Appendix 14

Reclamation, Closure, and Postclosure Maintenance Plan

POLYMET MINING

NorthMet Project
Reclamation, Closure, and Postclosure Maintenance Plan

November 2017

Contents

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Acronyms, Abbreviations and Units

Acronym, Abbreviation or Unit	Stands For
ACM	asbestos-containing materials
AOCs	Areas of Potential Concern
cfs	cubic feet per second
Cliffs Erie	Cliffs Erie, L.L.C.
CPS	Central Pumping Station
DNR	Minnesota Department of Natural Resources
GCL	geosynthetic clay liner
kV	kilovolt
LTVSMC	LTV Steel Mining Company
MDH	Minnesota Department of Health
MPCA	Minnesota Pollution Control Agency
MPP	Mine to Plant Pipelines
MSFMF	Mine Site Fueling and Maintenance Facility
msl	mean sea level
NRC	Nuclear Regulatory Commission
OSLA	Overburden Storage and Laydown Area
OSP	Ore Surge Pile
PCB	polychlorinated biphenyl
Plan	Reclamation, Closure, and Postclosure Maintenance Plan
PolyMet	Poly Met Mining, Inc.
Project	NorthMet Project
PTM	Permit to Mine
RO	reverse osmosis
RTH	Rail Transfer Hopper
VIC	Voluntary Inspection and Cleanup
VSEP	Vibratory Shear Enhanced Process
WWTS	Wastewater Treatment System

1.0 Introduction

This Reclamation, Closure, and Postclosure Maintenance Plan (Plan) for the NorthMet Project (Project) describes how Poly Met Mining, Inc. (PolyMet) will comply with the Permit to Mine (PTM) Regulations with respect to the requirements after mine operations end. In particular, this Plan addresses the reclamation standards and requirements of Minnesota Rules, parts 6132.1000 - 6132.3200. The various phases after the operations phase ends are defined in Minnesota Rules, part 6132.0100 as the "closure" and "postclosure maintenance" phases. Closure is defined in Minnesota Rules, part 6132.0100 as beginning "when, as prescribed in the permit to mine, there will be no renewed use or activity by the permittee." Therefore, for the purpose of the PTM Application (Application), PolyMet refers to the interim phase between operation and closure referred to as the "reclamation phase," where any remaining activities required to clean up the Mining Area will be accomplished prior to the start of closure (Section 15.3.1 of the Application). This term is used for simplicity and clarification in the Application, and is not to address the reclamation definition in Minnesota Rules, part 6132.0100.

Project phases discussed in this Plan are defined as follows:

- Construction – the approximately 18-24-month construction phase prior to Mine Year 1. This phase will include preparation and reclamation activities of areas disturbed by construction, and some of these activities will include temporary reclamation.

- Operations – the approximately 20-year phase of mining and production, from Mine Year 1 through Mine Year 20. It will begin when PolyMet starts production blasting and end when PolyMet stops mining and mineral processing. PolyMet will undertake progressive reclamation activities during operations, as appropriate.

- Reclamation – the approximately 4-year period of reclamation after operations ends, from approximately Mine Year 21 through Mine Year 24. It will end when structures not needed during closure and postclosure maintenance are demolished, footprints are reclaimed, and a barrier system is established around the perimeters of the mine pits.

- Closure – the period of time it takes to flood the West Pit, estimated to be from Mine Year 25 through Mine Year 54. It will end when the West Pit is fully flooded.

- Postclosure maintenance – the period after West Pit flooding is completed, estimated to begin in Mine Year 55. The postclosure maintenance phase is when treated water discharge will begin from the Wastewater Treatment System (WWTS) to an unnamed creek downstream of the future West Pit overflow. It will continue as long as necessary until then-applicable water quality standards can be met through non-mechanical treatment.

See Section 3.2 of the Application for additional description of Project phases. Figure 3-9 of the Application presents the overall anticipated schedule for the reclamation, closure, and postclosure maintenance phases. This figure also contains a summary of activities within each of these three periods. The activities described in this Plan are those that are scheduled to be completed during the reclamation,

closure, and postclosure maintenance phases, as defined above. Reclamation activities that are performed prior to the reclamation phase (defined as progressive reclamation) are described as part of the operations phase activities in Sections 3 and 7 through 10 of the Application. Figure 15-1 and Figure 15-2 of the Application show the Mine Site and Plant Site conditions, respectively, after closure.

This Plan may be periodically updated. After permits are issued, this plan may be updated to reflect the terms of the Permit to Mine, the individual NPDES/SDS Permit, the general NPDES/SDS stormwater permits, the Water Appropriation Permits, the Air Permit, and the Dam Safety Permits. A Revision History is included at the end of the Plan. Contingency reclamation plans and cost estimates needed for financial assurance are outside the scope of this Plan and are discussed as part in Section 16 and Appendix 15 of the Application.

1.1 Objective

The overall objective of the Plan is, consistent with the requirements of PTM Regulations and good mining practices, for the Mining Area to meet various criteria when it (or any portion of it) is shut down and no renewed use or activity will occur. These criteria include the following:

- the closed Mining Area or portion is safe, secure, and free of hazards
- it is in an environmentally stable condition
- it minimizes hydrologic impacts and the release of hazardous substances that adversely affect natural resources; and it is maintenance free

In addition to meeting the foregoing criteria, PolyMet's planned reclamation, closure, and postclosure maintenance work is intended to allow restoration of the Mining Area so as to encourage planning of future land utilization and to facilitate implementation of such future plans as contemplated by the PTM Regulations.

In general, under the Plan, PolyMet will reclaim areas within the Mining Area as soon as practical while the Project is in operation. In addition to such progressive reclamation, PolyMet will evaluate conditions within the Mining Area at the end of operations. Thereafter, PolyMet will implement the Plan with respect to areas in the Mining Area not previously reclaimed, including demolishing buildings and structures, reclaiming and vegetating the sites on which such facilities were located, completing any necessary remediation in compliance with applicable statutes and regulations, and implementing other necessary reclamation, closure, and postclosure maintenance practices to satisfy the standards and requirements of Minnesota law, including the pertinent reclamation standards set forth in Minnesota Rules, parts 6132.0200 - 6132.3200.

PolyMet's closure and postclosure maintenance activities will continue until standards of Minnesota Rules, part 6132.3200 have been met, including requirements that the closed Mining Area is stable, and free of hazards, and that hydrologic impacts and any releases of substances that adversely impact other natural resources have been minimized. As required by Minnesota Rules, part 6132.4800, postclosure maintenance will continue until the necessity for maintenance ceases, at which time Minnesota Department of Natural Resources (DNR) may issue release of the permittee once the requirements in Minnesota Rules, parts 6132.0100 to 6132.5300 have been satisfied.

1.2 Variances

Minnesota Rules, part 6132.4100 provide for variances from the requirements of PTM Regulations permittee and approved by the DNR Commissioner. PolyMet is submitting two variance requests as part of this Application. Details on each of these variances is provided below. Requested variances include:

- a request to leave in place the Colby Lake Pipeline and Pumphouse
- a request to leave in place the Plant Site utility tunnels

1.2.1 Colby Lake Pipeline and Pumphouse

Minnesota Rules, part 6132.3200, subpart 2, item E(4) requires that permittee-owned pipelines be removed or provisions made for continued subsequent use. The Colby Lake Pipeline is legacy regional infrastructure intended for use by third parties after closure. PolyMet requests a variance to allow the Colby Lake Pipeline and Pumphouse to remain in-place rather than being removed after the operations phase.

The Colby Lake Pipeline was installed in the mid-1950s and was originally used to provide water to the LTV Steel Mining Company (LTVSMC) plant facility. The pipeline is 5.5 miles in length, three feet in diameter, and ranges from 7 to 25 feet below ground along its alignment. Due to the nature of this infrastructure, PolyMet may have future contracts with place with third parties for future use of this infrastructure. If this is the case during reclamation, PolyMet will apply for provisions to be made for continued subsequent use through the DNR. If this is not the case upon completion of PolyMet's operations phase, the pipeline will be sealed and left in-place along with the Colby Lake Pumphouse.

Leaving the Colby Lake Pipeline and Pumphouse in-place protects the potential future use of the pipeline (including any rights of third parties for such future use). The land that the pipeline is buried within has multiple owners (as shown on Figure 1-5 of the Application and the tables in Appendix 1-11 of the Application), as such, the removal of or abandonment of the pipeline will require approval from all owners. Minerals are not encumbered by the three-foot diameter pipe which could be moved or removed should mining take place along its alignment. Decommissioning options will be evaluated in Mine Year 20 pending developments related to continued future use.

A variance to leave the Colby Lake Pipeline and Pumphouse in-place is equivalent or superior to its removal. As shown on Figure 9-5 of the Application, the Colby Lake Pipeline alignment lies beneath Second Creek, which is a listed public water starting at the pipeline crossing. The pipeline is approximately 20 feet below this creek. Additionally, as shown on Large Figure 5-32 of the Application, the pipeline runs between two former taconite pits, Pit 2Wx and Pit 2W, which have since filled with water, and is bordered by a large stockpile over a mile long along the southern portion of the pipeline. These mining developments have all occurred after construction of the Colby Lake Pipeline and create significant geotechnical concerns with respect to evaluation and subsequent removal of this pipeline. The listing of Second Creek as a public water also happened after the pipeline was already in place, and the removal of the pipeline, located approximately 20 feet below the creek, has potential to cause hydrologic impacts to the stream, which could require the reconstruction of a long length of stream. Also, the City of Hoyt Lakes has created a Conservation District along the south end of the pipeline since its construction.

Removal of the pipeline in this area could negatively affect the restrictions associated with these municipal land use requirements.

For the foregoing reasons, PolyMet is requesting a variance so that it may leave in-place the Colby Lake Pipeline and Pumphouse. A plan for decommissioning and, if necessary, permanent closure of these facilities will be submitted to the DNR in Mine Year 20.

1.2.2 Plant Site Utility Tunnels

Minnesota Rules, part 6132.3200, subpart 2, item E(4)(c) requires that equipment, facilities, and structures be removed and the foundation razed and covered with a minimum of two feet of overburden "within three years after closure begins, or within a longer period if approved by the commissioner." PolyMet plans to remove all of the equipment within the Plant Site utility tunnels, including the electrical lines and conduits, water lines, and sanitary lines; however, PolyMet is requesting a variance to leave the concrete tunnels themselves in-place after the operations phase.

The tunnels are open spaces that were blasted into the bedrock, then reinforced with poured concrete, during the mid-1950s for placement of utility lines throughout the former LTVSMC plant. They are approximately 2 miles in length, 20 feet tall, and vary from 20 to 40 feet wide. The tunnels were left in-place as part of LTVSMC's approved ferrous mine closure and the current closure plan of Cliffs Erie, L.L.C. (Cliffs Erie) under its ferrous permit to mine.

The location of the tunnels are shown on the original excavation plans (Erie Mining Company Drawing TJ-63 provided in Attachment 1). PolyMet is the owner of the tunnels, as shown on Figure 1-5 of the Application and the tables in Appendix 1-11 of the Application. Using Figure 5-18 of the Application as the basis for the groundwater elevations, it appears that the bottom of the tunnels are located well above groundwater (estimated to be 55 to 160 feet above groundwater). The tunnels are stable, concrete-reinforced void spaces within the bedrock underlying the existing plant facilities. The tunnels cannot be removed, per se, because they are open spaces. Collapsing or filling the tunnels would require a significant amount of material that would result in little to no change to the safety or appearance of the reclaimed Plant Site.

A variance to leave the Plant Site utility tunnels in-place is equivalent or superior to collapsing or filling the tunnels. The tunnels are stable void spaces in the bedrock. Granting a variance will avoid blasting activities that would be necessary to collapse the tunnels and/or the costs and environmental effects associated with excavation of significant quantities of borrow materials, transportation, and placement of the materials within the tunnels. Therefore, strict compliance with the rule to remove these structures will impose an undue burden on the applicant without providing a clear environmental benefit or benefit to public welfare.

2.0 Mine Site Reclamation, Closure, and Postclosure Maintenance

Mine Site facilities discussed in this section are described in Sections 3, 7, 10, and 11 of the Application, and depicted on Figure 7-1 of the Application. Phases discussed in this section include reclamation (Section 2.1), closure (Section 2.2), and postclosure maintenance (Section 2.3).

2.1 Reclamation

Upon completion of mining operations in the West Pit, reclamation activities will take place at the Mine Site in accordance with Minnesota Rules, part 6132.3200.

2.1.1 Structure Demolition and Reclamation

Demolition and reclamation of the equipment, machinery, and structures associated the Mine Site Fueling and Maintenance Facility (MSFMF) and Rail Transfer Hopper (RTH) (combined, approximately 7 acres in size) will occur during the second year of the reclamation phase. There are approximately 65 acres of parking lots and roads that will be reclaimed at the Mine Site. If used at the Mine Site, asphalt from paved parking lots and roads will be removed and recycled. After demolition of Mine Site buildings, two feet of overburden material suitable for vegetation will be placed over the former building footprints. Building areas and parking lots not needed during the closure or postclosure maintenance phases will be reclaimed and vegetated according to Minnesota Rules, part 6132.2700. Seeding and mulching will be based on PolyMet's Reclamation Seeding and Mulching Procedure (Attachment 2).

The RTH, which is described in Section 7.4.2.1 of the Application, will be reclaimed. Equipment will be removed from the RTH, and its rock platform will be covered with at least two feet of unsaturated overburden and revegetated. Sediment from the ditches and the RTH mine water pond will be placed in the East Pit. Any ore remaining in the RTH, the Ore Surge Pile (OSP), or along the Railroad Spur between the RTH and the OSP will be processed in the Plant prior to the start of the reclamation phase or placed in the East Pit.

The rail bed in the vicinity of the RTH will also be covered with at least two feet of unsaturated overburden and vegetated according to Minnesota Rules, part 6132.2700 and part 6132.3200. The railroad track and ties for the Railroad Spur will be removed and recycled or properly disposed. Any areas where locomotives may have remained stationary for extended periods will be inspected for potential petroleum product release, and if necessary, remediation measures will be initiated.

Other Mine Site infrastructure, including culverts and powerlines, will also be removed and reclaimed during the reclamation phase. Culverts will be removed from reclaimed roads and railroads to prevent potential flow obstruction due to clogged or dammed culverts and to minimize impediments to access and movement in the stream by aquatic life. Any culverts requiring removal will be replaced with channels; culvert locations will be graded and vegetated to provide a stable stream bank approximating a natural channel and floodplain configuration. Any potential for channel erosion during vegetation stabilization

will be controlled with appropriate best management practices (e.g. measures such as installation of wattles, excelsior blankets (wood wool), filter fabric, riprap).

Permittee-owned power lines (poles, pole hardware, and conductors) and substations will be removed and recycled. Foundations and anchors will be removed or demolished and covered with at least two feet of unsaturated overburden and revegetated. The permittee-owned 7.20 kV (kilovolt) distribution power lines at the Mine Site will be removed during reclamation. Power lines that will remain through the closure and postclosure maintenance phases include the 13.8 kV lines from the Plant Site to the Mine Site and the 4.16 kV distribution lines at the Mine Site. Prior to release from the PTM, these remaining lines will also be removed as described in this paragraph.

