days per year, over the 20-year life of the project.

Cathode copper (high purity metal) would be produced onsite by solvent extraction and electrowinning. The processing would produce other metals (nickel, cobalt, palladium, platinum, and gold) as precipitates rather than as finished metal. These precipitates would be shipped offsite for further refining. Processing would also result in the production of carbon dioxide and gypsum. A market may be found for both of these processing byproducts.

Total workforce at the project is expected to be between 490 and 600 jobs. Staffing levels are still preliminary and would depend on decisions to be made in the feasibility study and final design.

PolyMet is in the process of completing several studies that will be used to further refine the project and assist in development of the EIS. These studies include:

- A pilot process evaluation of the deposit that will use an approximately 40 ton bulk sample generated from diamond drilling to better define the end product, tailings and reactive residues.
- A waste characterization plan to define better reactive and non-reactive waste rock, tailings, and hydrometallurgical residues as well as the constituents of reactive mine drainage.
- A definitive feasibility study that will be used to further refine the mine process, mine plan and engineering to finalize capital and operating costs.
- A hydrology study that will be used to develop a project water balance and watershed model.

MINE AND STOCKPILES

PROJECT GEOLOGY

The NorthMet deposit is located within the Duluth Complex of northeastern Minnesota (see Figure 6-1). The Complex is a large, composite, grossly layered, mafic intrusion that was emplaced into comagmatic flood basalts along a portion of the Middle Proterozoic Midcontinent Rift System. The NorthMet deposit is situated along the western edge of the Complex within the Partridge River intrusion, which consists of varied troctolitic and gabbroic rock types that have been subdivided into a least seven igneous stratigraphic units by cataloging drill core. All of these igneous units, which are described below, exhibit shallow dips (10º-25º) to the south-southeast.

The regional and local geology are well known. There are over 1,000 exploration drill holes on this part of the Complex, and nearly 800,000 feet of core have been re-logged in the past fifteen years by a small group of company and university research geologists. Following is a composite description of the units in the NorthMet area, from the base to top:

Unit 1: Consists of a heterogeneous mixture of troctolitic to gabbroic rocks, with abundant inclusions of sedimentary hornfels footwall rocks and lesser discontinuous layers of ultramafic rock. Unit 1 is the dominant sulfide-bearing member in the NorthMet deposit. At least three platinum group element ("PGE") enriched "stratabound" layers are present within Unit 1, the uppermost of which has the highest concentrations of PGE. Unit 1 is 200 feet to 1000 feet thick, averaging 450 feet.

Unit 2:	Consists of homogenous troctolitic rocks, with minor sulfide mineralization, and a fairly persistent basal ultramafic layer that separates Unit 2 from Unit 1. Unit 2 averages about 200 feet thick.
Unit 3:	Consists of a fine-grained, poikolitic, anorthositic troctolite. Unit 3 is the major marker bed within the deposit due to its fine-grained nature and the presence of distinctive olivine oikocrysts that give the rock a mottled appearance. Unit 3 contains little or no persistent mineralization and averages 250 feet thick.
Unit 4:	Consists of homogenous ophitic augite troctolite with a local ultramafic layer at, or near, the base of the unit. There is little or no persistent mineralization in this unit and it averages about 300 feet thick.
Units 5, 6, and 7:	Consist of homogenous anorthositic troctolite grading to ophitic augite troctolite; units 6 and 7 have persistent ultramafic bases. There is little or no persistent economic sulfide mineralization except for a small horizon in six drill holes in Unit 6. These generally unmineralized units average about 1,200 feet in thickness, but because the top of Unit 7 has not been seen in drill core, this figure is probably a minimum. At the top of unit 6 is a mineralized zone which has the highest Cu and PGE (0.7% Cu, 1.5 ppm Pt + Pd; average thickness 25 ft) values for the deposit.

The footwall rock at NorthMet is the sedimentary Lower Proterozoic (1.8 Ga) Virginia Formation that is underlain by the Biwabik Iron-Formation. The Biwabik is the footwall to the deposit in only a few drill holes and should not be intersected in mining operations. The Virginia Formation may be mined for pit construction and encountered as inclusions in Unit 1, but contains no economic minerals.

There is little surface outcrop over the deposit. Unit 1 (at the base) is the most consistently mineralized unit ("mineralized" means containing minerals which contain metals of interest to the project) and constitutes the main ore horizon. The other units are less consistently mineralized. Mineralization is in the form of zones of disseminated copper-nickel-iron sulfides. These mineralized zones are throughout Unit 1 and irregularly distributed in the upper units. Definition of ore will be driven by assayed metal values, not by geologic definition; many of the discrete zones or "pods" of sulfide mineralization in the upper units will prove to be economic and be mined as ore; if not, they will be mined and stockpiled as lean ore or as reactive waste. Thus, geologic definition is very important in defining deposit genesis and geometry, but not in day to day mining practice, which will be assay driven**.** Assays show that about 11% of the material that is inside the twenty year pit shell and is in units 2-7 is classified as ore by metals value. Cross-sections, comparisons between closer spaced holes, and modeling indicate small, but distinct, zones of economic mineralization.

MINING METHOD

The deposit would be exploited by conventional open pit methods similar to those currently in use at other locations on the Iron Range. At full, steady state production a daily ore mining rate of between 25,000 and 32,000 tons per day would be achieved. This is equivalent to a maximum annual ore production of 11.5 million tons. An average waste:ore stripping ratio for the mine has been estimated at 1.2:1. Using an average ore production of 30,000 tons per day and taking into consideration overburden and mine construction practices it is estimated that the mine will generate about 12.5 million tons of waste rock annually. The total amount of material moved annually would be approximately 24.8 million tons. The mine would operate 24 hours per day, 365 days per year. Mining would be carried out using conventional diesel powered equipment though there may be an option to use one or possibly two electric rope shovels in place of the more versatile diesel hydraulic back-hoe excavators proposed. Ore-grade material would be truck hauled from the pit to a rail loading pocket (Loading Pocket) where it would be loaded into rail cars and rail hauled to the Processing Plant crusher dump pocket. Waste Rock and Lean Ore would be truck hauled to rock stockpiles located to the northwest and southeast of the deposit. Stockpiled rock would be categorized as reactive or non-reactive and would be placed on stockpiles according to the specifications of the Waste Rock and Lean Ore Management Plan, which will be developed as part of the EIS and the permit to mine.

OVERALL MINE CONFIGURATION

Pit Outline

The pit outline is shown in Figure 5-3 and a cross-section of the site showing the approximate pit cross section is shown in Figure 6-1. The outline and cross-section are preliminary and depict the maximum 20-year size.

MINE OPERATIONS

Drilling & Blasting

Waste rock and ore would require conventional drilling and blasting prior to excavation. Secondary blasting of oversize boulders would require the use of a track mounted, self-propelled diesel powered rig fitted with a hydraulic boom and top hammer drifter. Because of the importance of selective mining to the successful exploitation of this deposit, it is proposed to sample blast holes for grade control, waste characterization and material movement scheduling.

Grade Control & Production Scheduling

A key component of the mining operation would be *grade control*. In this context grade control is the term applied to the process of characterizing the rock mass ahead of mining to determine whether it should be sent to the Processing Plant or to a waste rock stockpile or a lean ore stockpile. Grade control would allow ore of different grades and quality to be blended for optimal processing and would enable differentiation between reactive and non-reactive waste rock. Grade control is discussed in more detail under Question 20. Once material has been characterized, production engineers would plan, schedule and control production to ensure it is hauled to the appropriate destination.

At the Loading Pocket, a minimum amount of ore storage would be available. Any major load-out delay would require a separate ore stockpile near the Loading Pocket. This temporary ore stockpile would be sufficiently large to accommodate about eight hours of production (approximately 12,800 tons). The ore stockpile would be established on an impermeable base that would drain to a collection sump and then to the reactive water collection and treatment system.

MINE DEWATERING

Water would accumulate in the mine pit from precipitation, seepage and surface inflow. The mine dewatering system would collect this water. Depending on the quality of the water, it would be sent to the water treatment system or discharged. The overall system is discussed in more detail below in connection with mine site drainage. The quality, quantity, and impacts of surface and groundwater from the mine and plant are discussed in response to Questions 13, 17 and 18.

STOCKPILES

General Description of Stockpiled Materials

Surface overburden, waste rock, and lean ore must be removed from the mining area to expose the underlying or adjacent ore. These materials would be hauled in large trucks from the mine area and placed in separate stockpiles in a series of lifts.

The stockpiles would be constructed and managed in accordance with the requirements of Minnesota Statute Sections 93.44 to 93.51 and the Minnesota Department of Natural Resources (MDNR) Mineland Reclamation Rules for Nonferrous Metallic Mineral Mining (Minn. Rules Chapter 6132).

Reactive and Non-Reactive Mine Waste Rock

Past experience has shown that sulfide-bearing rock, such as that present at the NorthMet deposit, can release trace metals and produce acid mine drainage when allowed to come in contact with water and oxygen.

The reactive and non-reactive mine waste rocks would be managed separately. Non-reactive rock can be placed on the surface and the drainage from the rock will meet all applicable water quality standards without any chemical treatment. Settling ponds may be needed to remove suspended solids and turbidity. The non-reactive mine waste rocks are those generally have a low sulfide and trace metal content.

Waste rock characterization has been the subject of on-going research by the MDNR. PolyMet has initiated a site-specific waste rock characterization program, one objective of which is to define reactive and non-reactive mine waste rocks. The criterion for classifying mine waste rocks will be analyzed in the EIS and determined in the Permit to Mine. The ultimate purpose of these studies is to estimate the drainage quality from stockpiles so that the waste rock and its drainage can be properly managed.

Non-reactive waste would be used to construct mine infrastructure such as haul roads, stockpile pads, for backfilling and to enclose or “encapsulate” the exterior of waste stockpiles. Reactive waste and lean ore would be stockpiled separately with minimum co-mingling.

When blast holes are drilled, additional sampling would be conducted if required to refine the geological model to insure that ore is located and waste classified at a scale appropriate to mining. It is expected that ongoing in-fill diamond drilling would be carried out as a regular part of the NorthMet operation, in addition to the blasthole drilling and grade control sampling already described.

Non-reactive mine waste rock would be handled in accordance with general requirements for storage piles described previously. Reactive mine waste rocks have the potential to create drainage containing solutes that adversely impact natural resources and would be handled in accordance with state rules for “reactive mine waste” (MDNR Rules 6132.2200). Minnesota rules require that appropriate methods for stockpiles containing reactive mine waste, are either to 1. modify the physical or chemical characteristics of the mine waste, or store it in an environment, such that the waste is no longer reactive, or 2. during construction to the extent practicable, and at closure, permanently prevent substantially all water from moving through or over the mine waste and provide for the collection and disposal of any remaining residual waters that drain from the mine waste in compliance with federal and state standards. PolyMet proposes to prevent water from contacting the reactive waste, to the extent practicable, and providing for collection and disposal of any water that drains from the reactive waste. Details on the designs of lining and capping systems for reactive waste will be included in the EIS.

General Layout of Reactive and Non-Reactive Stockpiles

Three stockpile areas have been proposed to provide the estimated 290 million tons of overall storage capacity. This is considered a conservative estimate that may be reduced as mine planning proceeds. As part of the EIS and the permit to mine, a mine waste management plan will be developed that will meet the requirements of the permit to mine. This plan will be based on the results of the waste characterization and related studies.

Stockpiles will be reclaimed progressively, so that when a section of stockpile is completed, it will be reclaimed based on the approved reclamation plan. Development, use, and reclamation would occur in progressive phases, with each phase providing storage for approximately three to five years of production.

Within the overall stockpile footprint, separate locations for various materials (overburden, lean ore, reactive and non-reactive waste rock) have not yet been specifically identified. A more detailed stockpile plan will be analyzed in the EIS and furnished as part of the Permit to Mine application.

Stockpiles would be designed to provide separate drainage for both surface runoff and seepage to specific collection points and settling ponds where appropriate monitoring and treatment can be provided.

MINE SITE DRAINAGE

Overview

The drainage design for the mine site overall, including mine, stockpiles, and mine infrastructure would segregate the runoff into two categories. Water that has come into contact with ore, lean ore or reactive waste rock could contain dissolved substances that violate water quality standards. This drainage would require treatment before discharge. This is referred to as reactive mine drainage. It includes the pit pumping, the seepage coming from the base of reactive waste rock/lean ore stockpiles, and the runoff from the Loading Pocket and any adjacent ore stockpiles. Quantity, quality and impacts of reactive runoff are discussed in response to Questions 17 and 18.

Runoff from portions of the mine site would not come in contact with reactive materials. This includes seepage from external wetlands through dikes and runoff from non-reactive materials, such as runoff from roofs and roads. The pit would be encircled by a ditch and dike system to intercept and handle non-reactive runoff. This non-reactive drainage system would discharge to three or more detention ponds as shown in Figure 5-3. The runoff from these areas is anticipated to only require treatment by sedimentation prior to discharge. After suspended solids have been settled out, the non-reactive runoff would be discharged to the Partridge River and adjacent wetlands.

Treatment

Treatment plans for mine drainage have not been finalized at this time and are discussed in greater detail in response to Question 18. Space has been reserved south of the Dunka Road for potential wastewater treatment facilities; this location would allow gravity drainage to the facility and discharge to the most downstream portion of the Partridge River.

After closure, if a treatment system were required, a low maintenance treatment system would be desirable. Although an assessment of options has not been finalized, the current preference is to have one low maintenance treatment system that could be located south of the Dunka road. This single system could receive gravity drainage from both the main reactive water stockpile and the southeast reactive water stockpile. Treatment options are discussed in response to Questions 17 and 18.

RAIL HAULAGE

The railroad is owned by Cliffs Erie facility and was used by LTVSMC to haul ore to the plant from the Dunka Mine and pellets from the plant to the dock at Taconite Harbor. The agreement between PolyMet and Cliffs Erie that provides an option to purchase the plant site assets also includes language defining a Rail Service Agreement under which Cliffs Erie would transport ore from the PolyMet mine to the plant site. The railroad is currently a private (non-common carrier) railroad. PolyMet assumes that the Cliffs Erie railroad would be operated by Northshore Mining Company (NMC). The railroad would be a branch of the NMC's current railroad operation to move taconite ore from Babbitt to Silver Bay since both Cliffs Erie and NMC are 100% owned by Cleveland Cliffs Inc.

Because of the extent of existing railroad infrastructure and because the Processing Plant primary crusher dumping pocket is currently configured for acceptance of ore from railcars, rail haulage from the mine to the plant is being proposed.

During operation of the Cliffs Erie taconite facility, ore was brought to the plant from the east via rail. During the later years of operation this line was no longer used. To restore the eastern rail connection for this project, a rail connection would be constructed as shown on Figure 5-7.

At the mine site, a rail spur would be constructed as shown conceptually on Figure 5-3. This spur is included in description and calculation of impacts of the overall mine site development.

PROCESSING PLANT

INTRODUCTION

The process design selected for recovering the base metals and Platinum Group Metals (PGMs) from the NorthMet deposit is based on two major steps:

1. An initial concentration step to recover all of the sulfide minerals by flotation followed by
2. An Autoclave leaching process, which has the advantage of extracting all of the base metals and PGMs. The base metals and PGMs can then be separated and recovered on site.

The Processing Plant design is based around the following key parameters

- A mining rate of 32,000 tons per day;
- Producing only copper metal on site and separate PGM precipitate and nickel/cobalt hydroxide, for off-site shipment and third party processing;
- Acquiring the nearby Cliffs Erie idled crusher/concentrator and all of the land needed for tailings disposal, water supply and storage. This facility also includes a fully established infrastructure of roads, rail, warehouses, offices, workshops, and spare parts.

The Processing Plant would comprise the following unit operations, which are described in Table 6-1 below:

Table 6-1
General Description of Unit Processes of Processing Plant

Unit Process	General Description
Crushing	The ore is crushed in stages to the size of about 0.4 inches or finer
Milling	The crushed ore particles are further reduced to fine sand (0.008 inches particles)
Flotation	The metal sulfide-bearing particles are separated for further processing.
Autoclave Leach	The metal sulfides in the flotation concentrate are oxidized under high pressure and temperature to allow recovery of the metals from solutions.
PGM Precipitation	The Platinum Group Metals (Palladium, Platinum and Rhodium) and gold are recovered from the leach solution
Pre Neutralization	The acidic leach solution is neutralized using limestone
Copper Solvent Extraction (SX)	The neutralized leach solution is mixed with an organic solvent to selectively remove the copper. The copper is then stripped from the solvent using an acidic aqueous solution.
Copper Electrowinning (EW)	The copper is removed from solution by electrochemical means.
Bleed Stream Purification	Iron and aluminum are selectively removed from the leach solution after the Copper SX process to allow recovery of higher-value nickel and cobalt. Residual soluble copper is also removed by precipitation.
Hydroxide Precipitation	Nickel and cobalt are precipitated together to produce a concentrate to be sold for further refining
Magnesium Precipitation	Small amounts of magnesium and other undesired metals are removed from the process stream before it is recycled.

Simplified flowsheets for the proposed Processing Plant are shown in the following figures:

Figure 6-6 Comminution and Flotation Schematic Diagram
Figure 6-7 Hydrometallurgical Process Plant Schematic Diagram and
Figure 6-8 Process Consumables Schematic Diagram

These simplified flow sheets do not show some process equipment that is intended to provide material handling and in-process storage. A more detailed description of the proposed Unit Processes of the Processing Plant is included as Exhibit A of the Scoping EAW.

Reactive Residues

The Processing Plant would produce reactive residues from five sources:

- Autoclave residue from Leach Residue Filter
- Gypsum from the Gypsum Filter
- Iron/Aluminum precipitate from the Iron/Aluminum (Fe/Al) Removal Filter
- Magnesium hydroxide precipitate from the Mg Removal Thickener
- Crud solids from crud removal

These residues will all be characterized as part of the waste characterization plan being developed as part of the Permit to Mine. Information that is available from the waste characterization will be included in the EIS. It is proposed that these residues be disposed in the Reactive Residue Facility (discussed below) sited in the existing tailings basin. The projection is that these residues will settle to a density of 70% by weight. After considering rainfall and evaporation, the decant return from the Reactive Residue Facility to the process is estimated to be approximately 330 gpm. These residues are discussed in more detail in response to Question 20.

Air Emissions

Air emissions from the processing plant are treated with various air scrubbers prior to discharge to the atmosphere. Airborne dust would be controlled by the installation of dust extraction at specific transfer points in the crushing plant. Water sprays would also be provided in the crusher to minimize dust emissions. Air emissions and the proposed control technologies are discussed in further detail in response to Question 23.

TAILINGS AND TAILINGS BASIN

EXISTING CLIFFS ERIE TAILINGS BASIN

PolyMet proposes to use the existing tailings facility at Cliffs Erie for disposal of the tailings products from the NorthMet project. This assumes that the waste characterization data and subsequent analyses will demonstrate that this is a suitable disposal site. If the characterization tests identify the tailings as reactive mine waste then they would be handled in accordance with state rules for “reactive mine waste” (MDNR Rules 6132.2200). The Cliffs Erie tailings basin was originally constructed by Eire Mining Company (predecessor of LTVSMC), and was used from 1957 to 2000.

There are three discrete cells in the existing basin, Cells 1E, 2E, and 2W, shown on Figure 5-5. Cell 2W is the largest (approximately 1,447 acres), and highest (150 feet on the south side to 230 feet on the north side) of the three cells. It is the driest and has gradually lost the ponded water remaining from taconite processing. Cell 1E is approximately 875 acres and is situated approximately 20 feet below the surrounding natural topographic ridge on its south side, and rises about 40 feet above Cell 2E on its north side; Cell 2E is about 616 acres and has the lowest dam crest elevation of the three cells, situated at the toe of Cell 1E on its north side and rising about 80 feet above natural ground level on its north side. Cells 1E and 2E continue to hold water. The existing basin does not have an overflow or discharge structure. A portion of the seepage from the toe of the dike was captured during operations and pumped back into the tailings basin. The existing water quality of the tailings basin and the seeps is discussed in response to Question 18.

FLOTATION TAILINGS

Initial tests of the flotation process have been conducted and additional pilot testing of the process using samples from the NorthMet deposit will be completed for inclusion in the EIS. The volume and composition of Flotation Tailings are discussed in response to Question 20. If the tailings are determined to be non-reactive, they would be discharged to Cells 1E and 2E using the existing piping and pumping arrangement. PolyMet estimated that the capacity of the existing facility would be more than sufficient for receiving Flotation Tailings for the 20-year life of the mine. A detailed analysis of the design, construction, and operation of the dams and tailings basin including basin storage capacities, closure and reclamation will be conducted as part of the EIS.

If the tailings are determined to be non-reactive, then the tailings disposal methods formerly used for taconite tailings at this facility would be used for Cells 1E and 2E. In this method, starter dams were constructed around the perimeter of the basin before tailing was discharged into the basin. The future dams may be constructed outside, or some distance inside, the present perimeter of Cell 1E or 2E if locally the Cliff Erie deposited tailings prove to be a questionable foundation for these structures. The tailings slurry would be discharged into the basin from multiple spigot points located on the existing dikes. As part of the EIS, the tailings will be evaluated for their suitability as a construction material. If the tailings are suitable, then the subsequent dams could be created by upstream deposition of heavy tailings waste from spigot points, raising each line as disposal moves inward. However, should PolyMet's Flotation Tailings be unsuitable for dam construction for whatever reason, alternative sources, including coarse taconite tailings from Cell 2W will be evaluated for the construction of the new dams.

The outer slopes of the basin are planned with an average slope of 3.5 to 1. The central reservoir would function as both a settling pond, where coarse and fine tailings settle out of solution, and a clear water reservoir, where water would be returned to the Processing Plant. The maximum ultimate height of the Flotation Tailings waste in the basin will be approximately 240 feet. The basin and dams will continue to be permitted through the MDNR and MPCA.

Water from the tailings basin would be added back to the concentrator Mill Water system to make up for water lost in that process. A detailed water balance will be conducted as part of the EIS. Based on PolyMet's projections, water from the tailings basin may need to be discharged to control process water quality or water levels in the basin. A proposed location for a decant structure or barge, discharge route, and treatment plant location is shown on Figure 5-5, providing a conceptual discharge path for this water. The water quality of the decant water is discussed in response to Question 18.

Although predictions of the basin water quality will be addressed in the EIS, the process water in the tailings basin would likely have high concentrations of dissolved solids and alkalinity. In addition, it is possible that the flotation process may make the process water unsuitable for direct discharge. Therefore, the conceptual design includes treatment of the decant water as shown in Figure 5-5. The seepage from the basin may also require treatment. Therefore, it is proposed to extend and improve the previous seepage collection system and to direct the collected seepage either back to the tailings basin or to the treatment plant. The possible alternatives for treatment are discussed in response to Question 18.

A 35-acre emergency basin is located adjacent to the tailings basin that was used by Cliffs Erie to receive taconite concentrate in case of an emergency plant shut down. This basin also received overflow sump water from the concentrator. PolyMet proposes to use this basin to receive its in process ground ore, flotation concentrate, and flotation tailings in case of an emergency plant shut down. The existing capacity of the basin would need to be increased by deepening the basin. The basin would be sized to prevent discharge from the basin into the environment. In process material that is discharged to the emergency basin would be pumped to the tailing basin.

REACTIVE RESIDUE CELLS

Reactive residue would be generated as part of ore processing. Characteristics of these wastes are given in response to Question 20.

PolyMet's plans call for the construction of a Reactive Residue Facility made up of smaller containment cells within existing Cell 2W of the tailings basin to hold these wastes. Each cell would contain approximately 2.3 million cubic yards of reactive residue, including gypsum wastes. Water from the Reactive Residue Facility would be added back to the hydrometallurgical water system to make up for water lost in that process. The exact location, number and design of these cells will be addressed in the EIS.

The lined Reactive Residue Facility would be developed in phases within existing Cell 2W, as shown on Figure 5-5. The phases are numbered on Figure 5-5 in the order they are assumed to be developed under the conceptual layout.

Mineralized Virginia formation hornfels is an acid-generating rock that was encountered in the Dunka Pit formerly operated by LTVSMC. In order to remove this material from contact with oxygen it was transported to the tailings basin and buried in taconite tailings in the general area of the Reactive Residue facility. The location of the Hornfels is shown in Figure 5-5. The impact of the proposed storage facility and the hornfels on the water quantity and quality from the site will be addressed in the EIS.

MINE CLOSURE PLANNING

The planned operating dates for the NorthMet project are from 2007 to 2027. A Closure Plan must be submitted as part of the application for the MDNR Permit to Mine (MDNR Nonferrous Metallic Mineral Mineland Reclamation Rules - MR 6132) and will be developed following discussions with the MDNR, the MPCA and the St Louis County Mine Inspector.

The following description is conceptual; the final closure plan and details will be developed in cooperation with the MDNR, MPCA and other local governments and agencies as appropriate. In general, all environmental hazards would be remediated, inactive pit areas closed, all buildings and structures would be demolished, and all associated sites reclaimed and vegetated. The EIS will evaluate the cost for closure of specific project components, as part of the EIS.

The Closure Plan will have the following general timetable, which may require adjustment as conditions and situation dictate:

- 2028 – stop production, stop mine dewatering, initiate tailings basin reclamation, control fugitive dust on the tailings basin, dispose nuclear, PCB and mercury containing devices, initiate collection and disposal of solid waste outside buildings, initiate mineland reclamation, remove equipment
- 2029– continue to control fugitive dust on the tailings basin, continue collection and disposal of solid waste outside buildings, initiate site remediation, continue mineland and tailings basin reclamation, start to demolish buildings, start to remediate fuel handling areas associated with buildings,
- 2030 – complete demolition and fuel handling area remediation
- 2031 – reclaim remaining area
- 2032 – maintain remaining reclamation, construct final pit overflow channels
- 2033 and beyond – monitoring, reclamation and water treatment will continue until released by DNR from reclamation liabilities and PCA determination that water quality monitoring and treatment are no longer required.

This timetable is based on Minnesota Mineland Reclamation Rules.

WATERSHED RESTORATION

Pit Overflow

If required, each of two major portions of the mine pit would have an overflow channel to direct overflow water from the pit to the nearest natural watercourse. The overflow points, nearest watercourse and detailed plans for the channels will be based on results of the hydrology study. The plans will be submitted to the MDNR and the MPCA for approval. Pit overflows would be monitored and inspected as defined in the NPDES Permit for the mine area. Post-closure water quality of the pit is discussed in further detail in response to Question 18.

Tailings Basin Reclamation

Assuming that the tailings are non-reactive and can be discharged into the existing LTVSMC tailings facility, an improved seepage collection system for the tailings basin would be implemented as part of the project. The exact design and efficiency will be developed and evaluated as part of the EIS. During operation and closure, seepage water quality will be monitored to determine if it would need to be collected and treated prior to discharge. At closure, if water quality standards were met, the return of seepage to the basin would cease. If it is determined that water treatment is required, treatment consisting of some or all of an on-site treatment plant, passive treatment systems and/or pumping to municipal treatment systems would be implemented and continued until the seepage meets water quality standards. These issues would be addressed in the EIS.

Fugitive dust would be controlled by mulching and revegetation as defined by MR 6132-2800.

The design of the tailings dam will be prepared by a qualified geotechnical engineer. The design will include a plan for monitoring structural integrity as the tailings basin is being raised and during post-closure as specified by MR 6132-2500. The geotechnical engineer will also recommend safe water levels for each cell. Safe levels will take into account a spring snowmelt/runoff and rainfall storm events and will be based on MDNR-approved design standards. Cells will be monitored and controlled to the recommended levels. All erosion to the dam face will be repaired and revegetated.

If the tailings are non-reactive, the tailings basin will be contoured and vegetated when tailings placement is completed according to MR 6132.2700. Wetlands will be created to the extent that they are compatible with the tailings basin hydrology and the requirements of the MDNR dam safety rules. As required, channels will be constructed to carry stormwater from the basin to the adjacent wetland. Appropriate energy dissipation devices (e.g., rip rap) will be installed where the drainage channel enters the wetland to distribute the stormwater. Detailed plans for the channels and outlet to the wetland will be based on results of a hydrology study. The entire tailings basin construction and reclamation plans will be submitted to the MDNR and the MPCA for approval. If the tailings are reactive, other methods will be developed and evaluated as part of the EIS. The final design will be consistent with mineland reclamation rules.

The Reactive Residue cells would be closed and capped. The details of this closure will be developed as part of the EIS.

Emergency Basin

The 35-acre Emergency Basin is adjacent to the Tailings Basin. This basin would have received ore concentrate during emergency plan shut downs. At closure, three core samples are proposed to be extracted and analyzed. These samples would determine if any further work would be required to identify possible contamination, which would require cleanup. If no contamination requiring cleanup is found, the area would be contoured to create wetlands and vegetated according to MR 6132.2700. In the event that contamination requiring cleanup is found, a Best Management Plan to address the contamination would be developed and submitted to the MPCA for approval. The initial concept for the plan would be to minimize the amount of stormwater reaching the contaminated soil and, therefore, reduce the potential for contamination to be transported out of the basin area. In either event, detailed plans for any required drainage channels and/or outfall structure would be based on relevant hydrologic data and submitted to the MPCA and the MDNR for approval. The basin stormwater outflow would be monitored and inspected as approved by the MPCA or defined in the NPDES/SDS permit for the tailings basin.

Mine Site Sedimentation Ponds

During operation sedimentation basins would be used to manage stormwater runoff from non-reactive stockpiles and other areas at the mine site. At closure, these ponds would be reclaimed and the stormwater diverted to the mine pits. Ponds that receive runoff from reactive stockpiles will be addressed as part of the EIS.

MINE SITE RECLAMATION & VEGETATION

Minewall

Minewall reclamation (according to MR 6132.2300) consists of removing brush, developing a setback from pit edge, sloping and properly vegetating overburden at the mine wall. Design of mine wall reclamation would take into consideration effects of wave action and ice at the expected final pit water elevation. The appropriate method to close the pit will be determined as part of the EIS and will consider various alternatives and their impact on natural resources. In addition to data from waste characterization studies, models will be developed to examine the hydrology and water quality of the reclaimed pit.

Stockpiles

Standard reclamation practice for non-reactive stockpiles (according to MR 6132.2400) consists of covering flat surfaces with overburden, site preparation and properly vegetating stockpiles. Methods for reclamation of reactive stockpiles will be developed as part of the EIS.

Surface Stockpile reclamation (according to MR 6132-2400) consists of site preparation and properly vegetating stockpiles. Areas disturbed as sources for cover material would be sloped and vegetated.

Fencing Pit Perimeter

Fencing, barricades and gates would be installed as per the plan developed and submitted to and approved by the St Louis County Mine Inspector. Safe access to each mine pit would be provided.

PLANT SITE AREA RECLAMATION

The crushing/concentrating facilities, shops and warehouses would be demolished. Structures would be taken down to the foundation and the foundations covered and vegetated according to MR 6132-2700 and 3200.

Demolition waste from structure removal would be properly disposed in on-site demolition landfills constructed and permitted in accordance with MPCA rules. Likely locations have been identified; including the tailings basin, coarse crusher basement, fine crusher basement, concentrator basement, and Plant Reservoir. MPCA landfill permitting cannot occur until the landfill locations are finalized and the landfills designed. Design and permit application would start one year prior to demolition.

After buildings have been demolished, areas of the Plant Site would be reclaimed and vegetated according to MR 6132.2700. All areas would be stabilized as required for stormwater management. Any culverts requiring removal would be replaced with channels.

SOLID WASTE CLEANUP/DISPOSAL

Major areas where scrap and solid waste have accumulated would be identified and the material would be sorted and properly disposed. Any contaminated soil would be remediated or properly disposed.

Any contaminated railroad ballast associated with removed track would be remediated or properly disposed.

MONITORING AND MAINTENANCE

Financial assurance as required by MR 6132.1200 would be provided for extended maintenance. Long term monitoring and maintenance will be conducted as required under permits.

Erosion Maintenance

All reclaimed areas would be inspected in May and September as well as following major rain events for erosion damage and all necessary repairs made. Inspection reports would be submitted within 60 days of the inspection.

Landfill Monitoring and Maintenance

Monitoring and maintenance for the Cliffs Erie Tailings Basin Coal Ash Disposal Area at the Hoyt Lakes site will continue as required by the existing Post-Closure Care Action Plan section of its Closure Plan dated May 2000.

Monitoring and maintenance required by the permits for the new demolition landfill(s) designed and permitted as part of the mine closure would be done.

Water Quality Monitoring

Monitoring and maintenance would be done as required by the NPDES permit for the Hoyt Lakes plant area, the NPDES/SDS permit for the tailings basin, and the NPDES permit the mine area.

Stormwater Inspections

Inspections required by the NPDES permit the Hoyt Lakes plant area, the NPDES/SDS permit for the tailings basin and the NPDES permit for the mine area will be continued.

ONGOING WATER TREATMENT

Ongoing water treatment may be required for reactive mine waste stockpile drainage, mine pit overflow and tailings basin seepage. During operation, each of these would have water quality monitoring and, if necessary, water treatment systems managed via NPDES permit. At closure, systems that achieve water quality objectives and are as maintenance free as possible would be developed.

Proposed Treatment of Topic in EIS:

The EIS will include a complete project description, including the timing of all phases of construction and operation.

The EIS will consider the proposed action of the Mine Site, Railroad Corridor, Maintenance Shops, Processing Plant, and Tailings Basin. The proposal does not contain connected or phased actions that will be considered in the EIS.

c. Explain the project purpose; if the project will be carried out by a governmental unit, explain the need for the project and identify its beneficiaries.

The primary purpose of the NorthMet mining operation is to provide copper, precious metal, and nickel-cobalt concentrates for sale to the world market. Over the project lifetime, it is expected that the operation will produce approximately 3.2 million tons of copper, 860,000 tons of nickel, 9.3 million ounces of palladium, and 2.6 million ounces of platinum.

PolyMet anticipates that optimized mining and processing operations will involve extracting and processing 32,000 tons of NorthMet ore each day. PolyMet will strive to operate the NorthMet project in a manner that is efficient, cost-effective, and that minimizes impacts to the environment. In this way, the production of copper and other metals can remain competitive, not only within the United States, but also in the worldwide metals market.

d. Are future stages of this development including development on any outlots planned or likely to happen? _ _Yes _X_No

If yes, briefly describe future stages, relationship to present project, timeline and plans for environmental review.

e. Is this project a subsequent stage of an earlier project? __Yes _X_No

f. If yes, briefly describe the past development, timeline and any past environmental review.

7. Project magnitude data
Total project acreage:

See Figure 5-2 for delineations of outlines used to calculate the following areas.

Project Component	**Area (acres)**	**Comments**
Plant Site	205	
Area 1 Shops	36	
Tailings Basin	2,166	Includes active tailings basin area only (Cells 1E, 2E and Reactive Residue Facility)
Railroad Construction Area	21	Includes only the proposed new trackage outside of the Mine Area.
Mine Area	3,015	Includes mine pit at ~620 acres and stockpiles at ~1,126 acres
Total	5,443	

Number of residential units: unattached **N/A** attached **N/A** maximum units per building

Commercial, industrial or institutional building area (gross floor space): total square feet:

Project Component	**Area (sq. ft.)**	**Comments**
Plant Site	692,462	PolyMet expects to use only portions of some of the buildings it will occupy at the facility. Approximately 254,000 sq. ft. of the listed plant site building square footage is expected to remain inactive.
Area 1 Shops	48,150	Six existing buildings will be used at the Area 1 Shops area.
Tailings Basin	0	
Railroad Construction Area	0	
Mine Area	41,250	For mine administration, lockers and lunchroom, general storage, etc., a 200' by 100' facility is assumed. A vehicle field service/refueling bay and the loading facility control building are also included. Actual areas will be determined at a later phase of the project.
Total	**781,862**	

Indicate areas of specific uses (in square feet):
Office **Manufacturing**
Retail **Other industrial** 781,862

Warehouse
Light industrial
Other commercial (specify)
Institutional
Agricultural

(Note: A relatively small amount of administrative office space will be required for plant and mine operations; the square footage for this office space is included in that given under "Other industrial.")

Building height If over 2 stories, compare to heights of nearby buildings

The tallest building on the plant site is the concentrator building, with the highest portion of the concentrator building being 174 feet above adjacent grade. The top tier of the concentrator building is higher than any of the stacks. The tallest stacks rise approximately 151 feet above adjacent grade. The Concentrator is set into the side of the hill upon which the overall plant was built. The Coarse and Fine Crusher buildings are on top of that hill. Therefore, the Coarse and Fine Crushers are the highest buildings at the Plant Site in absolute altitude. Beyond these, at the Plant Reservoir (which is at the highest point on the Plant Site hill) there is a water tower, which is the highest structure at the Plant Site. PolyMet stack additions have not been determined, best engineering practices will be used in final design and specific stack heights will be specified in the air quality permit application.

In addition to buildings the mining project would result in an increase in the LTVSMC tailings basin to a maximum height of 240 feet, which is 40 feet taller than the tallest portion of the existing basin. The mine site itself is estimated to result in a mine pit approximately 900 feet deep and waste rock stockpiles up to 320 feet in height.

8. Permits and approvals required. List all known local, state and federal permits, approvals and financial assistance for the project. Include modifications of any existing permits, governmental review of plans and all direct and indirect forms of public financial assistance including bond guarantees, Tax Increment Financing and infrastructure.

Table 8-1 lists permits and approvals that are known at this time.

Table 8-1
Permits and Approvals

Unit of Government	Type of Application	Status
Minnesota Department of Natural Resources	Permit to Mine	To be applied for
Minnesota Department of Natural Resources	Appropriations permit for tailings basins, and mine dewatering	To be applied for. (Process Water for the Plant Site to be provided by Cliffs Erie via an existing permit.)

Unit of Government	Type of Application	Status
Minnesota Department of Natural Resources	Dam Safety Permit Amendment • for tailings basin • for dikes at mine	• Existing Cliffs Erie permit will be transferred • To be applied for if needed
Minnesota Department of Natural Resources	Permit for work in protected waters, possible modifications and diversions of local streams	To be applied for if needed
Minnesota Department of Natural Resources	Approval for wetlands modifications under Wetland Conservation Act (as part of Permit to Mine)	To be applied for
Minnesota Department of Natural Resources	Water appropriations permit for potable water well for mine site administration building	To be applied for if needed
Minnesota Department of Natural Resources	Burning Permit (possibly needed for construction or land clearing)	To be applied for if needed
Minnesota Department of Natural Resources	Permit for taking of threatened or endangered species	To be applied for if needed
Minnesota Pollution Control Agency	Minnesota Air Emissions Permit	To be applied for
Minnesota Pollution Control Agency	SDS/NPDES permit for discharge of mine dewatering water	To be applied for
Minnesota Pollution Control Agency	SDS/NPDES permit for discharge to tailings basins	Existing Cliffs Erie permit will be transferred
Minnesota Pollution Control Agency	SDS/NPDES permit for discharge of sanitary wastewater at processing plant	To be applied for
Minnesota Pollution Control Agency	SDS/NPDES permit for stormwater discharge	To be applied for
Minnesota Pollution Control Agency	Minnesota Waste Tire Storage Permit	To be applied for
Minnesota Pollution Control Agency	General Storage Tank Permit (fuel tanks)	To be applied for
Minnesota Department of Health	Radioactive Material Registration (for low-level radioactive materials in measuring instruments)	To be applied for if needed
U.S. Army Corps of Engineers	Section 404 Permit for Wetland Impacts	To be applied for
U.S. Fish and Wildlife Service	ESA Consultation by U.S. Army Corps of Engineers to determine ESA impacts of federal action on federally endangered species.	Informal consultation
Minnesota Department of Health	Permit for Non-Community Public Water Supply System (serving an average of at least twenty-five individuals daily at least 60 days out of the year) and wellhead protection plan	To be applied for if needed
Minnesota Department of Health	Notification of Water Supply Well Construction	To be provided when constructed
Minnesota Department of Health	Permit for Public On-site Sewage Disposal System	To be applied for if needed
City of Babbitt	Building Permit for buildings at mine site	To be applied for
State of Minnesota	JOBZ designation for tax incentives	Applied for, application pending

9. Land use. Describe current and recent past land use and development on the site and on adjacent lands. Discuss project compatibility with adjacent and nearby land uses. Indicate whether any potential conflicts involve environmental matters. Identify any potential environmental hazards due to past site uses, such as soil contamination or abandoned storage tanks, or proximity to nearby hazardous liquid or gas pipelines.

The regional setting for the project is a landscape that has been historically used for mining and logging. The nearest large communities (Hoyt Lakes, Aurora, and Babbitt) were built to provide housing for workers at the mines and their associated processing plants. The Mine Site lies within the Superior National Forest while the Plant Site lies on the northeast boundary of the Forest. The Superior National Forest is managed for both economic and recreational purposes.

Mine Site

LAND USE OF THE MINE SITE

The Mine Site is currently vacant land in the Superior National Forest. The land is largely wetland, with small upland areas that are periodically logged. The National Forest has a system of unpaved roads constructed in the Forest to allow access and logging. The headwaters of the Partridge River circle the Mine Site on the north, east and south. The Dunka Road, a mining road constructed by Erie Mining Company (now Cliffs Erie) for access to the Dunka Mine about 9 miles to the northeast, crosses the southeastern corner of the Mine Site, as does the Cliffs Erie rail line formerly used to transport pellets to the shipping facility at Taconite Harbor, and ore from the Dunka Mine.

PREVIOUS LAND USE OF THE MINE SITE

The Mine Site has not been used for any purpose other than logging. Historic logging camps dating from before 1937 have been identified near the site; presumably portions of the mine site were logged at that time and have been intermittently logged since then. Portions of the Mine Site are scheduled for logging in 2004-2005.

The only other known use of the site is for exploratory drilling for mineral development. USX Corporation drilled the first exploratory holes on the site in 1969. PolyMet conducted limited drilling in 1990. More extensive drilling by PolyMet occurred in 1998 – 2000, and is continuing in 2004-2005.

LAND USES NEAR THE MINE SITE

To the north of the Mine Site is the Peter Mitchell Pit operated by NorthShore Mining Company, an operating unit of Cleveland Cliffs, Inc. The NorthShore mine maintenance and coarse crushing facilities are located at the eastern end of this pit, about four miles northeast of the Mine Site. NorthShore’s Number 2 Crusher is located directly north of the site at a distance of about one mile. These are the nearest buildings to the site. Beyond the Peter Mitchell pit is more forested land and the town site of the City of Babbitt, which lies about six miles north of the Mine Site. The western unit of the Boundary Waters Canoe Area Wilderness lies about 20 miles north of the Mine Site.

To the east of the Mine Site is wetland and forested land; the nearest residences appear to be along State Highway 2, about 12 miles east of the Mine Site. The NorthShore Mining Company Railroad is about three miles east of the site and the Dunka River is about four miles east of the site. The eastern unit of the Boundary Waters Canoe Area Wilderness is located about 21 miles to the northeast of the site.

To the immediate south of the Mine Site is the Partridge River and, beyond that, forested land. A power transmission line passes east-west just south of the western end of the mine on an alignment that includes the south side of Sections 9, 10 and 11. The nearest residence appears to be about five miles south, about three miles north of the unincorporated village of Skibo. The City of Hoyt Lakes lies about nine miles southwest of the Mine Site.

To the west of the Mine Site are forested land and the “One Hundred Mile Swamp.” About four miles west of the Mine Site is a Cliffs Erie rock stockpile, Cliffs Erie Area 3 Mine Pit and the Cliffs Erie Hoyt Lakes Plant Site where the PolyMet processing facility will be located.

Railroad Corridor

The railroad corridor between the Mine Site and the Plant Site has been and will continue to be a transportation corridor for hauling ore. Plans call for the construction of an additional length of railway (see Figure 5-7) to make the trip to the Plant Site more direct. Land uses for the railroad construction area are discussed below.

LAND USE OF THE RAILROAD CONSTRUCTION AREA

Construction of the rail line will disturb approximately 21 acres. The land is currently part of the Cliffs Erie mine site and includes the edge of the Area 2 Mine Pit and associated waste rock stockpiles as well as undeveloped deciduous/coniferous forest. Wyman Creek passes through an existing culvert at the east end of the rail construction area. A small portion of the wetland upstream from the culvert is included in the rail construction area.

PREVIOUS LAND USE OF THE RAILROAD CONSTRUCTION AREA

The railroad construction area has been mining property since the opening of the Cliffs Erie taconite facility.

LAND USES NEAR THE RAILROAD CONSTRUCTION AREA

The Railroad construction area lies between the Plant Site and the Mine Site. To the immediate north of the Railroad Construction Area are the Dunka Road and mine stockpiles. Wyman Creek and its associated wetland areas are directly north and east of the construction area. Further to the northeast of the railroad construction area is additional rock stockpile from the Cliffs Erie Area 2 Mine Pit. To the south of the Railroad Construction Area is the Cliffs Erie Mining Company railroad corridor and, beyond that, an area of undeveloped wetlands and wooded land. To the west of the railroad construction area is the Erie Area 2 Mine Pit and associated waste rock stockpiles.

Plant Site and Tailings Basin

Since the plant site and tailings basin are adjacent, they are treated as a single unit for purposes of describing local and adjacent land uses.

LAND USE OF THE PLANT SITE AND TAILINGS BASIN

The Plant Site is located at the former Cliffs Erie/LTVSMC taconite processing plant. It was used for processing taconite from 1957 to 2000. The property is currently inactive industrial land largely covered by the crushing, grinding, concentrating, pelletizing and shipping facilities of the plant.

Portions of the existing Cliffs Erie plant will continue to be owned by Cliffs Erie and will not be used by PolyMet. The plant is currently inactive except for limited use of office space; however several major projects have been proposed at the plant site. These include the Mesabi Nugget Direct Reduced Iron Project, the Excelsior Energy Project, the reactivation of the Cliffs Erie Railroad and pellet yard for shipping of pellets from United Taconite and the Cliffs Natural Stone business. The potential cumulative effects to these projects are discussed in response to Question 29.

The Cliffs Erie tailings basin lies directly north of the Plant Site. The existing tailings facility at Cliffs Erie will be used to contain tailings products from the NorthMet project. The Cliffs Erie tailings basin was originally constructed by Erie Mining Company, and was used from 1957 to 2000. The location and general plan of the tailings basin is shown on Figure 5-1; more detail is given in Figure 5-5. The basin consists of three large cells: 2W, 1E and 2E. Cell 2W is the largest (1,447 acres), and highest (200 feet) of the three cells. It is the driest and has gradually lost the ponded water remaining from taconite processing. Cell 1E is 970 acres and rises about 120 feet above ground level; Cell 2E is about 616 acres and is the lowest cell, rising only about 30 feet above ground level. Both cells continue to hold water. The tailings basin is currently undergoing reclamation under the Cliffs Erie Permit to Mine. The relationship of Cliffs Erie's existing permit to mine and any potential permit to mine for PolyMet will be discussed in the EIS.

LAND USES NEAR THE PLANT SITE AND TAILINGS BASIN

South of the Plant Site are wetlands that form the headwaters of Second Creek, a tributary of the Partridge River. Also located south of the plant are pits formerly mined for natural ore and taconite and mine stockpiles. Four miles south of the plant is Colby Lake and the Syl Laskin Power Plant owned by Minnesota Power. On the south side of the lake, about five miles from the plant, is the City of Hoyt Lakes. The homes in Hoyt Lakes are the closest residences. The City of Aurora lies about six miles southwest of the Plant Site.

To the west of the plant is the rail line of the Canadian National Railway Company, formerly the Duluth, Missabe and Iron Range Railroad. Further west are pits formerly mined for taconite and natural ore, as well as mine stockpiles. Directly west of the plant are the Embarrass Mountains, large hills rising about 500 feet above the nearby terrain.

To the east of the plant is the Number 2 pit and associated mine dumps. Further east is Wyman Creek and additional mine dumps. One Hundred Mile Swamp lies about four miles east of the plant and tailings basin.

The Cliffs Erie tailings basin lies directly north of the Plant Site. The basin is surrounded on the west, north and east by wetlands and low, forested uplands. The nearest homes to the north are rural residences on County Road 358, about one mile north of the tailings basin and three miles north of the Plant Site. Heikkilla Lake is located about two miles northwest of the tailings basin. Additional rural homes are located along County Road 615 about two miles north of the tailings basin. The Embarrass River follows a curving path around the north and west of the tailings basin at a distance of about three miles. The unincorporated town of Embarrass is on this river, about three miles northwest of the tailings basin and about 4.5 miles northwest of the plant. The western end of the Boundary Waters Canoe Area Wilderness lies about 17 miles north of the tailings basin.

PREVIOUS LAND USE OF THE TAILINGS BASIN

The tailings basin portion of the plant and processing area is a large dike constructed of tailings with road access along the top. Tailings were discharged as a slurry with process water. The design of the dikes allows the tailings to settle and the process water to be recycled back to the plant. Several pumping stations were located in the tailings basin and several transformers exist. Cliffs Erie records indicate that these transformers currently contain non-PCB mineral oil. An area within Cell 2W (shown on Figure 5-5) contains buried hornfels. Hornfels is a waste rock type containing sulfide minerals. Limestone was buried with the hornfels to provide neutralization of any acid that might be generated by the hornfels. Monitoring wells are installed surrounding the hornfels burial site and are monitored as part of the NPDES permit. The buried hornfels and their relationship to PolyMet's proposed reactive residue facility is discussed under Question 20. The Tailings Basin Reporting Area is located at the road access point to the tailings basin. This Reporting Area contains a lube station. In addition, two underground storage tanks were removed in 1988. A septic tank and drain field system remain in place.

An area immediately west of the Tailings Basin Reporting Area contains several small equipment and materials storage locations. Most of the salvageable materials are gone.

However several soil stained areas were observed. The Cell 2W salvage area is located along the western edge of the Tailings Basin. Salvage operations are evident with several small soil stained areas as well as the remains of a mobile storage tank containing Choherex, a petroleum-based dust suppressant.

Active treatment of acid mine runoff from the Dunka Mine stockpiles (located about 16 miles east-northeast of the plant near Birch Lake) produced a treatment sludge. The eastern margins of the Tailings Basin contain an area where this sludge was temporarily stored before being shipped offsite; little evidence of its existence remains.

The coal ash landfill was located south of the sludge staging area at the eastern side of tailings basin Cell 1E. The coal ash was generated at the Taconite Harbor power plant and shipped back to Hoyt Lakes on rail cars. The landfill was closed in accordance with a schedule of compliance with the MPCA. The landfill cover appears in good condition.

South of the coal ash landfill and west of the rail line is a petroleum-contaminated soil spread area. This land application site contains approximately 25,000 cubic yards of soil from the Area 1 Shops Tank Farm cleanup, and the cleanup of a remote fueling site not associated with PolyMet facilities. The site has been monitored in accordance with MPCA requirements.

Just south of tailings basin Cell 1E and outside the PolyMet controlled area is the Area 2 Shops area. This was the primary shop for the eastern mining areas and currently contains a locomotive fueling station for the in-mine locomotives. A septic tank and a drain field remain in place.

To the southwest of the tailings basin is the Emergency Basin that functioned as a drain outfall for storm water and overflow of process water for the Plant Site.

PREVIOUS LAND USE OF THE PLANT SITE

The PolyMet Plant Site includes both the Main Plant and the former Area 1 Shops. The Area 1 Shops were used for maintenance equipment. The maintenance activities included fueling, equipment rebuild and repair, steam cleaning and the use of an electrical shop. An underground tank leak (LUST #6421) was reported and corrective action was taken. The soil was removed and land spread near the tailings basin (see above). The MPCA closed the leak site on December 16, 1998.

The previous land use of the Plant Site was, of course, LTV Steel Mining Company’s processing of taconite. The plant extends beyond the area controlled by PolyMet.

At the far south end of the PolyMet property is the Bunker C Tank Farm, which is currently being investigated under the MPCA’s LUST program (Leak #12254). This area contains three large tanks used for storing #1, #2 and #6 fuel oil.

The Plant Site proper was used for crushing and concentrating of ore, and general maintenance facilities. Past practices may have resulted in releases of fuels and other chemicals. A detailed investigation has not been completed. Five aboveground tanks exist. One was used for fuel oil, one held alcohol and three held mineral oil.

Petroleum-contaminated soils from the Coarse Crusher building were stockpiled adjacent to the building before being shipped off site for treatment in July 2000.

Area 1 Shops

LAND USE OF THE AREA 1 SHOPS

The Area 1 Shops will be used by PolyMet to maintain equipment, the most important being mine haul trucks and other mining equipment. This was the former use of the facility during taconite mining. No new construction or changes in land use are anticipated.

The Area 1 shops facility includes the shop itself, a boiler house, a fire pump house, an oil storage facility and two unheated storage buildings; one for shovel and drill equipment and one for general warehousing.

PREVIOUS LAND USE OF THE AREA 1 SHOPS

The Area 1 Shops facility has been used for mine equipment maintenance since the opening of the Erie Mining Company taconite facility. During operation sanitary wastewater was disposed of through a septic tank and drain field system. Oily drainage from shop floor drains and other industrial wastewater was contained and recycled with residuals from oil/water separates being disposed of through outside services. A closed leak site exists for the fueling portions of the shops.

LAND USES NEAR THE AREA 1 SHOPS

The Area 1 Shops facility is located about 1.5 miles west of the plant site. The facility is located in an area of extensive, long-term mining operations.

To the immediate south of the Area 1 Shops is a small wooded area and, beyond that, haul roads, rail tracks and mine stockpiles. Further south is a large wetland complex associated with Second Creek. West of the Area 1 facility is the former Erie Mine No. 1 pit and associated mine dumps. This complex extends roughly four miles to the west. To the north is wooded land on the slopes of the Embarrass Mountains, a range of high hills. To the east of the facility is mineland, including haul roads, rail lines and mine stockpiles. The Cliffs Erie plant is further east from this mineland.

Proposed Treatment of Topic in EIS:

Land use conflicts are not anticipated due to previous and ongoing mining in the area. The EIS will not include any further discussion on the issue beyond what is included in the Scoping EAW.

10. Cover types. Estimate the acreage of the site with each of the following cover types before and after development:

Note:. Acreages for cover types are approximate and are based on Polymet habitat and wetland mapping , existing and proposed facility CAD mapping and 2003 FSA color aerial photography. Figure 5-2 shows the locations of the project features listed below.

Existing roads and railroads are treated as linear features having no area associated with them. The project will not change the land use and cover types along the extent of these features.

Cliffs Erie Plant Site

	Number of Acres	
Cover Types	Before	After
Brush/Grassland	7.6	7.3
Disturbed Land*	108.5	108.0
Impervious/Building	28.8	29.6
Plant Reservoir	1.9	1.9
Railroad	12.4	12.4
Road	13.1	13.1
Wooded/Forest	32.7	32.7
TOTAL	205.0	205.0

* Includes unimproved roadways, ditches and mining-related areas that can be identified on air photos as disturbed, but cannot be assigned a specific land use.

Tailings Basins

Active Tailings Basin Area (Cells 1E and 2E and 2W including Reactive Residue Facility)

Cover Types	Number of Acres Before	After
Brush/Grassland	11.7	
Grassland Under Reclaimation	2319.5	
Tailings Basin Wetland Under Reclaimation*	638.2	
Types 1 to 8 Wetlands (includes lakes)**	23.2	
Wooded/Forest	148.7	
Mine Infrastructure**		23.2
Reactive Residue Facility		336.0
Reclaimed Grassland		1158.0
Tailings Basin		1624.1
TOTAL	3141.3	3141.3

* Open water within existing Cells 1E and 2E

** Area for treatment plant on north side of Tailings Basin

Post-project conditions will include wetlands, brush/grassland, and forested land; details of tailings basin closure plan and wetland mitigation plan have not yet been established.

Area 1 Shops Area

Cover Types	Number of Acres Before	After
Brush/Grassland	2.4	2.4
Disturbed Land*	29.6	29.6
Impervious/Building	1.8	1.8
Wooded/Forest	1.7	1.7
TOTAL	35.5	35.5

* Includes unimproved roadways, ditches and mining-related areas that can be identified on air photos as disturbed, but cannot be assigned a specific land use.

Railroad Construction Area

Cover Types	Number of Acres Before	After
Brush/Grassland	0.5	
Disturbed Land*	7.8	13.5
Railroad	1.6	7.2
Types 1 to 8 Wetlands (includes lakes)	1.2	
Wooded/Forest	9.6	
TOTAL	20.6	20.6

* Includes unimproved roadways, ditches and mining-related areas that can be identified on air photos as disturbed, but cannot be assigned a specific land use.

Mining Area

Cover Types	Number of Acres Before	After
Brush/Grassland	293.5	1108.4
Disturbed Land***	65.9	
Types 1 to 8 Wetlands (includes lakes)	1257.0	
Wooded/Forest	1398.1	
Impervious Surface/Mine Infrastructure**		35.0
Mine Pit		619.6
Railroad		55.5
Road		37.6
Stockpile		1126.0
Treatment Pond		32.5
TOTAL	3014.5	3014.5

*   Post-project conditions will include pit lakes and may include wetlands and small amounts of wooded or revegetated land.
** Includes buildings and miscellaneous mining-related facilities
***   Includes unimproved roadways, ditches and mining-related areas that can be identified on air photos as disturbed, but cannot be assigned a specific land use.

If **Before** and **After** totals are not equal, explain why:

Proposed Treatment of Topic in EIS:
The EIS will discuss potential impacts from changes in cover types as well as provide additional detail on timing of cover type changes and post reclamation cover types.

11. Fish, wildlife and ecologically sensitive resources

a. Identify fish and wildlife resources and habitats on or near the site and describe how they would be affected by the project. Describe any measures to be taken to minimize or avoid impacts.

This section is organized into two major parts: 1) Wildlife Resources & Habitat, and 2) Aquatic Resources & Habitat.

Wildlife Resources & Habitat

With respect to wildlife resources and habitat, four general areas may be considered:

1. Mine site
2. Road and railroad corridors.
3. Plant site (including the Area 1 shop truck maintenance facility)
4. Tailings basin, and

These are addressed separately below.

MINE SITE

Wildlife Resources – Mine Site

Amphibians, reptiles, birds, and mammals were surveyed during field studies. Green and chorus frogs were observed in several wetlands on the study area. Tadpoles were also seen in several wet areas, but could not be identified as to species. Garter snakes were observed in clearcuts. Thirty-two species of birds were identified. Great blue heron, common snipe, belted kingfisher and swamp sparrow were observed near wetlands and ponds. Mourning dove, eastern kingbird, water pipit, chipping sparrow, song sparrow, and white-throated sparrow were associated with disturbed areas and grassland/shrublands. The remainder of species was primarily associated with forests, including five species of woodpeckers (black-backed woodpecker, hairy woodpecker, northern flicker, northern three-toed woodpecker, and pileated woodpecker). Woodpecker cavities and foraging sign were common on larger snags (>6 in diameter at breast height - dbh) and on stumps. Other cavity-nesting species seen in forests included black-capped chickadee and red-breasted nuthatch. Broad-winged hawk, least flycatcher, eastern phoebe, eastern wood peewee, gray jay, blue jay, common raven, common redpoll, American crow, winter wren, hermit thrush, American robin, gray catbird, red-eyed vireo, Nashville warbler, pine warbler, black-and-white warbler, common yellowthroat, dark-eyed junco, and snow bunting were found in forests. Ruffed grouse were heard drumming, especially on the central portion of the property.

Common mammals seen or identified based on sign included beaver, pine marten, red squirrel, white-tailed deer, moose, coyote, gray wolf, bobcat, river otter, and showshoe hare. Marten dens and sign were common in jack pine and spruce forests associated with wetlands. Red squirrel sign were abundant in jack pine forests. Deer and moose were associated with clearings associated with nearby forest, although moose droppings were common in sedge and alder wetlands near upland forests. Moose were most common on the western portion of the property. Black bear scat was seen in the north central portion of the property, and a bear and cub were seen near the western boundary of the property. Red fox scat was found in the study area. Coyote tracks were seen along roadways, and wolves were heard during night call surveys. Bats were seen flying over wetlands in the evening.

Wildlife Habitat – Mine Site

Habitat observed on the study area was typical of habitats associated with much of the Iron Range. The study area has little relief. The area consists of a mosaic of slightly elevated upland areas surrounded by wetlands, and slopes toward the east-northeast, in the direction of the Partridge River. Elevations range from 1,620 feet msl along the western boundary to 1,550 feet msl near the southeastern boundary of the study area. More upland habitat was associated with the central portion of the study area, in the vicinity of the proposed mine. The One Hundred Mile Swamp is the dominant feature on the landscape, located in the northern portion of the study area. The Partridge River drains this swamp and flows along the northeastern and eastern boundary of the study area, before entering and leaving the southeastern portion of the study area.

Forest vegetation dominates the study area. Most forest stands contained trees that were 12 inches diameter at breast height (dbh) or less. In general, the site can be divided into quadrants. The northwest quadrant is dominated by lowland black spruce, with scattered stands of quaking aspen and balsam fir/aspen; tamarack is also scattered throughout these stands. Most trees are estimated to be 60 years or older. Interspersed within forest stands are brush/sapling tree stands that were recently logged and provide habitat for deer and moose. Several wetlands are found in this quadrant, with One Hundred Mile Swamp comprising most of the western and northern portions of the quadrant.

The northeast quadrant is dominated by nearly equal amounts of jack pine and spruce, with scattered aspen stands and speckled alder swamps. Although there are scattered black spruce stands containing trees greater than 60 years in age, most trees, especially jack pine, are 20 to 60 years in age. There are few recently logged areas within this quadrant. The Partridge River and several large associated wetlands are found in this area. Most shrub/sapling tree habitat is associated with these wetlands and drainages.

Grouse tend to favor areas with younger aspen and birch trees associated with mature conifer forest habitat, and it appeared that grouse were more common in the northeast quadrant than in any other quadrant, especially during 2000 winter surveys.

The southeast quadrant contains a nearly equal mix of lowland and upland spruce, jack pine, and aspen, with some balsam fir and paper birch. Most tree stands are from 40 to 80+ years of age, although jack pine tree stands along Dunka Road are from 20 to 40 years of age. The Partridge River and a tributary to the river, Stubble Creek, are found in this quadrant and are dominated by sedge and cattail meadows and shrubs, including speckled alder and willow. Minnesota Power's Taconite Harbor to Hoyt Lakes powerline and Cliffs Erie's railroad are also important features in this quadrant.

Aspen, black spruce, and speckled alder wetlands dominate the southeast quadrant. There is more balsam fir in this quadrant than in the other quadrants, while jack pine is rare and found only in scattered stands. Most tree stands are 60 years of age or older, with the oldest stands found near the southern boundary of the quadrant; most jack pine stands have been harvested within the past 40 years. Clearings comprised of grasses, forbs, and shrubs were associated with the powerline right-of-way, and several recently logged areas. The Partridge River is the dominant aquatic feature in this quadrant, but several wetlands were also found along the powerline route.

The recently logged areas consist of grasses and ferns with aspen saplings and speckled alder. The areas of more mature upland forests consist of jack pine, balsam fir, and aspen, with lesser amounts of paper birch, red pine and white pine. The mature lowland areas consist mainly of black spruce and tamarack growing on a bed of sphagnum moss and clubmoss with speckled alder, Labrador-tea, and leatherleaf. The open wetland areas consist of grasses, sedges, cattails, speckled alder, and pussy willow.

Upland areas appeared to be used more by wildlife than wetlands, especially by large mammals such as deer and moose, probably because uplands provided greater cover and more browse and other food items during winter than did wetlands. Deer favor aspen and birch forests in northern Minnesota for foraging, while conifer-dominated stands are important in late winter.

Likely Impacts to Wildlife Resources and Habitat – Mine Site

Potential impacts to wildlife from activities associated with the Mine Site include the following:

- Habitat loss and modification
- Land use and disturbance
- Acid mine drainage

Habitat Loss and Wildlife Species Impacted

Habitat analysis is a standard approach used to assess the impacts of land management activities on wildlife. Habitat relates the presence of an organism to the physical (e.g., topography, microclimate) and biological (e.g., plant composition and cover) attributes of the environment.

Most habitat assessment studies focus on the biological attributes, which are often delineated as cover types, or areas of land or water with similar habitat characteristics. Once the landscape is delineated into a group of cover types, the relationship between occurrence of cover types and presence of various wildlife species can be determined. This relationship can be used to assess whether a certain species is likely to occur in an area, and how loss of or a change in cover types could influence wildlife species occurrence.

Development of the Mine Site would directly impact approximately 3,015 acres of wildlife habitat. Of this 3,015 acres, approximately 1,305 acres (43%) are wetland, and 1,710 acres (57%) are upland (Figure 11-3). Although undeveloped portions of the lease area, primarily on the perimeter of the Mine Site, will be retained as wildlife habitat and to buffer the Mine Site from adjacent, undisturbed habitats, noise disturbance and human presence would render these habitats unsuitable for some wildlife during mine operations.

Species that are fossorial, nest or roost in cavities, or are relatively immobile and could not avoid construction equipment would be killed during mine development. These include amphibians and reptiles, burrowing small mammals, rodents and other slow-moving mammals, and cavity nesting/roosting birds and bats. More mobile species, such as deer, moose, coyote, and birds would leave the area during construction, but would have to compete with other wildlife for food and shelter in newly-occupied sites. As a result, health and survivorship of these individuals could be lessened. If construction occurred during winter when most birds and bats are on wintering grounds or migrating, the number of wildlife killed during construction would be reduced. Displacement of resident species due to winter construction, however, would force these animals to seek new food and shelter sources during the time of year when these sources are most limiting and wildlife tend to be under greatest physical stress.

Habitat Fragmentation and Travel Routes

The proposed mine project would increase the amount of habitat fragmentation in the area, changing shrubland, and pole and young mature forest to disturbed areas, and later to mostly open-water habitat and grassland/shrubland/young forest. Construction and development of iron mines to the north and west of the property has made much of this area of limited value to wildlife, especially in areas with pits and waste rock stockpiles. Waste rock stockpiles have begun to revegetate and provide some browse and cover for wildlife, but their value is greatly reduced compared to habitat that existed in the area prior to mining.

In addition, timber harvesting in the area has already removed some of the mature timber in the area, and construction of the Mine Site would remove an additional 308 acres of mature forest. Mature forest provides habitat for species that favor older forests, and provides important cover for deer and moose during winter.

The travel routes of most non-flying wildlife in the study area typically followed existing or historic logging or drilling roads, powerline, road, and railroad rights-of-way, streams, and forest edges. Trails were also common between two adjacent forest types, especially between forage and shelter areas. There was no evidence that the Mine Site is used by large concentrations of wildlife or that the site serves as a critical wildlife corridor. However, the site does serve as a movement corridor, as demonstrated by tracks and trails that suggested movement primarily in an east-west direction, and also to the south. Studies of radio-collared lynx, and observations of gray wolf, bobcat, and coyote show that these animals are found on or near the Mine Site, and that the Mine Site is part of the movement corridor of these species After construction, these species would likely avoid the site.

Land Use Related Impacts

Light and glare, roads, and noise associated with the mine project would impact wildlife. The mine would operate 24 hours a day, 365 days per year, for approximately 20 years. Light and glare would primarily be associated with mine buildings, active stockpiles and the mine pit. Light and glare can benefit wildlife by attracting insects that are important to some species, such as bats. Light and glare, however, can affect the behaviors of wildlife and make some species more susceptible to predation at night. Most wildlife would avoid areas of the mine that are active and well-lit.

Wildlife injury and death are expected to occur from increased traffic volume on the roads. Information on the current number of wildlife killed annually on roads in the area is not known, but is likely small since only a few cars travel on the portion of the Dunka Road through the Mine Site each day. During mine construction and operation, vehicle traffic would increase on the Dunka Road. Thus, wildlife fatalities would be expected to increase during mine construction and operation. Amphibians, reptiles, and small and large mammals would probably be most affected. Habitat suitability for some wildlife would also be reduced near the Mine Site and more heavily used mine access roads due to vehicular traffic and noise.

The impacts of noise on wildlife are largely unknown and the assessment of impacts remains subjective. Wildlife are receptive to different sound frequency spectrums, many of which may be inaudible to humans. Wildlife also are known to habituate to noise, especially noises that are steady or continuous, such as noises that would occur at the mill. Wildlife are less likely to habituate to sudden, infrequent impulse noises.

Noise has the potential to impact all life functions of wildlife, but may have greatest impacts during breeding, roosting, and hibernation. Loud, sudden noises would be expected to displace a variety of wildlife found on the Mine Site, including deer, game birds, and small mammals.

Acid Mine Drainage Impacts

Water flowing from reactive waste rock stockpiles would be collected in ponds and treated prior to discharge to the Partridge River. Studies have shown that the waste rock has the potential to generate acid and leach metals. Drainage water would be collected in ponds and could be used by amphibians, birds, and small and large mammals as a potential foraging, loafing, and drinking site. The risk to wildlife health and potential for wildlife mortality would depend upon the acidity and concentration of metals in the water, and the types and duration of use by wildlife. Potential water quality impacts are described in the responses to Questions 17 and 18.

The risks to wildlife of a spill during the transport of materials used for maintenance and operation of the Mine Site, and during storage and use of the materials at the mine, would depend on the location of the spill and type and amounts of materials spilled. Potentially toxic compounds used in mine processes include water treatment chemicals, ammonium nitrate, gasoline, and diesel fuel. The management and use of these materials is described in the response to Question 20.

Mitigation of Impacts

A number of best management practices (BMPs) and reclamation measures would be taken to reduce or avoid impacts to wildlife. Specific BMP's and reclamation measures will be identified in the EIS.

The size of the footprint would be kept as small as possible to reduce the amount of habitat disturbance. Where feasible, trees and other large vegetation would be left as a buffer around the perimeter of the Mine Site to reduce glare, noise, and other disturbances to wildlife.

The mine would be constructed in phases to minimize the amount of area disturbed at any one time, and to allow sequential reclamation as mining activities permanently cease in each disturbance area. Small trees, scrub vegetation, and forest detritus would be mulched and removed with the topsoil and stockpiled for future use in reclamation. As sections of waste rock stockpiles or other mine facilities are closed, the sites would be graded for precipitation runoff and/or to better match the local topography, covered with soil, and revegetated. A stormwater management plan would be developed that identifies practices to ensure that stormwater runoff does not adversely impact off-site water quality.

Reactive waste rock would be stockpiled on top of a seepage barrier and drainage collected in lined storage ponds. The water in ponds would be treated prior to discharge to the Partridge River. Pit water would also be collected, sediments would be allowed to settle out, and then treated, if necessary, before discharge. Fuel and other hazardous materials would be stored within a roofed structure. Bulk oil storage tanks would be enclosed with a berm sized to contain all oil within the storage tanks.

Speed limits would be enforced along the Dunka Road and this would reduce the risk of wildlife-vehicle collisions. Mine workers would be given training to make them aware of the importance of the area to wildlife, to request that employees report sick or dying wildlife along roads or at facilities, to ensure that employees do not dump wastes or other harmful materials off the site, and to make employees aware of other actions that could be harmful to wildlife or their habitats. After mine closure, most access roads would be reclaimed.

RAILROAD CORRIDOR

Wildlife Resources– Railroad Corridor

The railroad route contains habitats for amphibians, reptiles, birds, and mammals. Several species of waterfowl were observed to be using the large marsh wetland. The marsh is also expected to support frogs, great blue heron, common snipe, belted kingfisher, swamp sparrows, beaver, and possibly river otter. The forested habitats are expected to provide habitat for woodpeckers, cavity-nesting birds (see Mine Site section for specific species), ruffed grouse, pine marten, red squirrel, white-tailed deer and possibly moose. The habitats are very fragmented in this area by stockpiles, mine pits, railroads, roads, and trails. The fragmented nature of the area may limit its use by some wildlife.

Wildlife Habitat – Railroad Corridor

Habitats within the proposed railroad corridor include a mix of upland and wetland habitats commonly found in the area. The railroad route closely follows or crosses several existing roads and trails north of its connection with the existing railroad (Figure 5-7). Ground elevations within the route range from 1620 feet msl on the north side where the route would extend from an existing mine road grade down to 1570 feet msl at the southeast where the route ties into an existing railroad grade. Habitats within the route include a mix of forest cover, roads and trails, and wetlands. The forests were predominantly mixed deciduous/coniferous cover with varying amounts of aspen, black ash, balsam fir, jack pine, and spruce. There is a wet meadow wetland in the northern portion, a black ash swamp adjacent to the central part, and a large shallow and deep marsh at the southeast end of the route. The wetlands are dominated by Canada bluejoint grass in the wet meadow and open water with a perimeter of cattails in the shallow water area with shrubs along the saturated perimeter. The marsh wetland is a floodplain extension of a perennial stream that drains approximately 2,000 acres. The primary north-south road along which the route runs is a gravel road in good condition. Three unimproved trails cross the route in the southern end.

Likely Impacts to Wildlife Resources & Habitat – Railroad Corridor

The proposed railroad would result primarily in the loss of a small amount of mixed upland forest land. A small amount of wetland filling may be necessary to connect the proposed railroad into the existing railroad embankment. The railroad would not significantly fragment habitats as it is planned to closely follow existing roads and trails. The railroad is not expected to significantly impact wildlife resources. Currently, much of the area through which the railroad passes is fenced with an approximately 6-foot tall fence which hampers wildlife movement. The construction of a railroad through this area is not expected to alter wildlife movements, but may allow more free dispersal if the fence is removed. The proposed railroad construction will not cross Wyman, Longnose, or Wetegs Creek.

Based on conceptual railroad design, it is anticipated that the following areas of habitat types will be impacted:

1. Shrub lands - 0.5 acre
2. Wetland – 1.2 acres
3. Railroad Right-of-way – 1.6 acres
4. Disturbed Roads and Trails – 7.8 acres
5. Forests/Wooded – 9.6 acres

PLANT SITE

The Plant Site has been extensively disturbed and/or filled as a result of previous construction and almost 50 years of mining-related activity. An aerial photo of the Plant Site is shown in Figure 11-1. With exception of the northeast quadrant of this site, the majority of the area is covered by buildings and tanks with deep and substantial foundations, mechanical equipment, related foundations product storage areas, and ballast or finished surfaces related to the construction of paved road, parking lots and railroad facilities. Proposed project construction located at the Plant Site will occur on previously paved areas or within existing buildings. No direct impact to wildlife resources or habitat is expected as a result of the construction and operation at the Plant Site.

TAILINGS BASIN

Wildlife Resources & Habitat – Tailings Basin

On October 30, 2001, all of LTV Steel Mining Company's (LTVSMC) mining related property was transferred to Cliffs Erie L.L.C. (CE).

CE has continued to aggressively carry out reclamation activities on the former LTVSMC tailings basin on a timetable that allows development and reuse of the site to be fully explored as stated in the CE Closure Plan dated May 23, 2002. The planned end use under the CE Closure Plan is wildlife habitat.

The tailings basin consists of three large cells: 2W, 1E and 2E (see Figure 11-2). Cell 2W is the largest (1,447 acres), and highest (200 feet) of the three cells. It is the driest cell and has gradually lost the ponded water remaining from taconite processing. Thus, the entire cell is upland and has undergone reclamation to establish an upland grass/forb plant community since 2000. This program relies heavily on an initial introduction of plentiful plant seed adapted to harsh conditions of the tailings basin. This circumstance limits the potential of early volunteer (native) plants to successfully colonize the basin.

Plant operations personnel have observed wildlife in the tailings basin for many years. Common wildlife visitors large enough to be clearly observed or to leave tracks include: white tailed deer, moose, badger, coyote, fox, muskrat, mink, otter, Canada geese, mallard, scaup, canvasback, redhead, blue-winged teal, American widgeon, swans, red tailed hawk, sparrow hawk, snow buntings, kingfisher, and numerous songbirds. The lowland pond areas in Cells 1E and 2E also attract other migrating waterfowl and shore birds for short periods of time.

Likely Impacts to Wildlife Resources & Habitat – Tailings Basin

Based on the conceptual basin operating plan and hydrometallurgical residue disposal facility plans, it is anticipated that the following areas of habitat types would be impacted (see Figure 11-2):

1. Shrub Lands/Grasslands - 12 acres
2. Tailing Basin Lowlands – 226 acres
3. Tailings Basin Open Water – 638 acres
4. Tailings Basin Upland – 2093 acres
5. Wetland – 23 acres
6. Wooded/Forest – 149 acres

The actual acreage of the existing tailings basin that would be impacted is likely less than what is described above. The above acreage identifies the entire tailings basin due current uncertainty about the amount and location of coarse tailings that will need to be borrowed from Cell 2W. The shrub lands and forested/wooded areas of the tailings basin represent the only areas on the interior of the area enclosed by tailings basin that have not been significantly disturbed by past tailings discharge related activities. The tailings basin lowlands represent lowlands and deepwater habitats that developed within the former LTVSMC tailings basin during operation and ongoing reclamation activities. The reclaimed grasslands represent the reclaimed portions of the west cell of the LTVSMC tailings basin, which was closed during operation of the basin by LTVSMC. The remaining areas classified as disturbed represent areas around the east cells of the LTVSMC tailings basin that were in operation when the plant shut down. These areas are under various stages of reclamation and include roadways.

Attraction of wildlife to open water in the tailings basin and reactive residue facility could be a potential impact depending on the level of attraction and the toxicity of the water.

Aquatic Resources & Habitat

Biological sampling of aquatic invertebrates and fish was completed in September 2004 for the Partridge River, two palustrine wetlands adjacent to the toe of the tailings basin, and Trimble Creek downstream of the tailings basin. A survey of freshwater mussels was also completed for the Partridge River, Trimble, Creek, and the Embarrass River in October 2004 (see Figure 11-4 for all the biological sampling locations). Aquatic invertebrate data will be available for EIS preparation, preliminary fish and freshwater mussel results are described below. Reports of all completed aquatic biological monitoring will be available for EIS preparation.

Stream fish assemblages were sampled by pulse DC electofishing using either a tote-barge or a portable backpack unit. The type of gear used depended on stream depth, width, and substrate type. The distance of stream reach included in the survey was generally based on 10x the stream width, but a minimum of 100 m was sampled. A single-pass method was determined adequate to establish an estimate of taxa richness within each sample reach.

Freshwater mussels were collected in October by visually searching and tactilely by hand using SCUBA and by snorkeling. Both living and empty (dead) freshwater mussels were collected, placed in a 0.125 mm mesh-sized bag, brought to the surface, identified, enumerated, total length measured and age of the mussels recorded.

With respect to aquatic resources and habitat, four general areas may be considered, mine site, tailings basin, road and railroad corridors, and effected downstream water bodies including the Partridge River. However, until greater detail is provided in the final fisheries and invertebrate reports, these areas are considered together to provide a general description of the aquatic resources and habitats of the entire project area. Potential impacts to aquatic resources from changes in quantity and quality of water are also identified in response to EAW Questions 12, 17 and 18.

FISH RESOURCES

The fisheries data that is currently available from the survey includes the range and average fish lengths, abundance, and trophic structure. Species abundance values will be included in the EIS, but because the effectiveness in sampling effort was not equal among all sites (resulting from low conductivity experienced at some sites, differences in stream width, bottom characteristics, etc.), the abundance values should be used cautiously. Similarly, the depth and surface area associated with the wetland sites eliminated the opportunity to use electofishing gear. Thus, the effort and gear-type should both be considered prior to making any inferences between fish assemblages or community structure between sites. Some general observations can be made for all habitats sampled.

No taxa collected in this survey were endangered or considered rare to the region. Table 11-1 identifies the fish species that were indentified.

Table 11-1: Fish Species Identified

Partridge River
Blacknose Dace
Brassy Minnow
Brook Stickleback
Central Mudminnow
Common Shiner
Johnny Darter
Longnose Dace
Northern Redbelly Dace
Pearl Dace
Tadpole Madtom
White Sucker
Trimble Creek
Brook Stickleback
Burbot
Central Mudminnow
Creek Chub
Northern Redbelly Dace
White Sucker
Wetlands Adjacent to the Tailings Basin
Brook Stickleback
Central Mudminnow
Common Shiner
Creek Chub
Fathead Minnow
Finescale Dace
Northern Redbelly Dace
While Sucker

FRESHWATER MUSSELS

A total of 82 mussels were collected at sampling locations on the Partridge River, Trimble Creek, and Embarrass River. Two species were found: *Pyganodan grandis* and *Lampsilis siliquoidea*, comprising 59 percent and 41 percent of the mussel species, respectively. Neither of these species are listed as state or federal threatened or endangered species. The greatest abundance of mussels was found at M-1 on the Partridge River (41 living mussels), followed by M2 on the Partridge River (4 living mussels), M-4 on the Embarrass River (3 living) and no mussels at M-3 on Trimble Creek (Figure 11-4). In general, population densities at these sampling locations can be considered low. Overall the mussel fauna in Partridge and Embarrass River is typical for small stream in the western Lake Superior Basin. The two species that were found are very widespread and common throughout the upper Midwest and are area generalists that occur in nearly all types and sizes of waterbodies.

LIKELY IMPACTS TO AQUATIC RESOURCES & HABITAT

With the exception of open water wetlands within the proposed mining area, development of the mine, plant site, road and rail corridors, and the tailings basin are not expected to cause direct physical displacement of fish, mussels, and invertebrates.

Potential impacts would be associated with:

- the discharge of treated drainage from various operating locations in the mine (i.e. treated reactive water discharged from treatment facility; non-reactive water discharged from detention basins)
- temporary disturbances to upland areas adjacent to streams intersecting upgraded road or new railroad corridors, and
- the discharge of water directly from the plant/tailings basin treatment facility
- Accidental spills that discharge toxic material into water

Potential impacts from discharges at the mining site are primarily associated with hydrologic/hydraulic effects on the integrity/stability of the receiving stream (Potentially effecting aquatic habitats in the Partridge River) and the water quality of potential receiving waters (may include Partridge River, Trimble Creek, Embarrass River and potentially others).

The predicted impacts to magnitude and duration of flow in the Partridge River, Trimble Creek and other waters are discussed in response to Question 13. Potential water quality impacts on receiving water are discussed in response to Questions 17 and 18.

Proposed Treatment of Topic in EIS:
The EIS will discuss potential impacts to fish and wildlife habitats. This discussion will make use of existing studies that are appropriate for identification of the potential impact. Examples of studies that may be used include The Copper-Nickel Study Plots and previous work in the area. A Rosgen Level 1 geomorphology assessment and hydrologic assessment (described below in Question 12) will also be used to assess any impact to aquatic resources. The EIS will also discuss potential mitigation for impacts to fish and wildlife habitat.

b. Are any state (endangered or threatened) species, rare plant communities or other sensitive ecological resources such as native prairie habitat, colonial waterbird nesting colonies or regionally rare plant communities on or near the site? _X_ Yes No

If yes, describe the resource and how it would be affected by the project. Indicate if a site survey of the resources has been conducted and describe the results. If the DNR Natural Heritage and Nongame Research program has been contacted give the correspondence reference number. Describe measures to minimize or avoid adverse impacts.

Wildlife Species of Concern

The MDNR conducted a Minnesota Natural Heritage Program database query during January 2000 for State and Federal Threatened and Endangered plant and animal species as well as State Special Concern Species and Native Plant Communities likely to be found on or near the site. The Minnesota Natural Heritage Program conducted a second database search on June 8, 2004. The results of that search showed that three state-listed plant species (least moonwort, neat spike-rush, and Torrey's manna-grass) are found in the area. In addition, one plant species (matricary grapefern) and one wildlife species (northern goshawk) were identified that are found in the area and are tracked by the Program, but are not given special status by the State of Minnesota.

During the time between the June 8, 2004 database search and the preparation of this Scoping EAW a wood turtle record was added to the database. This wood turtle was sighted about one mile south of the mine site on the Partridge River. The wood turtle is a state-listed threatened species.

U.S. Fish and Wildlife Service (USFWS) and U.S. Forest Service (USFS) were contacted for to identify potential species that may be of a concern in the project area. The Minnesota List of Endangered, Threatened, and Special Concern Species on the MDNR Website (http://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf) and the Birds of Fisherman's Point and Hoyt Lakes Area were reviewed.

Based on the above discussions, database search, document reviews, and field studies on and adjacent to the Mine Site, it was determined several wildlife species of concern may be found in the Mine Site, although most species are rare visitors to the area or migrate through the area during spring or fall. The following discussion provides an assessment of the current status of state and federally listed species at the project site with emphasis on the Mine Site.

FEDERALLY-LISTED THREATENED AND ENDANGERED SPECIES

The U.S. Army Corps of Engineers will consult with USFWS as required in Section 7 of the Endangered Species Act (ESA) prior to any federal decision on the project. The results of this consultation will be available for inclusion in the EIS.

Bald eagle (Threatened). No bald eagles were observed during surveys conducted in June of 2004. Although 100-Mile Swamp could provide foraging habitat for eagles, no large perch or nesting trees were seen near the swamp, thus it is unlikely that bald eagles would use the Mine Site. The nearest bald eagle nest is located 7.5 miles to the north on Birch Lake.

Canada lynx (Threatened). Canada lynx are rare in northern Minnesota. Surveys for lynx were conducted using bait traps and track surveys on the NorthMet site during winter 2000; no lynx were found.

Approximately 50 lynx have been seen in St. Louis County since 2000 and 4 of these lynx had young. The nearest sightings were approximately 6 miles from the project site. A lynx was captured and radio-collared approximately 12 miles north of the site in

August 2003; the animal subsequently moved west to near Pelican Lake in the northwestern portion of St. Louis County. The nearest sightings of a lynx with young were approximately 16 miles north of the project site in 2002 and 16 miles south of the project site in 2004. No lynx were recorded on the NorthMet Mine Site during these surveys. Recent studies of snowshoe hare and red squirrel pellet density suggest that hare and squirrel numbers are greatest in jack pine, red pine, black spruce, and mixed pole and mature forests; presumably, lynx would be more common in these habitats. Longer-term studies have shown that lynx favor mixed forests in Minnesota. Since lynx have been seen near the NorthMet Mine Site, and habitats used by prey species are common on the site, the potential exists for lynx to use or travel through the proposed Mine Site area.

Gray wolf (Threatened).

Approximately 2,600 wolves reside in northern Minnesota. Wolf packs are generally comprised of four to eight wolves. Several wolf packs have been identified, and individuals within the pack radio-collared, near the study area by the U.S. Geological Survey/International Wolf Center. Territory size for wolves in northern Minnesota ranges from 20 to 150 square miles and wolf packs tend to avoid areas used by other wolf packs.

Gray wolves were recorded on the site during surveys in 2000 and 2004. Wolves appeared to be traveling through the area and radio-collared wolves have been observed traveling within a few miles of the Mine Site. During 2000 and 2004, wolf tracks were seen along Dunka Road. Interestingly, wolf tracks were not observed on the study area during January 2000, when an exploration drill rig was operating, but only during March 2000, and June 2004, when the rig was not in operation. Thus, noise and activity associated with drilling activities may have discouraged wolves from using the area in the immediate vicinity of the exploration area. No active dens are known to occur in the Lease Area. Mine activities would displace wolves from the site and disturbances associated with mining could cause wolves to avoid the area; however, wolf tracks were seen on a service road along the boundary between the Northshore Mine and Mesaba and NorthMet Mine sites.

STATE-LISTED THREATENED AND ENDANGERED SPECIES

PLANT SPECIES OF CONCERN (THREATENED, ENDANGERED, AND SPECIAL CONCERN)

The MDNR was consulted to provide records from their Natural Heritage database for the Mine Site and within one mile of the site. The database showed the presence of, one state-listed threatened species, three state-listed special concern species, and one tracked, but not state-listed species.

A botanical field survey was conducted between July and August 2004 at the Mine Site. The area of the survey was greater than the project area, due to early uncertainty regarding the extent of the project. This survey was intended to provide field data concerning the presence or absence of certain MDNR state-listed or federal-listed plant species. Several species of rare plants were given priority in the search, but all state- and federal-listed species were included in the search along with other species listed as sensitive by the USFS Superior National Forest Region 9.

The survey was conducted by three teams of botanists during July and August of 2004:

Methods
Disturbed soils of roads, railroads, and trails through brushy or wooded areas; shallow water bodies; and forested, shrub, and grassy wetlands were considered potential habitat for listed species.

Searches were intensely focused on likely habitats identified from aerial photographs, topographic maps, and wetland maps. The site was first searched using widely spaced transects. Smaller habitat types located within major vegetation cover types were intensely searched to locate any rare plant species that may occur in them at times appropriate for their known phenologies.

Results
A total of thirteen species of rare or sensitive plants were located and identified during the rare plant surveys within and near the Mine Site including eight state-listed species (Figure 11-5). The survey located and identified two state-listed endangered species (Figure 11-6), one state-listed threatened species, and five state-listed special concern species. A total of six species are *Botrychium* ferns or moonworts and the rest are flowering plants. The species and populations are identified on Table 11-2.

Proposed Treatment of Topic in EIS:
The EIS will evaluate potential impacts to threatened and endangered species. Existing information will be evaluated and additional information collected if necessary to support state and federal regulatory requirements for threatened and endangered species. Potential mitigation strategies and alternatives will be evaluated to prevent and minimize any identified impacts.