Because the Central Pumping Station (CPS) will operate during the closure phase and potentially in the postclosure maintenance phase, demolition will be deferred until the DNR and Minnesota Pollution Control Agency (MPCA) determine that mechanical treatment is no longer needed. Approximately 24 acres of roads will be required to remain into postclosure maintenance for monitoring and maintenance activities, although this 24 acres only accounts for a 15-foot-wide corridor along the haul roads for access by small vehicles.

2.1.2 Temporary Stockpiles and Haul Roads Reclamation

Any excess material remaining in the OSP once the reclamation phase begins will be disposed of in the East Pit. Similar to the temporary stockpiles, the liner, piping, pumps, and sump and pond liners will first be removed and properly recycled or disposed at a permitted solid waste facility. The footprint of the OSP will be reclaimed by creating wetlands where possible. Portions of the footprint that cannot be converted into wetlands will be reclaimed by regrading, as necessary, scarifying the surface, or placing an unsaturated overburden cover, followed by seeding.

By the time the flooding of the West Pit begins in Mine Year 21, the Overburden Storage and Laydown Area (OSLA) will no longer be in operation. The majority of the material stored at the OSLA is expected to be reused for reclamation activities at the Mine Site. During the reclamation phase, the OSLA (approximately 41 acres total, including the area of Pond MW-OSLA) and any remaining overburden stockpiles will be reclaimed. Reclamation activities include sloping, benching as needed, and vegetation. Approximately 11 acres of wetlands will be impacted during construction of the OSLA. Where possible, wetlands will be created in these areas during the reclamation phase. For portions of the footprint that cannot be converted into a wetland, the surface will be scarified or an unsaturated overburden cover placed, followed by seeding.

Approximately 65 acres of haul roads are not necessary for access during the closure and postclosure maintenance phases. These roads will be reclaimed and vegetated within three years after the reclamation phase begins, in accordance with Minnesota Rules, part 6132.2700. Seeding and mulching will be based on PolyMet's Reclamation Seeding and Mulching Procedure.

Refer to Section 7.5.6 of the Application for a description of the reclamation activities at the temporary Category 2/3 and 4 Waste Rock Stockpiles and construction of the Category 1 Waste Rock Stockpile Cover System. The Category 4 Waste Rock Stockpile will be completely reclaimed during Project

operations. The reclamation activities at the Category 2/3 Stockpile and the construction of the Category 1 Stockpile Cover System will begin during Project operations and will be completed in the reclamation phase. Reclamation activities that occur during the reclamation phase at the Category 2/3 Waste Rock Stockpile will include removal of piping, pump systems, and liner systems from the temporary stockpile foundations and the associated sumps and ponds and properly recycled or disposed at a permitted solid waste facility. The footprint of the Category 2/3 Waste Rock Stockpile will then be scarified, or covered with unsaturated overburden, followed by seeding.

Reclamation activities that occur during the reclamation phase at the Category 1 Waste Rock Stockpile will include final construction of the Category 1 Stockpile Cover System, discussed as part of progressive reclamation in Section 10.4.5.4 of the Application.

2.1.3 Mine Pit Reclamation

Progressive reclamation of the mine pits, which will occur during the operations phase, includes backfilling of the East and Central Pits with material from the temporary Categories 2/3 and 4 Waste Rock Stockpiles and waste rock from the Central Pit and West Pit and flooding of the combined East/Central Pit. These activities are described in Section 10.4.6.4 of the Application. During operations, the East Pit and the Central Pit will be combined into one; therefore, these combined pits are referred to as the East Pit in this Plan unless otherwise noted.

Tasks that began during Project operations, when appropriate, to be completed in the reclamation phase will include:

- removal of select dewatering systems and in-pit power lines
- installation of a pit perimeter barrier, which may include fencing, rock barricades, ditches, and berms
- providing access to the pit bottom
- construction of an outlet control structure between the East Pit and the West Pit
- final backfilling of the East Pit, including remaining material from the OSP or in the mine water sumps and ponds, as needed
- water management, including flooding of the West Pit and treatment of the East Pit water to remove constituent load from backfilled waste rock

All power lines, substations, pumps, hoses, pipes, and appurtenances specifically used for dewatering the mine pits will be removed and recycled or properly disposed at a permitted solid waste facility. The pits will be allowed to flood with water. Some temporary pumps may remain in the mine pits for selected dewatering that will be necessary during reclamation. The water pipes between the WWTS and the East Pit will remain in place to cycle East Pit water through the WWTS, and the water pipes between the WWTS and West Pit will remain in place to convey treated water as needed to assist with flooding of the West Pit.

A pit perimeter barrier system will be installed in consultation with the St. Louis County Mine Inspector, as per Minnesota Statutes, Chapter 180. The system may consist of fences, rock barricades, ditches, and

berms. Fencing will consist of barbed wire in most locations, but when roads will remain adjacent to the fences, non-climbable mesh fencing will be installed.

Safe access to the bottom of each mine pit, as required by Minnesota Rules, part 6132.3200, subpart 2E(2)(a), will be provided by selected haul roads (i.e., pit ramps) built during pit development and mine operation. A gated entrance will be placed at each of the pit access locations.

A channel will be excavated from the southwest corner of the East Pit to the northeast corner of the West Pit to control overflows from the East Pit during the reclamation phase and for water management during the closure and postclosure maintenance phases. The overflow for the East Pit will be set at elevation 1,592 feet-msl to provide an adequate buffer between this overflow and the estimated natural overflow elevation of 1,594 feet-msl in the southeast corner of the pit. The annual average overflow from the East Pit to the West Pit will vary depending on the sources used to flood the pits with water. The outlet structure was designed for the expected peak overflow rate of 187 cubic feet per second (cfs), based on removal of 10% of the runoff from a 100-year, 24-hour rainfall event (5.2 inches of precipitation) within one hour. This is a conservative estimate based on total runoff volume and does not consider the potential reductions in peak flow due to the specific characteristics of the East Pit watershed.

The East Pit outlet structure will be formed out of bedrock or a reinforced concrete weir; the invert of the outlet will be set at the East Pit overflow elevation (1,592 feet-msl). An approximately 425-foot-long channel will connect the East Pit overflow to the West Pit. The channel has been conceptually designed to have a 6-foot-wide bottom with side slopes of 3H:1V. The final design details of the channel and the locations of the intake and discharge within each pit will be determined prior to the end of the operations phase.

During the reclamation phase, water from the East Pit will be cycled through the WWTS to remove oxidation products from the pit walls and backfilled waste rock. In general, East Pit water levels will be kept below the overflow elevation during cycling of water through the WWTS; however, periodic flow from the East Pit to the West Pit may occur during snowmelt in the reclamation phase. In the reclamation phase, the West Pit will begin to flood naturally with water from groundwater inflows, precipitation, and stormwater runoff from the tributary watershed. The flooding process will be augmented with the addition of water from the FTB seepage capture systems and WWTS. The West Pit water level will be kept below the estimated natural overflow elevation of 1579’ above mean sea level during filling. Water resource effects from the Project were assessed in Section 5.2.2 of the Final Environmental Impact Statement (Appendix 16.1).

The rock units in the pits are illustrated on Figures 5-1 through 5-3 of the Application. Rock units above the overflows will remain exposed after flooding.

2.1.4 Water Management Infrastructure Reclamation

Reclamation tasks related to the water management infrastructure during the reclamation phase will include:

- filling and rerouting of ditches

- removal of select pit rim berms
- restoration of mine water and stormwater sedimentation ponds
- select pump and pipe removal

The goal of the reclamation activities relating to water management infrastructure is to establish vegetation per Minnesota Rules, part 6132.2700 and to reintegrate the areas into the natural watershed per Minnesota Rules, part 6132.3200, subpart 2E(5).

During the reclamation phase, stormwater runoff within the Mine Site will be routed to the mine pits using a combination of existing and new ditches. Ditches will be maintained to direct stormwater into the pits for flooding. Use of ditches that already exist in Mine Year 20 will be maximized, but a few new ditches may need to be constructed to direct stormwater runoff into the East or West Pits during the reclamation phase. Reclamation activities at the ditches will include either installing ditch blocks or filling, covering with unsaturated overburden, and vegetating the surface.

The perimeter dikes located north of the Central and East Pits will be maintained in order to minimize mixing of Partridge River flows with the East Pit water (details are provided on Drawing SW-007 in Appendix 5 of the Application). Perimeter dikes located on the north side of the Category 1 Waste Rock Stockpile and along the west boundary of the Mine Site will be maintained to provide access to groundwater monitoring locations located in those areas.

Pit exclusion dikes (constructed at the top of the sloped overburden portion of the pit walls) and pit rim berms (constructed at the top of rock portion of the pit wall) will remain, as needed, to prevent inflow to the mine pits and potential erosion of the pits walls (details are provided on Drawing EW-008 in Appendix 3 of the Application). In some locations, the pit exclusion dikes and pit rim berms will be removed or breached for construction of ditches. When berms or dikes are removed, the unsaturated overburden material constituting the berms and dikes will be used for grading of disturbed surfaces prior to reclamation. Typical construction erosion control measures will be implemented as needed during ditch construction and dike removal work, such as installing silt fence on the down slope side of disturbed areas and control of surface water runoff. The disturbed surfaces will be scarified, unsaturated overburden placed, and the area will be revegetated, as described in the Reclamation Seeding and Mulching Procedure (Attachment 2).

The stormwater sedimentation ponds, the mine water ponds, and any remaining stockpile and OSP sumps and overflow ponds will be reclaimed by developing wetlands or by filling, covering with unsaturated overburden, and revegetating the area. Outlet control structures from Ponds A and B will remain in place to prevent Partridge River floodwater from entering the Mine Site. Outlet control structures from Ponds C (East) and D will remain in place to direct water under Dunka Road and the mainline railroad to the Partridge River along natural drainage paths. The overflow weir in Pond C (West) will be modified to create a more natural transition to the remaining stormwater ditch. The mine water sumps and ponds will require cleanout and removal of the geomembrane liner. Sediment removed from the ponds will be disposed of in the East Pit. The geomembrane liners will be recycled or properly disposed at a permitted solid waste facility.

Aboveground and underground pipelines and other facilities (e.g., booster pumps, associated controls), except the Colby Lake pipeline, utility tunnels at the Plant Site, and pipelines needed during the closure and postclosure maintenance phases, will be removed and the material recycled or disposed at a permitted solid waste facility. Foundations will be demolished to ground level or below and covered with at least two feet of unsaturated overburden. Surface disturbances will be scarified and revegetated. All mine water pipes and pumps will be removed and recycled except those used in the Category 1 Stockpile Groundwater Containment System and those for the flooding of the West Pit or cycling of the East Pit water.

The pipeline system that connects the OSP sump to the Equalization Basin Area and the pipeline system that connects the mine water ponds to the Equalization Basin Area will be removed during the reclamation phase. Also, one or more of the equalization basins, if they are not required during the closure and postclosure maintenance phases, may be removed and reclaimed. The pipeline system connecting the WWTS to the East Pit will be required to remain until the postclosure maintenance phase. The pipeline system connecting the Category 1 Stockpile Groundwater Containment System sumps and the West Pit to WWTS pipelines will be required to remain through the postclosure maintenance phase.

2.1.5 Water Management During Reclamation

PolyMet currently anticipates that water management will be a continuous process through the reclamation and closure phases, so these two phases are described together in Section 2.2.1.

2.2 Closure

During the closure phase, PolyMet will continue to manage water and maintain the remaining facilities and reclaimed areas.

2.2.1 Water Management During Reclamation and Closure Phases

Mine Site water management will be a continuous process through the reclamation and closure phases, so these two phases are described together in this section. Full details on Mine Site water management in the reclamation and closure phases are presented in Section 2 of Appendix 11.4 of the Application and summarized here. During the reclamation and closure phases, water management tasks will include the following:

- the WWTS will treat mine water from the Category 1 Groundwater Containment System (Section 2.2.1.1)
- WWTS effluent will be pumped to the East Pit and the West Pit during both the reclamation and closure phases (Section 2.2.1.1)
- water from the East Pit will be pumped to and treated by the WWTS to remove the flushing load of constituents added as waste rock was backfilled to the pit and the pit walls were inundated (Section 2.2.1.2)
- the West Pit will be flooded, supplemented by water pumped from the Plant Site (Section 2.2.1.3)
- the West Pit overflow structure will be constructed (Section 2.2.1.3)

The ultimate objective is to transition from the mechanical treatment provided by the WWTS to non-mechanical treatment systems as early in the reclamation, closure, and postclosure maintenance phases as possible, as described in Section 8.0 of this Plan. The transition from mechanical to non-mechanical treatment will occur only after the site-specific designs for non-mechanical systems have been proven and approved by the appropriate regulatory agencies in accordance with applicable laws and regulations. Further discussion of this transition during the postclosure maintenance phase is discussed in Section 2.3.1; however, this transition could occur in the reclamation or closure phases.

2.2.1.1 WWTS

During the reclamation and closure phases, the WWTS will primarily treat water from the Category 1 Stockpile Groundwater Containment System and water from the East Pit. The quantity and quality of the WWTS influent are expected to vary less, both annually and seasonally, during the reclamation and closure phase, as compared to the operations phase, because flows will be originating from stable components of the Project (Section 2.2.2.1 of Appendix 11.4 of the Application). The WWTS unit processes can be configured to treat the anticipated flow rates and applicable water quality requirements during the reclamation and closure phases (Section 2.2.5.1 of Appendix 11.4 of the Application).

The configuration of the WWTS during the operations phase will be maintained during the reclamation and closure phases, if needed, to accept water of different quality into two different treatment processes (Section 2.2.2.2 of Appendix 11.4 of the Application). The seepage from the Category 1 Stockpile Groundwater Containment System and water from the East Pit will be routed into a single equalization basin at the Equalization Basin Area for conveyance for treatment in the WWTS membrane separation system (Section 2.2.2.2 of Appendix 11.4 of the Application).

It is anticipated that the chemical precipitation train can be reduced from two sets of treatment units to one set of treatment units for reclamation and closure; however, operating conditions may be modified to optimize overall performance of the treatment units. This can likely be accomplished without significant effort due to the operational adaptability that will be built into the WWTS. The following describes the current expected activities, although these could be subject to change and will be updated prior to the reclamation phase. Sludge produced by the chemical precipitation treatment train will be dewatered via filter press, and the dewatered sludge will be hauled to a permitted landfill during the reclamation, closure, and postclosure maintenance phases (Section 2.2.5.1.1 of Appendix 11.4 of the Application). Primary membrane concentrate will be routed to the secondary membrane, which is proposed to be a Vibratory Shear Enhanced Process (VSEP) unit. VSEP concentrate will be routed to the chemical precipitation train for removal of metals and sulfate, and VSEP permeate will be routed to the East Pit. The primary membrane permeate will be pumped as WWTS effluent, as described below (Section 2.2.5.1.2 of Appendix 11.4 of the Application).