Table 11-2: Rare species survey results – mine site

Common Name	Scientific Name	State Status[1]	Polymet Mine Site Observations	Approximate number of Individuals	Habitat
Moonwort fern	*Botrychium dissectum var dissectum*	NON	2 populations identified	5	Full exposure, moss cover.
Daisy leaf moonwort	*Botrychium matricariifolium*	NON	12 populations identified	471	Full to shady exposure, edge of alder thicket, forest roads, along Dunka Road, and railroad and power line rights-of-way.
Michigan moonwort	*Botrychium michiganense (=hesperium)*	NON	6 populations identified	242	Full to shady exposure, edge of alder thicket, forest roads, along Dunka Road, and railroad and power line rights-of-way.
Moonwort fern	*Botrychium multifidum*	NON	11 populations identified	402	Full to shady exposure, edge of alder thicket, forest roads, along Dunka Road, and railroad and power line rights-of-way.
Pale moonwort	*Botrychium pallidum*	E	4 populations identified	58	Full to shady exposure, edge of alder thicket, along Dunka Road, and railroad and powerline right-of-way.
Ternate grape-fern	*Botrychium rugulosum (=ternatum)*	T	None identified		Disturbed habitats, fields, open woods, forests
Least grape-fern	*Botrychium simplex*	SC	20 populations identified	1,337	Full to shady exposure, edge of alder thicket, forest roads, along Dunka Road, and railroad and power line rights-of-way.
Floating marsh marigold	*Caltha natans*	E	13 populations identified	~150	Shallow water in ditches and streams, alder swamps, shallow marsh, beaver ponds, and Partridge River mudflat.
Neat spike-rush	*Eleocharis nitida*	T	11 populations identified	~1,450 sf	Full exposure, moist ditches along Dunka Road, wet area between railroad grades, and railroad ditch.
Northern commandra	*Geocaulon lividum*	SC	11 populations identified		On *Pleurozium* and *Sphagnum*moss mats under black spruce, open to partly shaded.
Vasey's rush	*Juncus vaseyi*	NON	3 populations identified	9 clumps	Low wet areas along Dunka Road.
Buttercup	*Ranunculus gmelinii*	NON	7 populations identified	~475 sf	On muddy soil of drying ponds, floating in 1.5 feet of water in channel, along Partridge River.
Lapland buttercup	*Ranunculus lapponicus*	SC	7 populations identified	~825 sf	On and adjcent to *Sphagnum* hummocks in black spruce stands, up to 60 percent shaded with alder also dominant.
Stalked bulrush	*Scirpus pedicellatus*	NON	11 populations identified		Conifer swamps and wet meandows.
Clustered bur-reed (floating marsh marigold)	*Sparganium glomeratum*	SC	13 populations identified	>100	Shallow pools and channels up to 1.5 feet deep in *Sphagnum*at edge of black spruce swamp, beaver pond, wet ditches, shallow marsh
Torrey's manna- grass	*Torreyochloa pallida*	SC	8 populations identified	~800 sf	In muddy soil along shore and in water within shallow channels, beaver ponds, shallow marshes, along Partridge River.

[1] E - Endangered, T - Threatened, SC - Special Concern Species, NON - not listed

12. Physical impacts on water resources. Will the project involve the physical or hydrologic alteration — dredging, filling, stream diversion, outfall structure, diking, and impoundment — of any surface waters such as a lake, pond, wetland, stream or drainage ditch? _X_Yes __No
If yes, identify water resource affected and give the DNR Protected Waters Inventory number(s) if the water resources affected are on the PWI: .

Describe alternatives considered and proposed mitigation measures to minimize impacts.

GENERAL DESCRIPTION OF PROJECT'S PHYSICAL IMPACTS ON WATER RESOURCES

Mine Site

Physical impacts on water resources from the mine site can be characterized into two categories:

1. Direct and indirect wetland impacts from mine pit (construction and dewatering), stockpiles and miscellaneous construction activity.

2. Potential fluvial geomorphology impacts to Partridge River from mine dewatering and stockpile discharges.

Railroad Corridor

Although the majority of the railroad corridor for this project would remain unchanged, there is a small section that needs to be constructed and construction would impact approximately 1.2 acres of wetland. The use of existing culverts and stream crossing will prevent any addition physical impacts to water resources from the railroad corridor.

Plant site

A new building will be constructed on upland at the plant site to house the autoclaves for the pressure oxidation process. There are no physical impacts to water resources anticipated from this construction.

Tailings basin

There could be physical impacts to water resources from the tailings basin. The extent and location of these impacts is not well known at this time. Water seepage from the tailings basin as well as potential wastewater discharges after treatment of process water from the reactive residue facility may have some hydrological impact on Trimble Creek.

Information about the amount of water and any potential impacts to Trimble Creek will be identified in the EIS.

MINE SITE WETLAND IMPACTS

Hydrology and Hydrogeology

The Mine Site is situated in the headwaters of the St. Louis River Watershed #3. The Mine Site north of the Dunka Road is partially encircled by the Partridge River. The headwaters of the Partridge River receive mine dewatering discharge from the Peter Mitchell Pit, operated by Northshore Mining Company and located less than one mile north of the Mine Site. Additional discharge to the Partridge River comes from the local tributary area including the One Hundred Mile Swamp and the far northern portion of the mine site. On the north side of the Mine Site, the Partridge River flows north and then east and turns south along the east boundary of the lease boundary before reentering the project site south of the Dunka Road where it flows southwest to where it leaves the south-central portion of the lease boundary.

Surface elevations of the Mine Site north of the Dunka Road range from 1630 feet MSL in the northern part to 1580 feet MSL along the Dunka Road. Surface elevations in the One Hundred Mile Swamp range from 1610 feet MSL northwest of the Mine Site to 1600 feet MSL near the north-central portion of the Mine Site. Ground elevations south of the Dunka Road range from 1580 feet MSL in the north to 1540 feet MSL along the Partridge River in the south. A surface water divide oriented generally from the southwest to the northeast is situated in the northern portion of the site. South of the drainage divide, surface water generally drains from north to south to culverts in five general locations under the Dunka Road. South of the Dunka Road, surface water generally flows south through large wetland complexes to the Partridge River.

Wetland Descriptions

Due to the large number and large acreage of potentially impacted wetlands and the early stage of planning, the individual wetlands have not been described. The identified wetland locations are shown on Figure 12-1. A tabulation of the identified wetlands including the type, classification, and total size is provided in Table 12-1. A total of 114 wetlands covering 2,544 acres have been identified within an area slightly larger than the proposed mine site (Figure 12-1). A summary of the wetlands by Circular 39 wetland type is provided in Table 12-3. Over one-half of the wetlands identified are predominantly black spruce and open bog communities. Approximately one-fourth of the wetland area is predominantly alder swamp communities. Wet/sedge meadow and shallow marsh communities cover nearly equal areas of the site, and lowland hardwood swamps make up a minor percentage of the wetlands (Table 12-3). The majority of the wetlands are present in complexes that either lie in the floodplain of the Partridge River or are tributary to the Partridge River. There are a few isolated wetlands and isolated raised bogs within the mine site that represent a small percentage of the total wetland resources (Figure 12-1). More detailed characterization, delineation, and descriptions of wetlands will be provided during specific permitting phases.

Wetland Impact Areas
The wetlands identified and mapped at the Mine Site are shown on Figure 12-1. Potential impacts to the Mine Site wetlands were determined based on the projected limits of mining activities, including stripping, stockpiling, water treatment, and support facility construction as described previously in response to Question 6b.

A detailed Mine Site plan and mine phasing plan have not yet been completed, so the timing of wetland impacts cannot yet be defined. All impacts are expected over the initial 1-year construction phase and subsequent 20-year mining plan. A mine plan, including detailed facilities layout and phasing of mining and stockpiling is under development. The resulting estimate of wetland impacts for construction and the first 5 years of operation will be submitted as part of the MDNR Permit To Mine and will be available for use in the EIS. The EIS will evaluate the entire estimated 1,257 acres of direct impacts to wetlands as well as indirect impacts from changes in hydrology or chemistry that could impact the species diversity or ecological functions of the wetlands.

A summary of all potentially impacted wetlands within the Mine Site is provided in Table 12-2. This table includes the wetland type, the Circular 39 classification, the Cowardin Classification, and the direct wetland impact area. The stockpile impact areas shown assume that all stockpiling will occur on the surface.

Summary of Wetland Impacts
It is anticipated that a total of 1,257 acres of wetland would be impacted by the proposed mining, construction of mine support facilities, rock and overburden stockpiling, and miscellaneous transportation and utility requirements during the life of the project (Figure 12-2). Preliminary evaluations indicate that approximately one-half of these wetlands are predominantly bog communities. Approximately one-fourth of the potential wetland impacts are predominantly shrub swamp communities. The remaining one-fourth of the potential wetland impacts includes a mix of wet/sedge meadows, shallow marshes, and lowland hardwood swamps. These impacts are summarized in Table 12-4. More detailed evaluation of wetland impacts will be determined during future planning.

Permitting for each phase of the project typically will be conducted on approximately 5-year increments as has been done at other Iron Range mines. The permitting for activities planned within each 5-year period will begin with a more detailed field delineation, characterization, and mapping of wetlands within areas of planned activities. Future mine planning will include attempts to avoid wetland impacts where practicable, but due to the operational requirements of the mining operations, opportunities to avoid wetlands may be limited. This analysis will be used to determine the level of mitigation that will be needed. Specific wetland mitigation plans will be developed and submitted for approval to compensate for the expected impacts.

Wetland Mitigation Strategy
Due to the proposed 20 year mine operation and associated gradual wetland impacts, PolyMet has proposed a five year cycle of wetland fill permitting and mitigation. This

would allow a more detailed delineation and mitigation of wetlands that will be impacted on schedule that is tied to the actual impact. The U.S. Army Corps of Engineers has not yet determined the suitability of this wetland strategy.

PolyMet has not yet identified a conceptual wetland mitigation plan. The EIS will evaluate potential wetland mitigation strategies including, on-site in-kind wetland creation, off-site out-of-kind wetland creation, high value wetland preservation, wetland enhancement, stream habitat enhancement, and use of wetland banks. This evaluation will focus on the feasibility of successfully mitigating the potential wetland impact.

Impacts to other Water Bodies
The Partridge River will not be physically changed by the project due to channelization or dredging. The Partridge River is identified as a Protected Watercourse on the Protected Waters Inventory, but there is no official PWI number for watercourses. Due to watershed modifications and mine dewatering discharges to the Partridge River some changes in streamflow will occur.

The Embarrass River and Trimble Creek are likewise subject to seepage from the existing Cliffs Erie Tailings basin and wastewater discharges from treated tailings basin water.

Proposed Treatment of Topic in EIS

Avoidance, minimization and mitigation of the 1,257 acres of potential wetland impacts will be evaluated as part of the EIS. Indirect impacts to wetland function on ecological diversity from changes in hydrology and water chemistry will also be evaluated. The EIS will also discuss the suitability and feasibility of various wetland mitigation strategies. Additional detailed wetland delineations will be included for the first five years of proposed mining activity.

The EIS will include a watershed assessment of the upper Partridge River due to net hydrologic effects of Polymet's proposal. This watershed assessment will evaluate the changes in watershed discharge due to land surface changes (loss of wetlands, vegetation, and mine pit construction), as well as the direct hydrologic changes from mine pit dewatering and other mine site discharges. The response to Question 13 describes a hydrogeologic study that will be used to quantify the mine site discharges. A Level 1 Rosgen geomorphic survey will be conducted for the Partridge River, down to Colby Lake to identify any potentially geomorphilogical sensitive stream reaches. If the watershed assessment combined with the Level 1 Rosgen geomorphic survey indicates a potential for fluvial geomorphic impacts resulting from Polymet's proposal, there will be additional evaluation of the impact. If this additional evaluation determines that the changes in magnitude, timing, duration or rate of stream flow will cause significant adverse impacts, additional mitigation and monitoring will be developed.

13. Water use. Will the project involve installation or abandonment of any water wells, connection to or changes in any public water supply or appropriation of any ground or surface water (including dewatering)? _x_Yes __No

If yes, as applicable, give location and purpose of any new wells; public supply

affected, changes to be made, and water quantities to be used; the source, duration, quantity and purpose of any appropriations; and unique well numbers and DNR appropriation permit numbers, if known. Identify any existing and new wells on the site map. If there are no wells known on site, explain methodology used to determine.

This project would require a new water appropriation for mine pit dewatering and would use a pre-existing water appropriation permit at the Process Plant, as discussed below. No water wells will be abandoned. The pre-existing appropriation permit proposed for use at the processing plant withdraws from Colby Lake, which is also the public water supply for Hoyt Lakes.

Mine Site

OVERVIEW OF MINE SITE HYDROLOGY

The proposed mine will require the appropriation of water from the pit in order to keep the pit dewatered.

The pit has the potential to receive water from the following sources:

- Direct accumulation of precipitation on the pit
- Groundwater inflow and direct runoff from the unconsolidated sediments overlying the bedrock
- Groundwater inflow from the Duluth Complex (gabbro)
- Groundwater inflow from the Virginia Formation and
- Groundwater inflow from the Biwabik Iron Formation (BIF)

The hydrologic impacts and expected quantities of water from each of these sources will be discussed below. The quantity and quality of surface runoff from stockpiles and surrounding mine facilities as well as the handling and treatment of stockpile seepage are discussed in response to Questions 17.

The proposed PolyMet mine will be located within the Partridge River Watershed, between Hoyt Lakes and Babbitt. The Partridge River flows through Colby Lake near the city of Hoyt Lakes before joining the St. Louis River on its way to Lake Superior. The Partridge River watershed is bounded by the Laurentian Divide just east of the Site. The Laurentian Divide separates the Hudson Bay drainage from the Lake Superior drainage.

At the Mine Site, the bedrock surface appears to be hummocky, with a general southeasterly slope. Approximately 40% percent of the Mine Site is covered by peat/wetland deposits, with the remaining area covered by rolling to undulating

Wisconsin aged Rainey Lobe till. Rainey Lobe till is generally a bouldery till with high clay content. To the south is the Toimi Drumlin Field. There are not significant quantities of outwash (sand and gravel) in the area of the mine site. Unconsolidated sediments in the mine site form a thin cover over the bedrock.

DIRECT RUNOFF AND PRECIPITATION – MINE SITE

Surface runoff to the pit from the surrounding land surface would be reduced by construction of dikes and trenches. Surface drainage would generally be controlled by exterior dikes or by natural drainage area divides around the perimeter of the site. A separate dike would be constructed north of the mine pit to connect the high ground to the northeast and northwest of the pit (see Figure 5-3). This is proposed to prevent water from the Partridge River and adjacent wetlands from draining into the mine area.

On the east lobe of the West Stockpile there are wetlands north of the pile and the natural drainage is to the north. The exterior of the stockpile in this area would be constructed to act as a dike. Seepage through this dike section could then be collected and drained to the non-reactive drainage system. Any residual seepage infiltrating from the seepage collection ditch would pass through the non-reactive base of the stockpile and be captured in the downstream section of the same collection ditch.

The general expectation is that these dikes can be constructed from select material removed during the initial stripping process. Soil characterization and testing during design would locate suitable materials for these dikes. Construction of dams and dikes through wet muskeg has been accomplished at a number of sites on the Mesabi Range. It typically includes rolling a progressive series of lifts into the peat soils to displace and compress the peat. Slurry wall cutoff trenches or other barrier construction may be added, if needed, to minimize seepage. Dikes will be subject to MDNR dam safety rules as appropriate. These dikes are proposed to prevent water from external wetlands from flowing onto the Mine Site.

Trenches are proposed to prevent surface run-off from entering the mine pit. The pit would be encircled by a ditch and dike system to intercept and handle non-reactive runoff. The trenches will intercept runoff from the interior of the Mine Site (including stockpile runoff that has not contacted reactive materials) and direct it to stormwater treatment ponds for discharge.

All stockpiles are proposed to be located near the rim of the pit (as shown in Figure 5-3). Water from non-reactive stockpiles would be collected in a Stormwater Collection System and conveyed to sedimentation basins and thereby prevented from entering the pit. The Stormwater Collection System would handle water that has not come into contact with reactive waste rock or ore and would not likely require treatment beyond sedimentation. A separate Reactive Water Collection and Treatment System would collect water that has come into contact with reactive materials for treatment as appropriate. The stormwater and reactive water systems are described in greater detail in response to Questions 17 and 18.

The intent of the dike and ditch system would be to minimize inflow into the mine pit from surface run-off and seepage from area wetlands. Additional details concerning this system and its effectiveness will be included as a topic in the EIS.

The volume of water produced from direct precipitation on the pit surfaces is important because it may come in contact with sulfide-bearing materials and, if so, would likely require treatment. This is especially true for that portion of the runoff that comes in contact with the inventory of freshly broken ore in the pit.

When considering the direct accumulation of precipitation, two separate volumes need to be considered: single storm event precipitation and yearly average/total precipitation.

Storm events will be analyzed during design and submitted as part of the permit applications for use in the EIS. Hydrologic design is required in order to correctly size the sumps that will be located on the footwall of the pit. Pit pumping would be done in stages, from sump to sump and the upper sumps designed to intercept as much runoff as possible to minimize pumping from the deepest parts of the pits. The sizes of the sumps are related to the rate at which water would be discharged to the Partridge River, and must be sized to prevent the discharge of any untreated water. This will be evaluated as part of the EIS.

The average yearly volume of water from the direct runoff of precipitation into the pits would depend on both precipitation rates and evaporation rates. The sumps can be designed to continually have water in them, allowing for some evaporation of water from the sumps. In addition, a certain volume of water that falls into the pit as precipitation would not reach the sumps, as it would be lost to evaporation from intercepted water and from depression storage. As part of the application for the appropriations permit and NPDES permit, a watershed yield model, such as the MDNR's WATBUD, Barr's Meyer Model or other similar model, will be used to quantify the long-term amount of water that will need to be discharge as a result of the direct accumulation of precipitation in the pit. The model will also be used to estimate the amount of runoff water from the pit and stockpile after reclamation. This information will be included in the EIS.

GROUNDWATER INFLOW AND DIRECT RUNOFF FROM THE UNCONSOLIDATED SEDIMENTS

Saturated conditions exist within the unconsolidated sediments at the site. Groundwater divides in this area generally coincide with surface water divides. However, groundwater flow can be interrupted or diverted by bedrock outcrops, which force deviations in the groundwater flow field (Siegel and Ericson, 1980). Figure 13-1 shows water table contours delineated by Siegel and Ericson (1980) for the area surrounding the Mine Site with arrows showing groundwater flow directions. At the Mine Site, groundwater flow is towards the Partridge River, a major discharge point for the area. Because of the shallow nature of the unconsolidated sediments, flow paths are generally thought to be short, with the recharge areas being very near the discharge areas.

The bouldery till of the Rainy Lobe which covers the site has an estimated hydraulic conductivity range of 0.1 to 30 ft/day (Siegel and Ericson, 1980). Regional studies have found that the ability of this unit to transmit water is highly dependent on the thickness of the sediments (Adams et al., 2004; Siegel and Ericson, 1980). At the Mine Site, the sediments may be more than 40 ft thick in spots, but are on average 10-15 ft thick.

The variability in sediment thickness and hydraulic conductivity allows for the possibility of significant quantities of water entering the pit via groundwater inflow. However, both mining and ecological concerns require that lateral inflow to the pit from the wetlands and other saturated sediments must be minimized by the use of dikes and trenches.

Much of the lowland area at the Mine Site is covered by wetlands (see Question 12). Flow generally occurs across the surface or within the top foot of the wetland surface and hydraulic conductivity tends to decrease with depth. Field observations have found numerous wetlands located near existing mine pits in the area that have not been dewatered. The exceptions to this is when granular sediments with high permeability underlay the wetland deposits and are connected to a water source such as a local stream of lake. The potential for this to happen is being evaluated through hydrogeologic and wetland studies that will be incorporated in the EIS.

As part of the ongoing feasibility study, a soil boring campaign will be conducted in the winter or spring of 2005 to obtain soils information and install piezometers. In areas where bedrock hills do not separate the area wetlands from the pit, unconsolidated sediments will be sampled and evaluated to determine whether sand seams exist that could transmit significant quantities of water into the pit. If such sand seams exist, cutoffs would be designed and installed to prohibit the inflow of groundwater/wetland water from entering the pit. Information about the unconsolidated sediments ability to transmit water and designs to prevent seepage into the mine pit will be included in the EIS.

GROUNDWATER INFLOW FROM THE DULUTH COMPLEX (GABBRO)

Existing information has indicated that the Duluth Complex (gabbro) produces small amounts of water. It is anticipated that the gabbro at the PolyMet site will have similar low water yield. However, because the amount of water can vary spatially, site specific data is needed to predict the yield of this unit into the PolyMet pits. Saline water was encountered at the Amax site, and the possibility of saline water at the Polymet operation will be evaluated in the EIS.

As part of the PolyMet feasibility study (being conducted concurrently with Environmental Review) the company will drill an additional 100 to 120 exploration holes at the site during the winter of 2005.

As part of this program, basic data was collected to assist in characterizing the quantity and quality of water that might be expected form the Duluth Complex. The emphasis of the effort was to capitalize on the winter drilling program, which had other intended purposes, to collect data that could be used to better understand the hydrogeology of the formation. This investigation was termed a phase I investigation with the understanding that an additional investigation (phase II) would be needed to better understand the hydrogeology. The basic approach to the phase 1 investigation included the following steps:

1. Check the drill cores and consulting with site geologists as drilling is proceeding to characterize drillholes that would be expected to have looser or tighter rock. This would include attempting to place one or more drillholes through a major fault zone.

2. Install water level monitoring equipment in a completed drillhole before it has been capped or abandoned and pump the drillhole to produce a significant drawdown. As pumping is occurring, monitor the conductivity of the pumped water and the level in the hole. As pumping is completed, take grab samples of the pumped water for further analysis.

3. Monitor the recovery of the water (if any) in the drillhole.

4. For one or two of the wells with the greatest number of fractures and/or lowest recovery rates, monitor adjacent holes while pumping is occurring to help evaluate the degree of interconnectivity between the holes and provide information for further evaluation of probable pumping quantities.

Phase I of a hydrogeologic investigation has been completed and results will be available for inclusion in the EIS. The results from the phase I investigation will be used to help design the phase II investigation. Results from the phase II investigation will also be available for use in the EIS.

GROUNDWATER INFLOW FROM THE VIRGINIA FORMATION AND THE BIWABIK IRON FORMATION

Within the region, both the BIF and the Virginia Formation are used for water supply. Based on specific capacity test data reported in the Minnesota Geological Survey's County Well Index, the BIF has an average hydraulic conductivity of 6 ft/day and the Virginia Formation at a depth greater than 250 ft has an average hydraulic conductivity of 0.06 ft/day. Although the proposed pit is not anticipated to contact the BIF, which will be separated from the pit walls by over 100 ft of Virginia Formation, there is potential for faulting in the Virginia Formation, which could transmit water from the underlying BIF. The amount of water that could contribute to the mine pit from the Virginia Formation will be investigated and discussed in the EIS. Since there is no reliable method to predict faulting in the Virginia Formation, it will not be evaluated in the EIS.

OVERALL MINE PIT APPROPRIATIONS

Direct precipitation is expected to be a major source of water to the pit. Based on runoff modeling the DNR has conducted for taconite pits, pit yield from precipitation alone at full development is expected to average between 300 gpm to 400 gpm. Short-term appropriations due to wet weather conditions are likely to be larger and would be controlled by the capacity of the pump. Cut-offs, dikes, or other seepage control measures would be used to minimize the seepage of surficial and near surface groundwater from entering the pit. Minimal amounts of water are expected from the Duluth Complex, however, specific capacity tests conducted in the winter or spring of 2005 will provide additional information on this potential source. The proposed mine pit should not intersect the BIF. Although the Virginia Formation can produce water, it has a lower conductivity thatn the BIF, and it not anticipated that large volumes of water would be generated from this unit. According to the County Well Index database, there are no water supply wells located within two miles of the Mine Site so well interference is not likely to be a significant problem.

Preliminary models were run by Polymet to get an "order-of-magnitude" estimate of the quantity of water entering the pit from both the Duluth Complex and the Virginia Formation. These models predicted that at 20 years, the entire pit would receive between 3 and 19 cfs of water from the bedrock units (1350-8500 gpm). Due to the assumptions that were used in this model, the results should only be considered as approximate. Following the analysis of field data collected as part of the phase I and phase II hydrogeology study the model will be revisited and further analysis performed for the EIS.

As part of the EIS a water balance will be prepared for the mine. This will provide a range of estimated flows from the mine as a function of time.

Process Plant

The Process Plant would primarily use recirculated water for operations. This water would need to be supplemented by fresh water to make up for water losses during operations. Water budget analysis indicates that the amount of make-up water needed may be as high as 4,200 gpm, but will likely be closer to 2,800 gpm. Cliffs Erie and Minnesota Power jointly hold an existing MDNR Appropriation permit (#490135) authorizing the taking of up to 6,307 million gallons per year (12,000 gpm average pumping rate) from Colby Lake. Polymet may be able to satisfy some or all of their make-up water need from Colby Lake, by amending and/or transferring part of the authority under this permit. A condition under this permit requires that Cliffs Erie pumps water from The White Water Reservoir into Colby Lake to offset their appropriation when the water level of Colby Lake is below a determined threshold. The control structure between the White Water Reservoir and Colby Lake was owned by Cliffs Erie, but is now owned by Minnesota Power. There is an agreement between Cliff's Erie and Minnesota Power whereby the conditions of the permit would be met. Any assignment of an appropriation permit from one party to another would require the consensus of all parties and the DNR's review and approval. The review would take into consideration effects on Colby Lake and Whitewater Reservoir water levels and outflow from Colby Lake. The volume and source of make up water will be addressed in the EIS.

Tailings Basin

Modifications will be made to the current seepage collection system at the Tailings Basin. This system will be designed to recapture process water seeping from the toe of the Tailings Basin to avoid untreated discharge of seepage from the basin. Captured water will either be pumped back to Cell 2E or will be pumped to a treatment plant for discharge. Seepage water has been collected from these sites in the past by Cliffs Erie. This collection will not need an appropriation permit because the system recaptures water previously authorized for appropriation as described above. The EIS will address details on the tailings basin seepage collection system, including the design, efficiency and volume recovered as a function of time, both during and after operation.

Proposed Treatment of Topic in EIS:
Mine Site - The amount of water that must be discharged to dewater the mine pit is a significant issue that will be included in the EIS. In order to better estimate this amount of water the following information will be included in the EIS.

- Design and effectiveness of diking and trenching to prevent surface run-off into the pit.
- Estimates of direct precipitation into the mine pit
- Results of unconsolidated sediment hydrology study
- Results of phase I and phase II hydrogeology study of the NorthMet Deposit including potential water to enter the pit from the Virginia Formation.
- Development of a water balance model to estimate the quantity of water entering the pit from various sources with consideration of seasonal changes and pit size.

This information will be used to help design water treatment facilities and estimate changes in Partridge River streamflow as part of the watershed assessment described in response to Question 12. Hydrologic modeling will also be done to estimate the quantity and timing of outflow from the pit and runoff from stockpiles after mining. This information will be necessary to determine potential water treatment needs for reclamation. Because this water is likely to have come into contact with exposed ore or could be saline, it could be reactive and need appropriate treatment. The amount of water potentially needing treatment will be an important consideration in the EIS.

Processing Plant and Tailings Basin – The EIS will use the results of the pilot plant process and existing information on the LTV tailings basin to develop a water balance model for the processing plant and tailings basin. The EIS will provide additional information on water quantity from the processing plant and tailings basin, including the redesigned seepage collection system. The following information will be used in the water balance model:

- Water generated from the flotation tailings and from the hydrometallurgical processing
- Water collected at the base of the existing tailings basin

- Makeup water needed for the processing plant

Similar to the mine site this information will be used to discuss water quantity effects as well as to develop a better understanding of water treatment needs. Additional information will be presented on the proposed appropriation from Colby Lake.

14. Water-related land use management district. Does any part of the project involve a shoreland zoning district, a delineated 100-year flood plain, or a state or federally designated wild or scenic river land use district? __Yes _X_No

If yes, identify the district and discuss project compatibility with district land use restrictions.

15. Water surface use. Will the project change the number or type of watercraft on any water body?
__ Yes _X_No

If yes, indicate the current and projected watercraft usage and discuss any potential overcrowding or conflicts with other uses.

16. Erosion and sedimentation. Give the acreage to be graded or excavated and the cubic yards of soil to be moved:

Table 16-1
Area and Volume of Grading and Excavation

Location	Acres	Cubic yards
Mine pit	620	380,000,000
Stockpiles	1,126	286,000,000
Railroad Construction Site	21	100,000
Plant site	20*	
Tailings basin	2,166	218,000,000 cy tailings 14,000,000 cy hydromet

*Minor grading for building construction

Describe any steep slopes or highly erodible soils and identify them on the site map. Describe any erosion and sedimentation control measures to be used during and after project construction.

MINE

The mine site itself is flat to gently sloped terrain. The areas within the mine project boundary proposed to be graded or excavated at the mine site (other than pits and stockpiles) would be for drainage features, treatment ponds, roads and railroad spur, and mine infrastructure; including loading pocket, maintenance shops and mine office/break rooms. Work would be conducted under the MPCA's NPDES requirements for construction stormwater management. This would include preparation of a construction Stormwater Pollution Prevention Plan that will specify construction sequencing and installation, maintenance and inspection of construction best management practices for erosion and sediment control. The construction practices would be specified during final design but those most likely to be applied include:

- prompt revegetation of distributed surfaces
- interim erosion protection of disturbed areas that would be re-graded at a later date, including interim seeding and/or mulching
- use of silt fences on short slopes during grading
- provision of berms and channels to intercept sheet flow and convey sediment to sediment basins
- energy dissipation devices installed at same time as installation of culverts and steep ditch sections
- staging or construction areas to minimize exposed soil

The pit would cover approximately 620 acres at the maximum extent and stockpiles would cover another 1,126 acres. Steep slopes would be created on stockpiles and on the edges of the pits. MDNR rules define practices for pits and stockpile construction.

Pit development regulations require that:

- The toe of the surface overburden portion will be set back at least 20 feet from the crest of the rock portion of the pitwall.
- Lift heights will be no higher than 60 feet and will be selected based on the need to protect public safety, the location of the pitwall 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 sloped area between benches will be no steeper than 2.5:1.
- Runoff water will either be temporarily stored on benches or removed by drainage control structures

Runoff from the overburden portion of the pit wall would be co-mingled with the pit runoff. Direct runoff onto the rock walls and floor of the pit would be directed to sumps located at intervals along the footwall of the pit. These sump and associated pumps would be sized to detain water and trap sediment before the accumulated water is pumped to the reactive water basin prior to treatment and discharge.

Details of the pit design and methods of reclamation will be described in the application for the Permit to Mine and included in the EIS.

STOCKPILES

The stockpiles would be constructed and managed in accordance with the requirements of Minnesota Statute Sections 93.44 to 93.51 and the MDNR Mineland Reclamation Rules for Nonferrous Metallic Mineral Mining (Minn. Rules Chapter 6132). Details of the stockpile design, location, construction and reclamation will be described in the application for the Permit to Mine and included in the EIS.

RAILROAD CONSTRUCTION AREA

Construction of the rail line would disturb approximately 21 acres. As described above, the construction for the project, including the railroad construction would be covered by MPCA's construction stormwater program and would include preparation of a construction Stormwater Pollution Prevention Plan that will specify construction sequencing and installation, maintenance and inspection of construction best management practices for erosion and sediment control. The construction practices would be specified during final design but those most likely to be applied include:

- prompt revegetation of distributed surfaces
- use of silt fences on short slopes during grading
- provision of berms and channels to intercept sheet flow and convey sediment to sediment basins
- energy dissipation devices installed at same time as installation of culverts and steep ditch sections

PLANT SITE AND TAILINGS BASIN

Soil disturbance at the plant site would be much smaller than at the mine site or railroad construction site. The major grading would be done for the foundations for a pre-engineered metal building adjacent to the existing warehouse. The area of disturbance would be approximately 20 acres. Typical construction erosion control practices would be employed as described above for the mine, stockpile and railroad construction areas.

The major tailings basin modifications would be ongoing construction and closure of lined containment cells for hydrometallurgical wastes on Cell 2W. Any sediment produced during construction would flow to the low point in the basin and infiltrate. There is a potential need for taconite tailings to be used for dam construction of flotation tailings basins proposed for Cells 1E and 2E. It is possible the Cell 2W would be used as a source for these tailings. Depending on the amount of tailings excavated, there could be significant disturbance of Cell 2W.

AREA 1 SHOPS

No grading or construction are anticipated at the Area 1 Shops other than maintenance of existing roads and re-activation of the existing shops.

Proposed Treatment of Topic in EIS:
This topic is minor, but it will be discussed with limited information beyond that in the EAW. Details of excavation activities and prevention of erosion on Cell 2W will be developed during EIS preparation.

17. Water quality: surface water runoff

a. Compare the quantity and quality of site runoff before and after the project. Describe permanent controls to manage or treat runoff. Describe any stormwater pollution prevention plans.

Like most major mining operations, the PolyMet project is expected to be covered by a combined permit for both stormwater and industrial wastewater discharges. Because some stormwater would likely require significant treatment, the distinction between runoff (Question 17) and industrial wastewater (Question 18) is a matter of definition. For purposes of this EAW site runoff will fall into one of three categories:

1. Non-contact runoff that consist of surface water runoff that has not come into contact with mining operations, but may be captured in stormwater collection systems and would need to be managed accordingly. Examples of non-contact runoff include water from adjacent wetlands or runoff from undisturbed portions of the site.
2. Non-reactive runoff that has come into contact with mining operations, but has not come into contact with reactive materials and the runoff would meet all applicable water quality standards without any chemical treatment, although settling ponds may be needed to remove suspended solids and turbidity. Examples of non-reactive runoff include runoff from roofs and drainage from stockpiles containing non-reactive mine waste.
3. Reactive runoff that has come into contact with ore, lean ore or reactive waste rock. This water could be acidic and could contain metals in concentrations that would require treatment before discharge. It includes the pit pumping, the seepage coming from the base of reactive waste rock/lean ore stockpiles and the runoff from the Loading Pocket and any adjacent ore stockpiles.

Non-contact and non-reactive runoff will be addressed as site runoff in Question 17, while reactive runoff will be addressed as an industrial wastewater discharge in Question 18. The distinction between reactive and non-reactive runoff is important and it will be a significant issue to be addressed in the EIS.
PolyMet proposes to co-mingle and manage non-contact and non-reactive runoff as a single source of runoff. Sources of this type of runoff and proposed management of these sources is described below:

- Mine site runoff. The pit would be encircled by a ditch and dike system to intercept and handle non-contact and non-reactive runoff. This drainage system would discharge to three or more detention ponds as shown in Figure 5-3. The runoff from these areas is anticipated to only require treatment by sedimentation prior to discharge. The proposed collection system would use typical mine drainage procedures and would not be leak proof.

- Area 1 Shops runoff. The Area 1 shops would continue to be used as a mine truck maintenance facility; runoff would continue to be regulated under the NPDES Stormwater regulations.
- Runoff from the rail corridor construction area would be regulated under the NPDES Construction Stormwater Permit. There are no additional plans for managing runoff from the rail corridor during regular operation.
- Plant site runoff. The Process Plant is proposed to be located within the existing Cliffs Erie taconite processing facility. Runoff from this facility would be regulated under the NPDES Stormwater regulations.
- Tailings basin runoff. All collected water from the tailings basin is proposed to be managed as industrial wastewater and is addressed in response to Question 18.

Runoff generation and management would also be dependent upon the project phase which would include construction, active operation, and post operation.

BACKGROUND WATER QUALITY DATA COLLECTION

Sampling was conducted at a variety of locations in the vicinity of the project from May 2004 through November 2004. The sampling locations are shown in Figure 17-2. These sampling locations were chosen to characterize the existing water quality of streams that may potentially receive discharges from the Mine Site or Plant Site, including the Tailings Basin.
Additional information for the remaining months of sampling will be compiled and submitted as part of the application for an NPDES discharge permit and for use in the EIS. Existing sources of water quality data will be evaluated and included as appropriate in the EIS. Potential sources of existing data include the Regional Copper-Nickel Study and sampling conducted by other mining projects in the area such as AMAX, Cominco, and Northshore.

MINE SITE

RUNOFF QUANTITY

Regional Setting

The proposed PolyMet Mine Site is located within the Partridge River Watershed, between Hoyt Lakes and Babbitt. The Partridge River flows through Colby Lake near the city of Hoyt Lakes before joining the St. Louis River on its way to Lake Superior. The Partridge River watershed is bounded by the Laurentian Divide just east of the Mine Site. The Laurentian Divide separates the Hudson Bay drainage from the Lake Superior drainage. To the north of the Mine Site is the Giants Ridge formation which also forms a watershed divide between the Partridge River and the Embarrass River watersheds. The Partridge and Embarrass Rivers are both tributary to the St. Louis River. Figure 17-1 shows the locations of the primary watersheds discussed here.

NorthShore Mining's Peter Mitchell Pits (Northshore) are located just north of the Mine Site, with some of the pits lying within the Partridge River watershed (Figure 17-1). Currently, Pit A has filled with water and discharges to the west and Pit B is still filling with water. Because Pit B does not currently contribute water to the Partridge River, its watershed is not part of the Partridge River watershed. However, as this pit continues to fill with water, it would eventually discharge (either naturally or via an engineered outlet) to the Partridge River. At that point, the pit's watershed would become part of the Partridge River watershed.

Existing/Historic Conditions

Streamflow

Low streamflow quantities are commonly used in water-quality and water-supply management applications, including determining waste-load allocations, discharge limits, and allowable water transfers and withdrawals. Frequency analysis is a common procedure for analyzing low-flow. In the United States, the 10-year 7-day-average low flow (denoted 7Q10) is most frequently used. Low flows were calculated for three ungauged locations on the Partridge River, shown in Table 17-1 (see Figure 17-1 for locations).

Average flow conditions were analyzed for several area streams. Average flows were calculated for three ungauged locations on the Partridge River, shown in Table 17-1.

Bankfull flow is generally considered to be the 1-day average high flow that has a recurrence interval of 1.5 to 2 years and is commonly used as a measure of high flow. High flows were calculated for three ungauged locations on the Partridge River, shown in Table 17-1. In general, the watershed exhibits a wide range of flow, with the potential for near no-flow conditions as well as very large flows. This is likely due to the high water table and shallow bedrock in much of the region, resulting in a "flashy" stream with a wide range of flows.

Table 17-1
Calculated Low, High, and Average Flow Statistics
For Ungauged Portions of the Partridge River

		Low Flow - 7Q10 (cfs)		High Flow - Q2 (cfs)		Average Flow (cfs)
Location	Drainage Area (mi^2)	Brooks And White	Siegel and Ericson	Siegel and Ericson	This Study	Siegel and Ericson
PU-1 without Pit B Area	10.8	0.23	0.05	90	57	6
PU-1 with Pit B Area	14.4	0.33	0.08	114	78	9

PU-2 without Pit B Area	20	0.49	0.13	149	111	13
PU-2 with Pit B Area	23.6	0.61	0.17	171	132	15
PU-3 without Pit B Area	54.4	1.71	0.65	340	325	37
PU-3 with Pit B Area	58	1.86	0.72	358	348	39

NORTHSHORE DISCHARGE

For a portion of 2003 and 2004, NorthShore's Peter Mitchell Pit B was dewatered to facilitate mining with the discharge going to the Partridge River upstream of the PolyMet site. During 2003, this discharge was approximately 34 cfs, much higher than the average flow for the upstream reaches and low flow for the river. NorthShore still has this discharge permit, and the company plans to keep the permit up to date allowing for the possibility of similar discharges in the future. The EIS will evaluate impacts from NorthShore discharges under cumulative effects.

Future Conditions

The proposed project would affect low, average and high streamflows in the Partridge River. The anticipated flows and the impacts will be addressed in the EIS. The two factors that would most affect site runoff are changes in land use and discharge of mine dewatering to the Partridge River. Although discussions of water quality due to reactive runoff are deferred until EAW Question 18, discussions of the quantity of water discharged in EAW Question 17 will include reactive runoff.

Land Use Changes

The proposed mine activities would result in land use changes for much of the Mine Site. Land use changes are described in detail in the response to Question 9. In general, existing areas of wetland and upland with high water table would be replaced by mine pit, stockpiles and mine infrastructure. Although the mine pit would allow rapid runoff, the sumps in the pit would be designed to allow efficient pumping over a longer period of time. With the addition of numerous collection and storage areas, the runoff from the Mine Site would be expected to become more steady and less "flashy". As part of the application for an NPDES permit and Minnesota Department of Natural Resources (MDNR) water appropriations permit, these land use changes will be used to predict future Partridge River flow statistics in terms of low, average, and high flows and from these prediction evaluations can be made to determine the significance of these changes. This can be done in part using the flow-drainage area relationships derived as part of this EAW and/or more detailed hydrologic modeling. This analysis will include calculations of runoff from storage piles and surrounding mine facilities. These submittals will be available for use in preparing the EIS.

Discharge of Mine Dewatering

The mine pits would accumulate water from four potential sources: precipitation, seepage from wetlands and glacial material, seepage from the Duluth Complex, and seepage from the Virginia Formation. The largest contributor of water to the pit would most likely be from precipitation and inflow from the bedrock (Duluth and Virginia formations). Trenches, dikes and/or other seepage control structures are proposed to prohibit the lateral inflow of water from area wetlands and surficial material. The overall pumping from the pit is expected to be low because, typically, the Duluth Complex and the Virginia Formation do not yield a substantial volume of water. As explained in response to Question 13, although the amount of water is not anticipated to be large, site specific data is needed to develop a better understanding of how much water would be produced by the Duluth and Virginia formations in the area of the NorthMet Deposit.

Mine dewatering water would be collected in sumps, pumped to the surface, treated if necessary, and discharged to the Partridge River. The mine pit sump areas and pump capacities would be designed to minimize any impact to the Partridge River's bankfull flow at the point of discharge. The effect of flow changes on the Partridge River needs to be evaluated in the context of percent increases in flow. The timing and duration of these flow changes are important as well. A better estimate of the quantity of mine dewatering discharge is needed prior to evaluating any impacts. The phase I and phase II hydrogeolocial studies (described in EAW Question 13) will be used to develop a better estimate of discharge. This information will be included in the EIS.

RUNOFF QUALITY

The quality of runoff from the mining area after development, during normal operations, and after closure will be a major topic of the EIS and NPDES permit application. This will require a detailed evaluation of available data, hydrologic modeling, and the development of chemical models to estimate water quality. Each of these stages of mine operation is discussed below. The impact of the proposed operation on the quality of the Partridge River will also be addressed in the EIS.

Existing Conditions

The quality of Mine Site runoff before mining development is likely similar to the overall water quality of the Partridge River which is currently under evaluation. The Regional Copper-Nickel Study identified the Partridge River as being influenced by mining activities. The water quality sampling program included two stations on the Partridge River, located upstream and downstream from the proposed Mine Site. These are listed as stations PM-3 and PM-16 in Table 17-2. Further characterization of the receiving waters and potential impacts will be included in the EIS.

Future Conditions

Normal Operations

As described above surface water runoff management is proposed with a non-contact/non-reactive runoff system and a separate system for managing reactive runoff. Both of these systems are proposed to allow sampling and appropriate treatment prior to being discharged to the environment. Design, operation and monitoring of these systems will be developed during preparation of the EIS. The proposed reactive runoff system as well as potential impacts to water quality from this type of runoff is addressed in more detail in response to Question 18.

The non-contact/non-reactive runoff system is described in response to Questions 6b and 13. Generally it is proposed to consist of a series of trenches and dikes that direct the runoff to settling ponds. The ponds would be designed to have a retention time that allows suitable sediment removal prior to discharge to area wetlands and the Partridge River.

The reactive runoff collection system is described in more detail in response to Question 18. The system will be designed such that potentially reactive runoff can be directed to treatment if necessary. Sumps from within the mine pit and runoff from the loading pocket would be directed to this same system. Runoff water within this system is proposed for discharge to the Partridge River. As described in response to Question 18, the design of the reactive mine waste storage area, wastewater treatment, and water quality considerations from reactive runoff are significant issues that will be evaluated in the EIS.

In addition to the water quality of the mine site discharge itself is the potential for the quantity of the discharge to cause bank erosion and sedimentation. The potential for geomorphological impacts and sedimentation to the Partridge River from pit dewatering will be developed during EIS preparation.

Closure

The mine site would be reclaimed after the estimated 20-year mine life. For this discussion potential effects to surface water after closure can be divided into four areas: 1) mine pit, 2) reactive waste rock piles, 3) non-reactive waste rock piles, and 4) disturbed areas.

The mine pit would be allowed to fill with water. The rate of filling is largely a function of precipitation, groundwater inputs, runoff from adjacent upland areas, and evaporation. However, water could be diverted from other sources to expedite pit filling. Potential sources will be evaluated as part of the EIS. Additional information on mine pit hydrology including modeling of water quantity and quality will be prepared for inclusion in the EIS.

As discussed above runoff from reactive waste rock is a significant issue for this project and it will be a central discussion in the EIS. Reclamation and closure of reactive waste rock stockpiles is discussed in more detail in response to Question 18. Progressive reclamation of stockpiles, prevention of infiltration into the stockpiles, and minimization of long-term maintenance and operation costs are important considerations that will be discussed and evaluated in the EIS.

Runoff from non-reactive waste rock stockpiles is not anticipated to create significant chemical water quality impacts. The waste characterization study, modeling estimates and operational monitoring are proposed to verify that this assumption is correct. If this assumption is correct, non-reactive runoff and non-contact runoff can be treated similarly. The EIS will describe and evaluate reclamation to prevent sediment load increases from this runoff after mine closure.

Plant Site
As discussed previously, industrial wastewater discharge from the Process Plant and Tailings Basin are discussed in response to Question 18, below. This section deals with stormwater runoff from the Plant Site.

RUNOFF QUANTITY

Existing Conditions

Processing of the ore would take place at the Cliffs Erie ore processing plant. PolyMet operations would be located in the northern most area of the plant in the area of the crushing plant and the concentrator plant. Historically runoff from these areas has been routed through ditches and culverts to the Emergency Basin.

Future Conditions

The crusher/concentrator portion of the Process Plant would be refurbished and brought up to date and a hydrometallurgical processing facility would be constructed. Runoff rates after development are not expected to change as the existing crusher/concentrator plant would be used and the hydrometallurgical processing facility would be constructed on existing impervious areas. Expected runoff quantity from the Process Plant project area will be estimated as part of the stormwater pollution plan submittal to the State.

RUNOFF QUALITY

Existing Conditions

The Cliffs Erie Hoyt Lakes Plant is currently inactive. It is expected that storm water runoff quality would be similar to the quality of runoff experienced during the operation of the plant under the LTV Steel Mining Company, unless it contacted process consumables or reactive materials.

Future Conditions

A storm water pollution plan was prepared for the Cliffs Erie facility. A storm water pollution prevention plan for the PolyMet facility will be developed as part of the NPDES/SDS industrial permit application. In general, stormwater runoff from the new facility should be similar to the conditions that have existed over the last 50 years. The major new concerns would be the possibility of stormwater contact with Process Consumables being unloaded or stored at the Plant Site.

Each of the Process Consumables includes a delivery and storage step prior to use. While detailed plans have not been completed, in general Process Consumables would be unloaded and stored in covered conditions and protected from contact with precipitation. Where unloading or storage must occur outside of the buildings the loading area would be surrounded by a collection berm and stormwater would be collected and routed to the process water system.

Precipitates are high-value products that would be stored and packaged for shipping and loaded indoors and shipped in protective containers.

Runoff controls and management of chemicals associated with operations will be described in the pollution prevention plan and will be dependent upon plans and specifications regarding the Process Plant as available at the time of the application submission.

For the remainder of the facility, existing stormwater pollution prevention controls would be followed. Depending on the status of the plant water balance, the treated runoff would be pumped to the Tailings Basin or discharged to Trimble Creek. The stormwater pollution prevention plan will specify new treatment or water reuse plans, if necessary.

Tailings Basin

QUANTITY and QUALITY

Existing Conditions
The Tailings Basin currently consists of three cells, 2W, 1E, and 2E. Cell 2W contains coarse and fine tailings from LTV Steel Mining Company operations, is currently being closed and would not receive additional tailings as part of the PolyMet operations. The other two basins were constructed by the LTV Steel Mining Company and would receive flotation tailings as part of the PolyMet operations. Some of the site runoff that is generated from areas directly adjacent to the Tailings Basin currently drains to the basin. Direct precipitation either infiltrates into the basin or is captured by the clear water pool. Some portion of the water in the Tailings Basin leaves as seep water at the toe of the basin or infiltrates into groundwater beneath the basin. As part of the EIS, baseline water quality will be collected in and around the tailings basin and plant site. Some historic data already exists and Polymet has collected some additional samples. Some current

concentrations exceed water quality standards. These will be discussed as part of the EIS.

Future Conditions

Cell 2W would not receive tailings as part of the PolyMet operations but a new Reactive Residue Facility is proposed to be sited there. PolyMet has also proposed using material from this cell for dam construction if PolyMet tailings are not suitable. Direct precipitation that falls on the existing Cell 2W would infiltrate, evaporate, or would be captured by the Reactive Residue Facility. Water accumulated in the Reactive Residue Facility would be recycled back into the Hydrometallurgical portion of the Process Plant. The current proposal for the project assumes that the tailings will be non-reactive and that Cells 1E and 2E can be used without modification. Precipitation that falls on Cells 1E and 2E would infiltrate, evaporate, or be contained in the Tailings Basin structure and be recycled to the Flotation Process at the Process Plant. The expected water quantity and water quality of water that leaves the Tailings Basin as seep water at the toe of Cell 2W, 1E and 2E or infiltrates into the groundwater is discussed in the response to Question 18.

Road and Railroad Corridors

RUNOFF QUANTITY

The transport of ore from the Mine Site to the Plant Site would be on an existing railroad with the exception of the construction of a short section of track that would extend from existing track that is adjacent to Wyman Creek and existing stockpiles (see Figure 5-2). There is very little impervious area associated with the railroad corridor, most the track is underlain with crushed rock that would facilitate infiltration. No new roads would be constructed as part of the project and the expected usage would be similar to historical usage during LTV Steel Mining Company operation.

RUNOFF QUALITY

Because the railroad track is primarily underlain with a pervious gravel base, during normal operation there would be little runoff generated in the railroad corridor. At the Mine Site and Plant Site stormwater collection and treatment plans will avoid direct impervious area discharges to receiving waters.

Side dump rail cars would be used to transport the coarse ore from the Mine Site to the Plant Site. These cars would be loaded within the confines of the Mine Site, and at the Plant Site ore would be deposited directly into the feed hopper of the coarse ore crusher as the side of the car is opened and the car is tilted into the hopper. It is not expected that there would be significant loss of ore along the railroad corridor, however spillage may occur in the section of railroad track closest to the loading pocket. This spillage could occur as the train initially shakes the load and dislodges pieces of rock not located well within the car hopper. Large pieces of rock that spill from railcars would be recovered to the loading pocket surge pile as a matter of routine work practice to maintain safe working conditions for the rail and mine equipment.

During construction of the railroad extension, temporary erosion control measures would be implemented where the corridor intersects wetlands or streams (i.e. Wyman Creek) to prevent sediment inputs.

Treatment of Topic in EIS:
The EIS will include surface water quantity and quality impacts as well as alternatives and mitigation to prevent or minimize impacts. Additional detail will be developed for surface water runoff systems that handle non-contact and non-reactive runoff as well as the quality and quantity of this water. Characterization of non-reactive runoff will also be estimated to ensure the suitability of treating this runoff source as non-contact runoff.

b. Identify routes and receiving water bodies for runoff from the site; include major downstream water bodies as well as the immediate receiving waters. Estimate impact runoff on the quality of receiving waters.

The impact of runoff from the mining area after development, during normal operations, and after closure on receiving waters will be a topic of the EIS and NPDES permit application. This will require a detailed evaluation of available data, hydrologic modeling, and the development of chemical models to estimate water quality.

Mining Area

The Partridge River is adjacent to the mining area from the north, east, and south. The Partridge River flows in a southwest direction to Colby Lake. The Partridge Rive has its headwaters in the Hundred Mile Swamp, including Mud Lake (69-148P). Little or no information is available on Mud Lake; there is no public access to the lake and no known recreational use. The Partridge River flows east along the base of the Giants Ridge formation to the Mine Site. Near the proposed Mine Site, the Partridge River turns south and then east, circling the Mine Site. In this location the watershed is almost entirely undeveloped. Stubble Creek joins the Partridge River about one mile below the Mine Site and the South Fork of the Partridge River enters about three miles below the Mine Site.

The river continues to flow through a largely undeveloped area, before emptying into Colby Lake. Colby Lake is a 540-acre mesotrophic lake which discharges to the lower reaches of the Partridge River. The lake is controlled by a concrete and rock weir. The City of Hoyt Lakes is located on the South Side of Hoyt Lakes and takes its drinking water from the lake.

Water from the Partridge River can also enter Whitewater Lake, located south of Colby Lake. Formerly known as Partridge Lake, Whitewater Lake was impounded in 1955 for use as a water storage reservoir for the Erie Mining taconite operation. It is separated from Colby Lake by three 8-foot gates that can be opened to release a large flow of water from Colby Lake to Whitewater Reservoir during high water levels. The diversion works also contains three high-volume pumps to move water back to Colby Lake during low water levels. Minnesota Power now operates the diversion works and has stabilized lake levels to facilitate recreational use on the lake. An overflow outlet to the St. Louis River on the southern dike is not used. Water losses due to groundwater seepage are substantial. Whitewater Lake receives sewage treatment effluent from Hoyt Lakes. Waters downstream of Colby Lake and Whitewater reservoir include the lower Partridge River, the St. Louis River, and Lake Superior.

As described previously, all forms of drainage from the Mine Site would be collected and treated, if necessary, prior to discharge. Before treatment, reactive runoff is expected to contain increased levels of dissolved solids and trace metals, such as copper, nickel, cobalt, and zinc. Each water source would be managed to control peak discharge rates to minimize erosion and effects on stream bank stability and to control sediments, metals, and other water quality parameters to levels below applicable criteria. There is a potential impact of increased sulfate concentration leading to mercury methylation in downstream water bodies and wetlands. It should also be noted that some background mercury levels in the Partridge River are above water quality standards.

STREAM CLASSIFICATION AND PHYSICAL EFFECTS

Erosion and stream instability are potential physical effects of a Mine Site discharge on the Partridge River. At the request of the MDNR, a physical classification of the Partridge River was performed using the Rosgen classification system to determine the capacity of the stream to receive a controlled discharge of water from the Mine Site.

Stream channel characteristics were measured at two locations in the Partridge that had been identified as potential locations of the Mine Site discharge (Figure 17-3). Field measurements taken during the site visit included: bankfull width, bankfull area, bankfull mean depth, bankfull maximum depth, floodprone width, dominant bed material, riffle slope, and channel cross sections. These measurements were used to classify the Partridge River stream reaches according to the Rosgen classification methodology.

Partridge River Reach 1, which lies at the eastern boundary of the Mine Site was classified as a Type C stream. This type of stream reach has an adequate floodplain to dissipate energy during higher-than-bankfull flows. No erosion problems were evident in the stream (despite high discharge flows from Northshore at the Partridge River headwaters). Because this reach is dominated by boulder riffles and beaver-pond pools, it is not very sensitive to disturbance and the potential for channel recovery is good.

Partridge River Reach 2, which lies at the southern boundary of the Mine Site was classified as a Type C5 stream. This reach has a milder slop than Reach 1 and is affected by frequent beaver dams. Although boulders are common at the riffle section, silt/clay was the dominant material at the surveyed cross-section. The silt/clay was due to the milder slope and the presence of beaver dams. No erosion problems were evident at this site. This type of channel is more sensitive to disturbance than the Type C channel. It appears, however, that boulders underlay a thin layer of topsoil in the stream corridor and they would serve to keep significant erosion in check.

Ponds and sumps would be used extensively in the Mine Site to reduce the peak discharge rate of runoff from impervious areas in the Mine Site and to minimize any potential erosion effects on the Partridge River. Standard practices such as the use of riprap would be employed to minimize erosion at the point of discharge.

Plant Site

The primary operations of PolyMet would be in the crusher and concentrator portions of the existing Cliffs Erie Processing Plant. Runoff from this area of the plant was historically routed to the Tailings Basin or to the Emergency Basin which was located on the Southwest corner of Tailings Basin Cell 2W. Water that seeps from the Emergency Basin and Cell 2W enters adjacent wetlands that eventually drain to the Embarrass River.

It is expected that changes in runoff quantity would be minimal as the new ore processing equipment would be housed within existing facilities or new facilities would be constructed on existing impervious areas. Water quality is not expected to be significantly different from previous operations. Piles of ore would not be stored on the Plant Site.

Tailings Basin

Runoff from the edges of the tailings basin would flow into the nearest cell of the tailings basin. Direct precipitation would fall on Cells 1E and 2E and on the new Reactive Residue Facility that would be sited on Cell 2W. The Reactive Residue Facility would have a decant structure within the cells to return water to the Hydrometallurgical Processing Plant. Precipitation that falls on the inactive Cell 2W outside the footprint of the Reactive Residue Facility and Cells 1E and 2E would infiltrate or drain to the collection system.

Water that infiltrates into Cell 2W has the potential to seep through the toe of the perimeter dams to surrounding wetlands that drain to the Embarrass River. Water that infiltrates into Cell 1E and 2E has the potential to seep through the toe of the perimeter dams to surrounding wetlands that drain to the north into Trimble Creek and Kaunonen Creek. New seepage collection systems would be constructed and would consist of ditches along the south, west and north side of Cell 2W and the north side of Cell 2E and pumps to return the water to Cell 1E and 2E. These systems will be designed to capture as much seep water as is feasible to reduce the volume of seep water that enters the surrounding environment. The efficiency of these systems will be addressed in the EIS. These wetlands and the creeks are tributary to the Embarrass River. The expected water quality of the seeps is covered in Question 18.

The Embarrass River flows east to west along the north side of the Giants Ridge formation before turning south near Biwabik to join the St. Louis River. The headwaters of the river are near Babbitt. The City of Babbitt discharges municipal wastewater to wetlands and pits in the headwaters of the watershed. In 2004 water quality data were collected upstream from the proposed PolyMet facility at the crossing of County Road

620. This location is designated PM-12 on Figure 17-2; available data are summarized in Table 17-2.

Road and Railroad Corridors

The transport of ore from the Mine Site to the Plant Site would be on an existing railroad with the exception of the construction of a short section of track that would extend from existing track adjacent to Wyman Creek and existing stockpiles. No new roads would be constructed as part of the project and the expected usage would be similar to historical usage during LTV Steel Mining Company operation. The existing railroad corridor crosses Longnose Creek, Wyman Creek, Wetlegs Creek, and the Partridge River.

Proposed Treatment of Topic in EIS

The EIS will include information on the quality and quantity of existing water bodies and any potential for changes to these parameters from all aspects of the mining project. Estimation of hydrologic and chemical balances in the Mine Site during normal operations and after closure and the potential effect of discharges on receiving water biota will need to be evaluated in the EIS (the hydrologic and chemical balances for the Tailings Basin and reactive runoff from reactive waste rock stockpiles are addressed in the Response to Question 18).

As part of the EIS, conservative estimates for the flow will be used to insure that any environmental impacts are minimized. (For example, the lowest reasonable estimate of 7Q10 will be used to insure that in stream water quality standards are met.)

18. Water quality: wastewaters

a. Describe sources, composition and quantities of all sanitary, municipal and industrial wastewater produced or treated at the site.

Overview

Water that would be generated from reactive waste rock stockpiles, mine pit dewatering, and the ore loading pocket has the potential to not meet water quality standards such that treatment of the water would be necessary prior to discharge. As discussed earlier in response to Question 17, for purposes of this discussion water from these sources are being considered an industrial wastewater discharge. The term reactive runoff is being used to describe this water that has come into contact with reactive material.

As part of the EIS, baseline data will be collected in areas being considered for mine waste disposal. This will include reviewing historical data and if necessary establishing new surface and/or groundwater monitoring location. Some or all of these monitoring locations may be used for permit monitoring during the project.

A major part of the EIS will be to address the quality, quantity and treatment of various types of wastewater both during and after operation. The EIS will also include a detailed discussion of wastewater treatment options.

Sanitary wastewater at the Mine Site will be managed and treated through the installation of an approved septic tank and related drain field. A second option would be to collect sanitary wastewater in a tank and provide for off-site treatment.

The Process Plant would produce both industrial wastewater and sanitary wastewater. In discussing industrial wastewater generation, the Process Plant and Tailings Basin need to be considered as a single system. Water in the Tailings Basin would be the primary source of water for grinding and flotation separation processes. Water would leave the flotation process as a slurry of tailings, which would be deposited, in the Tailings Basin where the liquid and solid phases separate. This water use process is then repeated in this circular fashion. The only discharge of industrial wastewater from the Process Plant will be via the Tailings Basin and the tailing discharge water will be treated, if necessary, to meet water quality standards. A new sanitary wastewater treatment facility employing primary and secondary treatment will need to be constructed to treat sanitary waste at the Process Plant.

Mine Site

The design of the reactive mine waste storage area and the reactive runoff collection system will be developed as part of the EIS and permits. In general the system will be designed such that potentially reactive runoff can be directed to treatment if necessary. The water quality of this runoff will be estimated from the waste characterization study (see EAW Question 20), available data, and modeling methods. Management and treatment of this runoff will also likely change as the project progresses from development, to active operation, and to post operation.

Initial mineral processing tests were conducted by SGS Lakefield Research Limited in 2000 as part of an evaluation of the property by the former owner. Although some water quality data exists, the EIS will primarily rely on data generated during the next processing tests that are scheduled to occur during the summer of 2005. The additional pilot process evaluation is proposed to provide data that can be used in conjunction with the waste characterization study and other existing data to perform calculations that estimate the mass loading of constituents from the different exposed and fractured rock surfaces at the Mine Site. This information can then be used in conjunction with expected volumes of precipitation or other water sources that come in contact with the rock; modeling will be required to estimate the concentration and loading of constituents from the various runoff sources.

Additional waste characterization studies will be conducted on waste rock and lean ore and information will be available as part of the EIS (see the response to Question 20 for details). The characterization studies are designed to define better the trace metal release and the acid generating and acid neutralizing capacity of waste rock and lean ore as a function of the sulfur content (acid generating) and as a function of unit and rock type. These studies are also designed to better define the interplay of acid generation and acid neutralization over time. The time scale of acid generation and neutralization for waste rock and the mine pit itself will have an effect on how the rock and pit will be managed during operation and after closure. Thus the outcome of the waste characterization study will dictate the appropriate application of mine waste storage, methods to prevent and control generation of problematic drainage and treatment techniques.

The conceptual design of the Mine Site (see Figure 5-3) has designated routes for runoff from each waste rock pile, lean ore pile, temporary ore storage pile, and other runoff sources to ponds designed to settle solids and to act as temporary storage to reduce the peak discharge rate of large storm events. In addition, the final design of the rock stockpiles would provide for the separation and collection of reactive runoff water from distinct areas of the stockpiles as defined by varying levels of sulfur and metal content in the stockpile rock. This approach would allow for separate monitoring and/or management of reactive runoff water during operations and after mine closure. This monitoring data could also be used to specifically tailor stockpile closure procedures from maximum efficiency and ecological benefit.

Depending on the source and expected quality of the runoff, runoff collected in each pond may either be discharged after solids have been removed or routed to a central treatment facility located at the Mine Site. Once the composition of the seepage water quality has been projected for the expected operating life of the mine (e.g. 20 years) and water quality standards and points of compliance identified, the options for wastewater treatment will be evaluated. Treatability studies will need to be completed as part of the EIS with synthetic wastewater or water from existing stockpiles of Duluth Complex.

SANITARY WASTEWATER

Operations at the Mine Site will result in the production of limited quantities of sanitary wastewater. Using normal parameters for industrial facilities, sanitary wastewater generation is expected to be less than 5000 gpd. PolyMet currently plans to manage and treat this wastewater with the installation of an approved septic tank and related drain field. A second option would to be to install a holding tank and contract for collection and off-site treatment of sanitary wastewater at a local municipal wastewater treatment facility.

Plant Site and Tailings Basin

Hydrometallurgical Processes

From a water use and wastewater perspective the Process Plant can be separated into two major parts: the ore beneficiation and hydrometallurgical processes. The hydrometallurgical water circuits would be self-contained. There are several waste streams that would report to the lined cells of the Reactive Residue Facility, proposed to be constructed on Cell 2W of the Tailings Basin. Decanted water from the Reactive Residue Facility would report back to the filter wash tank in the hydrometallurgical section of the Process Plant. Another potential waste stream, the spent electrolytic solution, would be recycled back into the solvent extraction-electrowinning process.

Potential leakage from the Reactive Residue Facility will be evaluated in the EIS.

Additions of water to the hydrometallurgical process would occur by adding water from the raw water supply as part of the overall plant appropriation from Colby Lake. Precipitation on the Reactive Residue Facility and discharge water from the scrubbers would add water to the hydrometallurgical water system. Water would be lost through entrapment in the voids of deposited residue, cooling tower evaporation, and evaporation from tanks and the residue facility itself. Reducing makeup water as needed can control the water quantity balance of the plant. Buildup of dissolved solids in the hydrometallurgical process water can be controlled to acceptable processing limits by the individual process steps in the hydrometallurgical process circuit. Additional detail about the use of processing steps to control buildup of dissolved solids will be included in the EIS.

As part of the EIS, complete water and chemical mass balances for the processing and hydrometallurgical circuits will be calculated. Water quality for each waste stream will be estimated.

Ore Beneficiation Processes

The other major part of the Process Plant is the ore beneficiation process, including crushing, grinding and flotation. This process would have an intermittent discharge of industrial wastewater. The flotation tailings from the ore beneficiation process report to Tailings Basin Cells 1E and 2E.

Some hydrologic data for the Tailings Basin currently exist. A hydrologic balance was performed by Barr Engineering (Barr 2001) for the Tailings Basin after operations had ceased at the LTV Steel Mining Company plant and after closure of Cell 2W. This study estimated that approximately 3,600 gpm seeps from Cell 2W to the surrounding area (not including seepage to Cell 1E from 2E). The study indicated that seepage from 2W into Cell 1E, 2E, and the surrounding area are decreasing. Cell 2W no longer receives discharge water and is not proposed to receive ore beneficiation process water, water levels beneath this cell are anticipated to continue to drop until a new equilibrium is achieved. This would result in less seepage flowing into Cells 1E and 2E and the surrounding area then were estimated during the 2001 study.

Additional hydrologic data can be obtained from the East Range Hydrology Project completed by the Minnesota Department of Natural Resources (MDNR) in March 2004 (MDNR, 2004). This study evaluated the long-term water levels in the three cells of the Tailings Basin after the LTV Steel Mining Company closure and the long-term need for dam safety permits. The study predicted that water would remain in Cell 1E and 2E but that water levels would remain stable after closure and not exceed dam safety thresholds. It was found that Cell 2W will normally be dry and that any water that accumulates on the cell would infiltrate rapidly. The study also concluded that infiltration would increase with time as the cell becomes more vegetated. The data and models created for this study can be modified to assist in developing a water balance for PolyMet's operations, which will be required as part of the EIS.

Under the proposed operating plan, PolyMet has predicted that discharges from the Tailings Basin will generally not be required in order to maintain the water balance. A MetSim process simulation model developed for the Process Plant estimates that there would be a net make-up water use of 2199 gpm. This model considered several losses such as loss to void space of tailings discharged to the Tailings Basin, evaporation from the Tailings Basin, evaporation from the thickeners, water loss from stacks, water loss from concentrate, as well as several other water losses in the Process Plant. The model included precipitation on the Tailings Basin as a source of water. Groundwater inflows to the Tailings Basin from Cell 2W were not considered. Although there is net water demand based on average annual conditions, in prolonged wet weather the Tailings Basin may accumulate water and a discharge may be required in order to maintain the water balance in the Process Plant and Tailings Basin. A discharge may also be required to manage the accumulation of dissolved substances in the process water.

As part of the NPDES permit application and the permit to mine, additional work will be necessary to better estimate net water use or accumulation that will occur in the Tailings Basin. This will allow an estimate of the probable frequency of climatic wet cycles that might make discharge of treated water necessary. An overall water balance of the plant and Tailings Basin area will need to consider the following components: water consumption by the plant, water lost in the void space of tailings discharged to the Tailings Basin, return of seepage water to the Tailings Basin by the recovery/pumping system; loss of water that seeps through the Tailings Basin that is not returned to the Tailings Basin by the recovery/pumping system, evaporation from the water pools of the Tailings Basin, direct precipitation on the Tailings Basin, and groundwater inputs to Tailings Basin Cell 1E and 2E from Cell 2W and from upland areas adjacent to the basin (for Cells 1E and 2E only). A detailed water balance will be available for use in the EIS.

A chemical mass balance model (MetSim) of the ore beneficiation plant indicates that the flotation tailings slurry will contain a mixture of tailings, dissolved constituents such as metals and other salts, and residual levels of the chemical additives. Several chemicals are used in the beneficiation/flotation process. These flocculants have a high affinity for solids and it is expected that the residual levels in the liquid will be in very low concentration. A complete chemical balance of the processing plant will be developed as part of the EIS to fully understand the water quality that will be generated from the process plant.

Another factor that would affect the overall quality of the wastewater is the capture and reuse of seepage through the dams of the Tailings Basin. There are several locations on the perimeter of the Tailings Basin where water seeps out to the exterior (Figure 18-1). To minimize water loss from the Tailings Basin, seep water would be managed by constructing a new seep water collection and return system (see question 6, Figure 5-5). Additional collection pipes or trenches would be constructed along the south, west and north side of Cell 2W and along the north side of Cell 2E (no seeps have been observed along the east side of the basin). Seep water that is collected by this system would be pumped back into Cell 1E or Cell 2E. The water quality of these seeps was monitored during the operation of the former LTV Steel Mining Company plant, after plant closure, and as part of the baseline surface water monitoring program (see Figure 17-2) in preparation for the use of Cell 1E, Cell 2E, and Cell 2W by PolyMet. Several water quality parameters were elevated in the seeps. These parameters included bicarbonates, boron, hardness, specific conductivity, and turbidity.

Water quality monitoring data that has been collected at the same Tailings Basin seep locations as part of the baseline surface water monitoring program for PolyMet, and as part of the current NPDES permit requirements suggests that the water quality of the seeps since the plant has ceased operations has stabilized or there has been a slight trend of improvement. In addition to this data, a flow and water quality data survey was completed at several additional seeps along the perimeter of the Tailings Basin in October 2003 and October 2004. The effect of the recaptured seep water on the PolyMet Process Water will need to be estimated in order to define the wastewater treatment requirements. The expected future water quality of seep water from Cell 1E and Cell 2E would be a function of many variables, including but not limited to the dissolved concentration of constituents in the liquid phase of flotation tailings, the mineralogical composition of the solids tailings, the mineralogical composition of the existing tails in Cell 1E and Cell 2E, weathering of existing taconite tailings and tailings that would be contributed from the PolyMet plant operation, and ultimately how weathering of the tailings contribute to the concentration of dissolved solids in the seeps. It should be noted that conceptual design of the Tailings Basin also includes the possible use of existing Cell 2W taconite tailings in future dam construction.

The existing tailings basin is not lined, and PolyMet does not propose to install a liner beneath the flotation tailings. There is a potential that process water will seep into the groundwater underneath the tailings basin and not be captured by the seepage collection system. The emergency basin may receive material and water from crushed ore, ore concentrate, and flotation tailings during and emergency plant shut down. The potential and impact of this groundwater seepage will be evaluated in the EIS.

SANITARY WASTEWATER

Sanitary wastewater will not be generated at the Tailings Basin.

A new sanitary wastewater treatment facility employing primary and secondary treatment will need to be constructed to treat sanitary waste at the Process Plant. The average number of Process Plant workers will be about 200. Using normal parameters for industrial facilities, sanitary wastewater generation is expected to be up to 4000 gpd (3 gpm). It is expected that this wastewater will require treatment for removal of BOD, bacteria and suspended solids.

Area 1 Shops

The Area 1 Shops will continue to be used as a vehicle maintenance facility for Mine Trucks. Sanitary wastewater will continue to be discharged to the existing septic tank and drain field system. Floor drains and other industrial wastewater will continue to be contained and reused with residuals from oil water separators disposed of through outside services.

Road and Railroad Corridors

No sanitary or industrial wastewaters will be generated from roads and railroad corridors.

b. Describe waste treatment methods or pollution prevention efforts and give estimates of composition after treatment. Identify receiving waters, including major downstream water bodies, and estimate the discharge impact on the quality of receiving waters. If the project involves on-site sewage systems, discuss the suitability of site conditions for such systems.

Mine Site

During the initial wastewater treatment studies, numerous wastewater technologies will be evaluated for use at the PolyMet site. Estimates of reactive runoff water quality and applicable water quality standards will be used to design the wastewater treatment studies and potential treatment technologies to address the water quality parameters of concern. As part of the EIS, models will be developed to estimate a comprehensive water quality. Parameters that have already been identified as potential issues include hardness, pH, trace metals (specifically mercury, copper, nickel, cobalt, and zinc), and sulfate. Other parameters that could cause concerns include residual blasting agents and chloride.

The PolyMet project is located in the Lake Superior basin that has stringent limits for mercury from new wastewater sources because of its bio-accumulative properties. The discharge standard for mercury is 1.3 ng/L at the PolyMet location. Precipitation in the area already exceeds this standard. The projects ability to meet this standard will be an important consideration in the EIS. Treatment methods considered as removal technologies for mercury and metals include sulfide precipitation, ion exchange, carbon adsorption, and reverse osmosis. The ability of taconite tailings and possibly flotation tailings from PolyMet will also be evaluated to remove mercury from solution. If it is determined that the project cannot meet the mercury standard as a new source, there is the possibility of providing pretreatment of the wastewater and discharging to an existing permitted wastewater discharge that is capable of requesting a variance. Mercury and the effect of any discharge on the mercury cycle will be addressed as part of the EIS.

Additional options for the management and treatment of Mine Site discharges exist. These include: 1) pumping the discharge to the Process Plant for direct use in hydrometallurgical processing, 2), pumping the discharge to the Tailings Basin for treatment prior to discharge from the basin or surface water and/or pumping to the Hoyt Lakes POTW for additional treatment, 3) pretreatment of the discharge prior to pumping to the Babbitt POTW for additional treatment, or 4) pretreatment of the discharge prior to pumping to the other industrial facilities for beneficial reuse and consumption. These will be evaluated as part of the EIS.

Wastewater treatability studies will need to be completed to demonstrate adequate removal efficiencies for mercury and possibly other pollutants.

Closure

The quantity and water quality of runoff from the waste rock stockpiles, lean ore piles, and the pit are expected to change after mine closure. Hydrologic models will need to be employed to estimate changes in runoff from stockpiles, runoff, precipitation and ground water inflows to the pit, and pit water elevation over various phases of pit closure. Results of the waste characterization studies will need to be used in concert with geochemical and hydrologic models to predict the effect of time on expected water quality of the waste rock stockpile runoff and pit water. Details on lining and capping systems of reactive waste rock stockpiles will be included in EIS.

After closure, pit dewatering would cease and the mine pit will begin to fill with water. The rate of filling is largely a function of precipitation, groundwater inputs, runoff from adjacent upland areas, and evaporation. The amount of time it will take the pit to naturally fill will be estimated. If this time is deemed to be excessive, options for more rapid filling will be evaluated. Water could be diverted from a number of local sources to expedite pit filling. Some of those sources include the waste rock pile runoff, Northshore mine pit overflows, other local mining pits overflows, a portion of high flows in the Partridge River, municipal or industrial runoff sources, or other municipal or local discharges. Expedited pit filling may have the benefit of reducing the pit wall rock oxidation, acid generation, and metal leaching. Alternative methods of filling the pit and water quality predictions for these alternatives will be evaluated as part of the EIS.

Treatment employed during the various phases of mine closure would need to be commensurate with expected runoff volume and water quality. Treatment options include continued operation of an active treatment system that was employed during mine operation, connection of the runoff and pit water discharges to a local municipal treatment plant, and/or implementation of a low maintenance treatment system.

Plant Site and Tailings Basin

Final selection of the treatment technology will require more data on wastewater composition and quantity, discharge location, applicable water quality standards, and point of compliance. Water balance and chemical modeling will estimate the water quantity and quality during Process Plant operations. At a minimum, chemical modeling will need to consider a wide variety of factors, including but not limited to: expected water management practices, make-up water use, precipitation, evaporation, seep recovery, seep losses, Process Plant operations and tailings slurry water chemistry, and the effect of tailings weathering on seep water chemistry. The level of dissolved solids in the Tailings Basin will also depend on the proposed plan of management of water in the Tailings Basin and the expected hydrologic conditions. Treatment could be used to control accumulation of some of the solids in the process water. Under dry climatic conditions, infrequent discharges may induce greater accumulation of less-treatable substances in the process water; this could require greater treatment efforts to manage the buildup.

Once the composition of the Tailings Basin water quality has been projected for the expected operating life of the Process Plant (e.g. 20 years), the options for wastewater treatment will be evaluated. Treatability studies will need to be completed with synthetic wastewater to determine the efficiency of treatment methods being considered.

Water treatment alternatives will be addressed in the EIS.

Receiving Waters

Treated wastewater from the Tailings Basin would be discharged to the Embarrass River or its tributaries. Data on flow and water quality for these receiving waters will be required as part of the EIS. The Wastewater Treatment Plant is proposed to be constructed on the north side of the Tailings Basin but the precise location of the discharge has not been decided. At this time, seeps flow into the headwaters of Trimble Creek and into nearby wetlands that discharge to the Embarrass River. Currently these seeps are included as part of the NPDES permit for the existing tailings facility, which is managed by Cliffs Erie.

The Embarrass River flows east to west along the north side of the Giants Ridge formation before turning south near Biwabik to join the St. Louis River. The headwaters of the river are near Babbitt. The City of Babbitt discharges municipal wastewater to wetlands and pits in the headwaters of the watershed. In 2004 water quality data were collected upstream from the proposed PolyMet facility at the crossing of County Road 620. This location is designated PM-12 on Figure 17-2; available data are summarized in Table 17-2.

A majority of the seeps from the Cliffs Erie Tailings Basin currently flow to the headwaters of Trimble Creek and then to the Embarrass River. The seeps have been monitored as described previously at locations PM 7, PM-8, PM-9 and PM-10 on Figure 17-2. Table 17-2 includes data collected at these sites as well as data from the Trimble Creek monitoring location, designated PM-11. Additional water quality monitoring data for these locations will be available for preparation of the NPDES permit application and for use in the EIS.

Downstream the Embarrass River flows to Sabin Lake and then to Wynne Lake. These two lakes, located north of Biwabik and Aurora, are connected by a navigable narrows and form a four-mile long water body. The lakes have MDNR public water access and are adjacent to the Giants Ridge recreational facility. Fish populations in Sabin and Wynne Lakes in 1996 were dominated by white sucker, walleye, bluegill sunfish, and northern pike. In 1998, the MPCA listed Wynne and Sabin Lakes on the 303(d) list of impaired waters on the basis of a fish consumption advisory for mercury issued by the Minnesota Department of Health.

The Embarrass River flows out of Wynne Lake through a diversion channel to Embarrass Lake in the City of Biwabik. The City has constructed a City campground, picnic area, beach, fishing pier, and boat landing with concrete boat ramp off Hwy. 135 along the west shore. Standard limnological quality measurements were taken in Embarrass Lake in 1983 and 1993. These measurements indicate that the lake is mesotrophic and has generally good water quality. Fish populations in 2002 were dominated by white sucker and northern pike, followed by rock bass, bluegill sunfish, and walleye. In 2002 the MPCA listed Embarrass Lake on the 303(d) list of impaired waters for mercury on the basis of a fish consumption advisory issued by the Minnesota Department of Health. The City of Biwabik discharges wastewater from its municipal treatment plant to a wetland that is tributary to Embarrass Lake.

Below Embarrass Lake, the river flows through Cedar Island Lake, Fourth Lake, and Esquagama Lake and then flows an additional four miles in a highly sinuous channel to join the St. Louis River. The City of McKinley discharges its wastewater treatment lagoons to a creek that is tributary to the Embarrass River below Esquagama Lake. In 1998, the MPCA listed Esquagama Lake on the 303(d) list of impaired waters on the basis of a fish consumption advisory for mercury issued by the Minnesota Department of Health. The immediately downstream reach of the St. Louis River has also been listed by the MPCA as an impaired water on the basis of a fish consumption advisory for mercury. Ultimately, the St. Louis River discharges to Lake Superior.

The impact of increased sulfate concentrations in receiving waters due to wastewater discharges will need to be addressed in the EIS. In some systems, increased sulfate concentrations can lead to an increase in methyl mercury production, which could increase the amount of methyl mercury in the food chain.

SANITARY WASTEWATER

The existing Cliffs Erie Sanitary Waste Water Treatment Plant is not included in the area to be purchased by PolyMet. A new dedicated wastewater treatment plant which would likely employ primary and secondary treatment would be provided at the Plant Site to treat sanitary wastewater prior to discharge. A plant designed to accommodate 200 workers would be capable of treating approximately 4000 gpd (3 gpm).

Sanitary waste would also be generated at the Area 1 shops. Historically, sanitary waste at this location was managed via an existing septic tank and related drain field. PolyMet proposes to continue this practice under its operating plans.

c. If wastes will be discharged into a publicly owned treatment facility, identify the facility, describe any pretreatment provisions and discuss the facility's ability to handle the volume and composition of wastes, identifying any improvements

necessary.

A sanitary wastewater system is proposed at the Mine Site. Two optional systems are available to manage this waste. The first option would include the installation of an approved septic tank and related drain field. The location for such a system has not been determined at this time but will be addressed in a NPDES permit application if the option is exercised. The second option would include installation of a holding tank for sanitary waste. A commercial sanitary waste management contractor would be responsible for maintenance and operation of this system. The commercial contractor would remove sanitary waste from the holding tank on a regular schedule. The final destination of the collected wastewater has not been determined; the Babbitt POTW is the most likely location. The design flow for the Babbitt wastewater treatment plant is 500,000 gallons per day; the plant now treats about 200,000 gallons per day so the plant could easily handle the estimated 5,000 gpd generated at the Mine Site.

As noted previously, an option for the management and treatment of tailings basin discharge would be to pre-treat and pump the discharge to the Hoyt Lakes POTW for final treatment. The currently permitted flow of the Hoyt Lakes POTW is 685,000 gallons per day; the plant now treats about 250,000 gallons per day so the plant could accommodate an additional 435,000 gpd flow from the tailings basin, if necessary. Pretreatment provisions have not been defined to evaluate this option. Improvements to the plant may be necessary to accommodate increased flows and/or final treatment.

Potential options for the treatment of discharges from the Mine Site also include conveyance to POTWs. Two such options were listed: 1) pump the discharge to the Tailings Basin for treatment prior to pumping to the Hoyt Lakes POTW for final treatment, and 2) pretreatment of the discharge prior to pumping to the Babbitt POTW for final treatment. Pretreatment provisions have not been defined to evaluate these options. Improvements to the plants would likely be necessary to accommodate increased flows and/or final treatment.

The use of POTW for wastewater discharge and the required pretreatment options will be evaluated in the EIS.

d. If the project requires disposal of liquid animal manure, describe disposal technique and location and discuss capacity to handle the volume and composition of manure. Identify any improvements necessary. Describe any required setbacks for land disposal systems.

The Project will not require disposal of liquid animal manure.

Proposed Treatment of Topic in EIS:

Estimates of the quantity and quality of industrial wastewater generation from the mine site, processing plant and tailings basin will be included in the EIS. Predictions will be made as a function of time, during both the operating life of the project and after operations cease.

The following studies and information will be developed as part of the EIS to better understand potential wastewater impacts, and methods of prevention and mitigation as appropriate.

MINE SITE

- Waste characterization study results
- Pilot Plant Process Testing
- Phase I and II Hydrogeological Evaluation
- Wetland Hydrology Study
- Effectiveness of mine site water management systems (including lining and capping systems for reactive waste rock stockpiles)
- Existing water quality data from other sources such as AMAX test shaft, Copper-Nickel Study, and other mining operations.
- Treatability studies for reactive runoff
    - Conceptual treatment design and tests capacity of design to meet expected water quality goals. Synthetic laboratory water, which has the expected chemical composition of seep and pond water, will be created for the test or water from existing stockpiles of Duluth Complex may be used.
    - A variety of treatment options will be evaluated. This may include both active and low maintenance treatment.

MINE SITE OPEN PIT

- Description of composition of the pit walls as a function of time
- Surface area of pit walls
- Models to predict water quality under various closure scenarios

PLANT-TAILINGS BASIN

- Tailings Basin/Plant Water and Water Quality Management Approach, including effectiveness of the tailings basin seepage collection system.
- Existing water quality data from tailings basin seepage
- Water quality impacts from emergency basin seepage and material discharged to the basin.
- Processing Plant and Tailings Basin Water Balance and Chemical Budget
    - Chemical budget, modeling of the Tailings Basin seep and pond chemistry requires the following inputs:
        - Model(s) will be run in conjunction with water balance and projected pond water chemistry.
        - Tailings characterization. From ongoing waste characterization studies for new Process Plant tailings.
        - Modeling and tailing leaching kinetics results delivered as part of the NPDES and permit to mine applications

        - Prediction of water quality in cells designed for hydrometallurgical residue
        - Interaction of water from Polymet operation with underlying taconite tailings

- Treatability Study for Seep Water and Water from the Ponds
    - Conceptual treatment design and tests of design to meet expected water quality goals. Synthetic laboratory water, which has the expected chemical composition of seep and pond water, will be created for the test or water from existing stockpiles of Duluth Complex may be used.
    - A variety of treatment options will be evaluated. This may include both active and low maintenance treatment.

OTHER ISSUES

- Existing Environment of receiving waters
    - Biological monitoring (fish, mussels, and invertebrates)
    - Existing water quality parameters that do not meet standards
- Mercury
    - Ability to meet 1.3 ng/L water quality standard for discharge
    - Methylation of mercury due to increased sulfate concentrations

Sanitary wastewater treatment, which will be needed at the Plant and Mine Site, is a conventional technology and will not require study for the EIS

REFERENCES

Barr. 2001. LTV Tailings Basin Interim Water Balance Study. Barr Engineering. September 2001.

MDNR 2004. East Range Hydrology Study. Minnesota Department of Natural Resources (MnDNR). March 2004.

19. Geologic hazards and soil conditions

a. Approximate depth (in feet) to ground water: 0 (in wetlands) **minimum** 3-4 feet (interflow zone in soils)
average to bedrock: 0 (bedrock outcrops) **minimum** / unknown but < 30 feet **average.**

Describe any of the following geologic site hazards to ground water and also identify them on the site map: sinkholes, shallow limestone formations or karst conditions. Describe measures to avoid or minimize environmental problems due to any of these hazards.

None

b. Describe the soils on the site, giving NRCS (SCS) classifications, if known. Discuss

soil granularity and potential for groundwater contamination from wastes or chemicals spread or spilled onto the soils. Discuss any mitigation measures to prevent such contamination.

Information on soils, including hydraulic conductivity, will be developed as part of the hydrogeological study to be conducted during the EIS. This data, along with the predicted water quality from the various waste units will be used to evaluate the potential for groundwater contamination and chemical transport.

With respect to soils and the potential for groundwater contamination, four general areas may be considered: the Mine Site, the Plant Site (including the Area 1 Shop truck maintenance facility), the Tailings Basin, and the Railroad Construction Area. These are addressed separately below. Specific chemicals to be used and stored on site and the measures to be taken to prevent spills or other releases are discussed individually in response to Question 20.

MINE SITE

Soil Types - A soil survey has not been completed for this portion of St. Louis County. A general description of the soils in Sections 1, 2, 3, 4, 9, 10, 11, and 12, T59N, R13W was obtained from the USFS (Figure 19-1). As a result of discussions with the NRCS soil survey team for St. Louis County, the following information is provided to describe the soils in the vicinity of the Mine Site:

The ongoing NRCS Soil Survey considers the area to lie within St. Louis County Geomorphic Area 28, the Allen and Wampus Moraines. These are minor glacial moraines of the Rainy lobe from the Automba phase of Wisconsinian glaciation. The material deposited by this glacial lobe is generally coarse-textured and stony and bouldery. Textures of the fine soil fraction are loamy sand to sandy loam, but rock material, including gravel, cobbles, and stones and boulders, can range from 35 up to 70 percent by volume. The surface relief of the area in question is gently rolling, with local relief ranging from about 10 to 30 feet. Slopes are mostly short and irregular. The landscape includes many closed depressions, most of which contain peatlands.

The soils have formed in the coarse-textured till, and a much denser till lies about 40 inches below the surface. The topographic sequence of mineral soils (starting with the highest topographic landscape position) include the well-drained Eveleth series, the moderately well-drained Eaglesnest and Whalsten series, and the somewhat poorly-drained Babbitt series (the official description for Babbitt series is yet to be developed but it is reportedly similar to the Brimson series). The topographically lowest member of the sequence is the very poorly-drained Bugcreek series. The organic soils in the nearby peatlands are primarily the Rifle and the Greenwood series, with the Rifle having generally mixed vegetation compared to the black-spruce dominated Greenwood.