WWTS effluent will be pumped to the West Pit to augment pit flooding and to the East Pit to maintain water levels and assist with removal of additional constituent load from the backfilled waste rock (Section 2.2.5.1 of Appendix 11.4 of the Application). At the beginning of the reclamation phase (through approximately Mine Year 21), effluent pumped to the East Pit may be treated to increase alkalinity, depending on the water quality collected from the East Pit at the time. The purpose of treatment will be to manage the mass of dissolved constituents in the East Pit. Specifically, the primary purpose of treatment

during the reclamation, closure, and postclosure maintenance phases will be to remove the flushing load of constituents added as waste rock was backfilled to the pits and the pit walls were inundated (Section 2.2.1.2 of Appendix 11.4 of the Application). If it is decided that the addition of alkalinity would be beneficial, PolyMet will coordinate this change with the MPCA and DNR.

Treatment of the East Pit flushing load (as described in Section 2.2.1.2) is expected to be complete before the West Pit is flooded (as described in Section 2.2.1.3). If this occurs, in the period after treatment of the East Pit flushing load is complete (about Mine Year 35) and before the West Pit would overflow (about Mine Year 52), the only influent to the WWTS would be the water from the Category 1 Stockpile Groundwater Containment System, a very low volume of flow. During this time, water from the containment system could be discharged directly to the West Pit, with agency approval, or treatment of the water from the containment system could transition to non-mechanical treatment with gravity discharge to the West Pit, after the non-mechanical system has been proven to provide appropriate treatment. If one of these options is approved and implemented, WWTS operations could be scaled back, suspended, or terminated at that time (Section 2.1.1 of Appendix 11.4 of the Application).

2.2.1.2 East Pit Flushing

As described in Section 7 of the Application, the saturated overburden and waste rock in the Categories 2/3 and 4 Waste Rock Stockpiles will be relocated to the East Pit during operations. This will result in a flushing of oxidation products into the East Pit water. Also, oxidation products that have accumulated on the pit wall rock will be flushed into the pits as the water level rises. The flushed oxidation products will be removed from the East Pit by pumping the pit water to the WWTS for treatment and returning the treated water to the pits.

After the cycling of water from the East Pit through the WWTS is complete, the steady-state water level in the East Pit will be established by an outlet structure described in Section 2.1.3.

2.2.1.3 West Pit Flooding

During the reclamation phase, pit dewatering will have ceased and the associated pit dewatering systems will be removed. The West Pit will begin to flood naturally with water from groundwater inflows, precipitation, and stormwater runoff from the tributary watershed. The flooding process will be augmented with the addition of seepage water from the FTB. Treated WWTS effluent will also be discharged to the West Pit during reclamation and closure (Section 2.1.1 of Appendix 11.4 of the Application).

The water level in the West Pit in the reclamation and closure phases will remain below the estimated natural overflow elevation of 1579’ above mean sea level by pumping water from the West Pit to the WWTS for treatment. An overflow structure will be constructed for the West Pit during the closure phase, as described in Section 6.3 of Appendix 11.4 of the Application.

2.2.1.4 Category 1 Stockpile Groundwater Containment System

The Category 1 Stockpile Groundwater Containment System will continue to operate during the reclamation and closure phases. Water collected by the containment system will be collected and routed to the WWTS for treatment prior to being pumped to the East or West Pit.

2.2.2 Maintenance of Reclaimed Areas

Establishment of dense vegetative cover and root mass is among the most effective methods to minimize erosion, so the quality and density of the vegetation will be periodically reviewed after reclamation construction is complete. Reclaimed areas will be inspected at least twice per year (in the spring and fall), as necessary, or as required by Minnesota Rules, part 6132.5200. Any areas that have been damaged by erosion, animal activity, or that have lost vegetation will be identified. A plan to reseed or repair the damage will be developed and implemented.

Reclaimed mine overburden slope erosion will be corrected and re-vegetated as needed. In areas where excess erosion is a repetitive problem, channels and/or outfall structures will be designed for those specific locations.

2.3 Postclosure Maintenance

Once the closure activities described in Section 2.2 are complete, a postclosure maintenance phase will begin. Monitoring will likely occur at a reduced frequency from the closure phase. Monitoring, reporting, and water treatment will continue until release from postclosure maintenance is granted by the DNR in accordance with PTM Regulations. If any of the monitoring data shows that additional work is needed, a plan will be created and implemented.

2.3.1 Water Management During Postclosure Maintenance

More details on Mine Site water management in the postclosure maintenance phase are presented in Section 2 of Appendix 11.4 of the Application and summarized in this section. During the postclosure maintenance phase, Mine Site water management tasks presently are anticipated to include the following:

- continued operation of the WWTS, with treated water discharge to a tributary of the Partridge River until the transition to non-mechanical treatment (Section 2.3.1.1)
- select pump and pipe removal, including the CPS and Mine to Plant Pipelines (MPP), once pumping has ceased from the Plant Site to the West Pit (2.3.1.1)
- equalization basin decommissioning and reclamation (2.3.1.1)
- maintenance of the water level in the West Pit below the natural overflow elevation, until the transition to non-mechanical treatment (Section 2.3.1.2)
- continued pumping of the Category 1 Stockpile Groundwater Containment System drainage to the WWTS (Section 2.3.1.3), until the transition to non-mechanical treatment

The ultimate objective is to transition from the mechanical treatment provided by the WWTS to non-mechanical treatment systems as early in the reclamation, closure, and postclosure maintenance phases as possible, as described in Section 8.0. Options for non-mechanical water treatment at the Mine Site during the postclosure maintenance phase are summarized in this section, Section 8.0 , and described in more

detail in Section 6 of Appendix 11.4 of the Application. The transition from mechanical to non-mechanical treatment will occur only after the site-specific designs for non-mechanical systems have been proven and approved by the appropriate regulatory agencies in accordance with applicable laws and regulations.

Two non-mechanical treatment systems at the Mine Site, which are independent of each other, could be used for long-term treatment of water from the Category 1 Stockpile Groundwater Containment System and the West Pit overflow. It is expected that the Category 1 Waste Rock Stockpile Non-Mechanical Treatment System will be deployed earlier than the West Pit Overflow Non-Mechanical Treatment System. The non-mechanical treatment system for the water from the Category 1 Stockpile Groundwater Containment System could potentially be deployed while the West Pit is still flooding. It is currently assumed that the WWTS will continue to operate for some period during the postclosure maintenance phase; however, the transition to the non-mechanical treatment systems will occur as soon as it has been proven it can provide appropriate treatment. This may occur during the reclamation, closure, or postclosure maintenance phase (Section 2.2.1.3 of Appendix 11.4 of the Application).

2.3.1.1 WWTS and CPS

During the postclosure maintenance phase, the WWTS will continue to treat water from the Category 1 Stockpile Groundwater Containment System until non-mechanical treatment with gravity discharge to the West Pit has been proven to provide appropriate treatment. The WWTS will also treat water from the West Pit as necessary to prevent the West Pit from overflowing. Because the West Pit will receive direct precipitation, it is expected that the flow will vary seasonally. The majority of this variability will be dampened by the volume of the West Pit and management of the West Pit water level.

Operation of the WWTS will occur year-round with the discharge directed to an unnamed tributary downstream of the future West Pit overflow that flows to the Partridge River until the non-mechanical treatment system is in use. Currently, PolyMet expects that the WWTS will utilize reverse osmosis (RO) or equivalent technology to treat water prior to discharge. The permeate from the RO or equivalent technology will be conditioned by a limestone contactor and degassifier prior to discharge to the Partridge River, which is the same method as is used for the Plant Site discharges for stream augmentation. Primary membrane separation unit reject concentrate will continue to be treated with the existing secondary membrane separation and chemical precipitation equipment to the extent practical, or will be evaporated, if necessary. The residual solids will be disposed off-site (Section 2.1.1 of Appendix 11.4 of the Application).

During the postclosure maintenance phase, it is anticipated that the quality of the water collected by the Category 1 Stockpile Groundwater Containment System will be consistent with the concentration values seen during the closure phase. The quality of the West Pit Overflow will likely have significantly lower concentrations of constituents of interest than the water from the Category 1 Stockpile Groundwater Containment System (Section 2.2.2.2 of Appendix 11.4 of the Application).

As described in Section 2.2.5.2 of Appendix 11.4 of the Application), the WWTS treatment train will be reconfigured to consist of the following components:

- pretreatment via media filtration
- RO or equivalent technology that will meet applicable water quality targets for metals and sulfate
- secondary membrane separation for volume reduction of the primary membrane separation system concentrate
- chemical precipitation of the secondary membrane concentrate
- if necessary, thermal treatment of a portion of the secondary membrane concentrate via evaporation/crystallization
- limestone contactor and degassifier

After the transition to non-mechanical treatment, the CPS and remaining infrastructure in the Equalization Basin Area will be reclaimed. Structures will be removed, covered with two feet of unsaturated overburden and vegetated. Piping and liners will be removed and recycled or properly disposed in a permitted solid waste facility. The basins may be created into wetland or filled, covered with unsaturated overburden, and revegetated.

2.3.1.2 West Pit Discharge to a Tributary of the Partridge River

During the postclosure maintenance phase, the water level in the West Pit will be maintained below the estimated natural overflow elevation of 1,579’ by pumping excess water to the WWTS for treatment, then discharge to an unnamed creek downstream of the future West Pit overflow that flows to the Partridge River. The ultimate objective is to transition from the mechanical treatment provided by the WWTS to a non-mechanical treatment system. Potential non-mechanical treatment systems include construction of an outlet structure from the West Pit, and a multistage system consisting of a constructed wetland, a permeable sorptive barrier, and an aeration pond as described in Section 6.3 of Appendix 11.4 of the Application.

2.3.1.3 Category 1 Stockpile Groundwater Containment System

Water collected by the Category 1 Stockpile Groundwater Containment System will be treated at the WWTS and then pumped to the West Pit or discharged to a tributary of the Partridge River. The drainage will continue to be treated at the WWTS until the West Pit lake concentrations meet the required water resource objectives or treatment is transitioned to a non-mechanical system. The non-mechanical treatment system for the Category 1 Groundwater Containment System is expected to include two permeable reactive barriers as described in Section 6.2 of Appendix 11.4 of the Application.

2.3.2 Maintenance of Reclaimed Areas

Reclaimed areas will be inspected annually and after major rainfall, or by the DNR commissioner as required by Minnesota Rules, part 6132.5200. Monitoring will likely occur at a reduced frequency from the closure phase. Any areas that have been damaged by erosion, animal activity, or that have lost vegetation will be identified during these periodic inspections. A plan to reseed or repair the damage will be developed and implemented.

Reclaimed mine overburden slope erosion will be corrected and re-vegetated as needed. In areas where excess erosion is a repetitive problem, channels and/or outfall structures will be designed for those

specific locations. Of the areas at the Mine Site, the Category 1 Waste Rock Stockpile Cover System, the overburden portions of the pit walls, and any reclaimed overburden stockpiles may require further maintenance in the postclosure maintenance phase.

Inspection and repair will continue until a partial or full release from the PTM responsibilities is obtained in accordance with the requirements of Minnesota Rules, part 6132.1400 and 6132.4800.

3.0 Plant Site Reclamation, Closure, and Postclosure Maintenance

Plant Site facilities included in this Project are discussed in this section are described in Sections 8, 10, and 11 of the Application, and depicted on Figure 8-1 of the Application. Phases discussed in this section include reclamation (Section 3.1), closure (Section 3.2), and postclosure maintenance (Section 3.3).

Vegetative reference areas will be used to evaluate the effectiveness of the reclamation vegetation activities at the Plant Site, as described in Attachment 3.

3.1 Reclamation Phase

3.1.1 Structure and Infrastructure Demolition and Reclamation

PolyMet will decommission the majority of the Plant Site during the reclamation phase. PolyMet will remove the tailings pipeline and associated pumping systems and will also demolish and reclaim the Beneficiation Plant, Hydrometallurgical Plant, and associated facilities. The exception is the WWTS, which will be used through the closure and postclosure maintenance phases as described in Section 3.2.1 and Section 3.3.1. Appropriate controls for airborne asbestos will be in-place during demolition. Locations of Plant Site Buildings are shown on Figure 8-1 of the Application. Reclamation will include establishing fencing within the Mining Area and implementing necessary site management and security measures, as necessary.

The sewage treatment stabilization pond liners and pipelines, potable water system, and fire water system will be removed and recycled or properly disposed in a permitted solid waste facility. Disturbed surfaces will be graded, scarified, and vegetated using the Reclamation Seeding and Mulching Procedure (Attachment 2). A variance is being requested for the utility tunnels to be closed and left in-place, as described in Section 1.2.2.

After demolition of Plant Site buildings, two feet of overburden material suitable for vegetation will be placed upon each facility's former footprint. Plant Site roads that are deemed not necessary for access for further use, monitoring, or maintenance will be scarified and vegetated. Asphalt from paved surfaces will be removed and recycled.

Infrastructure owned by third parties at the Plant Site will be reclaimed as agreed upon under the contractual rights of use with the third party. This could include reclamation of access roads or railroads modified or improved by PolyMet. PolyMet's ownership and rights of use and access are discussed in Section 4 of the Application.

Building areas, roads, and parking lots will be reclaimed and vegetated according to Minnesota Rules, part 6132.2700 by a qualified reclamation contractor. Seeding and mulching will be based on the Reclamation Seeding and Mulching Procedure (Attachment 2).

Where roads will be reclaimed, culverts will be removed to prevent potential flow obstruction due to clogged or dammed culverts and to minimize impediments to access and movement in the stream by

aquatic life. Any culverts requiring removal will be replaced with channels; culvert locations will be graded and vegetated to provide a stable stream bank approximating a natural channel and floodplain configuration. Any potential for channel erosion during vegetation stabilization will be controlled with appropriate best management practices (e.g. measures such as installation of wattles, excelsior blankets (wood wool), filter fabric, riprap).

3.1.2 Areas of Potential Concern

The Areas of Potential Concern (AOCs) that will be used by the Project and managed or remediated during the reclamation, closure, and/or postclosure maintenance phases are listed in Table 3-1. For these AOCs, continued participation in the Voluntary Inspection and Cleanup (VIC) program that Cliffs Erie started as part of its 2001 Ferrous Reclamation Plan is anticipated. The AOCs will be investigated and remediated as necessary on a schedule and priority agreed to with the MPCA under the VIC program.

Table 3-1 Plant Site Areas of Concern (AOCs) to be Managed or Remediated during Reclamation, Closure and Postclosure Maintenance Phases

Areas of Concern (AOCs) to be used by Project and managed/remediated during Reclamation, Closure, and/or Postclosure Maintenance
Area 1 Shops (AOC 1)
Area 2 Shops (AOC 38)
Administration Building (AOC 43)
Main Gate Vehicle Fueling Area (AOC 44)
Plant Site and General Shops (AOC 46)
Tailings Basin Reporting (AOC 47)
Booster Pump House with Transformer (AOC 48)
Tailings Basin Salvage and Scrap Areas (AOC 51)
Colby Lake Pumping Station (AOC 59)

3.1.3 FTB Reclamation

During FTB reclamation activities, PolyMet will establish vegetation, amend the FTB beaches and pond bottom with bentonite, construct the FTB Closure Overflow, and remove FTB-related infrastructure. Reclamation of the Tailing Basin buttress will not be necessary because the large rock fill material will be stable and erosion resistant; however, access will be maintained for inspection and maintenance as necessary.

3.1.3.1 Vegetation

Interior portions of the FTB will be graded to provide a gently sloping surface that effectively will route stormwater runoff to the FTB Pond and accommodate potential differential settlement of the underlying Flotation Tailings.

Upland areas will be mulched and planted with permanent vegetation to minimize air and water erosion. Vegetation types will be selected to limit root penetration to within the top 24-inches of the Flotation Tailings in order to minimize the potential for root penetration into the underlying bentonite-amended

Flotation Tailings layer planned for 30-inches below the Flotation Tailings surface. Fertilizer may be used but care will be taken to minimize carry-over into pond areas, which would encourage algae growth.

3.1.3.2 Bentonite Amendment

Bentonite will be added to exposed beach areas and to the bottom of the FTB Pond. Anticipated methods of bentonite amendment are described below.

During the reclamation phase, exposed beach areas will be amended with bentonite to limit oxygen infiltration into the Flotation Tailings. Granulated bentonite (approximately 3% by dry weight) will be added to an 18-inch thick layer of Flotation Tailings, overlain by an additional 30-inch layer of Flotation Tailings (see Drawing FTB-024 in Appendix 6 of the Application). The bentonite will be injected via agricultural equipment such as that commonly used for below-grade manure injection. This will entail pneumatic injection of bentonite through hollow tines of a rake pulled through the tailings, at the desired depth and at the desired rate of bentonite injection. If access proves difficult and/or to facilitate further mixing of the bentonite and tailings, the upper layer of tailings could be removed, then replaced. Testing of bentonite amendment methods will be conducted as described in the Template for Pilot/Field-Testing of Bentonite Amendment of Tailings, provided in Attachment I of the Flotation Tailings Management Plan (Appendix 11.5 of the Application). The cover layer of tailings will be vegetated in accordance with requirements of the Reclamation Seeding and Mulching Procedure (Attachment 2).

During the reclamation phase (estimated Mine Year 21 to 24), the pond bottom will be amended with bentonite to reduce the percolation from the FTB Pond, thereby maintaining a permanent pond that will provide an oxygen barrier above the Flotation Tailings to reduce oxidation and resultant production of chemical constituents. Adding bentonite to the bottom of the FTB Pond will also reduce the amount of water collected by the FTB seepage capture systems.

As part of FTB closure the transition zone between the beach and pond bottom will be covered with riprap to resist wave erosion that may occur. Detail 3 on FTB Permit Application Support Drawing FTB-024 shows the location of the riprap zone. The dimensions of the riprap zone and size of riprap will require final determination and confirmation at the time of basin closure and will depend on factors such as beach slope at time of closure, projected water level bounce from precipitation on the combined pond area/beach area existent at time of closure, and based on pond fetch and resulting wave run-up projections at time of closure.

The FTB final reclamation system will be designed and constructed in accordance with applicable requirements of Minnesota Rules, part 6132.2500, subpart 2. The proposed method of adding bentonite to the pond bottom is by broadcasting. Bentonite injection, or placement of a geosynthetic clay liner, are alternate methods. Details on the design and installation of the FTB Pond Bottom Cover System are provided in Section 5.2 of Appendix 11.4 of the Application. Testing of bentonite amendment methods will be conducted as described in the Template for Pilot/Field-Testing of Bentonite Amendment of Tailings, provided in Attachment I of the Flotation Tailings Management Plan (Appendix 11.5 of the Application).

3.1.3.3 FTB Closure Overflow

During the reclamation phase, the FTB Closure Overflow (Drawings FTB-021 and FTB-024 in Appendix 6 of the Application) will be constructed. However, during reclamation, FTB overflow will be prevented by pumping any excess FTB pond water to the WWTS. A description of the pond water elevations during non-mechanical treatment in the postclosure maintenance phase is provided in Section 3.3.1.2.

3.1.3.4 FTB Infrastructure Removal

During the reclamation phase, the following FTB infrastructure will be removed:

- Tailings Transport Pipeline, Booster Pumphouses, and Tailings Disposal Diffuser Raft
- Water Transfer Pipeline and Transfer Pump Raft
- Return Water Barge
- Return Water Pipeline
- 13.8Kv and 4.16Kv power lines
- power substations

In general, removal of infrastructure will occur prior to bentonite amendment of the FTB beach and pond areas. However, if components are needed to implement the bentonite amendment, those components will be removed after the bentonite amendment is complete.

Structures needed to pump pond water to the WWTS to prevent overflow will remain in place as long as needed.

3.1.4 HRF Reclamation

During the reclamation and closure phases, PolyMet will dewater the HRF, install a cover system, and remove infrastructure.

3.1.4.1 Dewatering

PolyMet will pump HRF pond water and HRF drainage to the WWTS for treatment and discharge. At the end of operations, the void spaces in the Residue within the HRF will be full of water. PolyMet will activate the HRF Drainage Collection System to collect drainage from the Residue, and operate the system until drainage ceases, currently estimated to be approximately 10 years after the end of the operations phase, as described in Section 6.3.1 of Appendix 16.16 of the Application. The rate of drainage will decrease over time as the pore water within the Residue is collected and removed.

3.1.4.2 Cover System

A multi-layer cover system will be placed over the Residue. Cover placement will be staged. Early in the Residue dewatering process, access to the Residue surface may be somewhat difficult, due to the fine-grained characteristics of the Residue. A temporary cover will be placed early during the reclamation phase to limit infiltration of precipitation while dewatering progresses and the Residue consolidates and settles. The barrier layer of the temporary cover, in addition to covering the deposited residue, will be extended over the dams to exclude rainwater infiltration back into the residue while also accommodating

settlement of the temporary cover system. The settlement of the temporary cover will be monitored, and when the rate and magnitude of settlement has diminished, the final cover will be placed.

The cover system is designed to have a relatively flat slope. The residue will be a water-deposited material that will naturally deposit at a relatively flat slope - currently estimated at a 1% slope. The residue, consisting of saturated silt-size particles, would be difficult to regrade to steeper slopes as part of closure. Placement of the temporary cover will accommodate differential settlement, and positive drainage will be re-established when the permanent cover is placed over the temporary cover during the closure phase. The temporary cover system design and sequencing are shown on Drawing HRF-020 and Drawing HRF-021 in Appendix 7 of the Application.

The permanent cover system planned for installation during the closure phase will consist of (in ascending order):

- a layer of LTVSMC tailings or common borrow immediately above the Residue with geotextile or geogrid reinforcing placed between the Residue and tailings/borrow if needed to create a working surface (Drawing HRF-020 of Appendix 7 of the Application)
- a barrier layer consisting of a geosynthetic clay liner (GCL) overlain by a 40-mil low density polyethylene or similar MPCA-approved geomembrane barrier layer
- drainage pipes to collect and direct runoff
- additional LTVSMC coarse tailings and/or common borrow and cover unsaturated overburdens placed on top of the barrier layer to create a covered surface capable of sustaining a vegetated cover
- vegetation, established as described in PolyMet's Reclamation Seeding and Mulching Procedure (Attachment 2)

An open-meadow closure approach will be used, with estimated contours as depicted in Drawings HRF-021 and HRF-022 in Appendix 7 of the Application. This approach will yield a gently sloping closure surface that readily sheds surface water runoff, accommodates future differential settlement of the underlying Residue, and minimizes ponding of water on the closed HRF surface. To control surface water runoff, the cover will slope gently toward the site perimeter to promote natural drainage. Final cover slopes on the cell interior will be relatively shallow (on the order of 1.0%) to minimize surface water runoff flow velocity and erosion. The sources of common borrow to be used for HRF closure will be determined either by PolyMet or by contractors bidding on construction at the time of closure. Selected borrow sources will be confirmed to meet specifications as part of bidder borrow source qualification, closure construction documentation, and borrow source criteria developed by PolyMet, as described in Appendix 11.1. Areas that are disturbed as borrow sources for the Project will be graded, reclaimed, and vegetated according to Minnesota Rules, part 6132.2700. Seeding and mulching will be based on the Reclamation Seeding and Mulching Procedure (Attachment 2).

Runoff that becomes channelized along the cell perimeter will be routed through plug-resistant inlet structures and piping systems (Drawing HRF-023). These piping systems, which are commonly used at closed solid waste management facilities, will be used to safely transmit runoff down-slope, particularly

after the transition of the relatively flat top slope to the steeper slope of the dam of the facility (at slopes on the order of 15%).

3.1.4.3 Infrastructure Removal

During HRF reclamation and temporary cover construction, the residue transport and deposition system will be removed.

3.1.5 Water Management Infrastructure Reclamation

Water management infrastructure, including stormwater ponds, ditches and culverts, that will not be used in the closure or postclosure maintenance phases will be reclaimed during the reclamation phase. Stormwater ponds will be reclaimed by developing wetlands or by filling and revegetating the areas. Reclamation of the ditches will include either installing ditch blocks or filling, covering with unsaturated overburden, and vegetating the surface. Any culverts requiring removal will be replaced with channels; culvert locations will be graded and vegetated to provide a stable stream bank approximating a natural channel and floodplain configuration. Any potential for channel erosion during vegetation stabilization will be controlled with appropriate best management practices (e.g. measures such as installation of wattles, excelsior blankets (wood wool), filter fabric, riprap).

Reclamation of water management infrastructure associated with the FTB and the HRF is described in Sections 3.1.3.4 and 3.2.1.4.

3.1.6 Water Management During Reclamation Phase

Water management will be a continuous process through the reclamation and closure phases so these two phases are described together in Section 3.2.1.

3.2 Closure Phase

During the closure phase, PolyMet will continue to manage water and maintain the remaining facilities and reclaimed areas.

3.2.1 Water Management During Reclamation and Closure Phases

Water management will be a continuous process through the reclamation and closure phases, so these two phases are described together in this section. Full details on Plant Site water management in the reclamation and closure phases are presented in Section 4 of Appendix 11.4 of the Application and summarized here. During the reclamation and closure phases, water management tasks will include the following:

- the WWTS will treat tailings basin seepage collected by the FTB seepage capture systems, excess FTB pond water (if needed to prevent overflow), and HRF pond water and drainage (Section 3.2.1.1)
- the FTB Pond will not be allowed to overflow (Section 3.2.1.3)
- the FTB seepage capture systems will continue to operate (Section 3.2.1.2)
- the HRF Leakage and Drainage Collection Systems will continue to operate (Section 3.2.1.4)

- stream augmentation will continue (Section 3.2.1.5)

3.2.1.1 WWTS

At the start of the reclamation phase, it is anticipated that the volume of water treated by the WWTS will increase relative to operations. During the first several years following Project operations, the volume of water collected by the FTB seepage capture systems should continue at a similar volume as during the last several years of the operations phase. However, more seepage is expected to report to the WWTS in the reclamation phase, because less seepage will be returned to the FTB Pond to maintain water levels as a result of production. Influent sources to the WWTS during the reclamation and closure phases will be tailings basin seepage collected by the FTB seepage capture systems, excess FTB pond water (if needed to prevent overflow), and HRF pond water and drainage.

During the reclamation and closure phases, WWTS effluent will continue to be discharged to Second Creek, Unnamed Creek, and Trimble Creek for stream augmentation (Section 3.2.1.5). Stream augmentation would continue as long as the FTB seepage capture systems are in place collecting tailings basin seepage. Some WWTS effluent will be blended with untreated tailings basin seepage and pumped to the Mine Site to accelerate flooding of the West Pit. A small portion of WWTS effluent may also be used to maintain the designed water volume within the FTB Pond.

3.2.1.2 FTB Pond

FTB pond water will be pumped to the WWTS as necessary to prevent any overflow from the pond (Section 4.1 of Appendix 11.4 of the Application).

3.2.1.3 FTB Seepage Capture Systems

The FTB seepage capture systems (described in Section 11.4.6.3 of the Application) will continue to operate through the reclamation and closure phases. Collected seepage will be sent to the WWTS for treatment and discharge, or blended with WWTS effluent and pumped to the Mine Site for use in flooding the West Pit as described on page 3-134 of the FEIS (Appendix 16.1). Alternatively, the collected tailings basin seepage would be sent to a non-mechanical treatment system, as described in Section 8.0, once PolyMet can demonstrate that non-mechanical water treatment technologies will effectively treat water to meet the applicable water quality standards.

3.2.1.4 HRF Leakage and Drainage Collection Systems

The HRF Drainage and Leakage Collection Systems (described in Section 11.4.7.3 of the Application) will continue to operate through the reclamation and closure phases. Collected drainage will be treated at the WWTS (or subsequently, at non-mechanical treatment systems, as described in Section 8.0, then discharged. Drainage water quality and quantity will be monitored. Potentially, drainage water quality could reach a point where it could be released directly without treatment while maintaining compliance with applicable water quality standards. It is expected that drainage will stop at some point during the closure phase. Once drainage stops or has decreased to a point of being insubstantial to final HRF closure, Drainage and Leakage Collection System pumps and pipes and supporting electric power systems will be removed.

3.2.1.5 Stream Augmentation

During the reclamation and closure phases, WWTS effluent or non-mechanical treatment system discharge, if applicable, will continue to be discharged to Second Creek, Unnamed Creek, and Trimble Creek, in quantities sufficient to meet the stream augmentation requirements determined during the NPDES/SDS permitting process. If Water Appropriation Permits are still held in the reclamation and closure phases, those permits will also define the required quantity of stream augmentation. If the Project transitions to non-mechanical treatment processes in the reclamation or closure phases, and if stream augmentation is still required, it would be provided through the non-mechanical treatment system, as described in Section 8.0.

3.2.2 Maintenance of FTB and HRF Dams and Facilities

Annual inspections will include identification of any detrimental effects from differential settlement and erosion. Areas where differential settlement is occurring may require retreatment with bentonite to remediate affected areas. Depth of root penetration will be evaluated once vegetation becomes well established to confirm that most roots are shallower than the depth of the bentonite amendment and/or are spreading laterally rather than vertically once the bentonite amended zone is encountered. If there are areas where erosion is occurring and exposing the bentonite amended layer, they will be remediated with additional erosion control measures and/or regrading as needed to prevent further erosion. If erosion does occur into or through the bentonite amended zone, the appropriate segments of the eroded area will be backfilled with a soil-bentonite mix, covered and revegetated.

The deeper portions of the pond bottom cover system will be protected from wave action and freeze-thaw cycles. Along the pond perimeter where wave action and freeze-thaw cycles occur, the bentonite layer will be armored by a protective layer (typically well-graded riprap). This layer will require periodic inspection early in the life of the reclaimed pond to confirm that the selected erosion control and freeze-thaw protection method (typically well graded riprap) is effective and to repair and upgrade riprap in any areas showing signs of erosion and/or freeze-thaw impacts. Details on the pond bottom cover system, riprap zone and beach are provided on Drawing FTB-024 of Application Appendix 6. Testing of the pond bottom cover system and protective layer will be conducted as described in the Template for Pilot/Field-Testing of Bentonite Amendment of Tailings, provided in Attachment I of the Flotation Tailings Management Plan (Appendix 11.5 of the Application).