Water erosion is not likely to be a problem with the soils because of the subdued topography and the stoniness of the soil material, which has an armoring effect. The surface horizons of the soils on higher parts of the landscape (Eveleth, Eaglesnest, and Babbitt) are thin (3 to 4 inches in thickness) with about 3 to 5 percent organic matter, and they are slightly more erosive than the underlying horizons. The whole-soil erosion factors (K) for soils fall into 14 classes (up to 0.64), and the erosion factors for the soils in these sections all fall in the lower half of those 14 classes.

Because of the dense underlying till, most of the mineral soils in the landscape (with the possible exception of the Eveleth) experience perched water tables during late spring and very early summer at a depth of 1 to 3 feet. The water table usually disappears relatively quickly following tree leaf-out, but may reappear for brief periods following unusually heavy precipitation. Excavation of these soils in the spring and early summer would likely intercept areas of perched water that will accumulate in the bottom of an excavation. The intercepted water will likely need to be collected to allow for orderly construction.

PLANT SITE

Soil Types - A soil survey has not been completed for this portion of St. Louis County. The native soils in the vicinity are likely to be typical of those found in the region (see Mine Site soils discussion, above). The soils in the Plant Site have been extensively disturbed, filled and compacted by almost 50 years of mining-related activity. The majority of the area is covered by buildings with deep and substantial foundations, paved road/parking lots, railroad tracks, gravel roads/part storage areas and by the large circular tailings thickeners.

TAILINGS BASIN

Soil Types - A soil survey has not been completed for this portion of St. Louis County. The native soils underlying the Tailings Basin are likely to be typical of those found in the region (see discussion of soils in the Mine Site, above). However, the soils beneath the Tailings Basin are now overlain by up to 200 feet of tailings deposited over many years of the Cliffs Erie facility's operation as Erie Mining Company and LTV Steel Mining Company.

Current plans call for no substantial alteration in the configuration of the existing basin unless tailings are needed for dam construction. Lined containment cells will be located on Cell 2W which has approximately 200 feet of tailings in it. As described previously in Section 6, Hornfels, a potentially acid-generating material, was transported to the tailings basin and buried in taconite tailings in the general area of the Reactive Residue facility. The location of the Hornfels is shown in Figure 5-5. Monitoring wells were installed. Data from the monitoring wells will be evaluated and any potential for the reactive residue facility to impact the hornfels or groundwater beneath the basin will be evaluated in the EIS. The goal is to design the lined reactive residue facility so that there are no impacts to the hornfels or groundwater, and this will be evaluated as part of EIS preparation.

RAILROAD CONSTRUCTION AREA

Soil Types - A soil survey has not been completed for this portion of St. Louis County. The native soils underlying the road and railroad corridors are likely to be typical of those found in the region (see discussion of soils in the Mine Site, above). These soils are not known to be highly erosive or permeable, and the typical presence of a layer of dense underlying till further reduces the risk of groundwater contamination in the event of a chemical spill.

POTENTAIL FOR GROUNDWATER CONTAMINATION FROM SPILLS

The highest potential for groundwater contamination could occur is associated with reactive runoff water management of the stockpiles, leakage from the unlined tailings basin, and spills from fueling operations of mine equipment. Management of reactive runoff from stockpiles and tailings basin leakage was previously discussed in response to EAW Question 18. The following discussion identifies PolyMet's plans to prevent groundwater contamination from fueling operations.

Detailed operational checklists will be developed and provided to all operators during fueling of storage tanks, transfer from storage tanks to mine fueling transports and fueling of mining equipment. Checklist items will include: confirming reserves in tanks before fueling; examination of transfer lines and other equipment to ensure they are in good condition; requirement that driver is out of the truck monitoring operations; vehicles are not moved until all lines are stowed, valves and covers checked and secured; and transfer and fueling is observed by Company personnel trained in operation and maintenance of equipment to prevent discharges and response to discharges.

Fuel transfer operations to and from permanent storage facilities will take place in designed low permeability and curbed areas to contain any releases. Any releases will be collected by facility personnel and managed in a manner appropriate to the material recovered. Containment area drainage features will be closed during transfer operations.

Fueling operations for mobile equipment will occur within areas capable of containing any released material to prevent direct discharge to surface waters. Soils impacted by released materials will be removed, evaluated for proper management, and directed to appropriate licensed facilities.

The facility will have emergency equipment and materials on-site to allow communications and to contain and recover any released materials. The equipment and materials will include radio and telephone communications and intercom systems, various material absorbents, booms, and spill kits. Also personnel protective equipment will be available on-site. In the case of a release the State Duty Officer would immediately be notified. Two additional actions will occur immediately and simultaneously; identify the source of the release and deploy personnel and equipment to contain the release.

Proposed Treatment of Topic in EIS:

Information on soils, including hydraulic conductivity, will be developed as part of the hydrogeological study to be conducted during the EIS. This data, along with the predicted water quality from the tailings basin and reactive stockpiles will be used to evaluate the potential for groundwater contamination and chemical transport.

20. Solid wastes, hazardous wastes, storage tanks

a. Describe types, amounts and compositions of solid or hazardous wastes, including solid animal manure, sludge and ash, produced during construction and operation. Identify method and location of disposal. For projects generating municipal solid waste, indicate if there is a source separation plan; describe how the project will be modified for recycling. If hazardous waste is generated, indicate if there is a hazardous waste minimization plan and routine waste reduction assessments.

Seven main waste streams or by-products/residues would be generated by the proposed project. These are: 1) surface overburden, 2) non-reactive waste rock, 3) reactive waste rock, 4) lean ore, 5) flotation tailings from the crushing, grinding and flotation of the ore, 6) hydrometallurgical residue, and 7) gypsum. None of these materials are listed hazardous waste under 40 CFR 261or MR 7045, since all mine wastes are excluded under Bevill amendment. However, with the exception of surface overburden, all wastes will be included in a mine waste characterization program. Mine waste characterization will be included as part of the EIS.

Surface overburden and non-reactive waste rock would be used for the construction of roads and other necessary infrastructure at the Mine Site or may be placed in stockpiles adjacent to the pit. As required by Minnesota Rules surface overburden would also be placed on the completed tops and benches of lean ore and waste rock stockpiles to enhance reclamation potential. The reactive waste rock and lean ore would be placed in lined, engineered waste rock stockpiles adjacent to the pit at the Mine Site. Alternatives for providing an impermeable base to the stockpiles are under consideration. The flotation tailings are proposed for disposal at the Cliffs Erie taconite flotation tailings basin near the Plant Site. The hydrometallurgical residue would be placed in a lined Reactive Residue Facility located in a closed taconite flotation tailings basin at the Plant Site. Initially gypsum would be placed in the Reactive Residue Facility. If a market can be developed, the gypsum would be placed in a temporary storage facility until sold.

As part of the EIS and permit to mine, PolyMet will develop a waste characterization program for all geological and plant process wastes. The estimated amounts, compositions and management practices for storage of these wastes and a general category of “other” wastes are described below. PolyMet has made these estimates based on the current 20 year mine plan, and the amount and type of material may change as additional drilling information and waste characterization data is generated.

Grade Control

A key component of the NorthMet mining operation is grade control. In this context grade control is the term applied to the process of characterizing the rock mass, prior to mining, to determine whether it should be sent to the Plant Site for processing, to a waste stockpile, or a lean ore stockpile. Grade control would allow ore of different grades and quality to be blended for optimal processing and enable differentiation between reactive and non-reactive waste rock. Once material has been characterized, production engineers can plan, schedule and control production to ensure that material is hauled to the appropriate destination.

It is important to reliably and accurately identify ore grade mineralization ahead of mining to extract maximum value and to avoid contamination of stockpiles with high sulfur material. Because of the size of equipment used, it is not uncommon in open pit mining for “mixing” to occur during excavation at the boundaries between areas designated as ore, lean ore, and waste. Depending on the point of reference, this mixing can result in “dilution” of ore with waste or lean ore; alternatively, material that should have been mined as ore may be “lost” to waste or to a lean ore stockpile.

The methods that PolyMet would use for mining, grade control, production scheduling and on-going waste classification are described in response to Question 6b of this EAW. While difficult to predict at this early stage of project development, best practice is for dilution not to exceed 5% of the total volume of ore mined and ore losses would not be expected to exceed 2% of the total volume of ore mined. These projected ore losses are toward the lower end of general mining standard due to large size of mineralized zones compared to the size of excavating equipment. The issue of grade control for waste rock management will be addressed in the EIS.

Surface Overburden

Surface overburden consists of “naturally occurring unconsolidated material overlying bedrock consisting of broken rock fragments or organic materials” (MR 6132.0100: Subp. 32). Generally this means glacial till and peat, which represent the parent material from which the local natural soils have developed.

The average thickness of the glacial till at the Mine Site is 13 feet. Based on PolyMet’s September 2004 block model and currently available drill core data, it is estimated that 10,300,000 in-place cubic yards of surface overburden will be generated over the projected 20-year mine life. Assuming a density of 2.43 tons per cubic yard, this equates to 25 million tons of overburden. This estimate will be refined in the EIS.

Excavated glacial till represents an important construction material for subsequent use in mine development and closure and management practices for these materials are oriented toward the control of erosion and sedimentation. These practices are described in the response to Question 16.

Rock Materials

The NorthMet deposit is located within the Duluth Complex. In this area the Complex is a series of seven grossly layered igneous intrusive rock units. These units are composed of augite troctolite to anorthositic troctolite (varieties of “gabbro”) separated by relatively thin ultramafic (olivine rich) horizons. The lowermost unit is the main “ore zone”, however, the upper parts have isolated zones or pods of ore grade sulfide mineralization. While overall sulfide mineralization is much less in the upper units, where it does exist it contains a high proportion of material with some metal value, and therefore PolyMet indicates they intend to mine this material as ore rather than waste. An economic analysis of the feasibility of this approach will be provided in the EIS.

It is expected that some of the footwall Virginia Formation (geological unit below the Duluth Complex) would be moved for pit access road and ramp construction. The Virginia Formation is a sedimentary rock (mudstone), unmineralized Virginia Formation is commonly moved and stockpiled in the Mesabi Range taconite mines. In the area of the NorthMet deposit, it has been contact metamorphosed to the point of partial melting by the intrusion of the Duluth Complex. Size of the entrained pieces within the Duluth Complex varies from inches to one hundred feet or more in drill core. Waste rock characterization data submitted by the company indicates that more than 10 million tons of Virginia Formation rock, with an average sulfur content of 2.9%, will be excavated. This material has a high potential to produce acid drainage and plans tailored to manage materials of this high degree of reactivity will be provided in the EIS.

The gross igneous layering of these rock units is geologically important in interpreting the genesis and geometry of the deposit, but in mining, the economic criteria described below will ultimately be the only discriminators between ore and waste.

Major sulfide minerals in the deposit include: cubanite and chalcopyrite (copper-iron sulfides), pentlandite (nickel-iron sulfide) and pyrrhotite (iron sulfide).

Rock Characterization

Material (rock) management in the mine is based on an initial economic criterion, then subdivision of that criterion based on economics and sulfur content. The economic criterion is called “cut-off”, which is the sum of all the metal values (positives) and all costs (negatives) applied to mining a quantity of rock. Rock masses with values below the metals value cut-off are waste, those above it are ore. The long-term mine plan is based on conservative, long range metal values, while short term mining plans are constantly re-evaluated to reflect current metals prices. The deposit will produce the following rock materials:

Ore-sorted first by metals value:

- Ore - a dynamic criterion based on metals value, subject to change over time
- Lean ore - a dynamic criterion based on metals value, subject to change over time

Waste rock –rock that may or may not contain metallic mineralization, but is in either case not profitable to process using known technologies:

> Non-reactive waste –Non-reactive waste rock is rock that can be placed on the surface and the drainage from the rock will not adversely impact natural resources, although settling ponds may be needed to remove suspended solids and turbidity.
>
> Reactive waste - rock that is shown through characterization studies to release substances that adversely impact natural resources.

Tailings are from the processing of ore. Although the proposed flotation process would be designed to concentrate metal sulfides for further processing, the composition of these tailings is not yet known. The Pilot Plant Process will generate tailings that will be subjected to waste characterization studies to determine tailings composition and reactivity.

Non-Reactive Waste Rock

"Waste rock" consists of "rock that may or may not contain metallic mineralization, but that is in either case not profitable to process using known technologies" (MR 6132.0100: Subp. 34). Non-reactive rock is rock that can be placed on the surface and the drainage from the rock will not adversely impact natural resources, although settling ponds may be needed to remove suspended solids and turbidity.

The determination of non-reactive waste rock is important to protecting water quality and preventing long- term maintenance associated with mineland reclamation. Sulfur content of waste rock is an indicator of whether water runoff would contain metals and require treatment. Other criteria, including trace metals, may also be needed. Although existing data can be used to estimate the chemical content could produce runoff requiring treatment, there are many variables in the chemistry of geologic formations that make these estimates unreliable. As stated earlier a waste characterization study is proposed using rock material from the NorthMet deposit to get a better understanding of how this rock will behave when exposed to air and water.

For project planning and based on existing data, a preliminary criterion of $\leq$ 0.05% sulfur has been selected to represent non-reactive waste rock for the purposes of EIS scoping. If subsequent waste characterization studies determine that this criterion was too low the project will generate more non-reactive waste rock and less reactive waste rock. However, if waste characterization studies determine this criterion was too high, or there are other constituents of concern the project will generate less non-reactive waste rock and more reactive waste rock. Waste characterization studies will begin during the EIS. These studies are long term and will continue throughout the life of the mine.

Using the above criterion, PolyMet estimates that based on its September 2004 block model and currently available drill core data, 43 % of the total waste rock and lean ore generated during the projected 20-year mine life will consist of non-reactive waste rock. This corresponds to 121.2 million tons of non-reactive waste rock.

Table 20-1 provides a summary of the metals and sulfur composition of the non-reactive waste rock of the NorthMet Deposit using the most recent information.

Table 20-1 Metals and Sulfur Composition of Non-Reactive Waste Rock Stockpile Material

Non-reactive stockpile material	Copper percent	Nickel percent	Sulfur percent	Cobalt ppm	Zinc ppm
Mean	0.016	0.021	0.03	45	68
Median	0.016	0.020	.04	43	66
Maximum	0.047	0.044	0.05	89	116
Minimum	0.001	0.002	0.01	5	14

PolyMet data: values from drill interval samples within approximate 20 year pit design. Classifications based first on economic criterion, then sulfur value.

As with surface overburden, non-reactive waste rock represents an important construction material for routine use in mine development and closure. It is anticipated that this material would be used for the construction of roads, railroads, and other infrastructure at the Mine Site and for could be used as a pad for stockpile construction and used to extend side slopes on reactive material piles. Excess non-reactive waste rock may also be placed in stockpiles adjacent to the pit (Figure 5-3).

Reactive Waste Rock

Reactive waste rock is that rock not meeting an economic cut-off that is shown through characterization studies to release substances that adversely impact natural resources (see MR 6132.0100, Subpart 28). Thus, reactive waste rock when placed on the surface may generate acid mine drainage or drainage water that contains constituents that adversely impact natural resources. Based on the preliminary criterion for non-reactive waste rock, reactive waste rock would be rock below the metals value of lean ore and containing >0.05% sulfur. Again, if waste characterization studies determine different cutoff criteria for reactive waste rock, the estimates for the amount of reactive versus non-reactive waste rock will change.

Using the above criterion, PolyMet estimates that based on its September 2004 block model and currently available drill core data, 35% of the waste rock and lean ore generated during the 20-year mine life would consist of reactive waste rock. This corresponds to 98.3 million tons of reactive waste rock. Table 20-2 provides a summary of metals and sulfur composition of reactive waste rock.

Table 20-2 Metals and Sulfur Composition of Reactive Waste Rock Stockpile Material

Reactive stockpile material	Copper percent	Nickel percent	Sulfur percent	Cobalt ppm	Zinc ppm
Mean	0.037	0.022	0.45	45	96
Median	0.031	0.022	0.10	45	76
Maximum	0.115	0.046	7.45	101	898
Minimum	0.003	0.001	>0.05	2	16

PolyMet data: values from drill interval samples within approximate 20 year pit design. Classifications based first on economic criterion, then sulfur value.

PolyMet's proposal is to place reactive waste rock in lined, engineered waste rock stockpiles adjacent to the pit at the Mine Site (Figure 5-3). Drainage water from the stockpiles would be collected from the liner and subjected to treatment to comply with appropriate water quality standards as determined by PCA (See Response to EAW Question 18).

The following stages of construction and methods of drainage water management have been proposed for reactive waste rock stockpiles:

- Waste stockpiles would be built progressively on an "as required" basis to minimize the area of exposed liner that would collect precipitation and to minimize the impact of early stage capital expenditure on project economics.
- In general, waste rock stockpiles would be constructed on one or more subwatersheds to concentrate drainage at specific points down slope for collection.
- Vegetation would be cleared over the area where the relevant phase of stockpile construction is to take place; marketable timber would be harvested while smaller trees and shrubs may be mulched for use in future reclamation.
- The layer of topsoil, peat, vegetable matter and sediments down to the point where glacial till is encountered would be removed and stockpiled for use in future reclamation.
- Glacial till would then be removed to a depth that will depend on the overall depth of till and the volume of material required for construction of a surface water exclusion dike.
- Where adjacent wetlands might seep toward the stockpile base, the glacial till removed during the previous construction step would be used to build a dike that would be thoroughly compacted during construction. By placing the material on the dike in layers and compacting each layer successively, the impermeability of the dike itself would be enhanced to a specified design criterion.
- Water that does infiltrate the dike from an adjacent wetland would not have come into contact with any waste rock and can therefore be collected in a channel and conveyed to a settling pond prior to monitoring and discharge to the Partridge River.

- Mining will be scheduled to provide inert, non-reactive waste rock (mostly from Unit 3) for the construction of a base layer or platform for what would become the main waste rock stockpile. The upper surface of this "base" will be graded to a low point that would become a future drainage collection point. Having established the basic shape of the platform, a layer of screened surface overburden, sand or possibly taconite tailings will be spread over the base to provide a protective layer on which an impermeable barrier of liner would be placed. This in turn will be covered with an upper protective layer of screened surface overburden, sand or tailings before run-of-mine reactive waste rock is placed on top of it.
- Any drainage from a reactive waste rock stockpile would be collected on the liner or impermeable barrier and drain to a lined basin.
- Drainage water will be pumped from the lined basin to a treatment plant located at the Mine Site prior to discharge to the Partridge River.

Additional detail on stockpile construction as well as alternative designs and layouts will be included in the EIS.

Lean Ore

Lean ore is defined by rule as rock containing metallic mineralization that is not profitable to process using technologies that exist at the mining operation (MR 6132.0100, Subpart 14). Regardless of its metal content, most of the lean ore would have a sulfur concentration above the preliminary and conservative criterion of >0.05% and be considered reactive. Thus, lean ore may generate acid mine drainage or drainage water that contains constituents in excess of the State's water quality standards.

PolyMet estimates that based on its September 2004 block model and currently available drill core data, 21 % of the waste rock and lean ore generated during the 20-year mine life would consist of lean ore. This corresponds to 60.1 million tons of lean ore that would be generated during the 20-year mine life. Table 20-3 provides a summary of the metals composition of lean ore.

Table 20-3 Metals and Sulfur Composition of Lean Ore Stockpile Material

Lean ore stockpile material	Copper percent	Nickel percent	Sulfur percent	Cobalt ppm	Zinc ppm
Mean	0.096	0.043	0.35	61	82
Median	0.097	0.042	0.21	59	79
Maximum	0.256	0.093	4.91	168	236
Minimum	0.007	0.010	0.01	12	12

PolyMet data: values from drill interval samples within approximate 20 year pit design. Classifications based first on economic criterion, then sulfur value.

As with reactive waste rock, lean ore would be placed in lined, engineered waste rock stockpiles adjacent to the pit at the Mine Site (Figure 5-3). Drainage water from the lean ore stockpiles will be collected from the liner and subjected to treatment to comply with applicable water quality standards as described in the response to Question 18. The construction sequence and methods of drainage water management for lean ore stockpiles are envisioned to be the same as that described for reactive waste rock stockpiles.

It may be possible to process the “lean ore” through the concentrator and metal production stages after mining stops at a deposit. Assuming the plant is operational and mining has ceased, this material is then not displaced by (or in competition with) material of higher value in the production process, and the mining costs have been largely covered in the original material movement.

Ore

As with the other parts of the deposit, the silicate portion of the ore is relatively constant, the metals composition is presented here in Table 20-4. This also represents the feed to the plant, the parent material of the tailings. Since there will be unrecoverable ore grade material in the floor and walls of the pit at the end of mining, the ore concentrations would provide a worse case estimate of the composition of pit floor and walls at the end of mining. Pit wall and floor composition as a function of time will be evaluated as part of the EIS.

Table 20-4 Metals and Sulfur Composition of Ore

Ore	Copper percent	Nickel percent	Sulfur percent	Palladium ppm	Platinum ppm	Gold ppm	Cobalt ppm	Silver ppm	Zinc ppm
Mean	0.44	0.11	1.00	0.425	0.110	0.060	78.9	1.6	83.8

PolyMet data: values from drill interval samples within approximate 20 year pit design. Classifications based first on economic criterion, then sulfur value.

Flotation Tailings

Flotation tailings are the waste-by-products of the mineral beneficiating processes, consisting of rock particles, which have undergone crushing, grinding and flotation, from which the profitable mineralization has been separated. The silicate portion of the flotation tailings will be the same as the ore feed (Table 20-1) Because sulfide minerals, including most iron sulfides, will be separated from tailings in the flotation process, the flotation tailings are projected by PolyMet’s metallurgical simulations to be approximately 0.17 % sulfur. Additional testing will be conducted to better estimate the actual sulfur content of the tailings. This data will be developed for the EIS.

Testing pilot plant of flotation tailing at Lakefield Research indicated tailings with a sulfur concentrations between 0.20 and 0.28%, however most of these metallurgical tests were performed so as to minimize pyrrhotite and other non copper-nickel sulfides recovery to the concentrate. Subsequently, PolyMet has elected to design the flotation process to emphasize total recovery of all sulfide mineral phases thereby providing for the projected reduced export of sulfur to tailings. PolyMet believes that tailings produced by a total sulfide recovery will be non-reactive and additional testing has been planned as part of the EIS. The actual composition and classification as reactive or non-reactive nature of flotation tailings will be determined by waste characterization of tailings generated in the Pilot Plant Process, and this information will be available for EIS preparation. Physical characteristics of the tailings and their suitability for use in dam construction will also be evaluated as part of the EIS.

PolyMet estimates that based on its September 2004 block model, 11,300,000 tons of flotation tailings would be generated annually. Table 20-5 provides a summary of the metals and sulfur values in the flotation tailings.

Table 20-5 Metals and Sulfur Composition of Flotation Tailings from Lakefield Testing

Flotation Tailings	Copper percent	Nickel percent	Sulfur percent	Gold ppm	Cobalt ppm	Silver ppm	Zinc ppm
Bulk Composite Concentration[1]	0.03	0.038	0.26	<0.02	61	21	110
Projected Concentration[2]	0.0255	0.035	0.17	0.0149	52.3	-------	22.8

[1]*Data taken from SGS Lakefield Limited Progress Report No. 6. Sulfur is median based on ten samples.*
[2]*Data from MetSim process simulation model.*

PolyMet proposes to discharge the flotation tailings to the Cliffs Erie taconite flotation tailings basin at the Plant Site. Use of this basin will be evaluated as part of the EIS. The management, treatment and discharge of water from the tailings basin are described in the response to Question 18. The design, construction, operation and management of the flotation tailings basin and related dams is described in the response to Question 6.b.

Hydrometallurgical Residue

PolyMet estimates that 355,000 tons of hydrometallurgical residue would be generated annually. This residue consists of four materials:

1. Autoclave residue from the leach residue filter
2. Iron/aluminum precipitate from the Fe/Al removal filter
3. Magnesium hydroxide precipitate from the Mg Removal thickener
4. Crud solids from crud removal

As the hydrometallurgical leach residue exits the autoclave, it is inherently acidic and needs to be subsequently subjected to elementary neutralization to neutralize the material to a near neutral pH (slightly alkaline) prior to placement in a lined, engineered disposal facility at the Plant Site (Figure 5-5). This Reactive Residue Facility will be designed to standards specified by the MPCA. Liquid associated with the hydrometallurgical residue will be recycled back into the hydrometallurgical process from the Reactive Residue Facility in a closed loop. There will be no water/liquid discharge from this facility.

Currently there is limited data available regarding the composition of the hydrometallurgical residue. Whole rock analysis of leach residue filter solids indicates that it primarily consists of compounds made up of iron, silicon, aluminum, calcium and sodium (> 85 %) and approximately13 % volatile matter such as sulfur, carbonates, water and organic compounds (SGS Lakefield Progress Report No. 7). Whole rock analysis of the iron/aluminum precipitate indicates that it primarily consists of compounds made up of iron, silicon, aluminum, and calcium (> 54 %), volatile matter (>27 %) and other components (> 27%) that are not determined in whole rock analysis (SGS Lakefield Progress Report No. 7). All materials will be characterized as part of the EIS.

"Crud" is a colloquial term used in the industry to describe the result of contamination of the organic/aqueous reagents by dust, silica and even insects. To enable filtration of the crud, a pre-coat/filtration medium (clay) is added to a makeup tank and gravitates to a holding tank prior to being mixed with the other constituents before being pumped to a small filter press. The filter cake containing unwanted solids and residual organic material will be discarded to the Reactive Residue Facility. The composition of the clay (Desiccite 25) is 97-99 % bentonite and 1-3 % silica. The composition of the contaminants removed by the clay has not been determined but it will likely consist primarily of aluminum, silica, and organic debris.

Gypsum

After precious metals recovery, the hydrometallurgical leachate solution is brought to pH > 2 using limestone in a three-tank neutralization cascade. Slurry from the precipitation tanks is pumped to a thickener, with the thickener underflow filtered using an automatic plate and frame pressure filter. The filter cake solids will consist of market-grade gypsum that is commonly used to make gypsum board (or sheet rock) for the construction trades. The composition of the gypsum will be >97 % CaSO4 2H20 with the remainder consisting of impurities. The filtrate from the filter press is recycled back into the process for copper extraction.

PolyMet estimates that 370,000 tons of gypsum would be produced annually. Current plans are to place this product in the lined Reactive Residue Facility at the Plant Site (Figure 5-5).

The quality of gypsum recovered from the process will be confirmed in future pilot testing that is scheduled to occur in 2005. In the event that an adequate market is available within reasonable haul distance, the gypsum will be placed in a temporary storage facility at the Plant Site. (If the gypsum is not marketable, the gypsum will be placed in the reactive residue facility.) Gypsum disposal will be addressed in the EIS.

Ongoing Waste Characterization Studies

As a part of the upcoming application for the permit to mine, PolyMet is preparing a waste characterization study. This study will include characterization of non-reactive waste rock, reactive waste rock, lean ore, ore, and flotation tailings. Hydrometallurgical residue and gypsum will be the focus of a separate, but similar study. The studies will include: 1) chemical analysis of each waste/product; 2) mineralogical and petrological analysis of mine materials; and 3) laboratory tests describing the acid generation and dissolved solids release from the materials.

The scope of work for the waste characterization study will be available for use in defining the EIS scope of work. In addition, results from the waste characterization study will be completed in a time frame that will allow the EIS contractor to incorporate the findings of the study into the Draft EIS.

The characterization of mine wastes/products will be an important element of the Draft EIS and in addition to planned studies described above there are numerous other sources of relevant information to support the EIS. This includes research conducted by the MDNR Division of Minerals. This work includes analyses of waste rock and drainage waters associated with samples of the Duluth Complex in both laboratory and field settings. PolyMet has also conducted several studies in the last five years. Finally, other agencies and mining companies have conducted studies of rock, tailings and drainage water associated with the Duluth Complex.

Other Wastes

As described in the response to Question 18, wastewater treatment plants would be operating at the Mine Site and Tailings Basin. These plants may generate treatment residue consisting of lime sludge, spent carbon and/or spent exchange resin. These materials contain metal values and other pollutants removed from water prior to discharge to surface waters.

Lime sludge would either be recycled into the hydrometallurgical process for recovery of metal values or will be disposed of in the Reactive Residue Facility. The annual generation of lime sludge is unknown at this time pending design of the wastewater treatment systems. Detailed information concerning the design and operation of the treatment systems will be provided in the NPDES permit application. This information will be available for inclusion in the EIS. Disposal of treatment sludges during and after operation will be addressed in the EIS.

Spent carbon and/or ion exchange residue would be managed by a commercial contractor for water treatment technology and related consumables. Spent materials would be transported off-site by the commercial contractor and the materials will be reprocessed by the contractor or other appropriately permitted facilities. The rejuvenated carbon and/or ion exchange media would be reintroduced into treatment service. The annual generation rate of spent carbon and/or ion exchange residue will be estimated during the design of the wastewater treatment systems and will be described in the NPDES permit application.

As described in Appendix A, steam plant(s) would be operated at the Plant Site to generate steam for autoclave preheating, slurry heating duties (Fe Removal and Cu Precipitation) and cathode washing in the copper stripping unit. Steam for autoclave preheating will be provided from the existing gas fired boilers. The other two duties will require either the addition of a small boiler or the modification of one of the (much larger) existing boilers to provide the smaller amount of required steam.

De-mineralized water is required for the steam boilers. Operation of a water de-mineralization plant(s) would generate a de-mineralization sludge. This sludge will consist of precipitated dissolved salts (e.g., Ca, Mg) removed from the steam plant water supply (Colby Lake via the Plant Reservoir). This sludge would be disposed of in the Reactive Residue Facility or Flotation Tailings Basin based on its characterization. The annual generation of de-mineralization sludge will be determined in later stages of the design process, but given the modest steam demand at the Plant Site the quantity of waste should be modest.

The existing Cliffs Erie Sanitary Waste Water Treatment Plant is not included in the area to be purchased by PolyMet. Therefore a new dedicated wastewater treatment plant would be provided at the Plant Site to allow treatment of sanitary wastewater streams prior to discharge to the environment. The discharge of treated sanitary wastewater from this plant is described in the response to Question 18. Operation of this plant would also generate a sludge that will require disposal. The composition of this sludge will be similar to other sanitary sludge in a work place setting. Using a per capita wastewater generation rate of 20 gallons/day , 200 employees at the plant site, and 5 to 10% solids content of the sludge, approximately 5 to 20 tons/year of sludge would be generated and require disposal. This sludge would be transported to the Hoyt Lakes wastewater treatment plant for treatment and management. Alternatively, the sludge may be treated and land applied as a part of stockpile reclamation activities. A sanitary wastewater system will also be provided at the Mine Site. The system could include a holding tank for sanitary waste. A commercial sanitary waste management contractor would be responsible for maintenance and operation of this system. The commercial contractor will remove sanitary waste from the holding tank on a regular schedule.

Small quantities of hazardous waste may be generated at the plant site in a manner similar to the taconite industry. These wastes may include solvents for machine shop degreasing, paint strippers, off-spec reagents, and other materials that may exhibit a characteristic of hazardous waste. Generated hazardous wastes are expected to be managed in accordance with the small quantity generator provisions of the hazardous waste rules (MR 7045.0206 Subp. 3 and 7045.0292 Subp. 5). Generator accumulation of hazardous wastes will occur inside a building with impervious flooring. Collection and transportation of the hazardous wastes will be by a licensed hazardous waste transporter and the materials would be sent to appropriate permitted hazardous waste treatment and disposal facilities.

Exhausted lead-acid batteries from plant vehicles would be stored inside a building with flooring to accumulate sufficient volume of batteries for shipment and recycling. Any battery noted as leaking or with a cracked casing would be containerized to prevent release to the environment. Battery accumulation would be conducted in accordance with the relevant provision of the hazardous waste regulations (40 CFR Part 266, Subpart G, or 40 CFR Part 273).

Cathodes and anodes used in copper electrowinning may be damaged as result of handling or corrosion attack. These materials would also be stored inside a building prior to shipment to an offsite scrap metal recycling facility.

A small amount of general trash would be generated at the Plant and Mine Sites. Trash may consist of rubbish, paper, cans, non-returnable consumable reagent containers, assorted filters, belts, hoses and similar materials acceptable management at permitted solid waste facilities. The trash would be placed in dumpsters and collected by a commercial contractor for management at a permitted solid waste facility. Receptacles for readily recyclable materials, e.g., aluminum cans, paper, etc. will be placed at convenient locations at the plant. The recyclable materials would be collected by a commercial contractor for transportation to appropriate recycling facilities. Returnable consumable containers would be collected by the commercial supplier of the consumable and recycled.

Operation of the NorthMet mine would require maintenance of a rubber tired loaders, haul trucks, service vehicles, etc. The maintenance activities will include replacement of worn tires. Waste tires would be managed at a waste tire management facility under a permit issued by the MPCA. Records at the waste management facility would document the annual generation of waste tires, and the volume and the ultimate disposition of waste tires. Commercial vendors would be engaged to transport waste tires to appropriate disposal or reuse facilities. No waste tires would not disposed of on PolyMet property.

It is anticipated that there will be periodic construction activities at the plant that would result in generation of demolition and construction wastes. Readily recyclable materials such as iron, steel, concrete would be evaluated for the feasibility of recycling based on the nature and volumes of material. Where feasible, these materials will be separated, temporarily stockpiled at the plant for accumulation and then transported to appropriate recycling facilities by a commercial contractor. Demolition and construction wastes not recycled would be temporarily stockpiled for accumulation and transported to appropriate permitted solid waste management facilities.

No ash will be generated by the project.

b. Identify any toxic or hazardous materials used at the site and identify measures to be used to prevent them from contaminating groundwater. If the use of toxic or

hazardous materials will lead to regulated waste, discharge or emissions, discuss any alternatives considered to minimize or eliminate the waste, discharge or emission.

A number of reagents and additives would be used in the process at the Plant Site. The reagents and materials would be stored in appropriate containers within buildings with impervious floors. The materials and containers would be separated as appropriate to prevent undesired reactions between the materials and threats to safety and the environment.

Petroleum fuels such as gasoline, fuel oil and diesel fuel will be stored on site for fueling plant vehicles. Storage of these fuels would be in above ground tanks designed, operated and maintained in accordance with applicable rules. Various lubricants would also be on site. These lubricants would be stored indoors or in tanks meeting regulatory requirements.

Used lubricating engine oil would be collected, stored in a tank meeting regulatory requirements, and recycled. The used oil would be managed in accordance with applicable used oil rules.

Risks from spills can be reduced by using paved or lined fueling/transfer pads, similar to those used at commercial gasoline filling stations. Stationary equipment can also be placed on paved or lined pads to minimize the potential for contamination from fuels, oil and lubricants.

Other materials that might be present on site would include fertilizers, pesticides or herbicides for vegetation management. These materials would also be stored in side a building with impervious flooring. All materials used in the processing circuit and plant, including steam plant, will be identified and evaluated in the EIS.

c. Indicate the number, location size and use of any above or below ground tanks to store petroleum products or other materials, except water. Describe any response plans.

A number of above ground tanks would be used at the Plant Site. These tanks would include both process and material storage tanks. The specific locations for tanks will be determined as the detailed design for Plant Site and Mine Site progresses. Figure 20-1 shows the general anticipated location of the tanks within the Plant Site, Area 1 and the Mine Site.

PolyMet will develop a Spills Prevention, Control, and Countermeasures Plan (SPCC Plan) for the Plant Site and the Mine Site in accordance with the applicable provisions of 40 CFR 112. Copies of the Plans would be kept at the Plant Site and Mine Site. The SPCC Plans address prevention, preparedness, and response factors, including spill prediction; containment; inspections and tests; personnel training; security; loading, unloading and transfer operations; facility drainage; and bulk storage containers.

Proposed Treatment of Topic in EIS:

The characterization, handling, and facility design for waste materials will be a significant issue addressed in the EIS. The three components of the project that will be the major focus of this discussion will be waste rock from the mine site, tailings from ore beneficiation process, and reactive residue from the hydrometallurgical processes. Below is a brief description of materials and issues that will be included in the EIS on each of these components:

Mine site waste rock:

- Amounts and composition of non-reactive waste rock, reactive waste rock, and lean ore as determined by the block model
- Determination of chemical composition of waste rock that will be the cutoff between non-reactive and reactive waste rock
- Determination of sulfide levels that will create acid mine drainage
- Evaluation of other constituents of concern in this material
- Details and effectiveness of the Grade Control Program including details on blast hole sampling for waste rock management
- Details and alternatives for reactive waste rock stockpile design and siting
- Development of a mine waste management plan
- Determination of the quantity and quality of drainage to be generated over time

Ore beneficiation process tailings:

- Characterization of tailings
- Suitability of disposal on existing unlined tailings basin
- Evaluation of alternatives for design, construction and siting
- Physical and chemical suitability of existing and new tailings for construction of tailings basin
- Determination of the quantity and quality of drainage to be generated over time

Hydrometallurgical processes reactive residue:

- Characterization and quantities of residue
- Design of reactive residue facility
- Suitability of reactive residue facility on existing tailings basin Cell 2W
- Evaluation of alternatives for design, construction and siting
- Determination of the quantity and quality of drainage to be generated over time.

Results from the Pilot Plant Processing study and the Waste Characterization Study will be used in conjunction with existing data to generate and characterize the above-described material. The Pilot Plant Processing study will generate tailings and reactive residue from a sample of the NorthMet Deposit using a pilot scale version of the proposed ore beneficiation and hydrometallurgical processes. The Waste Characterization study is a long-term study that would continue after the completion of the EIS. This study makes use of humidity cell test of rock and tailings from the NorthMet Deposit to determine the reactive or non-reactive nature of the materials. Initial results from these tests will be available for inclusion in the EIS. As part of the characterization study, PolyMet will conduct a complete chemical and mineralogical study of all of their waste. This information will be used to compare the predicted behavior of the PolyMet material with other samples of Duluth Complex material for which long-term data exists. Various methods to accelerate potential reactions and comparisons with existing data may be used to determine the suitability of the initial results.

Identification, handling, and facility design of other wastes will be included in the EIS.

21. Traffic. Parking spaces added: 0**.**
Existing spaces (if project involves expansion): See below

Estimated total average daily traffic generated: Estimated maximum peak hour traffic generated (if known) and time of occurrence

Provide an estimate of the impact on traffic congestion on affected roads and describe any traffic improvements necessary. If the project is within the Twin Cities metropolitan area, discuss its impact on the regional transportation system.

The LTVSMC/Cliffs Erie taconite facility operated for almost 50 years at the project location with approximately 2700 to 1300 employees depending on production rate. The proposed PolyMet facility would employ between 490 and 600 employees, so overall traffic impacts should be well below what has been experienced in the past.

Initially, all PolyMet access for both plant and mine would be via CR 666 to Hoyt Lakes. An alternate route for employees coming from the north is via the North Gate on County Highway 135. This could be used if demand justifies the expense of control at that location. Initially, mine employees would park at the plant and travel by bus or other company vehicle to the mine. Again access arrangements for entry from the east (to Babbitt) may be arranged if demand justifies the expense.

PolyMet plans to employ about 137 employees working five days per week and 270 persons working on three eight-hour shifts per day with shifts rotated to maintain operation 7 days per week. With reductions for weekends, each shift would have about 64 persons. The worst traffic situation would occur if the start or finish of the daytime employees coincided with shift change. The arriving and leaving shift workers and the day employees would combine to produce about 265 trips with 64 vehicles moving in one direction and 201 vehicles moving in the other direction. Delivery of materials and supplies to the plant might coincide with this peak traffic but peak hour traffic should be less than 300 vehicles per hour. This traffic count is well within the capacity of the existing paved two-lane county highway leading from Hoyt Lakes to the plant. Any arrangements for alternate entrances would reduce these minor traffic impacts.

During construction and startup it is possible that more workers would be present than during normal operation. The number of construction workers is unknown but should be less than 1,000 workers. Assuming a distribution of 33% day workers and 66% shift workers, with allowances for downtime for shift workers, the peak traffic would be less than 600 vehicles per hour (peak hour) during construction with a daily total of about 1900 trips per day. Again, this is well within the level of traffic experienced in the past when the taconite facility was operating.

Proposed Treatment of Topic in EIS:
No additional information will be provided on this topic besides what is already been provided in the Scoping EAW.

22. Vehicle-related air emissions. Estimate the effect of the project's traffic generation on air quality, including carbon monoxide levels. Discuss the effect of traffic improvements or other mitigation measures on air quality impacts. Note: If the project involves 500 or more parking spaces, consult EAW Guidelines about whether a detailed air quality analysis is needed.

Although a detailed analysis has not been completed, there is likely to be a negligible effect on air quality from project-related traffic. Arriving and departing traffic would be spaced over the peak hour and there are few traffic controls or conflicting traffic flows to cause long idling periods where CO emissions might become significant. The existing Plant Site parking lot has historically accommodated more than 500 vehicles but PolyMet staff would not require this many parking spaces.

Traffic from mine haul trucks and construction equipment is known to be a large source of fugitive particulate emissions at taconite plants and is considered to be part of the stationary source emissions and will be covered by response to Question 23 below.

Proposed Treatment of Topic in EIS:

No additional information will be provided on this topic besides what is already been provided in the Scoping EAW.

23. Stationary source air emissions. Describe the type, sources, quantities and compositions of any emissions from stationary sources of air emissions such as boilers, exhaust stacks or fugitive dust sources. Include any hazardous air pollutants (consult *EAW Guidelines* for a listing) and any greenhouse gases (such as carbon dioxide, methane, nitrous oxide) and ozone-depleting chemicals (chloro-fluorocarbons, hydrofluorocarbons, perfluorocarbons or sulfur hexafluoride). Also describe any proposed pollution prevention techniques and proposed air pollution control devices. Describe the impacts on air quality.

CURRENT AIR QUALITY OF PROJECT SITE

The project area is currently attainment with the National Ambient Air Quality Standards (NAAQS) for airborne particulate matter, nitrogen dioxide, sulfur dioxide, carbon monoxide, ozone, and lead and is currently attaining all Minnesota state air quality standards.

Recent monitoring data for sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) are not available. The existing ambient monitoring data for PM_{10}, ozone and carbon monoxide (CO) does not exactly reflect the current air quality at the project site, but it is the best available data geographically and temporally. The air around the project site may be somewhat cleaner than that in Duluth, Virginia, or at Hibbing Taconite, although ozone levels are actually higher at Voyageur National Park than in Duluth, which indicates that transport is a significant contributor to ozone concentration. Another indicator of the air quality in the project area would be background concentrations that MPCA has allowed to be used for modeling in the area. Because there is currently minimal industrial activity in the immediate vicinity, ambient concentrations may be close to background levels.

PROJECT SITE PERMITTING HISTORY

PolyMet would operate a portion of the currently idle Cliff Erie taconite process plant and adjoining tailings basin. The project would make use of existing structures and some equipment as well as the tailings basin. Existing equipment to be utilized includes the rail dump pocket, one of the primary crushers and the four associated secondary crushers, three tertiary crushers and the 6 associated quaternary crushers as well as 14 of the existing milling lines. The screens, conveyors, feeders and ore storage bins associated with the crushers and mills would also be operated by PolyMet as well as the existing boilers. The boilers are currently permitted to burn natural gas or No. 2 fuel oil, but they would only burn natural gas in the future.

Although the taconite plant is currently idle, a federal Title V permit is in force for the facility (Permit No. 13700009-001). This permit is valid through December 21, 2005. Table 23-1 below presents the currently permitted equipment that would be operated as part of the PolyMet operation based on the latest process design and the associated identification numbers from the permit and a description of the existing pollution control equipment:

Table 23-1
Currently Permitted Sources That Would Be Operated By PolyMet

EU I.D.	Process Description	Stack I.D.	Control Equipment I.D.	Control Equipment Description
EU 001	Boiler 3[1]	SV 001	NA	NA
EU 002	Boiler 4[1]	SV 001	NA	NA

[1] The current location of the boilers is not on PolyMet property, but they would be relocated to the processing plant.