3.2.3 Maintenance of Reclaimed Areas

The quality and density of the vegetation will be periodically reviewed after reclamation construction is complete. Reclaimed areas will be inspected at least twice per year (in the spring and fall), as necessary, or as required by Minnesota Rules, part 6132.5200. Any areas that have been damaged by erosion, animal activity, or that have lost vegetation will be identified. A plan to reseed or repair the damage will be developed and implemented as necessary.

3.3 Postclosure Maintenance

Once the closure activities described in Section 3.2 are complete, the postclosure maintenance phase will begin. Monitoring will likely occur at a reduced frequency from the closure phase. Monitoring, reporting,

and water treatment will continue until release from these activities is granted via the PTM. If any of the monitoring data shows that additional work is needed, a plan will be created and implemented to further improve water quality.

3.3.1 Water Management During Postclosure Maintenance

Water management in the postclosure maintenance phase at the Plant Site will continue much the same as during the closure phase. The primary difference will be that after the West Pit is completely flooded, West Pit water will be treated at the WWTS, and WWTS effluent will be discharged at the Mine Site, through an unnamed creek downstream of the future West Pit overflow. Also, during the postclosure maintenance phase, less water is captured by the FTB seepage capture systems as the FTB pond bottom cover system and bentonite-amended beaches and slopes reduce the infiltration through the FTB. Additionally, more WWTS effluent is discharged to the tributaries for stream augmentation than during the closure phase (Large Table 8 of Water Modeling Data Package Vol 2-Plant Site of Appendix 16.20 of the Application). Additional details on water management in the postclosure maintenance phase are presented in Section 4 of Appendix 11.4 of the Application and summarized in this section.

The ultimate objective is to transition from the mechanical treatment provided by the WWTS to non-mechanical treatment systems as early in the reclamation, closure, and postclosure maintenance phases as possible, as described in Section 8.0. Options for non-mechanical water treatment at the Plant Site during postclosure maintenance are summarized in this section and Section 8.0 and described in detail in Section 6 of Appendix 11.4 of the Application. The transition from mechanical to non-mechanical treatment will occur only after the site-specific designs for non-mechanical systems have been proven and approved by the appropriate regulatory agencies.

Two non-mechanical treatment systems at the Plant Site, which are independent of each other, could be used for long-term treatment of water from the FTB seepage capture systems and the FTB Closure Overflow. It is expected that the FTB Non-Mechanical Treatment System to treat tailing basin seepage will be deployed earlier than the FTB Closure Overflow (post-mechanical treatment options). The WWTS will continue to treat tailings basin seepage and FTB pond water until the transition to each of these systems (Section 6.4 and Section 6.5 of Appendix 11.4 of the Application, respectively).

3.3.1.1 WWTS

During the postclosure maintenance phase, the WWTS will continue to treat water collected by the FTB seepage capture systems, any HRF drainage, and excess water from the FTB Pond as needed to prevent overflow or until transition to non-mechanical treatment systems occur for these waters. The WWTS will continue to operate in the same configuration used during the operations and reclamation phases. Solids management may include chemical precipitation. WWTS secondary membrane separation unit concentrate will be precipitated and/or evaporated, with the residual solids disposed at an appropriate permitted landfill. WWTS effluent will continue to be discharged to Second Creek, Unnamed Creek, and Trimble Creek for stream augmentation (Section 3.2.1.5) as well as to an unnamed creek downstream of the future West Pit overflow.

3.3.1.2 FTB Pond

The purpose of the bentonite amendment of the FTB pond bottom and beaches is in part to maintain a net-positive water balance in the pond. During mechanical treatment in the postclosure maintenance phase, if relevant, any excess water from the FTB Pond will be pumped to the WWTS to prevent overflows. However, the ultimate goal is to allow overflow of the FTB Pond. The transition from preventing pond overflow to allowing it will occur only after the pond water has been demonstrated to meet applicable surface water quality standards, and after this demonstration has been approved by the appropriate regulatory agencies. Once this is demonstrated, pond water would be allowed to overflow.

During non-mechanical treatment, the pond level will be maintained by the elevation of the Closure Overflow. Based on the water models used to support permitting, some seasonal fluctuation in the pond elevation can be anticipated with levels at or near the overflow elevation in the spring through mid-summer, followed by decline through late summer and winter. Some fluctuation (rise and/or drop) can be anticipated in the fall depending on precipitation amounts. If it is determined following the transition to non-mechanical treatment that supplemental water addition is required to maintain pond level, then alternatives (such as Colby Lake) to supplement pond level will be identified at that time.

Additional detail on FTB pond water management during postclosure maintenance is presented in Section 6.5 of Appendix 11.4 of the Application.

3.3.1.3 FTB Seepage Capture Systems

The FTB seepage capture systems will operate during the postclosure maintenance phase until the seeps stop, the seeps meet water quality standards, or the transition to non-mechanical treatment is approved. Collected seepage will be sent to the WWTS for treatment and discharge or the collected tailings basin seepage would be sent to a non-mechanical treatment system, as described in Section 8.0 of this Plan, once PolyMet can demonstrate that non-mechanical water treatment technologies will effectively treat water to meet then applicable water quality standards.

3.3.1.4 HRF Drainage and Leakage Collection Systems

The HRF Drainage and Leakage Collection Systems (described in Section 11.4.7.3 of the Application) may continue to operate during postclosure maintenance although at greatly reduced rates if at all. Collected drainage will be treated at the WWTS (or subsequently, non-mechanical treatment systems) then discharged. Drainage water quality and quantity will be monitored. Potentially, drainage water quality could reach a point where it could be released directly without treatment while maintaining compliance with applicable water quality standards. It is expected that drainage will stop at some point during the closure phase. When drainage stops or has decreased to a point of being insubstantial to final HRF closure, Drainage and Leakage Collection System pumps and pipes and supporting electric power systems will be removed.

3.3.1.5 Stream Augmentation

During the postclosure maintenance phase, WWTS effluent or non-mechanical treatment system discharge, if applicable, will continue to be discharged to Second Creek, Unnamed Creek, and Trimble Creek, in quantities sufficient to meet the stream augmentation requirements determined during the

NPDES/SDS permitting process. If Water Appropriation Permits are still held in the postclosure maintenance phase, those permits will also define the required quantity of stream augmentation. If the Project transitions to non-mechanical treatment processes in the postclosure maintenance phase or earlier, stream augmentation would be provided, if necessary, through the FTB non-mechanical treatment system, as described in Section 8.0.

3.3.2 Maintenance of FTB and HRF Dams and Facilities

During the postclosure maintenance phase, FTB maintenance tasks will include:

- annual inspection of vegetation on the exterior dam faces and interior beaches, with erosion repaired and vegetation reseeded in accordance with requirements of the Reclamation Seeding and Mulching Procedure as needed until released from these activities by the DNR
- snow removal from the dam crest, if required, to allow access during winter months
- reconstruction of eroded dam crest, slope or toe
- fugitive dust control
- repair and/or replacement of damaged instrumentation and monitoring devices

During the postclosure maintenance phase, HRF maintenance will include routine surface care maintenance, such as mowing to prevent tree growth if needed and maintenance of stormwater drainage channel flow capacity. Any problems identified during a routine inspection will be corrected. This includes, but is not limited to, repair of the Leakage Collection System, security systems, cover materials, berms, culverts, riprap, vegetation, dams, or other infrastructure. For example, in the event that excessive erosion occurs, soil would be placed and compacted, and measures taken to prevent recurrence of the problem. If riprap were displaced, it would be replaced and measures taken to prevent a recurrence of the problem. If there are any areas where cover vegetation were poorly established or otherwise stressed, reseeding or other measures would be instituted and an adequate turf established.

Consistent with requirements of Minnesota Rules, part 6115.0390, Termination of Operations and Perpetual Maintenance, the FTB and HRF dams and appurtenances will be perpetually maintained.

3.3.3 Maintenance of Reclaimed Area

Reclaimed areas will be inspected as necessary, or as required by Minnesota Rules, part 6132.5200. Monitoring during the postclosure maintenance phase will likely occur at a reduced frequency from the closure phase. Any areas that have been damaged by erosion, animal activity, or that have lost vegetation will be identified. A plan to reseed or repair the damage will be developed and implemented.

Inspection and repair will continue until the DNR issues a partial or full release from the PTM responsibilities, in accordance with Minnesota Rules, part 6132.1400 and 6132.4800.

4.0 Transportation and Utility Corridors Reclamation, Closure, and Postclosure Maintenance

The components of the Transportation and Utility Corridors, including the MPP, power distribution system, and railroad, are described in Section 9 of the Application. During the reclamation phase, PolyMet will conduct a survey along the Transportation and Utility Corridors to inspect for potential ore spillage along the track. If spillage is found that could cause violations of applicable water quality standards, necessary response measures will be initiated.

The MPP, extending from the Mine Site Equalization Basin Area to the FTB and WWTS, will remain operational until pumping has ceased from the WWTS to the Mine Site, which would be after the Mine Site has transitioned to non-mechanical treatment for the Category 1 Stockpile Groundwater Containment System and for the West Pit Overflow, as described in Section 8.0. Once that has occurred, the MPP will be removed and properly recycled or disposed at a permitted solid waste facility. The area disturbed by these activities will be revegetated.

Permittee-owned power lines (poles, pole hardware, and conductors) and substations will be removed and recycled once they are no longer needed. Foundations and anchors will be removed or demolished and covered with at least two feet of overburden and revegetated. Specifically, the 13.8 kV distribution system from the Plant Site to the Mine Site will be removed prior to release from the PTM.

As noted in Section 3.5.3 of the Application and in accordance with the use agreement with Cliffs Erie, infrastructure owned by third parties will only be reclaimed as agreed upon under contractual rights of use, including the mainline railroad and Dunka Road. Reclamation by PolyMet will include:

- reclamation of Dunka Road passing bays constructed by PolyMet
- removal of rail line components and reclamation of the Connection Track
- progressive removal of PolyMet-owned powerlines and pipelines that are not required for further use during the next phase of reclamation, closure, and postclosure maintenance
- site grading and revegetation

The railroad track and ties along the new Connection Track will be removed and properly recycled or disposed at a permitted solid waste facility during the reclamation phase. The railbed will be reclaimed or evaluated for an approved subsequent use. Any areas where locomotives may have remained stationary for extended periods will be inspected for potential petroleum product release, and if necessary, remediation measures will be initiated.

5.0 Colby Lake Pipeline Corridor Reclamation, Closure, and Postclosure Maintenance

The components of the Colby Lake Pipeline Corridor, including the Colby Lake Pipeline, Colby Lake Pumphouse, and power distribution system, are described in Section 9 of the Application.

A variance request has been included in this Plan in Section 1.2.1 for the Colby Lake Pipeline and Pumphouse to remain in-place. Decommissioning options will be evaluated in Mine Year 20 pending developments related to continued future use.

Permittee-owned power lines (poles, pole hardware, and conductors) that are no longer needed in the Colby Lake Pipeline Corridor will be removed and recycled in the reclamation phase. Foundations and anchors will also be removed or demolished and covered with at least two feet of overburden and revegetated. Specifically, the 13.8 kV distribution system from the Main Substation at the Plant Site to the Colby Lake Pumphouse will be removed prior to release from the PTM; however, removal of this distribution system will be re-evaluated in Mine Year 20 pending developments related to continued future use of this infrastructure related to the Colby Lake Pipeline and Pumphouse.

6.0 Auxiliary Facilities Reclamation, Closure, and Postclosure Maintenance

6.1 Sanitary Systems and Water Supply Systems

During the reclamation phase, the following water supply and sanitary systems will be reclaimed:

- Area 1 Shops Septic System
- Area 2 Shops Septic System
- Potable Water Treatment Plant
- Fire water system
- Plant Site Sewage Treatment System, including the new sewage treatment system stabilization pond facility and the existing sewage treatment collection system
- Wells not needed during the closure and postclosure maintenance phases

The septic systems at the Area 1 Shops and Area 2 Shops will be pumped out, and the bottom of the tanks will be breached and filled with overburden or crushed rock and backfilled. The Potable Water Treatment Plant, fire water system, and Plant Site Sewage Treatment System will be removed and reclaimed per Minnesota Rules 6132.3200. Wells, once no longer needed, will be sealed by a licensed well driller in accordance with Minnesota Department of Health (MDH) rules.

6.2 Tanks

An inventory of tanks will be developed during the construction and operations phase. This tank inventory will be inserted into this Plan prior to the end of the operations phase as Table 6-1.

Large aboveground storage tanks will be cleaned and painted surfaces tested for lead prior to demolition. Tanks with insulation and associated wall and/or roof covers will be evaluated for potential asbestos-containing material (ACM). Insulation and coverings will be removed and disposed appropriately. Tank cleaning will remove remaining materials and sludge. The tanks will be cleaned and removed materials and cleaning residues will be sent to an appropriate recycling or waste disposal facility.

Tanks will be disassembled for disposal or recycling, as appropriate. Where lead paint abatement is required, the disposal/recycling plan will be modified to accommodate the lead content. Below-grade foundations will be left in place and covered with a minimum of two feet of overburden, specifically unsaturated overburden if at the Mine Site, and vegetated. Smaller aboveground storage tanks will be cleaned and removed without disassembly.

Table 6-1 Inventory of Tanks Requiring Demolition – PLACEHOLDER (to be provided prior to the end of the operations phase)

7.0 Waste Disposal

7.1 Demolition Waste Disposal

Concrete from demolition, with the exception of oil-stained concrete, will be crushed and used for structural fill, placed in building basements where possible and authorized by applicable law, including coarse crusher basement, fine crusher basement, and concentrator basement, or placed in an appropriate permitted landfill as required. The Plant Reservoir may be used through the reclamation and closure phases for Colby Lake pumping to support stream augmentation; however, if the reservoir is available, it may also be used for concrete demolition disposal.

7.2 Special Material Disposal

Special materials on-site during the reclamation phase may include ACM, nuclear sources, leftover paint, chemical, and petroleum products, fluorescent and sodium halide bulbs, certain batteries, electronic waste, lighting ballasts, small capacitors, and oil- or chemical-stained concrete. These materials will be safely collected, removed, and properly recycled or disposed of at an appropriate permitted landfill.

Surveys for ACMs within the existing former LTVSMC infrastructure at the Plant Site have been completed. ACMs (i.e., pipe and electrical insulation) in utility tunnels will be abated prior to the tunnels being used by the Project. ACMs (siding, hot water heating system insulation, lube system insulation, floor tile, etc.) from structure demolition will be removed, properly packaged, and disposed in an appropriate permitted landfill. New Project facilities will not include any new ACMs.

During initial closure of the former LTVSMC facilities by Cliffs Erie, all polychlorinated biphenyl (PCB) transformers (including sixteen large transformers), and capacitors were removed. New Project facilities will not include any new PCB transformers.

Cliffs Erie also inventoried all nuclear sources and disposed of them. Project facilities will include new nuclear sources in the Beneficiation Plant and in the Hydrometallurgical Plant. These new sources (number of new sources to be determined in during final design) will be disposed in accordance with U.S. Nuclear Regulatory Commission (NRC) regulations in the reclamation phase, as regulated by the MDH pursuant to their 2006 agreement with the NRC.

Left-over paint, chemical, and petroleum products from Project operations will be collected and properly recycled or disposed of during the reclamation phase.