EU I.D.	Process Description	Stack I.D.	Control Equipment I.D.	Control Equipment Description
EU 005	South 60” Crusher	SV 004	CE 002	Baghouse
EU 007	South 36” Pan Feeders to Conveyor 1A	SV 007	CE 005	Rotoclone
EU 008	South 36” Pan Feeders to Conveyor 1B	SV 008	CE 006	Rotoclone
EU 009	South Pan Feeders	SV 008	CE 118	Rotoclone
EU 011	Drive House 1 East Transfer	SV 010	CE 008	Rotoclone
EU 012	Drive House 1 West Transfer	SV 011	CE 009	Rotoclone
EU 136	Coarse Ore Storage	SV 111-114[2]	CE 139-142	Baghouse/Rotoclone
EU 013	Vibratory Feeders and Conveyors	SV 012	CE 119	Rotoclone
EU 018	Fine Crushing – West 1	SV 014	CE 012	Rotoclone
EU 019	Fine Crushing – West 1	SV 014	CE 122	Rotoclone
EU 020	Fine Crushing – West 1	SV 014	CE 123	Rotoclone
EU 021	Transfer Point – Conveyors	SV 014	CE 124	Rotoclone
EU 022	North Transfer Point	SV 015	CE 013	Rotoclone
EU 023	South Transfer Point	SV 016	CE 014	Rotoclone
EU 137	Fine Ore Storage – North	SV 115[3]	CE 143	Rotoclone
EU 138	Fine Ore Storage – South	SV 119-120	CE 147-148	Rotoclone
EU 024	Fine Ore Feeders – North 1-4	SV 017	CE 015	Rotoclone

[2] All of the stacks and rotoclones may not be utilized since a portion of the bin would be closed off. This is uncertain at this time.
[3] The remaining stacks and rotoclones associated with this emission unit would not be utilized.

EU I.D.	Process Description	Stack I.D.	Control Equipment I.D.	Control Equipment Description
EU 030	Fine Ore Feeders – South 3-4	SV 023	CE 021	Rotoclone
EU 031	Fine Ore Feeders – South 5-8	SV 024	CE 022	Rotoclone
EU 032	Fine Ore Feeders – South 9-12	SV 025	CE 023	Rotoclone
FS 008	Taconite[4], Rail Unload	Fugitive	NA	NA
FS 016	Tailings Road Dust	Fugitive	NA	Road Watering
FS 032	Tailings Basin	Fugitive	NA	NA

The facility as operated by PolyMet would not process taconite, but emission from crushing and related operations would be expected to be similar to when the facility was processing taconite. Tailings basin design and operation would be somewhat different because of the different characteristics of the floatation tailings and reactive residues produced from the processing of the non-ferrous ore.

At this point it is uncertain if the PolyMet facility would be permitted as a new or existing source. This could be a complex regulatory issue that will need to be worked out with MPCA. In any event, it is anticipated that a federal Prevention of Significant Deterioration (PSD) permit would be required to permit the new facility either as a new major source or as a major modification at an existing source. The PolyMet facility is also likely to be a major source of hazardous air pollutants (HAPs), so case by case Maximum Achievable Control Technology (MACT) requirements may apply.

DESCRIPTION OF STATIONARY EMISSION SOURCES

For the purposes of describing the air emission sources, it is useful to divide the proposed operation into functional areas including 1) the Mine Site, 2) the Dunka Road between the Mine Site, the Process Plant and the Area 1 Shops, 3) the Process Plant, 4) the Tailings Basin, and 5) the Area 1 Shops. The sections below describe the emission sources from each area in detail.

MINE SITE EMISSION SOURCES

The majority of emission sources at the Mine Site are fugitive in nature and reflect typical operations at an open pit mine. The first step in the mining process is the removal

[4] The facility would no longer process taconite, so this emission unit would likely be renamed.

of overburden which would be loaded into trucks using front end loaders and backhoes. This operation would generate particulate emissions as would the unloading of the trucks at the stock piles. Drilling and blasting of waste rock and ore would also generate particulate emissions as would the loading of waste rock and ore into trucks via backhoes and/or front end loaders. Waste rock would be hauled to stockpiles; ore would be hauled to the rail loading pocket. The dumping of the waste rock or ore at its destination would generate particulate emissions as would the mine truck traffic on the haul roads. The size of the haul trucks has not been decided upon at this time. For the worst case emission calculations, the smallest truck being considered, 150 ton capacity, was assumed to be used. This is the worst case because the emissions from unpaved road traffic are more strongly dependent on vehicle miles traveled than vehicle weight (i.e. more trips with smaller trucks would generate more dust). The ore would be transported to the Process Plant via rail. There would also be a minor amount of light truck traffic on the mine haul roads from transporting work crews, dispatching maintenance crews, and allowing site management to inspect mining activities. A fuel tanker would also travel on the mine haul roads to refuel the tracked vehicles that would operate in the mine pit. Particulate emissions from the handling of waste rock and ore would contain metals in the same proportion as these materials. Road surfaces would be constructed of non-reactive waste rock or other similarly inert materials with minimal metal content, so toxic air pollutant emissions are not expected from haul road traffic.

Ore would not be crushed at the Mine Site. All crushing and size separation would be performed at the Process Plant. However, non-reactive waste rock may be crushed and screened at the Mine Site, so that it can be used for road construction and other infrastructure construction related activities. It has been conservatively assumed that the entire projected amount of non-reactive waste rock generated would be crushed and screened. Toxic air pollutant emissions are not expected from the processing on non-reactive waste rock.

Two 10,000 gallon diesel fuel tanks would be located at the Mine Site. While the bulk of mine dewatering would be accomplished with electric pumps, diesel powered pumps would be used to access areas where power is not available. This is likely to occur only when the active mining area is changed or during similar occurrences. The remaining activities at the Mine Site are not expected to generate significant emissions. These activities would include equipment service and refueling facilities, office and toilet facilities, and other support activities. Dispensing equipment for lubricating and hydraulic oils as well as bulk storage tanks would be located at the field service facility.

Small boilers or heaters may be used for space heating in the office and toilet facilities and small hot water heaters may be used to produce hot water for personal use. These heaters would be fueled with liquid propane gas (LPG).

DUNKA ROAD

The section of the Dunka Road between the Mine Site, the Process Plant, and the Area 1 Shops would be used to transport equipment and personnel between the three sites. Access to the road is limited at both ends. The road is owned by Cliffs Erie, PolyMet would have legal access. Forest Service employees would also be allowed to use the road to access forest service lands in the area. Supervisory staff would be provided with field vehicles that would be allowed on the Dunka Road, but the remaining mine personnel would be transported from the processing facility to the mine via six passenger vans or similar vehicles. Private vehicles would not normally be allowed on the road.

Relevant air emissions along the Dunka Road would occur as a result of PolyMet vehicle traffic. This would include:

- Light truck traffic – including supervisor vehicles and personnel transport vans.
- Empty haul trucks going to/from the Area 1 Shops for routine maintenance.
- Disabled haul trucks transported with a truck retriever.
- Tracked mine equipment transported on a trailer.
- Truck traffic to haul tailings to the mine for stockpile liner construction.
- Fuel tanker traffic.

Emissions would consist of dust generated from the road surface. Toxic air pollutant emissions are not expected from the Dunka Road because it would be constructed of non-reactive waste rock or other similarly inert materials with minimal available trace metal content.

PROCESS PLANT

The Process Plant would include several different types of emission sources which can be divided into four main categories 1) Crushing, 2) Milling and Floatation, 3) Hydrometallurgical Plant and 4) Tailings Basin. The specific types of sources in each area are described below along with the basis for the emission calculations.

Crushing

The crushing operation would utilize the existing Cliffs Erie crushing plant. This would include primary crushing, secondary crushing, tertiary crushing and quaternary crushing operations as well as the associated screening, conveying, and ore storage equipment. Emissions would consist of ore dust which will contain metals in the same proportions as those found in the ore. Metals of interest from an air emission standpoint include: antimony, arsenic, beryllium, cadmium, chromium, cobalt, lead, manganese, mercury, nickel, phosphorus selenium, barium, boron, copper, molybdenum, vanadium, zinc, hafnium and tellurium.

The current process design calls for the use of only the equipment listed in Table 23-1 above. However, to maintain future operational flexibility, all or a portion of the remaining crushing equipment in the Cliffs Erie permit may be permitted as part of this project. The emissions rates below are based on two different operating levels: 1) operation of the full Cliffs Erie crushing plant at its maximum capacity, 2) operation of the proposed equipment at the projected mining capacity of 32,000 tpd.

Milling and Floatation

PolyMet intends to utilize 14 of the existing mill lines in the concentrator building. An additional 20 mill lines are currently present in the concentrator building. Milling operations of this type are not emission sources because a wet process is utilized.

The floatation process would have minimal emissions due to the reagents utilized. Fugitive dust emissions will be generated from handling materials in powder form. Volatile organic compounds (VOC) emissions would occur from the storage and use of organic compounds in a liquid or aqueous solution form.

Hydrometallurgical Process

The primary emissions sources in the hydrometallurgical plant are the autoclaves, the process tanks, and the electrowinning cells. These sources would be controlled by wet scrubbers. All of the sources that comprise the hydrometallurgical process are described in detail below.

There are three autoclaves in the hydrometallurgical process and each autoclave is vented, as is the associated flash vessel. The autoclave emissions are mostly carbon dioxide. Emissions from flash vessels include particulate matter, tracemetals from the ore, VOC, sulfuric acid mist, hydrogen fluoride (HF), hydrogen chloride (HCl), and hydrogen sulfide (H_2S). A cooling tower would be operated to cool the plant heating water. The only emissions are expected to be particulate matter entrained in the water droplets emitted by the tower.

The two iron reduction tanks would emit sulfur dioxide and sulfuric acid mist. The releach autoclave is expected to emit primarily steam and air. The pollutants emitted from the releach autoclave flash vessel would be the same as that described for the autoclaves flash vessels above. The three neutralization vents would emit carbon dioxide and sulfuric acid mist.

The copper electrowinning cells would emit sulfuric acid mist along with particulate matter and the tracemetals found in the ore. Only metal compounds soluble in an aqueous solution are expected to be emitted by this process.

The iron and aluminum removal process consists of a preheat tank, five iron removal tanks and two aluminum removal tanks. Sulfuric acid mist would be emitted from all of the tanks. Carbon dioxide would also be emitted from iron removal tanks T1, T2, T3, and T4 as well as the two aluminum removal tanks due to the addition of limestone.

The copper removal process includes a preheat tank, a deaeration tank and three copper removal tanks. All of these tanks would emit sulfuric acid mist. The copper removal tanks would also emit H_2S due to the addition of sodium hydrosulfide (NaHS).

The first and second stage hydroxide precipitation tanks would emit sulfuric acid mist. The precipitated hydroxide product would generate emissions from material handling, storage and bagging. These emissions would include particulate matter and the metals present in the ore, only in different proportions. This product would contain high quantities of nickel and cobalt, which are the desired products, as well as zinc.

Acid flocculent is used in the hydrometallurgical plant thickeners. It is shipped on site in solid form and prepared in a vendor-supplied package mixing plant including a storage silo, mix tank, storage tank and dosing pumps. Particulate emissions would occur when solid flocculent is added to the storage silo and when it is transferred to the mixing tank. After the mixing tank it would be in an aqueous solution and emissions would not occur. The silo would have a dedicated vent; the mixer emissions would be vented into the building and exhausted through general ventilation.

Sodium hydrosulfide is used in platinum group metals precipitation and copper removal. This chemical decomposes to H_2S. It would be shipped on site as a solid and mixed in a mix tank before being transferred to the storage tank. H_2S emissions would occur at the mix tanks, the storage tank, and when it added to the copper removal process as described above. The other point where sodium hydrosulfide is added to the process, the pipe reactor for precipitation of platinum group metals, is an enclosed system.

Guar gum is used in the copper electrowinning process. Solid guar gum would be mixed in a mix tank and then transferred to the storage tank. Minor amounts of fugitive emission would occur from addition to the mixer.

Hydrochloric acid would be added in the autoclave as a source of chloride. Emissions are expected from storage tank loading as well as from the tank vent and from the autoclave as described above. Sulfuric acid is also used in the process; emissions from tank loading and from the storage tank are also expected in addition to the process emissions described above.

Shellsol A100 would be used as a diluent for the copper extractant. It is a petroleum naphtha product that contains cumene and xylene (mixed isomers) in addition to trimethyl benzene (all isomers). Xylenes and cumene are HAPs. Working and breathing losses are expected from the 7900 gallon storage tank as well as fugitive emissions from the copper extraction process.

Cobalt sulfate would be used in the electrowinning process. Solid cobalt sulfate would be mixed with water and on-site in a combined mixing/storage tank. Small amounts of fugitive particulate emissions would result from adding the solid to the tank. The particulate emissions would contain cobalt.

Magnesium (MgO) oxide would be delivered to the plant via bulk tanker trucks or rail cars. The powdered MgO would be transferred to the storage silo via an enclosed pneumatic system, so the only emissions from loading would occur at the silo vent. Emissions into the building would also occur when MgO is transferred to the mix tank.

Lime would also be delivered in bulk trucks or railroad cars and would be transferred to the silo via an enclosed pneumatic system. Emissions would only occur at the silo vent.

Lime would be transferred from the silo to the lime mill via an enclosed conveyor, which would be vented. Milling would be conducted with a wet process, so particulate emissions would not occur downstream of the conveyor.

Crushed limestone would be delivered in bulk transport and unloaded into a storage bunker. A front end loader would transfer the limestone to a conveyor which would transport it to the limestone mill. Fugitive particulate emission would occur from unloading at the bunker, transfer to the conveyor, and where the limestone is added to the mill. Again, the milling process is wet, so emissions would not occur downstream of the conveyor, since the limestone would be in slurry form. The limestone contains a maximum of 2% crystalline silica which would be contained in the particulate emissions. In the hydrometallurgical process, the solids are separated via thickeners and filters, so crystalline silica is not expected to be emitted.

Steam would be required for autoclave preheating, slurry heating, and for the cathode washing unit in the copper stripping area. There are two existing 55 MMBtu/hr boilers (EU 001 and EU 002) at the site which would be used to meet all or some of these steam demands. Steam for building heating would be provided by the heat exchanger downstream of the scrubbers on the autoclave and flash vessel exhausts. The existing boilers can burn natural gas and No. 2 fuel oil, but PolyMet would only operate them on natural gas. The low projected utilization level of the boilers would mean that any cost savings from operating on interruptible natural gas service would not offset the additional issues related to fuel oil combustion. A small boiler may be installed in the plant to provide steam for the smaller demands. However, the emission calculations assume operation of the existing boilers at full capacity, which would generate far greater emissions than the actual steam demand regardless of whether the existing boilers or a new boiler are utilized to meet the demand.

Tailings Basin

Fugitive emissions would occur at the Tailings Basin from two processes: light truck traffic on unpaved roads and wind erosion from the portion of the Tailings Basin above the water level, not vegetated, and not treated with chemical dust suppressant. The emissions from the Tailings Basin would contain the same metals as the ore, but in different proportions.

Fuel Tanks

Diesel fuel and gasoline tanks for refueling company vehicles may be located at the Process Plant. Minimal VOC emissions would be generated by this activity and they have not been quantified at this point.

Area 1 Shops

Mine vehicle maintenance would be conducted in the Area 1 Shops. If PolyMet decides to contract with another company to operate the mine, the maintenance arrangements may be different. The activities at the shops would not generate appreciable air emissions. Activities that would potentially generate large amounts of emissions, such as spray painting, would not be done in these shops.

Small natural gas fired heaters provide space heat in the Area 1 Shops. Hot water heaters may also be utilized to produce hot water for personal use. These activities are considered insignificant per Minnesota Rules, so no appreciable emissions are expected.

PROPOSED POLLUTION CONTROL EQUIPMENT AND PRACTICES

As part of the air permitting process, the applicability of the federal prevention of significant deterioration program (40 CFR 52.21) and Title 2 Section 112 of the Clean Air Act (regulating hazardous air pollutants), will be determined. Any portions of the facility subject to these regulations would be required to add controls in compliance with these regulations. Control equipment may be required to model compliance with the National Ambient Air Quality Standards.

The sections below describe the proposed control equipment and control practices. It should be pointed out the determination on how the project will be permitted will effect the types of control practices used.

MINE

The major emission source at the Mine Site is the haul roads. Particulate emissions would be controlled through roadway watering except during freezing conditions where this could create safety hazards. During freezing weather, emissions would be controlled by the use of chemical dust suppressants, application of snow on the road surface, application of new road material, the scarifying of the road service or other measures. The final control efficiency will be confirmed with MPCA. The PolyMet mine would not be a taconite mine, but road construction practices would be similar as will the effectiveness of various dust control strategies.

DUNKA ROAD

The only source of emissions would be the dust generated from traffic on the road. The control practices utilized for the mine roads would also be used on the Dunka Road. The Dunka Road would be generally closed to personal vehicle traffic, which would minimize traffic levels and help reduce dust generation. Most of the mine workers would be bused from the processing plant to the mine. Additional control measures may be required to meet ambient air quality standards along the road, where a buffer is not present. This may include the application of chemical dust suppressants. The need for additional control measures would be evaluated during the PM_{10} modeling to be completed as part of the air quality permit application.

CRUSHING

At this point, it has been assumed that the existing control equipment would be utilized for the crushing operation. The control equipment for the entire Cliffs Erie crushing plant is discussed in this section, although PolyMet may only utilize the equipment listed in Table 23-1. Changes to the control equipment may be required to meet BACT and/or MACT requirements. At this stage in the process, the only toxic air contaminants would be metals that make up a portion of the rock dust that would be emitted. Therefore, the control efficiency for the toxic compounds would be the same as that for particulate matter. This is true of all of the sources in the crushing portion of the processing plant. Existing controls range between 97% to 99% control efficiency.

When LTV Steel Mining Company was operating, a major replacement program of emission control system ductwork and control devices in the tertiary and quaternary crusher area was underway. As part of the reactivation of the facility, PolyMet plans to complete this program.

MILLING AND FLOATATION

VOC emissions would occur from the storage and use of the frother solution which contains isopropyl alcohol and methyl isobutyl carbinol (MIBC). Total VOC emissions from all of these activities are less than 0.5 tpy, so no control equipment is being considered at this time.

The sodium isopropyl xanthate (SIPX) mixing and storage tanks would be kept under a slight negative pressure to collect any offgas which would be routed to a dedicated pollution control device to control carbon disulfide emissions along with any other sulfur compounds produced from the decomposition of the SIPX. The final design of the control device may be dictated by the need to address impacts from the carbon disulfide emissions or to comply with MACT requirements if applicable.

Minor amounts of particulate emission would be generated by the addition of flocculent and dextrin to their respective mix tanks. Any emissions generated would be inside the building and whatever does not settle out would be exhausted via the general building exhaust. No add-on control equipment is specified for these activities. However, the dextrin mix tank would be enclosed and it would be equipped with an enclosed bag splitter to minimize emissions.

HYDROMETTALURGICAL PLANT

Each autoclave and flash vessel would have a dedicated scrubber to remove the majority of the entrained particulate matter and acid gasses. The scrubber is expected to be of venturi type with raw water as the scrubbing liquor. The exhaust stream would contain a large amount of steam at this point. The combined gas from the autoclave scrubbers would be routed to a heat exchanger used to produce hot water. The hot water would be used for building heating in the winter months. Any hot water not needed for heating would be cooled in the cooling tower. A large amount of steam would be condensed in the heat exchanger. Additional particulate matter and acid gasses would be removed with the condensate. The remaining gasses would be routed to the main scrubber which would be of venturi design also with water as the scrubbing liquid. Other scrubbing liquors may be considered, such as an alkaline solution, if additional removal of acid gasses or mercury is required to meet BACT or MACT requirements.

The iron reduction tanks would be covered and kept under negative pressure with emissions controlled by the main scrubber. The efficiency of the venturi scrubber would be at least 90% for sulfur dioxide and 99% for sulfuric acid mist. If scrubbing liquids other than water are utilized, the control efficiencies should be higher.

The releach autoclave and the associated flash vessel would share control equipment with the other autoclaves. The emissions would be routed to one of the autoclave scrubbers with a damper in place to allow the venting to an alternate scrubber if one system is down for maintenance. The exhaust gas would then go to the heat exchanger and main scrubber. The pollutants and the control efficiencies would be the same as for the other autoclaves.

Control equipment has not been specified at this time for the cooling towers. Methods of reducing liquid water droplet drift may be implemented as a result of the BACT determination.

Emissions from the copper electrowinning process would consist of droplets of the electrolyte which become airborne. This solution would contain sulfuric acid and dissolved particulate compounds, including metals. Each electrowinning cell would be covered with emissions routed to one of four wet scrubbers.

The iron and aluminum removal tanks emit sulfuric acid mist with some also emitting carbon dioxide (greenhouse gas). The preheat tank, the five iron removal tanks and the two aluminum removal tanks would all be covered and kept under negative pressure. The collected offgas would be routed to the main scrubber.

The three copper removal tanks would emit sulfuric acid mist and H_2S. The associated preheat tank and deaeration tank would emit only sulfuric acid. The tanks would all be covered and kept under negative pressure. Emissions will be controlled by the main scrubber.

Particulate emissions would be generated by the handling and bagging of the hydroxide product. This product also contains large amounts of nickel, cobalt, and zinc along with other metals. Emissions would be controlled with the use of fabric filters or equivalent controls.

Particulate emissions from the vendor-supplied acid flocculent storage silo would be controlled with a fabric filter. The fugitive emissions from transferring the powdered flocculent to the mix tank would be emitted into the building with any emissions not settling out going out through building ventilation. These emissions would not be controlled.

The sodium hydrosulfide mixing tank and storage tank would be sealed and kept under negative pressure. An enclosed bag splitter would be installed above the mixing tank to minimize particulate emissions from the addition of solid sodium hydrosulfide to the mix tank. The offgas would be routed to a wet scrubber with water as the scrubbing liquor.

Fugitive emissions would be emitted into the room from transferring bulk containers of guar gum and cobalt sulfide to the mix tanks. Any particulate matter that does not settle out into the building would be emitted through the building ventilation. No control equipment is planned for these sources.

Small quantities of pollutants would be emitted from the diluent tank, the sulfuric acid tanks, and the hydrochloric acid tank. Emissions from the tanks are less than 1 tpy, so the installation of pollution control equipment is not planned. Fugitive emission of the diluent would also occur in the copper extraction area. Potential emissions are estimated as 2.6 tpy of VOC. Due to the relatively small quantity of emissions and fugitive nature which would make effective control difficult, these emissions would not be controlled.

The magnesium oxide storage silo would be controlled with a fabric filter. At least 99% control would be achieved. A small amount of fugitive emissions into the building may occur when magnesium oxide is transferred to the mixing tank. These emissions would go out the general building ventilation and add-on control equipment would not be utilized. However, a screw feeder would be used to transfer the magnesium oxide to the enclosed mix tank, which would minimize emissions.

The lime silo would also have a fabric filter to control emissions with 99% removal efficiency. The enclosed conveyor used to transport the lime to the mill would be vented to another fabric filter with the same collection efficiency. Collected lime dust would be added to the mill. Emissions would not be generated from the lime milling operation because this is a wet process.

The limestone storage and handling equipment would not have pollution control equipment. Much of the emissions would be fugitive in nature and emissions are not expected to be significant because the limestone would be in the form of crushed rock, not a pulverized mineral. Emissions would not be generated from limestone milling because this would be a wet process.

Fugitive emissions would be generated from the filling of the liquid SO_2 tanks. The tank would be pressurized and sealed during normal operation and appropriate steps would be taken to minimize emissions to the atmosphere during loading both to minimize emissions and to ensure worker safety. Any SO_2 spilled into the containment area would be pumped to the process areas where it is normally used.

The boilers would not have pollution control equipment, but emission would be minimized by only burning natural gas. Restrictions on operating hours or fuel combusted may also be accepted to keep emissions below the PSD significant level. If a new small boiler is installed it would also be only natural gas fired and relatively small in size, so emissions would not be significant. If a new boiler is installed with a capacity greater than 10 MMBtu/hr, it would be subject to a MACT limit for CO, but the limit would be met through good combustion practice as opposed to add-on control equipment.

TAILINGS BASIN

Dust emissions from the unpaved roads in the Tailings Basin would be controlled in the same manner as the mine haul roads. A 60% control efficiency has been assumed as a conservative first estimate. The final control efficiency would be confirmed with MPCA. Emissions from the Tailings Basin would not be directly controlled, but the design would seek to minimize the area above the water line. Portions of the basin that are inactive for extended periods of time would be seeded or covered with mulch. Areas that are inactive for shorter amounts of time would be sprayed with dust suppressant. Dusting would be minimal during the freezing months because recently applied tailings would freeze and become covered with snow while inactive areas would be covered in snow.

Fugitive dust emissions from the reactive residue cells would be minimized through the design of the cells. Water levels would be maintained above the residue and residue would be discharged below the water level.

AREA 1 SHOPS

As described above, emissions from the Area 1 Shops would be insignificant. Pollution control equipment would neither be necessary or practical for this portion of the project.

AIR EMISSION LEVELS

Tables 23-2 and 23-3 present the emission levels for various potions of the project as well as the entire project including the processing plant, the Dunka Road and the mine. Fugitive emissions for this type of facility are not included in the determination of PSD applicability. However, fugitive emissions would have to be included in any determination of ambient air impacts, so emissions totals are given for point sources (Table 23-2) and point source plus fugitive emissions (Table 23-3).

Emission levels are presented for criteria as well as toxic air pollutants. The list of toxic pollutants includes any HAPs that would be emitted plus any additional compounds that would be evaluated in the air emissions risk analysis (AERA) based on the initial review of process reagents and emissions.

DISCUSSION OF PROJECT IMPACTS ON AIR QUALITY

Several lines of investigation are open for evaluating the significance of the impact from air emissions on human health and the environment from the proposed project. First, as part of this Scoping Environmental Assessment Worksheet, the proposer has completed an Air Emissions Risk Analysis (AERA) which investigates the impact from “air toxics.” Under the AERA process, a proposer estimates the concentrations of pollutants emitted by the project and compares those concentrations to a list of pollutant-specific health benchmarks established by the Minnesota Department of Health. This provides regulators a tool to estimate the overall impact from a very long list of pollutants. Based on this evaluation, the impacts associated with air emissions, that are reasonably expected to occur from this project, do not have the potential for significant environmental or health effects. Because many assumptions were necessary to complete the AERA at this stage of the project, the AERA will be re-evaluated during the Environmental Impact Statement to verify that the original work was valid.

Second, the air emissions permitting and EIS will require that the proposer address the National Ambient Air Quality Standards (NAAQS) for the "criteria" pollutants. The criteria pollutants are: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), lead (Pb), particulate matter (PM_{10}), particulate matter ($PM_{2.5}$), and sulfur dioxide (SO_2). The NAAQS are set at levels that are intended to be protective of human health (including sensitive groups) and the environment. As such, compliance with the NAAQS is a good indicator of insignificant impact of a project on the environment. Third, the proposer will also have to address the impact of air emissions on visibility and acid deposition in pristine areas.

CLASS I AREAS

There are four Class I areas that are potentially impacted by this project: Boundary Waters Canoe Area Wilderness (approximately 20 miles north), Voyageurs National Park (approximately 50 miles northwest), Isle Royal National Park (approximately 130 miles east-northeast), and Rainbow Lake Wilderness (approximately 90 miles south).

The specific requirements for the Class I area impact analysis will be negotiated with MPCA and the Federal Land Managers as part of the Air Quality Permitting process. This will be done in compliance with applicable federal regulation.

CRITERIA POLLUTANT EMISSIONS (CLASS II AREAS)

PM_{10} would be the primary criteria pollutant of concern for this project. There are several unresolved issues at this point relating to criteria pollutant dispersion modeling, so the evaluation of air quality impacts for this pollutant will be deferred until the air quality permit application and/or the EIS. The project will be required to model compliance with the ambient air quality standards at the ambient boundary.

SUMMARY

Emissions from criteria pollutants, with the exception of PM_{10}, are not a significant issue for this project. SO_2, NO_x, CO, lead, and VOC do not require additional review. Other PSD pollutants that do not require further evaluation include: fluorides, H_2S, and total reduced sulfur compounds.

Class I area impacts are expected to be minimal, but the scope of any impact analysis will have to be negotiated with the Federal Land Managers (FLMs) for the nearby Class I areas. At a minimum, a Class I area increment analysis at the Boundary Waters for PM_{10} emissions is likely to be required. The results of the analysis agreed upon with the FLMs will be discussed in the air quality permit application and/or the EIS.

Further analysis of the impact on ambient air quality standards as well as the Class II increment due to PM_{10} emissions will be included in the air quality permit application. A demonstration that impacts are acceptable will be included in the application and possibly the EIS. A BACT analysis for PM_{10} is also expected to be required. This will be included with the permit application. Changes to the proposed pollution control equipment may be discussed in the EIS.

A BACT analysis may also be necessary for sulfuric acid mist emissions. This will be included with the air quality permit application if required. Impacts from sulfuric acid mist emissions will be evaluated in the AERA and also the Class I area impact analysis if required by the FLMs. Changes to the proposed pollution control equipment may be discussed in the EIS.

A case by case MACT determination may also be required for some of the sources. Any required analysis will be included with the air quality permit application. If changes to the proposed pollution control equipment are required, this may be discussed in the EIS.

To assist the MPCA in commenting on the scope of the Northmet Project Scoping EAW, the MPCA requested that an Air Emissions Risk Analysis (AERA) be prepared for the project. An AERA was submitted to the MPCA by the project proposer. The MPCA hired consultant: reviewed the AERA, dispersion modeling and emissions; assessed whether all parts were completed in accordance with MPCA guidance; identified gaps, recommended areas where additional refinement of the information or impact analysis related to air emissions should happen during the EIS; and presented their findings to the MPCA project manager. The MPCA project manager drafted an agency recommendation that went to the MPCA Risk Managers who then finalized and signed the recommendation.

Proposed Treatment of Topic in EIS
The EIS will include descriptions of air emissions sources, potential control technologies and any impacts to Class I and Class II areas.

A BACT analysis will by completed for PM_{10} and sulfuric acid mist. A MACT applicability analysis will be completed. A case by case MACT determination may be required for some sources. Other sources may have to comply with a MACT standard for their source category if one has been promulgated.

The EIS will verify the results of the previously completed Air Emission Risk Analysis (AERA). This verification will include the following analysis:

> Conduct source-specific air dispersion modeling of those units that could influence the final risk estimates, specifically focusing on the risk drivers from the AERA (crusher/grinding operations and Hydromet plant; nickel and nickel compounds, hydrogen chloride, NO2, manganese) and/or conduct a quantitative sensitivity analysis of the critical sources using the new design parameters (location, height, exit velocity, emission database) to determine if the overall risks calculated in this AERA are still conservative estimates.

The EIS will also contain a Class I and Class II increment analysis for air emissions from the project

24. Odors, noise and dust. Will the project generate odors, noise or dust during construction or during operation?_x_Yes __No

If yes, describe sources, characteristics, duration, quantities or intensity and any proposed measures to mitigate adverse impacts. Also identify locations of nearby sensitive receptors and estimate impacts on them. Discuss potential impacts on human health or quality of life. (Note: fugitive dust generated by operations may be discussed at item 23 instead of here.)

Odors

Odors are not expected from the mine, with the possible exception of diesel exhaust odors. The potential impacts of vehicle emissions are treated in response to Question 23.

Mineral flotation tailings such as would be deposited in the tailings basins are reported to be essentially odor-free. The smaller containment cells at the tailings basin would contain other PolyMet process residues, but these are not expected to produce odors.

The ore processing facility is another potential source of odor. Odors at the plant, however, are not expected to be a problem. The chemical processes involved in the PolyMet operation do not have the potential for significant odor generation. The flotation reagents used in the process have a slight odor, but the flotation process is conducted within a closed facility. Despite the presence of sulfates in the ore that would be processed, the PolyMet process does not generate significant amounts of gasses that smell of sulfur or sulfide. The air scrubbers that would be in place are expected to eliminate any offensive odors from the stack emissions.

(Other potential impacts of the air emissions from the ore processing facility are discussed in response to Question 23.)

Dust

Fugitive dust emissions from ongoing operations, including ongoing construction of stockpiles, are inventoried and discussed in response to Question 23.

Dust production is expected during initial clearing and stripping of the mine if weather is dry. Because of the large numbers of wetlands and high surficial water table, soils are expected to be wet during much of initial mine development (overburden stripping). Construction of mine facilities, including roads, loading pocket, railroad spur and local building(s) would generate dust typical of large construction projects. Similarly, the construction of the railroad extension and new building construction at the ore processing facility may also result in dust production for a several months. The nearest residential receptor for dust impacts would be at a distance of approximately five miles. It appears highly unlikely that construction-related dust impacts would be significant

Dust generation from the tailings basin is discussed in response to Question 23. The potential for dust lift off caused by dry, windy conditions would be managed under a Fugitive Dust Control Plan that would include minimizing unvegetated beach and dike area, application of temporary seeding to areas that would be inactive for a substantial time, application of mulch to areas that would be inactive for short terms, and application of dust suppressants to problem areas.

Noise

Noise impacts from the NorthMet site would be expected to be similar to impacts experienced from the existing Peter Mitchell Mine which is located approximately one mile north of the proposed mine and from ongoing logging activities in the National Forest.

A typical mine truck to be used at the project would be the Cat 793C. The Caterpillar Company supplied noise levels using the ISO6393 test specifications. According to Caterpillar, the static level of a standard version 793C OHT is 121 dB. A model of the 793 equipped with extra noise suppression (793C XQ) produces 110 dB (static) or 115 dB dynamic (ISO6395 spec) 112 dB uphill - fully loaded and 117 dB downhill - fully loaded. While these are very loud, the noise level at the nearest receptor (the Boy Scout camp at a distance of greater than 5 miles) would be expected to be below the nighttime state noise standard of not exceeding 50 dB fifty percent of the time (L_{50}).

In addition to violation of noise standards, an additional concern is simple audibility. A person can hear and discern sounds at much lower levels than the noise standards. In general, people do not expect an environment completely lacking in human-produced sounds. However, an exception to this is wilderness areas, where visitors expect to have only natural sounds. Whether a noise is audible depends on the acuity of the listener, the sound level and tonal structure of the noise of interest and the sound level and tonal quality of other background sound that may tend to mask the noise. Predicting the limits of audibility is therefore, a complex issue.

Railroad horns should not be a significant source of noise to local residents. Although all of PolyMet's ore would be delivered by 10 to 20 trains per day, there is only one, private, at-grade crossing on the rail line between the Mine Site and the Processing Facility. It is on the existing rail line and has been used in other mining operations. This line was used for more frequent trips with greater tonnage hauled during operations of LTV Steel Mining Company. Under the proposed project this crossing would see less traffic of lesser tonnage than it previously experienced.

Truck Noise

Ongoing and persistent noise is of most concern. Of particular interest, therefore, is the noise coming from trucks and excavators, which would be operating nearly continuously during the years the mine is in service.

The NorthMet mine is not likely to carry into the Boundary Waters Canoe Area (BWCA), the nearest portion of which is located approximately 20 miles to the northeast. Prevailing winds are from the northwest, so that areas to the northeast of the Mine Site are acoustically sheltered.

During winter, it is predicted that noise from 170-ton trucks would not be detectable at distances greater than 22 miles. During summer, truck noise is expected to be inaudible at a distance of 19 miles. Even in winter, therefore, noise from mine activities would be expected to be very infrequently audible in the BWCA, and then only in the BWCA's southwestern most fringe. Mitigation of this potential impact could be achieved by increasing the size and effectiveness of mufflers on the haul trucks. Additional mitigation for nearby receptors, if required, could be accomplished by placing a barrier between the truck and the potential receptor.

Preliminary modeling of noise emissions from the mine was done by PolyMet to confirm the general findings of the Regional Copper-Nickel Study.

Preliminary simulations, conducted by PolyMet, with these assumptions indicated that the operation would be inaudible at the nearest edges of the BWCA. With such conservative assumptions, it is likely that the actual attenuation effects would be greater than assumed, reducing noise levels further. Preliminary calculations indicated that the L_{50} levels allowed by Minnesota law would not be exceeded outside of 2,500 meters (1.55 miles) from the site. Residences in the area are well outside this radius from the Mine Site.

Consideration of the Boy Scout camp was also made in the preliminary model. Sound reaching the Boy Scout camp would have traveled over 5 miles. The model used includes airborne and ground attenuation, giving an overall level of approximately 18 dB at the Boy Scout camp. This level may be audible on a calm, quiet night.

The mine area's nearest permanent noise receptors, in this case private residences in the City of Babbitt, are approximately six miles away. The above information indicates that mine truck noise at this location is likely to be well within the limits of Minnesota noise standards and less than 18 dB. The City of Babbitt is located on the other side of the Giant's Ridge formation and would be topographically shielded from noise. Any noise from the NorthMet site likely would blend into the existing background community noise and be lower than levels from the NorthShore mine, which is located between the Mine Site and Babbitt.

Other residences near the Mine Site, in Hoyt Lakes and Skibo, are farther from the Mine Site than the Boy Scout camp. Additionally, they are crosswind of prevailing winds from the Mine Site, giving some added attenuation to the noise level received. Using the simulation, which does not take into account their crosswind location, Hoyt Lakes and Skibo would experience levels of approximately 12 and 16 dB, respectively. This noise is well within the limits of Minnesota law.

Blasting Impacts

As described in Section 6, blasting would be required to mine the ore. Much of the area has previously experienced blasting during the operation of the Cliffs Erie (operating as Erie Mining Company and LTV Steel Mining Company) and NorthShore Mining Company taconite mining operations. Blasts at PolyMet are expected to be significantly smaller than those at taconite mines so, in general, blast disturbances are expected to be smaller than those that have occurred previously at mines. In addition, most of the taconite mines in the area are significantly closer to homes and businesses than the proposed PolyMet mine; therefore the smaller impacts would be dissipated over a greater distance before reaching a receptor. Therefore, impacts are predicted to be significantly smaller than those previously experienced at communities in the area.

Blasting safety (i.e., impacts to employees within the mining area) is regulated by the Mine Safety and Health Administration of the U.S. Department of Labor. Safety procedures would include strict restrictions on site access, closure of access roads and gates where the public or other mine workers might attempt to enter the site and evacuation of personnel and equipment to safe areas well before blasting. Supervisors in radio-equipped vehicles would monitor the site and its immediate access. Train movements and any nearby logging operations would be coordinated and temporarily halted as required to maintain safe clearance.

The environmental impacts of blasting at non-ferrous mining operations are regulated by the Minnesota Department of Natural Resources (MDNR) under Minnesota Rules Section 6132.2900 to ensure that effects of air overpressure and ground vibrations from production blasts will not be injurious to human health or welfare and property outside mining areas.

Five categories of potential impacts of blasting in surface mines are ground vibration, air blast, flyrock, dust, and fumes. Minnesota has a ground vibration limit of 1.0 inches/second with no specified frequencies. The distance (approximately 6 miles) from the PolyMet site to the nearest home makes vibration damage extremely unlikely. A seismic monitoring program is required by law and is considered standard practice in major mining operations. PolyMet proposes to implement a seismic monitoring program for this project. Minnesota rules required monitoring at a location adjacent to the nearest structure located on lands not owned or controlled by the mining company and where the MDNR considers necessary to investigate complaints.

Air blast is the shockwave propagated through the atmosphere. Minnesota regulations limit air blast to 130 dB. Glass breakage is the first sign of excessive air blast and generally occurs at 140 dB or above. Minnesota Rules require that the operator must monitor all open pit blasts. As with ground vibration, the air blast monitoring station is required to be located adjacent to the nearest structure located on lands not owned or controlled by the mining company. Air blast can be affected by wind direction as well. In unusual conditions air blast can be deflected and focused by atmospheric conditions, including temperature inversions. Erie Mining Company/LTV Steel Mining Company conducted an air blast monitoring program. The practice was to explode a small test shot to check atmospheric conditions for air blast; PolyMet proposes to implement a similar air blast monitoring program.

Flyrock is rock that is blown loose from the free face of the rock and travels beyond the area intended for blasting. Both air blast and flyrock can be minimized by proper blasting planning, including drill hole placement, sequencing velocity, face orientation, and monitoring of explosive weight. Air blast can be affected by wind direction as well. In unusual conditions air blast can be deflected and focused by atmospheric conditions, including temperature inversions. Erie Mining Company/LTV Steel Mining Company conducted an air blast monitoring program. The practice was to explode a small test shot to check atmospheric conditions for air blast; PolyMet proposes to implement a similar air blast monitoring program.

Dust and gases are usually not a major problem outside the immediate blasting area. As with air blast, wind direction is important. When necessary, dust and gas production can be reduced by wetting the area to be blasted. Excessive fumes can be avoided by good explosive design and usage. It is typical of the large blasts used at taconite operations that explosives must sometimes sit in the ground a long time because of the large sizes of the patterns, long drilling times, and waiting for favorable weather, etc. This is not likely to be as significant at PolyMet where blast sizes would be smaller.

Proposed Treatment of Topic in EIS:

This topic is minor, but will be discussed with limited information beyond that in the EAW. The EIS will include additional information on potential sources and verify simulations and assertions. Operational and structural mitigation to prevent potential impacts will be discussed.

25. Nearby resources. Are any of the following resources on or in proximity to the site?

Archaeological, historical or architectural resources? _x_Yes __No
Prime or unique farmlands or land within an agricultural preserve?
__Yes _x_No
Designated parks, recreation areas or trails? __Yes _x_No
Scenic views and vistas? __Yes _x_No
Other unique resources? __Yes _x_No

If yes, describe the resource and identify any project-related impacts on the resource. Describe any measures to minimize or avoid adverse impacts.

HISTORICAL AND ARCHEOLOGICAL RESOURCES

PolyMet hired cultural resource specialists from the 106 Group to conduct background research and visit the project site in August and September 2004. Based on this information the 106 Group developed a report that was used to address this EAW Question.

Archeological Resources

In 1999, a cultural resources survey was conducted within the proposed Mine Site by Foth & Van Dyke prior to exploration drilling in the location of the proposed mine pit. During this survey, archaeologists excavated 166 shovel tests along proposed drill hole transects in Sections 2, 3, and 10, T59N, R13W. No archaeological resources were identified in this area (Foth & Van Dyke 1999). This survey included only the proposed pit area and did not include the stockpile, Plant Site or Tailings Basin areas.

In 2004 the archaeological assessment by the 106 Group included background research, a visual reconnaissance, and assessment of archaeological potentials within the project area, including the Mine Site, Plant Site, Rail Construction Area and Tailings Basin.

The assessment concluded that there is low potential for the presence of archeological resources in the processing facility, Tailings Basin, and proposed Railroad Construction Area. The Plant Site has been heavily disturbed by the previous construction and operations of the taconite processing facility and is considered to have little to no potential for containing intact archaeological resources.

The 106 Group concluded that portions of the Mine Site have low potential, while other areas have unknown potential for containing archaeological resources, because so little survey work has been completed in this region of the state.

Historical Resources

In 2004 the 106 Group conducted a preliminary architectural history assessment that included background research, a visual reconnaissance of the project area, particularly the mill complex and associated tailings basins, waste rock stockpiles, and railroads.

The processing facility, tailings basins, and proposed railroad spur incorporate buildings, structures, and objects of the former Erie Mining Company processing facility. This assessment-level investigation shows that this property has the *potential* to be historically significant and eligible for listing on the National Register of Historic Places. Further study and evaluation at the Phase II level would be necessary to confirm this. The Erie Mining Company Railroad is the only architectural resource within the proposed mining area, and the potential historic significance of this resource would be evaluated within the context of the Erie Mining Company processing facility.

In subsequent discussions with the staff of the Minnesota Historical Society and the U.S. Army Corps of Engineers, it was proposed that the following steps would be undertaken to satisfy the requirements of the National Historic Preservation Act:

- The conceptual design of the southeast stockpile area has been modified to avoid the apparent location of site 21SLmn (01-314 [Knot Camp]) and provide a 200-foot buffer from the site as shown on 1937 and 1939 air photographs. A Phase I investigation will be completed during the preparation of the Draft Environmental Impact Statement to locate the boundaries of the site and ensure that through avoidance the project will avoid either direct or indirect impacts to the site.

- As part of the preparation of the Draft Environmental Impact Statement, a Phase I reconnaissance level survey will be conducted on the portions of the proposed Mine Site not previously evaluated by Foth and Van Dyke to assess those areas identified by the 106 Group as having "unknown" potential for containing archeological resources. Such areas were defined as the undisturbed portions of the study area:
  - within 500 ft. (150 m) of an existing or former water source of 40 acres (19 hectares) or greater in extent, or within 500 ft. (150 m) of a former or existing perennial stream;
  - located on topographically prominent landscape features;
  - located within 300 ft. (100 m) of a previously reported site; or
  - located within 300 ft. (100 m) of a former or existing historic structure or feature (such as a building foundation or cellar depression).

  Areas defined as having a relatively low potential for containing intact archaeological resources included inundated areas, former or existing wetland areas, poorly drained areas, and areas with a 20 percent or greater slope. Low potential areas and areas in which Holocene (less than 10,000 years old) deposits have been significantly disturbed are defined as having little or no potential for containing intact archaeological resources.