Fluorescent and sodium halide bulbs will be removed from fixtures, collected, and properly disposed.

Oil- or chemical-stained concrete will be tested to characterize the material for potential beneficial reuse such as use for structural fill. If the material does not meet the solid waste criteria for beneficial reuse, the oil-stained concrete will be removed and properly disposed of during the reclamation phase.

7.3 Product Disposal

It is expected that all products produced by the Project (copper concentrate, nickel concentrate, mixed hydroxide product, and platinum-group elements precipitate) will be shipped off-site to customers. If any products cannot be shipped, they will be placed in the HRF or disposed in an appropriate permitted landfill as allowed by applicable laws and regulations.

The reagent suppliers will remove from the Plant Site any reagents remaining in the reclamation phase. In many cases, the suppliers of chemicals and equipment will be responsible for furnishing tanks and will therefore be required to remove and dispose of those tanks during the reclamation phase.

8.0 Plans to Transition from Mechanical to Non-Mechanical Water Treatment

An important objective of the Project is to provide water treatment for as long as necessary to meet applicable regulatory standards at groundwater and surface water compliance points. The Project includes long-term mechanical treatment (reverse osmosis or equivalently performing technology) at the WWTS with a goal of transitioning to a non-mechanical treatment technology over the long term. While non-mechanical treatment technology will still require periodic maintenance and repair, this goal is consistent with the closure and postclosure maintenance requirements of the PTM Regulations, including the regulatory goals of minimizing and eventually eliminating the need for maintenance.

This section provides PolyMet's conceptual plan for transitioning from mechanical water treatment to non-mechanical treatment technologies. Section 6 of Appendix 11.4 of the Application provides additional detail on non-mechanical treatment technologies. PolyMet plans to transition from mechanical to non-mechanical water treatment as soon as PolyMet can demonstrate that non-mechanical water treatment technologies will effectively treat water to meet the applicable water quality standards. PolyMet anticipates conducting evaluations, including data collection and pilot-studies, during the mine operations and, if necessary, after operations cease to demonstrate the ability to transition to non-mechanical water treatment while maintaining compliance with then applicable water quality standards. PolyMet anticipates that its evaluation of non-mechanical treatment systems will include several components of the Project, including the Category 1 Stockpile Groundwater Containment System, West Pit overflow, FTB seepage capture systems, and FTB Closure Overflow (post-mechanical treatment options).

Non-mechanical water treatment technologies are proven methods of water treatment, but they need to be tailored to site-specific conditions, principally those relating to water quality. Non-mechanical water treatment technologies can be thoroughly evaluated in four steps: (1) collecting site-specific information (e.g., hydrology and influent water quality), (2) laboratory testing, (3) pilot-scale testing, and (4) designing a system for full scale implementation.

PolyMet to date has collected and analyzed a substantial amount of water quality and related data with respect to the Project and the historic and existing condition of the Mining Area. It also has conducted extensive modeling with respect to the anticipated performance of the Project's pollution control systems, including the Tailings Basin and the associated seepage capture systems, the WWTS, and various liners and covers to prevent groundwater infiltration and surface water runoff of parameters of concern. Subject to review and approval by the DNR and MPCA, PolyMet plans to undertake a number of additional data collection and analyses during operations, such as those summarized below.

At the Tailings Basin, additional site-specific hydrologic information will be collected when the seepage capture systems are constructed and throughout operations. Additional data will also be collected on the quality of the seepage from the FTB. Thus, the four steps for evaluating non-mechanical water treatment at the Tailings Basin will be implemented during Project operations, potentially allowing the non-mechanical water treatment system at the Tailings Basin to be put in place shortly after operations are complete and the FTB pond bottom cover system is installed. If the transition to non-mechanical

treatment is undertaken prior to the completion of West Pit flooding, Colby Lake water possibly could be used to aid in the flooding of the West Pit. If used for this purpose, Colby Lake water may require treatment for mercury prior to transfer to the West Pit, and its use would be dependent on NPDES/SDS and Water Appropriation permitting discussions. Alternatively, West Pit flooding could be extended, depending on water quality results and other considerations.

At the Mine Site, the four steps for evaluating non-mechanical treatment technologies could be finalized in less than the time estimated for completion of the West Pit flooding (e.g., approximately 35 years after the end of Project operations). Additional time is included in PolyMet's current plan, however, because the water quality in the pit may take some time to reach equilibrium after the West Pit has flooded. Therefore, PolyMet currently anticipates implementing the four evaluation steps during the closure phase (approximately Mine Year 25 - Mine Year 28). As a result, non-mechanical water treatment technology could be implemented at the Mine Site during the closure phase or during the postclosure maintenance phase.

The water models used to support permitting for the Project were not designed to estimate when treatment for compliance with water quality standards can be ended, nor are they intended to estimate when treatment can transition from mechanical to non-mechanical systems. Rather, PolyMet will assess actual treatment requirements on a recurring basis through operations and the post-operations phases based on the actual results of monitoring discharges, performance of engineering controls, and conditions of the water resources. This process will rely on monitoring results (supported by additional analysis through modeling, as appropriate) to continuously protect groundwater and surface water in compliance with applicable water quality standards.

9.0 Monitoring During Reclamation, Closure, and Postclosure Maintenance

Monitoring, as proposed, is described in Section 14 of the Application. As noted on Table 14-1 of the Application, monitoring will continue during the reclamation, closure, and postclosure maintenance phases in accordance with permit conditions of the PTM, the individual NPDES/SDS Permit, the general NPDES/SDS stormwater permits, the Water Appropriation Permits, the Dam Safety Permits, and the Air Permit. If issued for the Project, some of these permits will require permit modifications for the reclamation, closure, and postclosure maintenance phases. For example, the NPDES/SDS Permit is a five-year permit, so there may be several changes to the permit between the construction and reclamation phases, if issued. Details of the reclamation, closure, and postclosure maintenance phase monitoring plans will be developed prior to the start of each Project phase.

10.0 Reporting During Reclamation, Closure, and Postclosure Maintenance

Reporting, as proposed, is described in Section 14 of the Application for monitoring results and in Appendix 13 for the annual PTM report. As noted on Table 14-1 of the Application, reporting the results of the monitoring for each permit will continue during the reclamation, closure, and postclosure maintenance phases in accordance with permit conditions of the PTM, the individual NPDES/SDS permit, the general NPDES/SDS stormwater permits, the Water Appropriation Permits, the Dam Safety Permits, and the Air Permit. Additionally, as required in Minnesota Rules, part 6132.1300 and described in Appendix 13.1 (Annual Report Template), an annual report is required for the PTM every year a permit is held. Details of reclamation, closure, and postclosure maintenance phase reporting will be developed prior to the start of each Project phase

Revision History

Date	Version	Description
11/03/2016	1	Initial release – submitted with Permit to Mine Application, Version 1
08/30/2017	2	Updated in response to DNR comments
12/08/2017	3	Updated in response to DNR comments

Attachments

Attachment 1

Erie Mining Company Drawing TJ-63

P.N.

DETAIL A Rev (5)

Reservoir

Garage

General Shops

Secondary Crushing Plant

Drive & Junct. House

Drive House #2

Warehouse

Diesel Gen. Floor see Dwg TD-C34

L.O. Tank 571

Rev (4)

Rev (7)

Rev (12)

see Detail A Rev (5)

blasting to be done at this time. backfill until ready for future construction.

For continuation see Dwg. TJ-G4 Rev (7)

Rev (5)

Shaded areas represent Elec. Tunnel. For excavation details, see Dwg TB-32.

Rev (10)

Rev (12)

Base Point D

Elev. 1695'-9"

Elev. 1688'-0"

Elev. 1653'-0"

Elev. 1638'-0"

Yard Elev. 1580'-0"

Bottom of Tunnel Floor Slab

776'-0" 140'-0" 147'-0" 67'-0" 15'-0"

SECTION A-A Rev (7)

Future Tunnels

Concentrator

Tailings

Thickeners

Future Tunnels & Extensions

D-3 (Emergency Tunnel)

Rev (4) For excavation details of cross-hatched areas see dwg. "TB-74.

Rev (6) Removed Det'l B; Added trench in Concentrator; Rev. exc. for overflow pipe

Rev (5) Added cut North end S-2. Rev exc. for overflow pipe. Added trench at Drive Hse #2. Added trench at East end S-1, Det'l A. extn of Elec. tunnels; Det'l B; Tunnel S-11; pit in Lube Oil Hse; pipe trench at Drive Hse #1.

NOTES

Elevations are given to bottom of tunnel floor slab.
Dimensions shown are neat lines of tunnels, i.e., out to out of tunnel walls. Allowance must be made for trench drains.
Bottom of tunnels slopes uniformly between any two (2) given elevations.
for General Excavation Plan, see Dwg. TJ-3.
for excavation plan of Crusher Plants & Drive Houses, see Dwg. TJ-G4.

DWG. NO.	DESCRIPTION
TB-32	Excavation for Elec. Tunnels
TE-72	Conc. Masonry - Service Tunnel
TG-51	Conc. Det'ls - Service Tunnel
TG-54	Conc. Det'ls - Service Tunnel
TB-14	Conc. Mas. - Main Pipe Tunnel
TJ-3	General Excavation Plan
TJ-G4	Crush. Plts. & Dr. Hses - Gen'l Exc Pl.

NO.	INITIALS	DATE	REVISION
8	JB-G.M.	11-1-55	Added excav. to Tunnel E-8 South End Added Sect. A-A Added Escape Hatch To Tunnel E-8 Removed notation "Tunnel E-18"
7	JB	2-2-55	
6	DJS	4-25-55	Widened excavation north of Drive House
5	JS	7-29-55	REMOVED DETAIL 'C' & REVISED TUNN. S-11 E5-5
4	JJC	10-5-54	See Rev. note above
3	GMK	10-20-54	See Rev. note above.
2	ALP MF	10-25-54	Added Detail C. (Diesel Gen. Exc.)
1	MAIN MF	12-22-54	Revised Excavation North End S-2

NO.	INITIALS	DATE	REVISION
6	ALP MF	7-14-54	Added excav - overflow pipe.
5	LMH	7-21-54	ADDED 25 LF TAILING TUNNELS & TUNNEL N-5. REV EXC. OF FLOW PIPE
4	ALP MF	9-15-54	Rev Elevs & Dims of S-2 thru S-6
3	LMH MF	9-17-54	ADDED EXCAV. - WEST END S-1 REV. FIRE POND STATION EXCAV.

DRAWN BY A. L. Pellegrini 6-22-54
TRACED BY
CHECKED BY Leo M. Kelly 6-28-54
APPROVED 6-29-54

ERIE MINING COMPANY
COMMERCIAL TACONITE PLANT
DULUTH, MINN.
A LIMITED PARTNERSHIP
CONSULTING ENGINEER'S OFFICE NEW YORK, N.Y.

EXCAVATION PLAN
ELECTRICAL & SERVICE TUNNELS

SCALE 1" = 100'-0"

TJ-63

ITEM	NO. REQ.	DESCRIPTION	MATL.	LOCATION	WGHT. PER UNIT	WGHT. ON DWG.	REMARKS

BILL OF MATERIAL

Attachment 2

Reclamation Seeding and Mulching Procedure

Hoyt Lakes, Minnesota **STANDARD PROCEDURE**		
RECLAMATION SEEDING AND MULCHING		
General Manager's Approval _____ Manager's Approval _____ Initiator _____	Date Effective 12/14/12	Standard Procedure (SP) Number ER15
History: 2/14/12 – ER15 - initial version 9/10/13 – Edited to support Plant Site Fugitive Emission Control Plan submittal 8/25/17 – Edited for submittal of Permit to Mine Application, Version 2 11/16/17 – Edited for submittal of Permit to Mine Application, Version 3		

PART I. DESCRIPTION

This work shall consist of the operations of establishing herbaceous ground cover on designated reclamation areas within the NorthMet Project including Flotation Tailings Basin (FTB), Hydrometallurgical Residue Facility (HRF), Pit Wall Overburden Slopes, Category 1 Waste Rock Stockpile, reclaimed roads, reclaimed building sites, and other disturbed areas. It shall include seeding, mulching, fertilizing, and any other work specified in conjunction therewith.

The primary objectives of establishing herbaceous ground cover are to:

- Rapidly (3-5 years) establish a self-sustaining plant community
- Control air emissions
- Control soil erosion
- Provide for wildlife habitat, and
- Minimize to the extent practicable the need for maintenance

In accomplishing these objectives, preference will be given to the establishment of plant communities consisting of native plant species. The introduction of invasive species will be avoided to the extent that such a practice does not interfere with the timely and effective accomplishment of the primary objectives for vegetation establishment.

1.01 CONSTRUCTION REQUIREMENTS

A. General

If any of the work provided for herein is performed under unfavorable conditions or contrary to the restrictions and requirements set forth, the Contractor shall assume full responsibility for

the results by repairing any damages and replacing unacceptable work as the *Operations Contact* directs.

The Contractor will provide seed, fertilizer, mulch and any other materials necessary to complete the job unless notified in writing that PolyMet will provide materials.

Contracted equipment and/or substitutions from that listed herein or in the Vegetative Specifications must be approved by the *Operations Contact* before the substitution can be made.

B. Placing and Working-In Fertilizer

Fertilizers shall be applied at the rates indicated in the Vegetative Specifications, using mechanical spreading devices to the fullest extent practicable, and providing uniform distribution of the material over the designated areas.

Unless otherwise specified, immediately prior to sowing the seed, the fertilizer shall be worked into a depth of approximately eight inches on the level and four inches on all slopes, using rotovators, klodbusters, discs, harrows, etc., or as specified on the Vegetative Specifications. On slopes, the cultivating equipment shall be operated in a general direction at right angles to the direction of surface drainage wherever practical.

C. Sowing Seed

The season of planting (dates approximate) for the various seed mixtures shall be as follows:

Season of Planting

Winter:	March
Spring:	Fertilization will commence as soon as the ground is workable, and planting will commence as soon after May 1st as is practicable and will be completed by approximately June 15th.
Summer:	Approximately July 20th - August 10th
Fall:	After October 15th

On areas to be mulched after seeding, no more seed shall be sown on any day than can be mulched on the same day. In any event, the lag time between seeding and mulching shall not exceed 24 hours where the mulch is placed after seeding. Should the mulch application be delayed more than 24 hours, the *Operations Contact* may order the area reseeded at the Contractor's expense.

Seed shall be sown by means of mechanical, Truax native seed drill or hydrospreading of the seeds at the specified rate of application. The use of hand operated mechanical spreaders will be permitted only on areas which are inaccessible to, or too small for the other equipment approved herein, all as determined by the *Operations Contact*. During windy weather, no seeding shall be done with cyclone type broadcasting devices.

All legume seed used must be pre-inoculated. If a hydroseeder will be used to distribute seed, double the appropriate bacteria culture will be added to the hydroseeder tank immediately before planting commences. The inoculant will be supplied by the Contractor and must be kept cool by the Contractor until the time of its use.

If a seed drill of the agricultural type is used, the drill shall be operated in a general direction at right angles to the direction of surface drainage, wherever practical, and the seed shall not be sown to a depth greater than 1/2 inch. Small seed species such as red top, etc., shall be sown through the grass seed attachment or by other approved means.