- As part of the Environmental Impact Statement, the direct and indirect effects of the proposed project on the Cliffs Erie plant site (former Erie Mining Company Plant site) will be defined. This step will include collection of additional background data on the plant and evaluation of the possible strategies for mitigation of these effects. These strategies could include data recovery and inclusion of historical considerations and review in the project design process.

OTHER NEARBY RESOURCES

The soils on site do not include prime or unique farmlands and no such lands are believed to exist in the vicinity of the project.

A hiking trail is identified on national forest maps in Section 17, T58N, R12W between Big Lake and Stone Lake. Campsites and a Boy Scout Camp are identified adjacent to Big Lake and Stone Lake. The nearest of these resources would be approximately 5 miles from the mine site.

Proposed Treatment of Topic in EIS:

The topic is minor, but will be discussed with limited information beyond that in the EAW. The EIS will verify the location of Knot Camp to avoid disturbance. The historical significance of the Cliff's Erie plant site will be evaluated and mitigation proposed if warranted. The EIS will also provide additional information on areas of "unknown" potential for containing archeological resources. Any resources identified will be discussed and mitigation to prevent impacts will be proposed.

26. Visual impacts. Will the project create adverse visual impacts during construction or operation? Such as glare from intense lights, lights visible in wilderness areas and large visible plumes from cooling towers or exhaust stacks? __Yes _X_No

If yes, explain.

Mine Site

Mining will continue on a 24-hour per day basis; site lighting will include both fixed lighting and vehicle lighting. Hauling to the top of stockpiles may cause vehicle lighting to be visible in the surrounding landscape. For purposes of this discussion, stockpiles were assumed to be as high as 320 feet above the local terrain so lights could be visible for a significant distance. The actual height of stockpiles will likely be less as this estimate of height was using previous information that indicated a higher striping ratio and larger volume of waste rock than more current estimates (see EAW Question 20).

The terrain rises sharply to the north so receptors to the north, including those in the BWCA will be unlikely to see the stockpiles or vehicle lights on top of these piles. The nearest receptors for visual impacts would be homes and campsites south of the site at a distance of about 5 miles. Assuming the mine stockpiles were 320 feet high, and including the effect of the earth's curvature, the top of the stockpile would about 0.7 degrees above the horizon, equivalent to an object one foot high at a distance of 100 feet. In the wooded terrain, most persons would not be able to see the stockpiles unless they were on a high hill or were otherwise elevated above the surrounding trees and brush.

This is comparable to previous visual impacts experienced from stockpiles adjacent to existing pits, including the Peter Mitchell Pit directly north of the site, the Erie pits to the northwest of the site and the Dunka Pit to the northeast of the site. The impacts from this project would be less because the mine is located on lower terrain, rather than the height of land of the Mesabi Range and the site is more isolated from nearby residences than those pits. Since the Boundary Waters Canoe Area Wilderness is at least 20 miles away, and since other mines are closer to the Boundary Waters than the proposed mine, no significant visual impacts are predicted from mining facilities.

Plant Site

No significant changes are anticipated to the existing large buildings at the plant site. The proposed autoclave building will be smaller and lower than the surrounding buildings formerly used for the concentrator and pellet plant. Therefore, no off-site visual impacts are predicted.

Tailings Basin
The tailings basin is potentially visible to rural residences on County Road 358, about one mile north of the tailings basin. The continued use of the tailings basin will widen the silhouette of the low mound on the southern horizon. This is not anticipated to be a significant visual impact.

Proposed Treatment of Topic in EIS:
The EIS will not contain any additional information beyond what is included in the EAW.

27. Compatibility with plans and land use regulations. Is the project subject to an adopted local comprehensive plan, land use plan or regulation, or other applicable land use, water, or resource management plan of a local, regional, state or federal agency?
_X_Yes __No.

If yes, describe the plan, discuss its compatibility with the project and explain how any conflicts will be resolved. If no, explain.

St. Louis County has a comprehensive land use plan that was adopted in January 1996. The land use plan sets general goals for the County. The majority of the project area (with the exception of a small portion of the Tailings Basin, see below) is outside of the area regulated by the St. Louis County comprehensive land use plan.

The project's mining area and some transportation corridors are within the jurisdiction of the City of Babbitt. The project's processing facilities, and portions of the transportation corridors are within the jurisdiction of the City of Hoyt Lakes. The tailings basin is primarily within the jurisdiction of the City of Hoyt Lakes, although the northernmost portion of the Tailings Basin is within Waasa Township.

According to Jim Lasi of City of Babbitt, the City has adopted a comprehensive plan and both 1) the mining activities, and 2) transportation (along the existing road and railroad corridors) of ore from the Mine Site to the Plant Site, are consistent with the comprehensive plan.

According to Richard Bradford of the City of Hoyt Lakes, the City has not developed a comprehensive plan, and as a result, the operation of the processing facility and use of the Tailings Basin is not subject to an adopted comprehensive plan. Similarly, the use of Dunka Road and the railroad for transportation of ore and other mining-related activities is not subject to an adopted comprehensive plan.

The St. Louis County comprehensive land use plan includes Waasa Township. The portion of the Waasa area in which the Tailings Basin is located is zoned for industrial use. As such, the use of this area for the Tailings Basin is compatible with the land use plan.

Proposed Treatment of Topic in EIS:

The topic is minor, but the EIS will include limited information beyond that in the EAW. The EIS will evaluate mineland reclamation strategies to develop those designs that are most compatible with surrounding land uses and local community goals.

28. **Impact on infrastructure and public services.** Will new or expanded utilities, roads, other infrastructure or public services be required to serve the project? __X__Yes __No. If yes, describe the new or additional infrastructure or services needed. (Note: any infrastructure that is a connected action with respect to the project must be assessed in the EAW; see *EAW Guidelines* for details.)

In general, the project makes use of existing infrastructure at the Plant Site and Tailings Basin. Electrical, gas, and water supply infrastructure is already in place and modifications and upgrades are not anticipated. Access to the Plant Site is available via existing local railroads, roads and highways.

Transportation of vehicles between the Plant Site and the Mine Site would take place via the existing (private) Dunka Road. Mining personnel would commute to and from the Plant Site and home area in their own vehicles using existing local roads and highways.

The ore would be transported from the Mine Site to the Plant Site along an existing railroad corridor. Only a relatively small railroad connection (see Figure 5-1) would need to be constructed for this project; this would be a private project on private property. Potential impacts of that railroad construction are addressed elsewhere in this EAW.

As acknowledged in the responses to Questions 17 and 18, options for the management and treatment of discharges from the Plant Site and Mine Site include pumping to the Hoyt Lakes and/or Babbitt POTWs. Both facilities have some available capacity to treat additional wastewater. If PolyMet were to pursue wastewater treatment at either facility and depending on the discharge flow rate, expansion of the capacity of a POTW may be necessary. Detailed plans regarding wastewater management and treatment for the Plan Site and Mine Site will be provided in the NPDES permit application and will be available for use in the EIS. If these plans call for discharge to a POTW, the POTW will be consulted as part of EIS preparation and prior to completion of the NPDES permit application so that details regarding required pretreatment and flow limitations (or required POTW expansion) can be resolved and described in the EIS and permit application.

Operations at the Mine Site would require electrical power. This would likely require the placement of an electrical substation at the Mine Site and the location of a short transmission line to the substation. Minnesota Power was recently requested to provide a conceptual plan for such an installation. When the conceptual plan is available, it will be evaluated for potential impacts. The results of this evaluation and any potential mitigations or alternatives will be included in the EIS.

Treatment of Topic in EIS:
The EIS will include an evaluation of wastewater treatment alternatives that propose to

use existing Hoyt Lakes or Babbitt POTW's. If any of these alternatives are deemed suitable for further evaluation, the EIS will include details about existing plant capacity and discuss options for increasing capacity and meeting NPDES permit conditions.

The EIS will also include additional detail on the electrical line and substation associated with the mine site. Potential impacts will be identified as well as mitigation of alternatives to prevent or minimize impacts.

29. Cumulative impacts. Minnesota Rule part 4410.1700, subpart 7, item B requires that the RGU consider the "cumulative potential effects of related or anticipated future projects" when determining the need for an environmental impact statement. Identify any past, present or reasonably foreseeable future projects that may interact with the project described in this EAW in such a way as to cause cumulative impacts. Describe the nature of the cumulative impacts and summarize any other available information relevant to determining whether there is potential for significant environmental effects due to cumulative impacts *(or discuss each cumulative impact under appropriate item(s) elsewhere on this form).*

CUMULATIVE IMPACTS

Cumulative impacts analysis addresses the combined effects of the proposed project and the effects of past, present and reasonably foreseeable future actions. These effects are analyzed by evaluating whether the affected resource, ecosystem or human community has the capacity to accommodate additional effects. These include both direct and indirect effects on a given resource, ecosystem and human community and include actions by private and governmental bodies. Cumulative impacts may occur when similar impacts accumulate or when diverse impacts have a synergistic effect. Cumulative impacts should be analyzed over the entire life of the potential project impact and not just the life of the project. Finally, cumulative impacts analysis should focus on truly meaningful effects.

The affected resource of interest for cumulative effects analysis is important in determining the geographic and temporal boundaries of the analysis. This in turn helps identify the past, present and reasonably foreseeable actions that will also be included in the analysis. For example, cumulative effects related to water quality would be limited to the watershed of interest and would not consider the effect of a nearby action in a different watershed.

INVENTORY OF POTENTIAL CUMULATIVE EFFECTS

The first step in a cumulative impacts analysis is the identification of potential cumulative effects associated with the proposed project. Review of previous responses in this scoping EAW and general consideration of other proposed actions in the Arrowhead Region resulted in the following tabulation of potential actions having potential cumulative effects:

- Air quality and visibility impairment related to mining and industrial emissions from multiple sources
- Ecosystem acidification related to industrial plant emissions from multiple sources
- Ecological (and human) health impairment resulting from the bioaccumulation of mercury as related to industrial plant emissions from multiple sources
- Wetland loss related to mine construction activities
- Water flow changes related to wetland losses caused by construction activities at multiple mines and by water appropriation/discharges at multiple industrial facilities
- Water quality impairments related to wetland losses caused by construction activities at multiple mines and by industrial plant and mine discharges from multiple sources
- Wildlife habitat loss or fragmentation (and potential effects on threatened or endangered wildlife) related to mine construction activities
- Threatened or endangered plant species loss related to mine construction activities
- Employment and economic output related to construction and operation of multiple industrial facilities
- Tax revenue changes related to construction and operation of multiple industrial facilities
- Social structure changes related to construction and operation of multiple industrial facilities

INVENTORY OF POTENTIALLY AFFECTED RESOURCES

To avoid vagueness, cumulative impacts should be analyzed in terms of the specific resource, ecosystem and human community being affected. In addition, the cumulative impacts analysis should focus on those impacts that are significant enough to be meaningful. The following is a general inventory of resources that could be potentially affected by the PolyMet project and the extent of those resources beyond the zone of direct impact:

- Air quality in Class II areas adjacent to the Cliffs Erie site and in federally administered Class I areas (e.g., BWCAW, Voyageurs National Park)
- Deposition of sulfates, nitrates, and mercury to low buffering capacity aquatic and terrestrial ecosystems in federally administered Class I areas (e.g., BWCAW, Voyageurs National Park)
- Water quality and flow in the upper Partridge River, upper Embarrass River and in Colby Lake, Second Creek, Sabin Lake, Wynne Lake
- Wetlands in the vicinity of the mine and in its related watershed - Partridge River Watershed
- Wildlife habitat at the mine site and greater surrounding area
- Populations of state and federal listed threatened, endangered and special concern plant species at the mine site and the related populations throughout

Minnesota
- Aquatic biota and fish in Partridge River and Embarrass river watersheds as a portion of the Lake Superior basin
- Economy and tax base of Babbitt, Hoyt Lakes, Aurora and in the local region
- Community structure and well being of Babbitt, Hoyt Lakes, Aurora and the local region

Note that the "project impact zone" and the "extent of the resource beyond zone of direct impact" can be different for each resource. For instance, the project's impact on a plant species is most likely limited to the immediate vicinity where direct or indirect impacts are great enough to cause a loss of individual plants. The extent of the plant species beyond that area would include all areas where the species is found in Minnesota. On the other hand, the project impact zone for particulate emissions to the air would likely be larger than the immediate project area, although the extent of the resource beyond the project impact area might be defined as northeastern Minnesota. Impacts in Federal protected areas (e.g. the BWCA) must meet more stringent standards and thresholds than elsewhere in the region. Because the project is located in the Lake Superior Basin, more stringent water quality standards, particularly for mercury, apply through the GLI.

It should be noted that noise impacts are of local significance and are not easily treated as cumulative impacts. According to Brian Timerson, MPCA (personal communication, 2005) cumulative impacts for noise are extremely unlikely. Because of the logarithmic nature of noise measurements, a doubling of sound energy (i.e., a second equal source) only produces about a 3 dB increase in sound levels. Therefore, for a cumulative impact to occur and cause an exceedance of noise standards, there would have to be two sources, both producing sound at levels just below the standard at the receptor of interest. In practice, noise sources are usually so different that one predominates and the other is insignificant. Therefore, given the distance separating the proposed projects at the Cliffs Erie Site, it is unlikely for potential noise impacts to be cumulative and noise is not considered further in this section of the EAW.

"OTHER ACTIONS" THAT MAY AFFECT RESOURCES

To the extent that a resource may be impacted by PolyMet, it must also be determined whether other actions or projects will affect that resource. These "other actions" include both governmental actions and private actions (which may also have governmental approvals). The following is a list of past, present and reasonably foreseeable actions that may have impacts on the resources listed above:

Governmental Actions

- City of Babbitt wastewater treatment discharges to the Embarrass River
- City of Hoyt Lakes wastewater treatment discharges to the Partridge River
- Logging of the Superior National Forest lands.
- Logging of state and county lands in the Arrowhead Region

- Implementation of taconite MACT standards by facilities in the Arrowhead Region
- Implementation of Electric Utility MACT Standards for coal-fired power plants in Minnesota
- Implementation of the Regional Haze Rules to reduce emissions of SO2, NOx, and fine particles in Minnesota, adjoining states, and states found to contribute significantly to visibility impairment in the Class I areas in Minnesota.
- Implementation of the Best Available Retrofit Technology (BART) rule to be proposed in April 2005 to reduce emissions of SO2, NOx, and fine particles in Minnesota, adjoining states, and states found to contribute significantly to visibility impairment in the Class I areas in Minnesota.
- Implementation of Minnesota's Regional Mercury TMDL in the Partridge and Embarrass Rivers

Future governmental actions are generally included in agency plans and budgets and can be predicted with some certainty.

Private Actions

- LTV Steel Mining Company (LTVSMC) closure in the Embarrass and Partridge River Watersheds
- Erie Mining Company establishment in the 1950's and development of the City of Hoyt Lakes in the Partridge River watershed
- Northshore Mining Company mine site crusher operations in the Partridge River watershed and Arrowhead Region airshed
- Other taconite plant operations (with proposed modifications, if appropriate) located in other watersheds but in the Arrowhead Region airshed
- Operation of Whitewater Reservoir in the Partridge River watershed
- Minnesota Power Syl Laskin Energy Center operations in the Partridge River watershed and the Arrowhead Region airshed
- Minnesota Power Taconite Harbor power station operations in the Arrowhead Region airshed
- Minnesota Power Hibbard power station operations in the Arrowhead Region airshed
- Logging on private lands (Minnesota Power land -former LTVSMC property, Cliffs Erie land, other private land) in the Partridge River Watershed
- Proposed Cliffs Erie Railroad Pellet Transfer Facility construction and operation in the lower Partridge River watershed and the Arrowhead Region airshed
- Proposed Mesabi Nugget construction and operation in the lower Partridge River watershed and in the Arrowhead Region airshed
- Proposed Mesaba Energy power generation station construction and operation in the Arrowhead Region airshed and Partridge River watershed (if located at the Cliffs Erie site)

- Other speculative non-ferrous mines in the Partridge River watershed and Arrowhead Region airshed
- Proposed Minnesota Steel Industries, LLC (MSI) DRI/steel plant construction near Nashwauk, MN, and operation in the Arrowhead Region airshed
- Shutdown of LTVSMC furnaces in the Arrowhead Region airshed

Private actions are more prevalent in the project area. Past private actions include the operation of Northshore Mining Company's crusher at the Peter Mitchell mine and its processing plant at Silver Bay and Minnesota Power Company's operation of three power generation stations: Syl Laskin, Hibbard and Taconite Harbor. With regard to air emissions, major regional sources, including taconite processing plants and power plants, were considered for inclusion in the cumulative effects evaluation. Other past and present private actions were also considered for cumulative impacts to other potentially affected resources.

Future private actions are less certain; projects may be studied for feasibility and then abandoned. A number of projects have been officially brought to the notice of the State of Minnesota and, in some cases, of the Federal government.

> Mesabi Nugget Company, LLC, is currently actively pursuing permits for construction of the iron conversion project at the Cliffs Erie site; it will be located in an old mine pit near the PolyMet Plant Site.
>
> Cliffs Erie is currently planning the construction and operation of a taconite pellet railroad load- out facility near the PolyMet Plant Site.
>
> Excelsior Energy Inc. of Minnetonka, MN, has been selected by the Department of Energy to receive $36 million for the development of a 531-megawatt Mesaba Energy Project in northern Minnesota. The project will produce more than 1,000 local construction jobs over three years and at least 150 permanent jobs when commercial operations commence. Depending on the location of the project, this proposed future action may be relevant to several cumulative impact issues. One location under consideration is near Hoyt Lakes but the final location for this facility remains unresolved. Because this proposed project has not advanced to the feasibility stage, it was not considered further for inclusion in the cumulative impacts analysis. If this project (Mesaba Energy) advances, MN Rules will require environmental review of the impacts related to Mesaba Energy.
>
> Permitting has commenced on the opening of a two new mines at the Ispat Inland taconite facility near Virginia with mine dewatering discharged to a tributary to the Embarrass River.
>
> Additional non-ferrous mining ventures have been discussed in the general vicinity of the PolyMet project. These include the Teck Cominco and Birch Lake projects. Except for ore sample collection, neither project has commenced detailed planning activities for full-scale operations. They remain speculative at

this time. Teck Cominco notified state officials in 2004 that active efforts to develop its project have been tabled indefinitely. Because neither proposed project has advanced to the feasibility stage, they were not considered further for inclusion in the cumulative impacts analysis. If either project advances, MN Rules will require the future preparation of a mandatory EIS for each project. Cumulative impacts related to these projects will be addressed at that time.

Minnesota Steel Industries, LLC (MSI) has proposed to reactivate the former Butler Taconite mine and tailings basin near Nashwauk, and construct a new crusher, concentrator, pellet plant, direct reduction plant, and steel mill consisting of two electric arc furnaces, two ladle furnaces, two thin slab casters, and hot strip rolling mill to produce sheet steel. This project will be located in the Mississippi River watershed.

SUMMARY OF CUMULATIVE IMPACT ISSUES TO BE ADDRESSED

Twelve cumulative impact issues will be addressed in the EIS. Each of these issues is discussed below. Each discussion provides background on the issue, a description of the approach to evaluate the issue, and a description of the data needs to perform the analysis.

1. Hoyt Lakes Area Projects and Air Concentrations in Class II Areas

Background

There are currently three projects that have submitted permit applications or environmental review information to state agencies for their planned operations at the former LTVSMC (now Cliffs Erie) operations near Hoyt Lakes, Minnesota.: PolyMet, Mesabi Nugget, Cliffs Erie Pellet Handling. For environmental review purposes, the major area of concern with the close proximity of these three projects is on air quality outside of the LTVSMC ambient air boundary where people actually live and wildlife habitat is present. Given the close proximity of these three projects there is the potential for cumulative effects on air quality outside of the Cliffs Erie site boundary. The potential cumulative impact of these three projects on ambient air quality outside of the Cliffs Erie site is recognized as an issue for the environmental review process and an analysis of the cumulative impacts of the three proposed projects will be completed for the EIS.

Approach to Evaluation

An air dispersion modeling study will be performed. Background information on the study will be provided:

- Description of the air dispersion modeling protocol (including relevant assumptions). If the number of stacks becomes cumbersome from a modeling standing point, professional judgment will be used to consolidate stacks or emissions as appropriate given available modeling guidance from regulatory agencies.

- Summary of estimated emissions of SO2, NOx, and PM10 by emission unit (if available) for each of the three projects proposed for the Cliffs Erie site (including relevant assumptions). Emission estimates will be provided by project proponents. If necessary, an emission scenario will be developed for projects lacking the necessary modeling details.
    - Description of the air dispersion model; a regulatory approved model will be used for the analysis (either ISCST3 or ISC PRIME).
    - Description of the receptor grid; the receptor grid will be established outside of the Cliffs Erie site boundary, from the site boundary out to 10 kilometers. Receptors will be placed on the Cliffs Erie site boundary with a 100 meter spacing. Receptors will have a 100 meter spacing from the site boundary out to 2 kilometers. Receptors will have a grid spacing of 1 kilometer starting at 2 kilometers from the Cliffs Erie site boundary out to 10 kilometers.
    - Description of meteorological input data; 1972-1976 Hibbing data will be used for the analysis.
- Modeling results will be tabulated and summarized and compared to the national and state ambient air quality standards (NAAQS/MAAQS)
    - Background air concentrations will be added to the modeled air concentrations. By including background air concentrations in the analysis it is assumed that past and present actions will be reflected in these background air concentrations. Depending on the availability of data, this assumption may need to be revisited upon actually conducting the study.
- Timeframe: the proposed facilities are assumed to be constructed and at full operations by 2008
- Report preparation and submittal to the MPCA and EIS contractor so that results can be evaluated and included in the EIS.
    - Model input/output files made available to the MPCA.

The impact analysis will be completed based on the results of the modeling study. Background information (see above) and final modeling results will be summarized in a report to be submitted to the MPCA and the EIS contractor. Description of air emissions control technologies is expected to be a significant section of the report. Uncertainties in the modeling study will be identified and discussed. The modeling and results will be verified by the MPCA (this may be delegated to the EIS contractor). Results of the cumulative analysis will be incorporated into the EIS by the contractor with guidance from the MPCA.

Data Needs for Analysis of Cumulative Impacts

- Emission estimates of SO2, NOx, and PM10 by emission unit (if available) from each of the projects proposed to be located at the Cliffs Erie site: to be provided by project proponents
- Stack parameters and locations for units emitting SO2, NOx, and PM10; to be provided by project proponents
- Descriptions of relevant pollution control technologies proposed for each

project; to be provided by project proponents
- Data for emission reductions related to shut down of LTV furnaces; to be provided by MPCA
- Modeling receptor grid outside of the Cliffs Erie site boundary
- Hibbing meteorological data (1972-1976)
- Modeling guidance from regulatory agencies for multi-facility air modeling projects
- Ambient air monitoring data for SO2, NOx, and PM10 from the nearest appropriate site.

2. Class I Areas PM10 Increment

Background
PolyMet is expected to trigger Prevention of Significant Deterioration (PSD) permitting for PM10 emissions only. Therefore, it is expected that PolyMet will be required to evaluate its potential impact on PM10 increment in the Class I areas. For Class I areas, the Federal Land Manager (FLM) guidance for assessing a project's potential impact on the PM10 increment requires that emissions of PM10, SO2, NOx, and primary sulfate be included in the analysis. The FLM guidance requires that the secondary pollutants ammonium sulfate and ammonium nitrate, which are formed from the primary emissions of SO2 and NOx, be counted as particulate and added to the air concentrations estimated for PM10. Therefore, due to the FLM procedures for assessing PM10 increment impacts, PolyMet will also include its SO2 and NOx emissions in the modeling evaluation.

This analysis will incorporate PM10 emissions speciation data (coarse particulate, fine particulate, etc), as well as SO2, NOx, and primary sulfate emissions for the project, and use the CALPUFF modeling system per FLM guidance to estimate ambient air concentrations in Class I areas within 250 kilometers of the project site. Specific details of the increment modeling for Class I areas will be resolved with the FLMs. Results will be summarized in a Class I areas report to be submitted to the FLMs (with state agencies receiving a copy as well) as part of the PSD permitting.

Recent Class I evaluations (e.g., Mesabi Nugget and Northshore Mining Company) have identified exceedances of the 24-hour PM10 Significant Impact Level (SIL)[1] in the BWCAW. The FLMs have expressed concerns about exceedances of the SIL. Given the results of these previous modeling studies and the close proximity of the project site to the BWCAW, PolyMet will provide an assessment in the EIS of potential impacts from multiple facilities with regard to PM10 in Class I areas. This assessment will include an evaluation of the potential emission reductions from in-state and out-of-state sources that are likely to result from implementation of the Regional Haze Rule and the Best Available Retrofit Technology (BART) rule and the potential decrease in air pollutant concentrations in Minnesota's Class I.

Approach to Evaluation
A semi-quantitative assessment of Class I Areas PM10 Increment will be performed.

Background information on Class I Areas PM10 Increment in Minnesota will be summarized:

- Summary of long-range regional transport issues for PM2.5 (fine aerosol), sulfate, and nitrate
- Summary of the IMPROVE monitoring network data for particulates (including ammonium nitrate, ammonium sulfate, coarse particulate, and elemental carbon and organic carbon for the period of record for the Voyageurs National Park site and the BWCAW site
- Summary of the PM10 air concentrations available from any nearby state monitoring sites
- Summary of air modeling studies conducted to date and the available results, with particular emphasis on major source contributions of fine particulate from in-state sources and out-of-state sources (national studies, CENSARA, other state efforts)
- Summary of current and foreseeable future federal regulatory controls to PM2.5, PM10, sulfates, nitrates: implementation of the Taconite MACT standard (PM10 as a surrogate for metals); Regional Haze Rule; NOx SIP call (40 CFR parts 51, 72, 75, 96; Clean Air Interstate Rule; EPA proposed rule (Federal Register, Vol. 70, No. 35) for NOx in Class I Areas); EPA "to-be" proposed rule for Best Available Retrofit Technology, BART (April 2005)
- Summary of current and foreseeable future state regulatory controls and/or actions (State acid rain rule and statewide SO2 emissions cap; Title IV of the 1990 Clean Air Act Amendments, affected MN sources
- Timeframe: Emissions projections (increases, decreases) from the proposed facilities, as well as from existing facilities subject to the various regulatory requirements, will be through the year 2020.

Estimates of current PM10, SO2, and NOx emissions from sources in Minnesota will be summarized based on the most current emission inventory available. Emissions will be reported for major geographic areas in the state (Twin Cities, Iron Range, etc.). The trend of state-wide emissions will be assessed using existing historical emission inventory data. This analysis will cover the period of record for such data. Background monitoring data (PM 2.5) for Voyageurs National Park and Ely (Fernberg Road) will also be summarized as will PM10 monitoring data from nearby sites.

Cumulative impacts will be based on projections of the potential increases or reductions in SO2, NOx, PM10 emissions from current Minnesota sources.. Emission estimates from the following reasonably foreseeable actions will be included in the analysis:

- Existing Taconite Plants w/Proposed Modifications
- Proposed Mesabi Nugget Plant
- Proposed Cliffs Erie Railroad Pellet Transfer Facility
- Proposed MSI DRI/Steel Plant
- Implementation of Taconite MACT Standards
- Shutdown of LTVSMC Taconite Furnaces
- Implementation of the Regional Haze Rule and BART rule (to be proposed)

The assessment will summarize the potential implications for PM10 increment in the BWCAW. Results will be summarized in a report to be submitted to the MPCA and the EIS contractor. Description of air emissions control technologies is expected to be a significant section of the report. The results will be verified by the MPCA (this may be delegated to the EIS contractor). Results of the cumulative analysis will be incorporated into the EIS by the contractor with guidance from the MPCA.

Data Needs for Analysis of Potential Cumulative Impacts

- Monitoring data from the IMPROVE Network for Voyageurs National Park and the BWCAW
- Air modeling studies (national, CENSARA, other state efforts)
- PM10, SO2, and NOx emission inventory data (total facility) from the MPCA
- PM10 monitoring data for existing nearby sites
- Estimated potential emission increases from reasonably foreseeable actions

Notes:

[1] The exceedance of a SIL, by itself, does not indicate that adverse impacts will be associated with a project's emissions. The SILs were established by U.S. EPA as a threshold for decision-making with regard to potential cumulative impacts from one or more projects. A SIL is set at 4 percent of the Class I area increment. U.S. EPA's working assumption is that as long as no individual source contribution exceeds 4 percent of a Class I increment, it is unlikely that the accumulation of sources over time will exceed that increment. In other words, if all new/modified sources model impacts below the respective SILs, there is reasonable assurance that cumulative potential impacts from all new/modified sources would not exceed the available increment. The need for a cumulative analysis with regard to increment consumption is made on a case-by-case basis, taking into account numerous factors, including the level of air emissions controls for the project sources (this information provided in the project's BACT report), significance of the exceedance of a SIL, economic feasibility to install additional air emission controls, and magnitude of emissions from the project as compared to emissions from existing sources.

3. Ecosystem Acidification Resulting From Deposition of Air Pollutants

Background

Acid deposition is a long-range pollution transport problem caused by local, regional, national and international emissions of nitrogen oxides and sulfur dioxide. Acid deposition, has two parts: wet and dry. Wet deposition refers to acidic rain, fog, and snow. Dry deposition refers to acidic gases and particles; approximately 50 percent of acid deposition is due to dry deposition. Prevailing winds blow the compounds that cause both wet and dry acid deposition across state and national borders, and sometimes over hundreds of miles. The strength of the combined effects of wet and dry deposition depend on many factors, including how acidic the water is (pH and hydrogen ion, H+), and the chemistry and buffering capacity of the aquatic and terrestrial ecosystems, including watershed vegetation and soils.

Minnesota has been a leader in the assessment of acid deposition impacts and regulation of pollutants contributing to ecosystem acidification. Acid deposition is currently regulated under Minnesota Rules through an acid deposition standard of 11 kilograms per hectare per year and a statewide SO2 emissions cap (Mn. Rules Chapter 7021) and federal rules (Title IV of the 1990 Clean Air Act Amendments and 40 CFR Parts 72 and 75). These regulations generally apply only to large electrical generating units (EGUs).

Acid deposition is an ongoing concern for states with low buffering capacity ecosystems. Most (90%+) of the acid deposition in Minnesota is due to out-of-state sources. Minnesota has low-buffering capacity lakes (typically seepage lakes with no inlets or outlets). Minnesota's terrestrial ecosystems (soils, vegetation, etc.) have been found to be less sensitive to acid deposition than the aquatic ecosystems. Seepage and headwater lakes are found within 10 kilometers of the Cliffs Erie site. Therefore, an assessment of potential cumulative effects should be provided in PolyMet's EIS for aquatic ecosystems.

PolyMet's projected emissions of pollutants from the processing plant that contribute to acid deposition are relatively low (3.6 tons per year (tons/yr) of SO2, 12.42 tons/yr of sulfuric acid mist/SO3, and 78 tons/yr of NOx; see Question 18 in this EAW). In spite of these low emissions, the (FLMs) may request that PolyMet conduct an assessment of its estimated project emissions for potential sulfur and nitrogen deposition for Class I areas within 250 kilometers of the project. If such an analysis is performed, the Class I modeling results will then be included in the acid deposition cumulative impact discussion.

Approach to Evaluation
A semi-quantitative assessment of cumulative acid deposition in Minnesota will be performed. Background information on acid deposition in Minnesota will be summarized:

- Summary of the long range pollutant transport issue (National Acid Precipitation Assessment Program; NAPAP)
- Summary of Minnesota's assessments of ecosystem buffering capacity (1980 – 2000)
- Summary of Minnesota's air modeling studies of source contributions (1986)
- Summary of Minnesota regulatory controls to protect sensitive ecosystems
- Summary of current and foreseeable future federal regulatory controls
- Timeframe: Emissions projections (increases, decreases) from the proposed facilities, as well as from existing facilities subject to the various regulatory requirements, will be through the year 2020.

Trend analysis will be conducted for SO2 and NOx statewide emissions (using existing state wide emission inventory data) and for deposition monitoring data at three sites in northern Minnesota. These analyses will cover the period of record for such data and will include comparisons to the state wide emission cap and the deposition standard (11 kilograms/hectare/year) which were established to protect Minnesota's aquatic terrestrial ecosystems.

The potential cumulative impacts will be based on projections of the potential increases or decreases in sulfate and nitrate deposition to Minnesota ecosystems from reasonably foreseeable actions:

- Existing Taconite Plants w/Proposed Modifications
- Existing Power Plants
- Proposed Mesabi Nugget Plant
- Proposed MSI DRI/Steel Plant
- Implementation of the Clean Air Interstate Rule.
- Implementation of the Regional Haze Rule and BART rule (to be proposed)
- Shutdown of LTVSMC Taconite Furnaces

The results of the cumulative impacts assessment will be compared to the Minnesota annual acid deposition standard which was promulgated to protect sensitive ecosystems. The assessment will summarize the potential implications for Minnesota ecosystems.

Results will be summarized in a report to be submitted to the MPCA and the EIS contractor. Description of air emissions control technologies is expected to be a significant section of the report. The results will be verified by the MPCA (this may be delegated to the EIS contractor). Results of the cumulative analysis will be incorporated into the EIS by the contractor with guidance from the MPCA.

Data Needs for Analysis of Cumulative Impacts

- Existing studies assessing Minnesota's ecosystem buffering capacity
- Existing air modeling results that identify Minnesota source and/or out-of-state contributions to deposition in Minnesota
- State air emission inventory data for SO2 and NOx emissions; 1975 to 2005
- Deposition monitoring data from the National Atmospheric Deposition Program (NADP) for Voyageurs National Park, Fernberg Road (Ely), and Wolf Ridge (Finland).

4. Mercury Deposition and Bioaccumulation in Fish

Background

Mercury emissions, deposition, and bioaccumulation in fish tissue have been the focus of researchers, state and federal regulators, and the public for more than a decade. Mercury is a long-range transport pollutant. In most areas of Minnesota, up to 90% of the mercury entering a lake or river comes from a wide variety of natural and man-made pollution sources located throughout North America and the rest of the world; 10% or less of the mercury falling on Minnesota's water is estimated to be from Minnesota sources. Conversely, most of the mercury from Minnesota's air emission sources tends to be transported outside the state. Water discharges of mercury account for less than 1% of the mercury which reaches Minnesota waters. In addition, microbial activity within aquatic and terrestrial ecosystems affects the amount of methylmercury that is available for uptake by biota. Therefore, there is not a direct relationship between 1) Minnesota mercury air releases, 2) the amount of mercury entering Minnesota lakes, and 3) concentration of mercury (as methylmercury) in fish.

Air emissions of mercury in Minnesota have been regulated by the Voluntary Mercury Reduction Initiative (Minnesota Statutes, section 116.915). In 1999, the legislature allowed Minnesota businesses, in cooperation with the MPCA, to voluntarily reduce mercury emissions from a 1990 baseline by 70% by 2005. According to the MPCA's 2002 progress report to Legislature on the Mercury Reduction Program (January 2002) and the emissions data provided in the preliminary mercury TMDL (http://www.pca.state.mn.us/water/tmdl/tmdl-mercuryplan.html#statewideplan), that has been accomplished due largely to reduction in purposeful uses of mercury in consumer products (e.g. latex paints, fungicides, etc.).

Lake sediment data, deposition monitoring data, and fish tissue data that have been collected in Minnesota since the early 1990s indicates that mercury deposition and subsequently fish tissue concentrations in Minnesota have declined since the 1970s in some areas, but have not declined in others. In order to attain water quality standards, the MPCA has recently proposed to require a 93% reduction in mercury emissions from in-state mercury air emission sources and a similar reduction from outside-of-Minnesota emission sources. The preliminary draft of the mercury TMDL contains information on mercury deposition and mercury in water and fish tissue, as well as state-wide, national and worldwide inventories.

Given Minnesota's emphasis on reducing mercury emissions and fish tissue concentrations, the fact that the proposed PolyMet project will have mercury emissions (albeit <2 lbs/yr), and the presence of numerous lakes in the Hoyt Lakes area, a cumulative analysis for mercury will be provided in PolyMet's EIS.

Approach to Evaluation
A semi-quantitative assessment of cumulative mercury deposition will be performed. Background information on mercury deposition in Minnesota will be summarized:

- Summary of the long range transport issue
- Summary of studies assessing mercury deposition and bioaccumulation in fish tissue in Minnesota's aquatic ecosystems
- Summary of air modeling results for source contributions (national, state efforts).
- Summary of state actions and the state's proposed statewide TMDL (93% reduction in MN emissions)
- Summary of current and foreseeable future federal regulatory controls
- Timeframe: Emissions projections (increases, decreases) from the proposed facilities, as well as from existing facilities subject to the various regulatory requirements, will be through the year 2020.

The assessment of potential impacts will be completed through mercury emission trend analyses using existing state wide emission inventory data and trend analyses of annual wet mercury deposition monitoring data at two sites in northern Minnesota. These analyses will cover the period of record for such data and will include comparisons to natural background.

Cumulative impacts will be based on projections of the potential increases or reductions in mercury emissions from general source categories (e.g., electric utilities, mining, products, etc). Emission estimates from reasonably foreseeable actions will be included in the analysis:

- Existing Taconite Plants w/Proposed Modifications
- Existing Power Plants w/Proposed Modifications
- Proposed Mesabi Nugget Plant
- Proposed MSI DRI/Steel Plant
- Implementation of Taconite MACT Standards
- Shutdown of LTVSMC Taconite Furnaces
- Implementation of the Electric Utility MACT standards
- Implementation of Minnesota's regional Mercury TMDL

Potential emissions of mercury from current and reasonably foreseeable future projects will be subject to the statewide TMDL. The implementation plan for the TMDL will specify the actions necessary to control mercury emissions so as to meet water quality standards.

Results will be summarized in a report to be submitted to the MPCA and the EIS contractor. Description of air emissions control technologies is expected to be a significant section of the report. The results will be verified by the MPCA (this may be delegated to the EIS contractor). Results of the cumulative analysis will be incorporated into the EIS by the contractor with guidance from the MPCA.

Data Needs for Analysis of Cumulative Impacts

- Existing studies assessing mercury deposition and bioaccumulation in fish tissue Minnesota
- Existing air modeling results that identify contributions from Minnesota and/or out-of-state emission sources to mercury deposition in Minnesota
- Available statewide mercury emissions estimates for 1990, 2000, and 2005 from the state.
- Deposition monitoring data from the National Atmospheric Deposition Program (NADP) for the Marcell Experimental Forest (near Grand Rapids) site and the Fernberg Road (Ely) site.

5. Visibility Impairment

Impairment of visibility is caused by very small particles, including solid particles and aerosols. Like acid deposition and mercury deposition, emission of pollutants that cause visibility impairment are generated from natural sources, as well as anthropogenic sources in Minnesota, the United States and throughout the world. Visibility impairment can be caused by direct emissions of SO2 (aerosol), primary SO4 (particulate) and elemental carbon (particulate). However, secondary formation of chemicals (e.g., ammonium sulfate and ammonium nitrate) also contributes significantly to visibility impairment. Visibility is of primary concern in the Class I areas - national parks and wilderness areas.

In addition to the regulations under PSD for Class I areas, US EPA has promulgated regulations aimed to reduce "regional haze". States have joined regional planning organizations or RPOs to develop state budgets for pollutants leading to the formation of fine particles, and to require states to develop state implementation plans (SIPs) by 2008 to reduce emissions to within those budgets. Minnesota is a member of the central states RPO called CENRAP. However, because it borders two other RPOs – the Midwest RPO to the east and the western RPO (WRAP) to the west, inventories of emission sources in Minnesota are included in all three RPOs.

Visibility monitoring is conducted in Minnesota's Class I areas (Voyageurs National Park; Boundary Waters Canoe Area Wilderness, BWCAW) as part of the IMPROVE network.

Given the proximity of the proposed facility to the BWCAW, as well as the close proximity of other known projects to the BWCAW, an assessment of potential cumulative visibility impacts will be included in PolyMet's EIS, taking into account the planned government actions to reduce regional haze and improve visibility in the Class I areas.

Due to the long-range transport of pollutants that affect visibility, the federal regulations intended to improve visibility in the Class I areas will also result in improvements to visibility in Class II areas.

Approach to Evaluation

A semi-quantitative assessment of cumulative visibility impacts will be performed. The assessment will focus on Minnesota's Class I areas. Background information on visibility pollution in Minnesota will be summarized:

- Summary of long range transport issue
- Summary of IMPROVE monitoring network in Voyageurs Nat. Park and Boundary Waters Canoe Area Wilderness
- Summary of air modeling results for source contributions (national, CENSARA, other state efforts).
- Summary of current and foreseeable future federal regulatory controls
- Timeframe: Emissions projections (increases, decreases) from the proposed facilities, as well as from existing facilities subject to the various regulatory requirements, will be through the year 2020.

The assessment of potential impacts will be completed through statewide SO2, NOx, and PM10 emission trend analyses using existing statewide emission inventory data (listing of sources and ton/yr emissions). Trend analysis will provide breakout of emissions by geographic area of the state (Twin Cities, Iron Range, etc.) In addition, a trend analysis of background monitoring data from Voyageurs National Park and Ely (Fernberg Road) will be provided, including plots of light extinction and other pertinent parameters, depending on data availability.

Cumulative impacts will be based on projections on the potential increases in SO2 and NOx emissions in Minnesota from current and reasonably foreseeable actions. Emission estimates (or decreases) from the following past, current and reasonably foreseeable actions will be included in the analysis:

- Existing Taconite Plants w/Proposed Modifications
- Proposed Mesabi Nugget Plant
- Proposed Cliffs Erie Railroad Pellet Transfer Facility
- Proposed MSI DRI/Steel Plant
- Implementation of Taconite MACT Standards
- Shutdown of LTVSMC Taconite Furnaces
- Implementation of the Electric Utility MACT standards
- Emission reductions in other parts of Minnesota (Metropolitan Emission Reduction Project)

Results will be summarized in a report to be submitted to the MPCA and the EIS contractor. Description of air emissions control technologies is expected to be a significant section of the report. The results will be verified by the MPCA (this may be delegated to the EIS contractor). Results of the cumulative analysis will be incorporated into the EIS by the contractor with guidance from the MPCA.

Data Needs for Analysis of Cumulative Impacts

- IMPROVE Network monitoring data for Voyageurs National Park and the BWCAW
- Existing studies assessing cumulative visibility impacts in Minnesota
- Existing air modeling that identifies contributions from Minnesota sources
- State emission inventory data pertaining to SO2, NOx, and PM10

6. Loss Of Threatened And Endangered Plant Species

It is assumed that the development and operation of the Mine Site will result in the taking of several species of special concern and at least one state-listed threatened or endangered species. Therefore, a cumulative impacts analysis will be performed to assess the cumulative loss of those specific species populations.

Approach to Evaluation

A semi-quantitative analysis of cumulative impacts will be performed. Because the Minnesota Department of Natural Resources is charged with administering the program to protect state-listed threatened and endangered species and managing species with the potential to become threatened or endangered within the state of Minnesota, the entire state will be defined as the geographic boundary for analysis. While the range of most of the potentially affected species extends beyond the state boundary, the regulatory program does not, and it would be difficult to determine “truly meaningful effects” within the species natural ranges that extend into other states and Canada. The species that will be addressed in the analysis are listed in Table 29-1.

Table 29-1: Rare species present within or near the PolyMet Mine Site

Common Name	Scientific Name	State Status[1]	PolyMet Mine Site Observations	Approx. # of Individuals	Habitat
Pale moonwort	*Botrychium pallidum*	E	4 pops .	58	Full to shady exposure, edge of alder thicket, along Dunka Road, and railroad and powerline right-of-way.
Ternate grape-fern	*Botrychium rugulosum (=ternatum)*	T	None identified		Disturbed habitats, fields, open woods, forests
Least grape-fern	*Botrychium simplex*	SC	20 pops .	1,337	Full to shady exposure, edge of alder thicket, forest roads, along Dunka Road, and railroad and power line rights-of-way.
Floating marsh marigold	*Caltha natans*	E	13 pops .	~150	Shallow water in ditches and streams, alder swamps, shallow marsh, beaver ponds, and Partridge River mudflat.
Neat spike-rush	*Eleocharis nitida*	T	11 pops .	~1,450 sf	Full exposure, moist ditches along Dunka Road, wet area between railroad grades, and railroad ditch.