Broadcast seeders shall be used in wet areas where drill seeders tend to clog-up and will be followed by a cultipacker or equivalent.

If a hydroseeder is used, it shall have continuous agitation action that keeps the seed mixed in uniform distribution in the water slurry until pumped from the tank. The pump pressure shall be such that a continuous, nonfluctuating stream is maintained.

All seeded areas shall have the seedbed firmed or the seed worked in or covered after seeding and prior to mulching. Soil firming or seed covering shall be accomplished within twenty-four hours after seeding.

D. Mulch Classification

Mulch material shall conform to the requirements for one of the following types, as specified in the Contract:

Type 1 - Mulch shall consist of grain straw, hay, cutting of agricultural grasses and legumes. The material shall be relatively free of seed bearing stalks of noxious grasses or weeds, as defined by the rules and regulations of the Minnesota Department of Agriculture.

Type 2 - Type 2 mulch shall consist of a mixture of Type 1 (straw, hay, etc.) with a tackifier such as guar, starch or asphalt emulsion materials.

Type 3 - Type 3 mulch shall consist of Type 1 (straw, hay, etc.) spread on the ground and anchored using an Imco disc or comparable equipment.

Type 4 - Type 4 mulch shall consist of approved chemical application.

Type 5 - Type 5 mulch shall consist of wood fiber, newsprint, chopped straw, cotton fiber or any combination of the four listed materials.

Type 6 - Type 6 mulch shall consist of an initial application of Type 1 mulch held in place with Type 5 mulch.

E. Applying Mulch

Type 1 - Wherever possible, Type 1 mulch shall be placed with blower equipment. The rate of application shall be 2 tons/acre. Where so specified and provided for in the Vegetative Specifications, the mulch shall be anchored the same day it is placed, unless otherwise authorized by the *Operations Contact*.

Type 2 - Type 2 mulch materials shall be applied by blowing, with tackifier being sprayed into the Type 1 material as it leaves the blower. Disc anchoring will not be required. The rates of application shall be 2 tons of Type 1 and 250 gallons of tackifier per acre.

Type 3 - Type 3 mulch materials shall be applied by blowing or spreading. Application rates shall be 2 tons of Type 1 mulch per acre (or other approved rate). The mulch shall be anchored with an Imco disc or other approved equipment the same day it is placed.

Type 4 - Type 4 mulch shall be applied with hydraulic spray equipment at the rate of 650 gallons per acre (four parts water to one part TREX), or 1,300 gallons per acre (9 parts water to one part Coherex) or another rate and chemicals as designated by the *Operations Contact*. The slurry mixture shall be uniformly sprayed on the prepared seed bed. The *Operations Contact* will verify, by inspection of tank loading and spray application, that materials applied correspond with the per acre requirements within reasonable limitations.

Type 5 - Type 5 mulch shall be applied with hydraulic spray equipment at the rate of 1,500 to 2,000 lbs./acre (or other approved rate). The slurry mixture shall be uniformly sprayed on the prepared seed bed.

Type 6 - Type 6 mulch materials shall be applied by:

1) Blowing on 2 tons/acre of Type 1 mulch material.
2) Application over the Type 1 mulch of 1000 lbs./acre Type 5 mulch.

F. Litter Reduction

Litter reduction will be a spring treatment used on interior areas displaying an excessive amount of organic material from previous year's growth. A brush hog, weed chopper or other equipment approved by the *Operations Contact* shall be used to chop and scatter the existing vegetative material. This treatment will normally be used alone.

G. Plowing

Plowing will be a fall treatment used on interior areas choked with root-bound vegetation or containing excessive amounts of litter. Unless otherwise specified, this treatment shall be done immediately prior to placing and working in fertilizer. Approximate depth of cut shall be eight (8) inches.

1.02 METHOD OF MEASUREMENT

A. Seeding (Areas)

Seeding will be measured by the area seeded, regardless of the seed mixture or quantity of seed used, and regardless of whether the seed was furnished by the Contractor or PolyMet. Areas reseeded by order of the *Operations Contact*, after the original seeding of the area was accepted, will be measured and added to the area originally seeded.

B. Mulch (Mulch - Tons)

(Non-Petro Binder - Pounds or Gallons)
(Dust Retarding Chemicals - Gallons)

Mulch material of Type 1 will be measured by the weight furnished and applied acceptably.

C. Disc Anchoring (Acres)

Disc anchoring of Type 1 mulch will be measured by the area in acres of mulch disced acceptably.

D. Plowing (Acres)

Plowing will be measured by the area in acres treated acceptably.

PART 2 VEGETATIVE SPECIFICATIONS

2.01 TREATMENT A - FERTILIZING AND PLANTING FLAT AREAS

This treatment, described below, will be done on

- the flat, fine tailings found at the FTB and HRF interior areas
- on some coarse tailing FTB and HRF dams with slopes flatter than 3:1
- top and benches of Category 1 Waste Rock Stockpile
- reclaimed roads and building sites
- other disturbed areas

A. Fertilization

1. Application will be made using a mechanical spreader, hydro-seeder, or other equivalent device approved by the *Operations Contact*.

2. Soil testing will be completed to evaluate fertilizer needs. In absence of soil testing, fertilizer will be applied on mineral overburden at a uniform rate of 200 pounds of 19-19-19 per acre (or equivalent) and on tailings at a uniform rate of 333 pounds of 18-46-0 (or equivalent), or other rate designated by the *Operations Contact*.

3. After application, the fertilizer will be worked and thoroughly mixed with the tailing or mineral overburden using a disc (or equivalent) to an approximate depth of six (6) inches.

B. Sowing of Seed

1. Seed Mixtures for temporary dust control on FTB beaches.

Mixture Number	Species		Rate (lbs/acre)
A1[1]	Oats (*Avena sativa*)		100
		Total	**100**
A2[2]	Winter Wheat (*Triticum aestivum*)		100
		Total	**100**
A3[3]	Annual Rye (*Loliuum italicum*)		20
	Alfalfa (*Medicago sativa*)		5
	Redtop (*Agrostis stolonifera*)		5
	Alsike Clover (*Trifolium hybridum*)		5
		Total	**35**
A4	Any substitute mixture or individual species designated by the *Operations Contact*. Substitutes may become necessary due to seed availability or suitability.		

[1] State Seed Mix* 21-111. Temporary cover for spring and summer plantings.
[2] State Seed Mix* 21-112. Temporary cover for fall plantings.
[3] Seed mix used by LTVSMC for temporary dust control.

2. Seed Mixtures for permanent reclamation cover on FTB upland beaches, Category 1 Waste Rock Stockpile top, bench and reclaimed roads, building sites and other disturbed areas.

Mixture Number	Species	Rate (lbs/acre)
B1[1]	Fringed Brome (*Bromus ciliates*)	2.00
	Bluejoint (*Calamagrostis canadensis*)	0.13
	Poverty Grass (*Danthonia spicata*)	0.50
	Nodding Wild Rye (*Elymus canadensis*)	1.25
	Slender Wheatgrass (*Elymus trachycaulus*)	2.00
	Fowl Bluegrass (*Poa palustris*)	0.87
	False Melic (*Schizachne purpurascens*)	0.25
	Total Grasses	**7.00**
	Common Yarrow (*Achillea millefolium*)	0.03
	Pearly Everlasting (*Anaphalis margaritacea*)	0.02
	Flat-topped Aster (*Doellingeria umbellate*)	0.04
	Tall Cinquefoil (*Drymocallis arguta*)	0.06
	Large-leaved Aster (*Eurybia macrophylla*)	0.02
	Stiff Goldenrod (*Oligoneuron rigidum*)	0.14
	Smooth Wild Rose (*Rosa blanda*)	0.16
	Black-eyed Susan (*Rudbeckia hirta*)	0.26
	Gray Goldenrod (*Solidago nemoralis*)	0.06
	Upland White Aster (*Solidago ptarmicoides*)	0.04
	Lindley's Aster (*Symphyotrichum ciliolatum*)	0.03
	Smooth Aster (*Symphyotrichum leave*)	0.14
	American Vetch (*Vicia americana*)	0.50
	Total Forbs	**1.68**
	Oats or Winter Wheat (season dependent)	25.00
	Total Cover Crop	**25.00**
	Totals:	**33.50**

Mixture Number	Species	Rate (lbs/acre)
B2[2]	Meadow Brome (*Bromus biebersteinii*)	8.0
	Canada Wild Rye (*Elymus canadensis*)	8.0
	Switchgrass (*Panicum virgatum*)	8.0
	Canada Bluegrass (*Poa compressa*)	5.0
	Intermediate Wheatgrass (*Thinopyrum intermedium*)	8.0
	Red Fescue (*Festuca rubra*)	5.0
	Timothy (*Phleum pretense*)	3.0
	Alfalfa (*Medicago sativa*)	12.0
	White clover (*Trifolium repens*)	3.0
	Grass and Legume Total	60.0
	Oats or Winter Wheat (season dependent)	25.0
	Totals:	85.0
B3[3]	Canada Bluegrass (*Poa compressa*)	10
	Redtop (*Agrostis stolonifera*)	5
	Cicer Milkvetch (*Astragalus cicer*)	10
	Alfalfa (*Medicago sativa*)	20
	Perennial Ryegrass (*Lolium perene*)	10
	Alsike Clover (*Trifolium hybridum*)	10
	Total	65
B4	Any substitute mixture or individual species designated by the *Operations Contact.* Substitutes may become necessary due to seed availability or suitability.	

[1] State Seed Mix* 36-311. Woodland Edge for reclamation in NE MN. The proportion of legumes and rate of cover crop seeding for FTB beaches may be adjusted based on field results.

[2] Adapted from "Guidelines for Reclamation Plantings on Taconite Tailings Basins and Stockpiles". MDNR Lands and Minerals. January 2012, *Updated August 2013*

[3] Used by LTVSMC for permanent taconite tailings reclamation, except alfalfa was substituted for birdsfoot trefoil The seeding rate of cicer milkvetch may be reduced on flat areas.

3. Wetland Seed Mixtures for permanent reclamation cover on wet tailing soils near FTB pond; and wet soils atop the East Pit backfill and/or depressions associated with former temporary stockpile footprints.

Mixture Number	Species	Rate (lbs/acre)
C1[1]	Fringed Brome (*Bromus ciliates*)	2.00
	Bluejoint (*Calamagrostis canadensis*)	0.10
	Virginia Wildrye (*Elymus virginicus*)	1.50
	Tall Manna Grass (*Glyceria grandis*)	0.25
	Fowl Bluegrass (*Poa palustris*)	0.65
	Total Grasses	**4.50**
	Tussock Sedge (*Carex stricta*)	0.04
	Pointed Broom Sedge (*Carex Scoparia*)	0.05
	Dark Green Bulrush (*Scirpus atrovirens*)	0.20
	Woolgrass (*Scirpus cyperinus*)	0.06
	Total Sedge and Rushes	**0.35**
	Canada Anemone (*Anemone canadensis*)	0.10
	Marsh Milkweed (*Asclepias incarnate*)	0.24
	Flat-topped Aster (*Doellingeria umbellate*)	0.10
	Common Boneset (*Eupatorium perfoliatum*)	0.09
	Grass-leaved Goldenrod (*Euthamia graminifolia*)	0.04
	Spotted Joe Pye Weed (*Eutrochium maculatum*)	0.14
	Blue Monkey Flower (*Mimulus ringens*)	0.03
	Giant Goldenrod (*Solidago gigantean*)	0.03
	Eastern Panicled Aster (*Symphotrichum lanceolatum*)	0.03
	Total Forbs	**0.80**
	Oats or Winter Wheat (season dependent)	6.85
	Total Cover Crop	6.85
	Totals	**12.50**
C2	Any substitute mixture or individual species designated by the *Operations Contact.* Substitutes may become necessary due to seed availability or suitability.	

[1] State Seed Mix* 34-371. Wet meadow NE MN.

4. The individual species or mixtures will be sown in one application in areas clearly designated by the *Operations Contact*.

5. Method of Application If the seed is not premixed, it will be mixed by the contractor in the proper proportions and sown using a hydroseeder, Truax native seed drill, broadcast seeder or equivalent.

6. Soil firming using a cultipacker or equivalent will be required for all Treatment "A" acres and will follow seeding as soon as possible. In all cases, packing will be complete within 24 hours of seeding.

C. Mulching – Type 3

2.02 TREATMENT B - FERTILIZING AND PLANTING SLOPES

This treatment, described below, will be done mainly on the FTB and HRF dam slopes and benches, Pit Wall Overburden Slopes, and Category 1 Waste Rock Stockpile slopes but some may be done on natural ground.

A. Fertilization

1. Application will be made using a mechanical spreader, hydroseeder, or another equivalent device approved by the *Operations Contact*.

2. Soil testing will be completed to evaluate fertilizer needs. In absence of soil testing, fertilizer will be applied on mineral overburden at a uniform rate of 200 pounds of 19-19-19 per acre (or equivalent) and on tailings at a uniform rate of 333 pounds of 18-46-0 per acre (or equivalent), or other rate designated by the *Operations Contact*.

3. After application, the fertilizer will be worked and thoroughly mixed into the tailing or topsoil with a klodbuster or equivalent to an approximate depth of 4 inches (6 passes over a given area).

B. Sowing of Seed

1. Seed Mixtures for permanent cover on FTB and HRF dam slopes and benches. Pit Wall Overburden Slopes and Category 1 Waste Rock Stockpile slopes:

Mixture Number	Species	Rate (lbs/acre)
D1[1]	Fringed Brome (*Bromus ciliates*)	2.00
	Bluejoint (*Calamagrostis canadensis*)	0.13
	Poverty Grass (*Danthonia spicata*)	0.50
	Nodding Wild Rye (*Elymus canadensis*)	1.25
	Slender Wheatgrass (*Elymus trachycaulus*)	2.00
	Fowl Bluegrass (*Poa palustris*)	0.87
	False Melic (*Schizachne purpurascens*)	0.25
	Total Grasses	**7.00**

Mixture Number	Species		Rate (lbs/acre)
	Common Yarrow (*Achillea millefolium*)		0.03
	Pearly Everlasting (*Anaphalis margaritacea*)		0.02
	Flat-topped Aster (*Doellingeria umbellate*)		0.04
	Tall Cinquefoil (*Drymocallis arguta*)		0.06
	Large-leaved Aster (*Eurybia macrophylla*)		0.02
	Stiff Goldenrod (*Oligoneuron rigidum*)		0.14
	Smooth Wild Rose (*Rosa blanda*)		0.16
	Black-eyed Susan (*Rudbeckia hirta*)		0.26
	Gray Goldenrod (*Solidago nemoralis*)		0.06
	Upland White Aster (*Solidago ptarmicoides*)		0.04
	Lindley's Aster (*Symphyotrichum ciliolatum*)		0.03
	Smooth Aster (*Symphyotrichum leave*)		0.14
	American Vetch (*Vicia americana*)		0.50
		Total Forbs	**1.68**
	Oats or Winter Wheat (season dependent)		25.00
		Total Cover Crop	**25.00**
		Totals:	**33.50**
D2[2]	Meadow Brome (*Bromus biebersteinii*)		8.0
	Canada Wild Rye (*Elymus canadensis*)		8.0
	Switchgrass (*Panicum virgatum*)		8.0
	Canada Bluegrass (*Poa compressa*)		5.0
	Intermediate Wheatgrass (*Thinopyrum intermedium*)		8.0
	Red Fescue (*Festuca rubra*)		5.0
	Timothy (*Phleum pretense*)		3.0
	Alfalfa (*Medicago sativa*)		12.0
	White clover (*Trifolium repens*)		3.0
		Grass and Legume Total	60.0
	Oats or Winter Wheat (season dependent)		25.0
		Totals:	85.0

Mixture Number	Species	Rate (lbs/acre)
D3[3]	Meadow Brome (*Bromus biebersteinii*)	10
	Red Fescue (*Festuca rubra*)	10
	Perennial Ryegrass (*Lolium perene*)	10
	Cicer Milkvetch (*Astragalus cicer*)	10
	Alfalfa (*Medicago sativa*)	20
	White Clover (*Trifolium repens*)	10
D4	Any substitute mixture or individual species designated by the *Operations Contact.* Substitutes may become necessary due to seed availability or suitability.	