Northern commandra	*Geocaulon lividum*	SC	11 pops .		On *Pleurozium* and *Sphagnum*moss mats under black spruce, open to partly shaded.
Lapland buttercup	*Ranunculus lapponicus*	SC	7 pops .	~825 sf	On and adjacent to *Sphagnum* hummocks in black spruce stands, up to 60 percent shaded with alder also dominant.
Clustered bur-reed (floating marsh marigold)	*Sparganium glomeratum*	SC	13 pops .	>100	Shallow pools and channels up to 1.5 feet deep in *Sphagnum* at edge of black spruce swamp, beaver pond, wet ditches, shallow marsh
Torrey's manna-grass	*Torreyochloa pallida*	SC	8 pops .	~800 sf	In muddy soil along shore and in water within shallow channels, beaver ponds, shallow marshes, along Partridge River.

[1] E - Endangered, T - Threatened, SC - Species of Concern

The life history of each species will be described including what is known about their preferred habitats, the role of disturbance in their life history, range, sensitivity to stresses, and the current level of understanding of the species. This characterization will differentiate between pioneering species and those that are part of mature communities.

Species losses from the following reasonably foreseeable actions will be included in the analysis as forecasted for 27-years consistent with the PolyMet projection of 2-years of construction, 20-years of operation and 5-years of closure:

- Proposed MSI DRI/Steel Plant

- Proposed Ispat Inland Mine Pits
- Proposed Cliffs Erie pellet railroad loading project
- Proposed Mesabi Nugget Project

Losses from other projects with the potential to affect the species of interest will also be included in the analysis if the necessary species population information is available at the time of the analysis and can be provided by MDNR.

The past projects will include projects for which the MDNR has issued takings permits for the species of interest.

Through compilation of known records of each species within the state from the Natural Heritage Information System, a distribution map for each species will be prepared. The data will be compiled to summarize the number of known populations, approximate numbers of plants, and locations. Takings permit information will be analyzed to determine the extent of past losses. The baseline condition will also include a description of how land use conditions affecting the various species have changed over time and how they are likely to change in the future; both with and without the proposed projects.

Impacts related to past, present, and reasonably foreseeable future impacts be evaluated through a semi-quantitative summary of number of populations and individuals of each species that may be affected and the magnitude of those effects based on the knowledge of the species within the state. This evaluation will include determining whether the various species are particularly vulnerable to decline. The “magnitude” of the effects will be evaluated within the context of the state, the affected region, and the MDNR regulatory program.

Alternative configurations of the project will be evaluated to determine if the projected impacts can be minimized.

If it is determined that unavoidable impacts will result to threatened species; plans will be made to mitigate for those impacts. The mitigation for the loss of state-listed threatened, endangered, or special concern species will be developed in consultation with the MDNR Natural Heritage and Nongame Research Program in administration of the state threatened and endangered species permit requirements (Minnesota Rules Chapters 6134 and 6212) pursuant to statutory authority Minnesota Statutes, section 84.0895.

Data Needs for Analysis of Cumulative Impacts

- Natural Heritage Information System records for the potentially affected species
- Takings permit information from throughout the state for the potentially affected species
- Life history information for the potentially affected species
- Specific threatened and endangered species survey information for reasonably foreseeable future projects

- Land cover and habitat characteristics for the proposed project site(s) before the proposed project and the likely land cover and habitats that will be present after the project is complete
- United States Department of Agriculture, Forest Service, Region 9 Sensitive Species List

7. Loss of Wetlands

The development and operation of the Mine Site will result in the loss of wetland resources. Therefore, an analysis will be performed to assess the cumulative loss of those specific wetlands and the past and projected loss of other wetlands in the Partridge River watershed.

Approach to Evaluation
A semi-quantitative analysis of cumulative impacts to wetlands will be performed. Because several of the primary functions performed by wetlands are directly related to watershed processes, the analysis will be performed on a watershed basis. The geographic area of analysis will be the Partridge River watershed. Historical activities within the Partridge River watershed that have affected wetland resources are primarily mining activities and urban development that started on a large scale in the early 1950's. The remainder and majority of the watershed have seen limited disturbance and loss of wetlands. The baseline condition for wetland resources will be established using the following approach.

The National Wetland Inventory data will be used to help establish the baseline wetland condition in the undisturbed areas of the watershed since it is the best data representing the extent of wetland resources in the Partridge River watershed. In the areas of the watershed that have been significantly altered, wetlands will be mapped and classified to the extent feasible using a number of historic data resources layered in a geographic information system including:

- 1930's aerial photographs
- Original U.S. Geological Survey 7.5 minute quadrangle topography maps from the early 1950's, prior to the onset of significant mining activities
- MDNR GIS data that incorporates notes from the original survey of the area and includes detailed wetland vegetation information

The baseline condition will also include a description of how conditions affecting wetlands have changed over time and how they are likely to change in the future; both with and without the proposed projects.

A similar wetland mapping effort may be conducted to establish wetland conditions at an interim point in time, (e.g., 1970) to help track trends in wetland loss.

The next step will be to prepare a mapping of wetland resources as they exist at the present time, before the start of any further projects in the Partridge River watershed.

This wetland mapping will be prepared using information from the National Wetland Inventory mapping and from site-specific wetland surveys that have been conducted within the areas of the Partridge River watershed. This wetland mapping will be compared to the historic wetland (baseline) mapping to quantify the effects of past activities on wetland resources within the analysis area.

Wetland losses from the following reasonably foreseeable actions in the Partridge River watershed will be included in the analysis as forecasted for 27-years, consistent with the PolyMet projection of 2-years of construction, 20-years of operation and 5-years of closure:

- Proposed PolyMet mine
- Portions of the proposed Cliffs Erie pellet railroad loading facility in the Partridge river watershed
- Future expansion of Northshore Mining Company's Peter Mitchell open pit mines

Losses from other proposed projects with the potential to affect wetland resources in the Partridge River watershed will also be included in the analysis if wetland impact information is available at the time of the analysis.

Impacts related to past, present, and reasonably foreseeable future actions will be evaluated through a quantitative summary of the number of acres of various wetland types that may be have been affected in the past and may be affected in the future and the magnitude of those effects within the watershed. Trends that may be discernible from evaluating the data will be evaluated. This evaluation will include determining whether various wetland types are particularly vulnerable to rapid degradation. The "magnitude" of the effects will be evaluated within the context of the overall wetland resources within the watershed.

Alternative configurations of the project will be evaluated to determine if the projected impacts can be minimized. Unavoidable wetland impacts will be mitigated in accordance with the state and federal wetland permitting programs.

Data Needs for Analysis of Cumulative Impacts

- National Wetland Inventory maps for the Partridge River watershed
- 1930's, 1970's and most recent good quality aerial photographs
- Original U.S. Geological Survey 7.5 minute quadrangle topography maps from the early 1950's, prior to the onset of significant mining activities
- MDNR GIS data that incorporates notes from the original survey of the area and includes detailed wetland vegetation information
- Wetland inventories from past and proposed projects within the watershed
- Future mine plans for the Northshore Mining Company mine
- Wetland mitigation plans for the past and reasonably foreseeable future projects

8. Loss or Fragmentation of Wildlife Habitat

Background
Since the state was established (1858), Minnesota's ecosystems have all been affected by both anthropic and natural disturbances. The drastic reduction in native prairie, which has been converted to row-crop agriculture, is a well-known example of anthropic disturbances. Much of the forested areas of the state are still forested and appear to have been less impacted by disturbance in that they remain forested with native species. However, both anthropic activities (e.g., mining, urbanization and logging) and natural disturbances (e.g., fire, windstorms, and insect infestation) have altered the character of the original ecosystems in the Arrowhead Region.

Assessment of the cumulative impacts of any single anthropic activity such as mining in the forested northern areas of the state is therefore difficult because that specific impact must be separated from all the other anthropic and natural disturbances that have occurred. An assessment of cumulative impacts to wildlife habitats is not only constrained by the available data, as are all such analyses, but by the interacting effects of anthropic and natural disturbances.

Approach to Evaluation
The approach to evaluation of habitat fragmentation will be to choose an appropriate analysis area, a baseline time and condition and then: 1) assess the cumulative disturbance (habitat loss) of past and current mining and associated infrastructure development on that baseline condition; and 2) assess the cumulative disturbance of past, current and proposed future actions on that baseline condition. Using other available information, a qualitative description of the habitat in areas disturbed by mining and habitat changes that were not associated with mining (e.g., logging, fire, windstorms, and insect infestation) will also be provided.

Marschner's map of the original vegetation of Minnesota (see Heinselman, 1975) will be used to define the baseline vegetation condition. This map was compiled from the U.S. General Land Office Survey Notes (GLO). This map is based on field notes of the GLO surveyors, who conducted the original land surveys of Minnesota during the period 1850 to 1905. It was drafted at a 1:500,000 scale. Marshner mapped 16 vegetative/ecosystem categories, ranging from marshes to pine groves. The map therefore is the best representation of the original ecosystems of Minnesota before the impact of European man.

The quality of historical records generally is directly proportional to the area considered (i.e., the average of small-scale errors tends toward zero as increasingly large areas are considered). The geographic boundary for impact analysis will therefore be necessarily large: the Arrowhead Region including the counties Cook, Lake, St. Louis, Carleton, Aitkin, Itasca, and Koochiching. For finer discrimination, albeit with more potential error, cumulative impacts in two subsections of Minnesota landscape, the Laurentian Highlands and the Nashwauk Uplands Subsections of the Northern Superior Uplands Ecological Section will be tabulated. These two subsections encompass most of the mining activity that has occurred in northern Minnesota. In addition, analysis of this large area ensures that affects to wide-ranging species, such as wolf, lynx, bear, and deer, and species groups that require large habitat areas (e.g., interior forest-dwelling birds and medium- to large-size mammals), are adequately considered in the analysis.

The actual acres of the various ecosystems mapped by Marshner (16 categories, ranging from marshes to pine groves) that have been disturbed by past and current mining and infrastructure development will be tabulated as will the relative loss by ecosystem category. These tabulations will also be summarized by ecological subsection. The area disturbed will be derived either from the "Forested Areas" map from the Manitoba Remote Sensing Centre (16 classes, including Urban/Industrial, Gravel Pits and Open Mines, and Roads and Improved Trails and Rail Lines), 2003 Mine Features GIS mapping layer available from MDNR, or if those map layers are not suitable, then from the "1990 Census of the Land" (9 categories including Urban and rural development and Mining). A similar assessment will be carried out overlaying a GIS layer of the projected cumulative disturbance 27 years in the future (total time of construction, operation and closure of PolyMet mine) as related to the following proposed future actions:

- Proposed PolyMet Mine
- Proposed Mesabi Nugget Plant
- Proposed Cliffs Erie Railroad Pellet Transfer Facility
- Proposed MSI DRI/Steel Plant
- Future mining plans for existing taconite operations

An interpretation of the extent of ecosystem loss will be performed for four categories of Minnesota wildlife: small-and-medium sized mammals, large mammals, birds, and herptofauna. In addition, an interpretation of habitat loss will be performed for populations of gray wolf, Canada lynx and bald eagle (species listed as threatened by U.S. Department of the Interior). All of these assessments will be qualitative and will be informed by previously completed studies in northern Minnesota (see below).

Previous assessments will be used to provide perspective on those changes in ecosystems that are associated with the cumulative effects of mining in contrast to those associated with other anthropic and natural disturbances (e.g., logging, fire, windstorms, and insect infestations). These assessments were not specifically targeted on the mining areas of the state, but instead considered either the entire forested area of the state or some sub-area in northern Minnesota. The following assessments will be reviewed to provide a brief qualitative perspective on ecosystem changes not related to mining:

- Friedman, S. K. 2001. Landscape scale forest composition and spatial structure: A comparison of the presettlement General Land Office Survey and the 1990 forest inventory in northeastern Minnesota. Ph.D. thesis, University of Minnesota, St. Paul. Friedman reconstructed the presettlement forest vegetation in northeastern Minnesota using General Land Office Survey Records and assessed change in this forest following the introduction of logging and the suppression of fire.
- Minnesota Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management in Minnesota (GEIS). The GEIS analyzed impacts resulting from timber harvesting and associated management activities in Minnesota, such as logging, reforestation, and forest road construction. Four

sections of the GEIS may be useful in describing forest change not related to mining, including: Section 5.2.1 Forest Area and Cover Type Abundance, Section 5.2.4 Forest Fragmentation, Section 5.6.1 Forest Resources - Extent, Composition, and Condition, and Section 5.7.4 Cumulative Unmitigated Significant Impacts.

- Minnesota Forest Resource Council (MFRC) Landscape Project. The MFRC Landscape Project is a landscape level program and coordination effort. As part of the Project, a number of reports have been generated that may be used in this evaluation of cumulative impacts. All reports are available from the MFRC website http://www.frc.state.mn.us/Info/MFRCdocs.html, and include:
  - Changes in disturbance frequency, age and patch structure from pre-European settlement to the present in north central and northeastern Minnesota. LT-1203a
  - Contemporary forest composition and spatial patterns of north central and northeastern Minnesota: An Assessment using 1990s LANDSAT data (accompanying maps/plates). LT-1203b
  - Changes in forest spatial patterns from the 1930s to the present in north central and northeastern Minnesota: An analysis of historic and recent air photos (accompanying maps/plates). LT-1203c
  - Potential future landscape change on the Nashwauk Uplands in northeastern Minnesota: an examination of alternative management scenarios using LANDIS. LT-1203d
  - Background paper: relationships between forest spatial patterns and plant and animal species in northern Minnesota (Report) (Appendices). LT-1203f
- Forest Plan Revision Final Environmental Impact Statement for Chippewa and Superior National Forests. As part of their comprehensive planning process, the U.S. Forest Service developed an Environmental Impact Statement that discussed changes in forest conditions with time. Appendix H is a cumulative review that is most relevant. This document can be found at http://www.superiornationalforest.org/analyses/2004Plan/feis/index.shtml.

Data Needs for Analysis of Cumulative Impacts

- Marschner's map of the original vegetation of Minnesota – available from the DDNR Data Deli (http://maps.dnr.state.mn.us/deli/)
- The land cover map "Forested areas" from the Manitoba Remote Sensing Centre – available from the Minnesota Land Management Information Center (http://www.lmic.state.mn.us/chouse/land_use_comparison.html)
- The land cover map "1990s Census of the Land" – available from the Minnesota Land Management Information Center
- The map: "Ecological Subsections of Minnesota" – – available from the DDNR Data Deli
- 2003 Mine Features GIS mapping layer available from MDNR
- In addition, the reports cited above (Friedman, GIES, MFRC, and U.S. Forest Service) are necessary and available as noted.

Friedman, S. K. 2001. Landscape scale forest composition and spatial structure: A comparison of the presettlement General Land Office Survey and the 1990 forest inventory in northeastern Minnesota. Ph.D. thesis, University of Minnesota, St. Paul.

Heinselman, M.L. 1975. Interpretation of Francis J. Marschner's Map of the Original Vegetation of Minnesota. USDA Forest Service, North Central Forest Experiment Station, St. Paul, MN. Available from: MDNR - Division of Forestry's digitized GIS layer of Marschner's map.

9. Streamflow and Lake Level Changes

Background

Cumulative impacts to the physical character of streams and lakes can occur from increases or decreases in flow or changes in the pattern of flow. The causes can include both point discharges (e.g., mine dewatering discharges) and changes in watershed runoff caused by land use changes (e.g., timber harvest). The impacts of flow changes can include erosion, sedimentation, drought, and high velocities resulting in flushing of aquatic life. Changes in frequency of bankful flow can cause stream degradation. Changes to streams may accumulate over time, even for non-contemporaneous impacts if, for example, a stream is eroded and degraded by one event and then further eroded by a second event.

Flow impacts to streams and lakes are regulated under the MDNR's program for appropriations of water and for work in public waters. Physical impacts to wetlands are also regulated by the Corps of Engineers, the MDNR and the MPCA.

PolyMet will have point discharges of industrial wastewater to the Partridge River (from the Mine Site) and to the Embarrass River (from the Processing Facility and Tailings Basin). The discharges to the Embarrass River are expected to be relatively small in volume. The plant discharges from the tailings basin can be timed to coincide with the most appropriate flow conditions in the Embarrass River. Other changes to the Embarrass River that might be cumulative are limited to the small and intermittent discharge from the Babbitt Wastewater Treatment Plant, forest harvesting and the impacts of rural residential development in Embarrass Township. Again, these are relatively small impacts. Most mining-related discharges for Northshore Mining Company and Cliffs Erie are not to the Embarrass but to the Partridge. Therefore, the possibility of significant impacts to the Embarrass River via either direct discharge or cumulative impacts of discharge (including PolyMet) are believed to be small.

PolyMet's discharges to the upper Partridge River (including mine dewatering) are expected to be larger and not capable of being delayed because long-term storage of the mine dewatering discharge would require an impracticably large reservoir. In addition, PolyMet will appropriate water for the Processing Plant from Colby Lake (which is part of Partridge River drainage), raising the possibility of increases in discharge during wet weather and decreases in discharge during dry weather. Short-term peak discharges from the Mine Site will be mitigated by design of sedimentation and treatment basins to limit peak flows to appropriate pre-development flows. During reclamation, there will be a period of time when the PolyMet Mine Pit will be filling with water and the flow to the Partridge River will be reduced as water accumulates in the Mine Pit. Therefore, the cumulative impact of greater concern is the long-term flow regime of the Partridge River, including changes to the duration and frequency of exceedence of the bankful flow.

Approach to Evaluation

A quantitative assessment of cumulative impacts due to changes in flow will be performed for the Upper Partridge River (including Colby Lake).

Evaluation of hydrologic changes could be done with two major types of models: Changes in short-term flow patterns (e.g., storm runoff) are typically analyzed using hydrologic simulations models such as TR-20, HEC-1 (now HEC/HMS) or SWMM. Long-term flow patterns are most readily analyzed using models such as WATBUD, SWMM (in continuous simulation mode) or the Meyer model. As mentioned above, the changes to the long-term flow regime are more likely to have impacts so the latter class of models would be most applicable.

A stream evaluation conducted in 2004 found that the upper Partridge River was in good condition in the reaches evaluated. Therefore it is proposed to take the present condition as the baseline condition. The model will first be calibrated to available flow gaging data. This will include the effects of past and present actions (through the date of monitoring) including :

- Existing Cliffs Erie and discharges from pits (as of date of monitoring)
- Modification of land use (including wetland loss) by past mining practices within the upper Partridge River watershed
- Existing discharge from Northshore Mining Company Mine and Crusher area
- Existing Syl Laskin Energy Center discharges
- Existing discharge from City of Hoyt Lakes POTW
- Operation of Whitewater Reservoir
- Typical timber harvest activities on SNF, state and county lands and private lands.
- Existing runoff from the development of City of Hoyt Lakes

The hydrologic models will be modified to include actions since the date of the monitoring and potential future actions including:

- Changes to discharges due to closure of LTVSMC
- PolyMet Mine Site discharges to Partridge River and appropriations for PolyMet from Colby Lake
- Long-term flow management of PolyMet mine pit during and after filling of pit
- Implementation of Regional Mercury TMDL

- Potential future discharges and appropriations at Mesabi Nugget facility
- Appropriations, discharges and land use changes at proposed Cliffs Erie Railroad Pellet Transfer Facility construction and operation (parts of these impacts are not in upper Partridge watershed)
- Changes in runoff quantity due to future development of City of Hoyt Lakes
- Any reasonably foreseeable changes to discharges from Hoyt Lakes POTW due to development and/or treatment system changes
- Any potential changes in water discharge from Northshore Mining Company discharges in Partridge River watershed
- Any reasonably foreseeable changes to timber harvest activities on SNF, state and county lands and private lands.

The threshold of significance for this cumulative impact assessment for streams will be the likelihood of major change in stream morphology as defined by the Rosgen classification method or other applicable method (Rosgen, 1994). This analysis will be based on stream reconnaissance completed in 2004 by PolyMet as a base condition which will then be modified by predicted changes in streamflow.

The threshold for evaluation of cumulative impacts to Colby Lake will be significant changes to the range or frequency of high and/or low-water conditions in the lake as determined by the annual maximum and minimum stage-probability relationships for the lake.

Data Needs for Analysis of Cumulative Impacts

- Flow data for Partridge River
- Lake level data for Colby Lake
- Discharge data for Hoyt Lakes POTW
- Discharge data for Erie Mining Company and successors LTVSMC and Cliffs Erie discharges from pits
- Historic air photos or GIS coverages showing modification of land use (including wetland loss) by past mining practices within the upper Partridge River watershed
- Discharge data from Northshore Mining Company Mine and Crusher area and evaluation of possibility of changes to Northshore Mining Company discharges in future
- Appropriations and discharge data for Syl Laskin Energy Center discharges
- Operation plans and historic lake levels for Whitewater Reservoir
- Data on typical timber harvest activities on SNF, state and county lands and private lands.
- Estimates of existing and future land use for City of Hoyt Lakes
- Estimates of future PolyMet Mine Site discharges for mine development, operation and closure, including long-term flow management of PolyMet mine pit during and after filling of pit
- Estimates of potential future discharges and appropriations at Mesabi Nugget facility

- Water balance for proposed Cliffs Erie Railroad Pellet Transfer Facility construction and operation

10. Water Quality Changes

Background

Cumulative water quality impacts can occur from point or non-point discharges of pollutants to a given water. For most water bodies, cumulative impacts occur through simultaneous or near simultaneous discharges that are in reasonable geographic proximity. Accumulation of pollutants in sediments is an exception to this generalization. Point discharges of industrial or municipal wastewater are regulated under the MPCA's NPDES permit program. Non-point discharges above natural background levels occur when land use changes increase areal export of pollutants. In the project vicinity, these changes include filling of wetlands and construction of mining and other industrial facilities that may have lower-quality runoff. Impacts of both point and non-point discharges can be mitigated by treatment.

PolyMet will have point discharges of industrial wastewater to the Partridge River (from the Mine Site) and to the Embarrass River (from the Processing Facility and Tailings Basin).

Approach to Evaluation

A quantitative assessment of cumulative water quality impacts will be performed for the Upper Partridge River (including Colby Lake) and the Upper Embarrass River (including Wynn and Sabin Lakes). PolyMet's discharges will be treated to meet chronic aquatic toxicity-based standards but levels of metals such as nickel may be elevated above natural background levels. At the Plant Site and Tailings Basin, discharges from the Wastewater Treatment Plant may contain dissolved solids, hardness, chlorides and possibly sulfate at levels above background. Other common pollutants such as BOD, bacteria and suspended solids are not expected to be present in significant quantities in the discharges. The actual construction of the PolyMet facility can be expected to generate sediment but this impact is readily mitigated by sedimentation and will be of short duration. Therefore, this impact is not proposed as a suitable subject for cumulative impact analysis.

A number of models are available to analyze generation, fate and transport of pollutants in streams. Models recently used in Minnesota EIS's and NPDES permitting procedures include HSPF and QUAL2E and dilution models. Because toxic metals are largely conservative substances and a loss of these substances is not expected over the long term, an initial practical evaluation could be conducted using a conservative dilution model of the stream water quality. If this indicates that potential cumulative impacts may be experienced, a more comprehensive model could then be applied. It appears likely that the initial modeling phase will be required for the NPDES permit and will be available to the EIS contractor. In this phase, both streams will be modeled using the hydrologic loading of water from tributary subwatersheds (see previous discussion of cumulative impacts of flow changes) for dry, normal and wet conditions. The background loading of pollutants from the watershed will be estimated based on historic and recent monitoring results. For each hydrologic scenario, loading from the PolyMet facility will be included and the resultant concentrations will be calculated as a simple dilution model. Upstream and downstream additions of pollutants from other discharges will be evaluated for past, present and future actions by other parties

The models will first be calibrated to existing conditions monitoring data from 2004. This will inherently include the effects of past and present actions (through the date of monitoring) including:

- Embarrass River
    - Existing discharges from Babbitt POTW
    - Existing Cliffs Erie tailings basin seepage
    - Other existing sources within the former LTVSMC site (e.g. waste rock piles tributary to Spring Mine Creek)
    - Modification of land use (including wetland loss) by past mining practices within the Embarrass River watershed above Sabin and Wynne Lakes
    - Typical timber harvest activities on SNF, state and county lands and private lands
    - Existing rural and residential development in Embarrass township
    - Construction of Embarrass Wetland Bank by LTVSMC
    - Closure of LTVSMC

- Partridge River and Colby Lake
    - Existing Cliffs Erie discharges (overflow) from pits
    - Other existing sources within the former LTVSMC (e.g. waste rock piles adjacent to Wyman Creek)
    - Modification of land use (including wetland loss) by past mining practices within the upper Partridge River watershed
    - Existing discharge from Northshore Mining Company Mine and Crusher area
    - Existing Syl Laskin Energy Center discharges
    - Existing discharge from City of Hoyt Lakes POTW
    - Operation of Whitewater Reservoir
    - Typical timber harvest activities of SNF, state and county lands and private lands
    - Existing runoff from the development of the City of Hoyt Lakes

The hydrologic models will than be modified to include actions since the date of the monitoring and potential future actions including:

- Embarrass River
    - PolyMet tailings basin wastewater treatment plant discharge
    - Changes to existing discharges from Cliffs Erie tailings basin due to PolyMet's proposed collection and treatment of seeps

    - Implementation of Regional Mercury TMDL
    - Any reasonably foreseeable changes to discharges from Babbitt POTW due to development and/or treatment system changes
    - Any reasonably foreseeable changes to timber harvest activities on SNF, state and county lands and private lands

- Partridge River and Colby Lake
    - PolyMet Mining discharges from Mine Site and long-term discharges from closed pit and stockpiles
    - Potential future discharge from Mesabi Nugget facility
    - Proposed Cliffs Erie Railroad Pellet Transfer Facility construction and operation
    - Any reasonably foreseeable changes to timber harvest activities on SNF, state and county lands and private lands
    - Changes in runoff quality due to future development of City of Hoyt Lakes
    - Implementation of Regional Mercury TMDL
    - Any reasonably foreseeable changes to discharges from Hoyt Lakes POTW due to development and/or treatment system changes

Minnesota water quality standards were promulgated to protect human health and aquatic life. The threshold for this cumulative impacts assessment will be Minnesota's chronic aquatic toxicity-based standards applicable to the respective waters being evaluated and the Class I drinking water standards that are applicable to Colby Lake as a drinking water source for the City of Hoyt Lakes. The future conditions scenarios will be completed for both operation and post-closure conditions, assuming that all other reasonably foreseeable actions have been completed.

Data Needs for Analysis of Cumulative Impacts

- Estimates of current and future hydrologic loadings from subwatersheds (see previous cumulative impacts discussion for flow)
- Water quality monitoring data for Embarrass and Partridge Rivers and Colby Lake
- Any reasonably foreseeable changes to discharges from Hoyt Lakes and Babbitt POTW's due to development and/or treatment system changes
- Estimate of reasonable scenarios of area and frequency of future timber harvests within the Partridge River and Embarrass River watersheds.
- Current discharge monitoring data for the Northshore Mining Company facilities and any reasonably foreseeable changes in discharges
- Data on past and existing Cliffs Erie tailings basin seepage and pit and plant discharges,
- PolyMet Mine Site discharges, including post-closure discharges
- Potential future discharges and appropriations at Mesabi Nugget facility

- Historic air photos or GIS coverages showing modification of land use (including wetland loss) by past mining practices within the Partridge and Embarrass River watersheds
- Data on typical present and future timber harvest activities of SNF, state and county lands and private lands
- Data on existing and potential future rural and residential development in Embarrass township
- Data on Embarrass Wetland Bank
- Data on existing Syl Laskin Energy Center discharges and possible future changes to these discharges
- Data on operation of Whitewater Reservoir
- Data on land use or other factors affecting existing or potential future runoff from the development of the City of Hoyt Lakes
- Typical timber harvest activities of SNF
- Changes in runoff quality due to future development of City of Hoyt Lakes
- Implementation of Regional Mercury TMDL
- Any reasonably foreseeable changes to discharges from Hoyt Lakes POTW due to development and/or treatment system changes

11. Economic Impacts

Background

Construction and operation of multiple industrial developments in the Arrowhead Region (Aitkin, Cook, Itasca, Koochiching, Lake, St. Louis and Carlton Counties) will create numerous jobs, increased tax revenues, and royalties to the state and private interests. The effects of the multiplication factor of jobs and the cash spent to operate such facilities would expand the demand for intermediate products. Thus, supplying firms output would increase and create additional jobs and tax revenue throughout the local and regional economy. Additional employees in various sectors of the economy would create demand for additional goods and services such as grocery stores, service stations and clothing stores that would also create an induced impact on the economy. In short, the construction and operation of multiple developments would generate direct, indirect and induced impacts to the local and regional economies. Therefore an assessment of the cumulative employment and economic effects of all proposed major projects will need to be performed as a part of each project’s individual EIS.

Scope

The EIS requirement for cumulative impact analysis requires that “reasonably foreseeable” future projects be included in the analysis. A proposed criterion for “reasonably foreseeable” is that any State agency has received a permit application from the project proposer or the project proposer has formally initiated the environmental review process. This criterion should be applied to the projects listed in the following sections at the time the EIS scope is defined.

The geographic scope for this cumulative employment and economic impact analysis is proposed to be St. Louis County, MN due to the location of principal proposed projects and the anticipated geographical extent of their effects. Additionally, accepted economic models exist for the County and, the communities in this area will provide goods and services to the projects and those employed by the projects.

Approach to Evaluation

A quantitative assessment of cumulative employment and economic effects will be performed. Background information on employment and the economy of St. Louis County and the East Range will be summarized:

- Historical population trends by county and major population centers since 1970*
- Historical employment trends by county since 1970*
- Historical tax revenue trends by county since 1970*
- Summary of historical economic activity (major industries, major sources of employment) by county since 1970*
- Summary of population, employment, tax revenue and economic activity in 2002 (the baseline year)

* *Approximate date. Actual historical data will be collected based on availability of primary sources and the economic/fiscal impact model used for the assessment.*

Impact analyses will be completed through input-output mathematical modeling to estimate employment impact, output impact and value added measures in terms of total (direct, indirect and induced) impacts for the construction period, operations period and closure period. Analyses will also assess impacts to State, Local and Federal taxes and royalties. All prices will correspond with the most recent data available.

Baseline conditions will be based on the economic activity reported in the most recent tax year available in the County/East Range. Cumulative impacts will be assessed by combining the baseline economic activity and projections of average annual employment (year by year) and estimated construction cost (year by year) for each of the following future (if they meet the criterion for “reasonably foreseeable”) and past actions:

- Proposed NorthMet Project (PolyMet Mining Inc.)
- Proposed Erie Nugget Project (Mesabi Nugget, LLC)
- Proposed Mesaba Energy Project (Excelsior Energy, Inc.)
- Proposed Cliffs-Erie Railroad Pellet Transfer project (Cliffs-Erie, LLC)
- Proposed Soudan Deep Underground Science and Engineering Laboratory (University of Minnesota)
- Proposed NOνA Off-Axis Detector (University of Minnesota)
- Proposed expansions of existing taconite plants
- Shutdown of LTVSMC

The analysis will report findings for a typical year in four discrete periods: baseline year, construction period, operating period and closure period. Findings will be reported as employment, output impact (dollars), value added impact (dollars) and tax impact (dollars).

Data Needs for Analysis of Cumulative Economic Impacts

Data will be collected with the assistance the East Range Joint Powers Board (ERJPB) and the University of Minnesota – Duluth. Working with Iron Range Resources (IRR), St. Louis County Planning Department, Minnesota Department of Employment and Economic Development (DEED), and the Arrowhead Regional Development Commission (ARDC), the consultant team will collect data from the Townships, Cities, St. Louis County, the State of Minnesota and other sources including the individual projects listed above. Data pertaining to the following will be collected, examined and used in the impact modeling process:

- Input – Output mathematical model (e.g., IMPLAN Professional)
- Economic activity data files (e.g., IMPLAN Data Files)
- Average annual employment (year by year) and estimated construction cost (year by year) for proposed projects (see above).

12. Social Impacts

Background

The proposed project and the resulting economic and employment impacts will have some cumulative effects on the social structure and fabric of the East Range communities. In addition to the impacts upon the infrastructure systems and community services than can result from increased employment and utility needs, there are several aspects to be considered, including changes to social systems, cultural activities, community organizations, building/facility requirements, expressions of community identity and the esthetic and cultural character of communities. Therefore an assessment and characterization will need to be performed of the existing state of these aspects of the environment, forecasting how they may change if the foreseeable actions are implemented, and developing means of mitigating changes that are likely to be adverse from the point of view of the affected East Range population.

Scope

The EIS requirement for cumulative impact analysis requires that "reasonably foreseeable" future projects be included in the analysis. A proposed criterion for "reasonably foreseeable" is that any State agency has received a permit application from the project proposer or the project proposer has formally initiated the environmental review process. This criterion should be applied to the projects listed in the following sections at the time the EIS scope is defined.

St. Louis County (specifically the municipalities of Aurora, Babbitt, Biwabik, Cook, Ely, Hoyt Lakes, Mountain Iron, Orr, Soudan, Tower and Virginia as well as the surrounding cities and towns) is proposed to be the geographic scope for the cumulative social impact assessment because this area will see the most dramatic change in population and infrastructure needs due to the influx of construction and full time workers for the projects.

Approach to Evaluation

A qualitative assessment of cumulative social structure effects will be performed. Background information on social structure of the East Range will be summarized:

- Summary of 2002 (or latest available data year) population characteristics including: structure by age, sex, family size, ethnicity, income, type of employment (including unemployed)
- Summary of 2002 (or latest available data year) community structure for project area cities and towns, including: size of government organizations (cities, townships and counties); participation in voluntary associations (description of groups and linkage to national organizations, if any); and inequities (economic, social or cultural) among community groups.
- Summary of 2002 (or latest available data year) housing availability and community services in major communities, including: police protection, health care, elderly care, schools, libraries, retail centers, recreational facilities, gathering places, computer access facilities.

Impact analysis will be completed through trend analyses:

- Trend analysis of population characteristics (structure by age, sex, family size, ethnicity, income, type of employment - including unemployed).
- Trend analysis of change in community structure: size of government organization (cities, townships and counties); participation in voluntary associations (description of groups and linkage to national organizations, if any); and inequities (economic, social or cultural) among community groups.
- Trend analysis of projected changes in availability of housing and community services including: police protection, health care, elderly care, schools, libraries, retail centers, recreational facilities, gathering places, computer access facilities
- Assessment of stakeholder perception toward proposed projects as related to perceived changes in quality-of-life issues such as: health, safety, security (personal and economic), political power, family stability, use of the natural environment, environmental quality, displacement or relocation, and trust in political and social institutions (intended to gauge community and stakeholder consensus on the cumulative effects of proposed projects on their shared vision for the future of the East Range).

Baseline conditions will be based on the social structure of the East Range in 2002. Cumulative impacts will be assessed by combining the baseline social structure and projections of change related to the following future (if they meet the criterion for “reasonable foreseeable”) and past actions:

- Proposed NorthMet Project (PolyMet Mining Inc.)
- Proposed Erie Nugget Project (Mesabi Nugget, LLC)
- Proposed Mesaba Energy Project (Excelsior Energy, Inc.)
- Proposed Cliffs-Erie Railroad Pellet Transfer project (Cliffs-Erie, LLC)
- Proposed Soudan Deep Underground Science and Engineering Laboratory (University of Minnesota)

- Proposed NOvA Off-Axis Detector (University of Minnesota)
- Proposed expansions of existing taconite plants
- Shutdown of LTVSMC

The analysis will report findings for a typical year in four discrete periods: baseline year, construction period, operating period and closure period. Findings will be reported as projected changes in population characteristics, community structure, public attitudes, and availability of housing and community services.

Data Needs for Analysis of Cumulative Impacts

Data will be collected with the assistance the East Range Joint Powers Board (ERJPB). Working with Iron Range Resources (IRR), St. Louis County Planning Department, Minnesota Department of Employment and Economic Development (DEED), and the Arrowhead Regional Development Commission (ARDC), the consultant team will collect data from the Townships, Cities, St. Louis County, the State of Minnesota and other sources, including the results of the IMPLAN modeling process. Data pertaining to the following will be collected, examined and used as the basis for the cumulative social impact assessment process:

- Population data by county as provided by DEED or similar database.
- Population change projections derived from projected employment changes.
- Projected change in government organization structure as determined by respective government units.
- Projected change in participation in voluntary organizations as determined by respective organizations.
- Description of inequities among community groups as determined by group representatives (responsive government units and responsive voluntary organizations as suggested by government units).
- Projected changes in housing availability as determined by economic input-output analysis.
- Projected changes in availability of community services resulting from projected population changes. Change in availability will be determined by responsible governmental units, school districts, care facilities, local Chamber of Commerce, and DEED, as appropriate.
- Identification and definition of stakeholders

30. Other potential environmental impacts. If the project may cause any adverse environmental impacts not addressed by items 1 to 28, identify and discuss them here, along with any proposed mitigation.

There are two areas of potential impacts that need to be identified that were not addressed elsewhere in this EAW.

- Potential for encountering asbestiform fibers in the NorthMet Deposit
- Mineland Reclamation

These issues will be addressed separately in this section.

Potential of Asbestiform Fibers

Asbestiform fibers have been linked to rare type of lung cancer called mesothelioma. There is some uncertainty in the public health community about whether the type of the fibers present in the Peter Mitchell Mine (Northshore Mining Company operation) have the same health effect as the fibers that come from exposure to commercial asbestos. There is also a concern about the impact of asbestiform fibers in drinking water. However, the ore to be mined from the NorthMet deposit is different from the ore obtained from the Peter Mitchell Mine and needs to be evaluated for the potential for asbestiform fibers.

Analysis of representative samples of the NorthMet deposit and the Duluth Complex show that the ore body is typically dominated by crystalline silicate minerals – calcic plagioclase feldspar, pyroxene, olivine, biotite, chlorite, serpentine and amphibole. Plagioclase feldspar (the predominant mineral accounting for approximately 55-60 percent of the ore body) is not known to be carcinogenic. Previous work has shown that some of these minerals split into cleavage fragments that meet the minimum definition of a fiber which is a length to width raito of 3:1. This deposit contains only minor amounts of amphibole minerals – the minerals most likely to produce long thin fibers similar to those associated with commercial asbestos.

A characteristic of non-asbestiform crystalline habits is that when pressure is applied to the crystal, the crystal fractures, forming crystals or cleavage fragments of the acicular variety. Cleavage refers to the preferential breakage of crystals along certain planes of structural weakness. Such planes of weakness are called cleavage planes. A mineral with distinct cleavage planes will preferentially fracture along these planes and will produce acicular fragments. Acicular crystals are long and needle like but are thicker than the fibrous variety. The strength and flexibility of cleavage fragments are approximately the same as those of single crystals. Cleavage fragments do not have the strength, flexibility, or other properties of asbestiform fibers.

The rod mill feed and scavenger tail samples collected during initial pilot plant testing, using ore from the NorthMet deposit, were subjected to a separate analysis to determine the presence of asbestos. The corresponding mineralogical evaluation of the rod mill feed and scavenger tail samples collected from pilot plant testing, using ore from the NorthMet deposit, showed that both samples were dominated by crystalline silicate minerals – calcic plagioclase feldspar, pyroxene, olivine, biotite, chlorite, serpentine (scavenger tail only), and amphibole – with only minor amounts of sulfides (primarily pyrrhotite and cubanite) and trace amounts of carbonate minerals. Plagioclase feldspar, the major mineral occurring in the ore body, has not been shown to be carcinogenic. Amphibole minerals present in any ore body can occur in an asbestiform or non-asbestiform habit. McMaster University Occupational and Environmental Health Laboratory reported that no asbestos was identified in samples collected during the initial pilot plant testing. However, tailings samples will be collected and analyzed during the processing tests conducted in 2005. This information will be available for use in the EIS.

PolyMet proposes to limit any potential for exposure to asbestiform fibers by controlling emissions from process steps that are likely to produce particulate emissions. A description of these process steps follows:

- Primary crushing: particle emissions controlled by fabric filters (99%+ control efficiency).
- Secondary crushing: particle emissions from the pan feeders are currently controlled by Type W rotoclones (conservatively assuming 97% control efficiency for emission calculation purposes; vendor information indicates 98.8% control efficiency).
- Ore storage: emissions from the coarse ore storage bin are controlled by 2 Type W rotoclones and 2 fabric filters (assumed average control efficiency of 98% for emission calculation purposes).
- Tertiary and quaternary crushing; feeders, conveyors, transfer points: particle emissions currently controlled by Type W rotoclones (97% control efficiency for emission calculation purposes).
- Fine Ore Storage: Particle emissions from the North and South bins are currently controlled by Type W rotoclones (97% control efficiency for emission calculation purposes).
- Fine ore feeders (feed ore to the milling lines): particle emissions currently controlled by Type W rotoclones (97% control efficiency for emission calculation purposes).
- Each autoclave and flash vessel is planned to have a dedicated venturi-type scrubber to remove entrained particulate matter and acid gases; raw water is to be used as the scrubbing liquor.
- Steam condensation in a heat exchanger, which is expected to remove additional particulate and acid gases.
- Remaining gases routed to the main scrubber, which will be of venturi design, also with water as the scrubbing liquor.

Proposed Treatment of Topic in EIS:
Although mesothelioma is an important issue, the low probability of encountering asbestiform fibers in the NorthMet deposit will limit the need for detailed analysis of the

issue in the EIS. Additional testing for asbestiform fibers is proposed to occur as part of the Pilot Plant Processing study, and the results of these tests will be included in the EIS. If the results of these tests are consistent with current understanding of the NorthMet deposit, no additional analysis or mitigation will be developed. Existing information about the cleavage fragments crystals related to risk of mesothelioma will be reviewed and summarized in the EIS.

Mineland Reclamation

The goal statement from Minnesota Rules Chapter 6132.3200 Closure and Postclosure Maintenance is, "The mining area shall be closed so that it is stable, free of hazards, minimizes hydrologic impacts, minimizes the release of substances that adversely impact other natural resources, and is maintenance free". There are three components to PolyMet's proposal that require careful consideration for successful mineland reclamation. These components are the mine pit itself, waste rock stockpiles, and the tailings basin. The following discussion identifies some of the closure issues with each of these components.

Mine pit- The size and shape of the mine pit would be dependent on the location of ore and economic factors. PolyMet as part of the Definitive Feasibility study is evaluating the ultimate depth and configuration of the mine pit. A current estimate on pit size is approximately 600 acres and the depth is approximately 900 feet deep. These estimates are subject to change as the ore body is better defined. Significant issues that must be addressed as part of reclamation planning are refilling of pit, pit outflow, water quality of pit, and potential for construction of littoral zones to enhance productivity.

Waste rock and lean ore stockpiles- The size, location, design, and composition of waste rock and lean ore_stockpiles will be critical to developing a reclamation plan that is protective of the environment while minimizing long term maintenance costs. As discussed earlier the determination of non-reactive waste rock versus reactive waste rock will be an important outcome of the waste characterization study. The design of reactive waste rock stockpiles is also significant as it will need to balance the need for protection of water quality with the desire to prevent long-term maintenance costs. Large lined reactive waste rock stockpiles that generate significant water treatment demands are not likely to achieve this balance. Minnesota rules require that appropriate methods for stockpiles containing reactive mine waste, are either to 1. modify the physical or chemical characteristics of the mine waste, or store it in an environment, such that the waste is no longer reactive, or 2. during construction to the extent practicable, an at closure, permanently prevent substantially all water from moving through or over the mine waste and provide for the collection and disposal of any remaining residual waters that drain from the mine waste in compliance with federal and state standards.

Tailings basin- As described in EAW Question 20, the characterization of the flotation tailings will be critical to determining a suitable design and reclamation for the basin. Potential wastewater treatment of seeps and pond overflow will need to be addressed.

Vegetation and eventual land use of project components will also be important considerations in mine planning. Although the time frame for mining is 20 years and additional time will be needed for reclamation there is potential to reclaim the site such that many impacts from the previous disturbance can be mitigated.

Watershed restoration-

To the extent practicable, all lands disturbed by mining will be reintegrated into their original watersheds. Pre-mining flows and water balance will be reestablished to minimize impacts on the watershed and down stream users.

Proposed Treatment of Topic in EIS:

The EIS will evaluate the proposal with consideration for compliance with DNR rules for mineland reclamation. Minnesota Rules for nonferrous metallic metal mining (Chapter 6132) describe the DNR's policy for nonferrous mines, "…that mining be conducted in a manner that will reduce impacts to the extent practicable, mitigate unavoidable impacts, and ensure that the mining area is left in a condition that protects natural resources and minimizes to the extent practicable the need for maintenance." Alternative designs, layouts, and siting will also be evaluated to determine the most feasible reclamation strategy. The three criteria that will be used in this evaluation will be protection of natural resources, minimization of long-term maintenance, and eventual land use objectives.

As part of the permit to mine, a detailed financial assurance analysis will be conducted. This will include final closure and will also address premature shut down. An evaluation of reclamation costs and its effect on facility design, construction and closure will be discussed in the EIS.