[1] State Seed Mix* 36-311. Woodland edge for reclamation in NE MN.
[2] Adapted from "Guidelines for Reclamation Plantings on Taconite Tailings Basins and Stockpiles". MDNR Lands and Minerals. January 2012*, Updated August 2013*.
[3] Used by LTVSMC for permanent taconite tailings reclamation, except alfalfa was substituted for birdsfoot trefoil and meadow brome was substituted for smooth brome. The seeding rate of cicer milkvetch may be reduced on flat areas.

State Seed Mixes
Standard seed mixtures used by Mn/DOT, BWSR, and some divisions of the DNR have been revised and consolidated into one list of State Seed Mixes. Standards for the mixes have also been combined, with both BWSR and Mn/DOT requiring that mixes be sold as pure live seed (PLS), Source Identified (Yellow Tag) when available, and specific labeling requirements. Please see:
http://www.bwsr.state.mn.us/native_vegetation/state_seed_mixes.pdf.

2. Method of Application - if seed is not premixed, it will be mixed by the Contractor in the proper proportions and sown using a hydroseeder or similar equipment approved by the *Operations Contact*.

3. The seed will be covered by dragging a light chain over the surface, one (1) pass of the klodbuster or covering by a similar method approved by the *Operations Contact*.

4. All legume seed will be pre-inoculated and supplemented in hydroseeder tank.

2.03 TREATMENT C - MULCHING ONLY

These are fertilized and seeded areas which require additional mulching or areas mulched for dust control.

A. Mulching

1. Mulch will be distributed at a rate provided in Part I of the general specifications and uniformly spread to provide the most adequate vegetative protection on all treatment acres as directed by the *Operations Contact.*

2.04 TREATMENT D - MAINTENANCE

These are fertilized, seeded, and mulched areas which require additional maintenance until vegetation is established. Maintenance work will be directed by *Operations Contact* and may include repair and stabilization of erosion and additional applications of fertilizer, seed, and/or mulch, as necessary.

Attachment 3

Documentation of Vegetative Reference Areas

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BARR

Technical Memorandum

To: Christie Kearney, Poly Met Mining, Inc.
From: Pete Kero, Dan Engel
Subject: Documentation of Vegetative Reference Areas
Date: August 22, 2017
Project: 23690862.14 100 003

On behalf of PolyMet Mining, Inc. (PolyMet), Barr Engineering Co. has identified, surveyed and documented vegetative reference areas as required by Minnesota Rules, part 6132.1100, subpart 7B and part 6132.2700, subpart 2C, item 2. The documentation of the vegetative reference areas contained in this memo will be used to comparatively measure the vegetation success of PolyMet's reclamation activities. This memo documents the vegetative reference area selection process, the vegetation survey methods, and the results of the 2017 reference area vegetation survey.

Selection of Vegetative Reference Areas

PolyMet worked with the Minnesota Department of Natural Resources (DNR) to select appropriate vegetative reference areas for the NorthMet Project. Minnesota Rules, part 6132.2700, subpart 2C, item 2 defines the criteria for vegetative reference areas:

> *"The vegetation on a reference area may be either planted or naturally occurring. For the purposes of controlling erosion, it shall be self-sustaining, regenerating, or a stage in a recognized vegetation success that provides subsequent land uses such as wildlife habitat or timber production. Reference areas must be representative of the site conditions and possible uses that might exist on mining land forms."*

On May 10, 2017, staff from PolyMet and Barr met with Rory Oberhelman at the DNR Lands and Minerals office in Hibbing to discuss the selection process for the vegetative reference areas, review DNR-recommended sites, review the DNR reclamation inspection data, and discuss DNR reclamation inspection methods.

On May 24, 2017, staff from PolyMet and Barr visited the DNR-proposed vegetative reference areas to collect preliminary data on these areas and consider alternative sites.

On June 16, 2017, staff from PolyMet and Barr visited the PolyMet-proposed vegetative reference areas, which were slightly different than the DNR-proposed vegetative reference areas, with DNR staff (Rory Oberhelman and Andrew Reed). At this meeting, DNR staff provided a verbal concurrence with the proposed vegetative reference areas and proposed vegetation survey method. Verbal approval of the proposed vegetation survey methods was confirmed during a meeting with DNR staff on July 12, 2017.

Vegetation Survey Methods

The method used for documenting vegetation in the vegetative reference areas is based on the relevé method, which is widely used in Minnesota, and documented in the DNR's *Handbook for Collecting Vegetation Plot Data in Minnesota: the Relevé method (2nd Edition)* (Reference (1)). Exhibit A contains the Sampling Plan for Vegetative Reference Areas, which includes minor modifications from the plan provided to the DNR for review on June 16, 2017. These modifications include content changes to better align the Sampling Plan with DNR data requests and wording changes to improve clarity of the Sampling Plan.

Vegetation Survey Results

On June 23, 2017, Barr visited the site to establish and survey plots within the selected vegetative reference areas. Large Table 1 contains survey data and summary statistics for each of the plots. Large Figure 1 and Large Figure 2 show the locations of the vegetative reference areas and the survey plots. The longitude and latitude for the center of each plot are shown on Large Figure 2. Exhibit B contains representative photographs of each plot.

Pit Wall Slope

The vegetative reference area for overburden portion of the pit wall slopes is located at the west of end of the Area 2W Pit (Large Figure 1 and Large Figure 2). In 2014, this area passed a 10-year DNR reclamation inspection pursuant to Minnesota Rules, part 6130.3600, subpart 4B. This vegetative reference area has a planted community that is self-sustaining, and not subject to regular management. During the survey, Barr observed that the plot contained three species of vascular plants, 98 percent ground cover of living vegetation and its litter, 1 percent cover of bare soil, and 1 percent cover of bare rock. Most of the species in the plot are introduced, but not considered invasive (Large Table 1, Photographs 1 through 9 of Exhibit B).

Stockpile Flat

The vegetative reference area for stockpile flats is located on the north side of LTV Steel Mining Company (LYVSMC) Stockpile 2012 (Large Figure 1 and Large Figure 2). In 2013, this area passed a 10-year DNR reclamation inspection pursuant to Minnesota Rules, part 6130.3600, subpart 4B. This vegetative reference area has a planted community that is self-sustaining, and not subject to regular management. Because PolyMet's only permanent rock stockpile (the Category 1 Waste Rock Stockpile) will be reclaimed using an engineered geomembrane cover system that will be seeded with no deep-rooting plant species, the survey plot was positioned in an area without shrub or tree species. During the survey, Barr observed that the plot contained eight species of vascular plants, 99 percent ground cover of living vegetation and its litter, no bare soil, and 1 percent cover of bare rock. Most of the species in the plot are introduced, but not considered invasive (Large Table 1, Photographs 10 through 18 of Exhibit B).

Stockpile Slope

The vegetative reference area for stockpile slopes is located on the north side of LTVSMC Stockpile 2012 (Large Figure 1 and Large Figure 2). In 2013, this area passed a 10-year DNR reclamation inspection pursuant to Minnesota Rules, part 6130.3600, subpart 4B. This vegetative reference area has a planted community that is self-sustaining, and not subject to regular management. Because PolyMet's only permanent rock stockpile (the Category 1 Waste Rock Stockpile) will be reclaimed using an engineered geomembrane cover system that will be seeded with no deep-rooting plant species, the survey plot was positioned in an area without shrub or tree species. This plot was also elongated to omit shrub species that were present on the stockpile slopes. During the survey, Barr observed that the plot contained 15 species of vascular plants, 90 percent ground cover of living vegetation and its litter, 5 percent cover of bare soil, and 5 percent cover of bare rock. Most of the species in the plot are introduced, but not considered invasive (Large Table 1, Photographs 19 through 26 of Exhibit B).

Tailings Basin Flat

The vegetative reference area for the tailings basin flats is located at the northwest corner of the LTVSMC tailings basin (Large Figure 1 and Large Figure 2). In 2012, this area passed a 10-year DNR reclamation inspection pursuant to Minnesota Rules, part 6130.3600, subpart 4B. This vegetative reference area has a planted community that is self-sustaining, and not subject to regular management. During the survey, Barr observed that the plot contained seven species of vascular plants, 95 percent ground cover of living vegetation and its litter, 5 percent cover of bare soil, and no bare rock. Most of the species in the plot are introduced, but not considered invasive (Large Table 1, Photographs 27 through 35 of Exhibit B).

Tailings Basin Slope

The vegetative reference area for the tailings basin slopes is located at the northwest corner of the LTVSMC tailings basin (Large Figure 1 and Large Figure 2). In 2015, this area passed a 10-year DNR reclamation inspection pursuant to Minnesota Rules, part 6130.3600, subpart 4B. This vegetative reference area has a planted community that is self-sustaining, and not subject to regular management. During the survey, Barr observed that the plot contained eight species of vascular plants, 95 percent ground cover of living vegetation and its litter, 5 percent cover of bare soil, and no bare rock. Most of the species in the plot are introduced, but not considered invasive (Large Table 1, Photographs 36 through 44 of Exhibit B).

Summary

PolyMet worked with the DNR to select vegetative reference areas that will be used to comparatively measure the vegetation success of PolyMet's reclamation activities. Each of the vegetative reference areas is representative of site conditions and each vegetative reference area has passed a 10-year inspection by DNR staff pursuant to Minnesota Rules, part 6130.3600, subpart 4B, which is similar to the requirements of Minnesota Rules, part 6132.2700, subpart 2C, item 2.

In June 2017, Barr established and surveyed a total of five plots in the vegetative reference areas, one for each of the following mine feature types: pit wall, stockpile flat, stockpile slope, tailings basin flat, and tailings basin slope. These baseline survey data indicate that each of the plots has more than 90 percent ground cover of living vegetation and its litter, and none of the plots contain invasive species.

References

1. **Minnesota Department of Natural Resources.** *A Handbook for Collecting Vegetation Plot Data in Minnesota: The Relevé Method.* 2nd. 2013.

Attachments

Large Table 1 2017 Vegetation Survey Data
Large Figure 1 Vegetative Reference Area Locations
Large Figure 2 Vegetative Reference Area Detail
Exhibit A Sampling Plan for Vegetative Reference Areas
Exhibit B Photographs

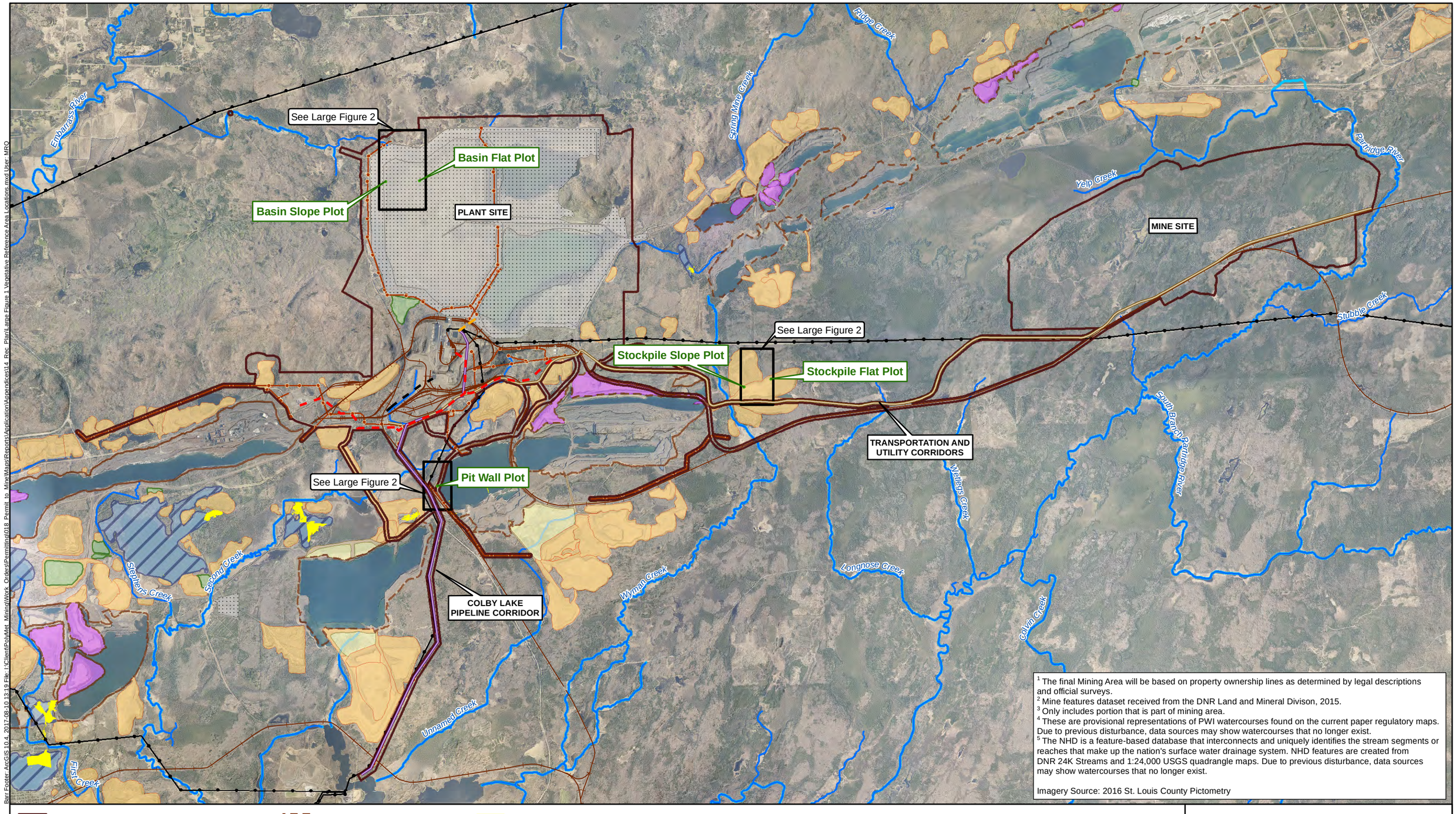
Large Table 1
2017 Vegetation Survey Data
Vegetative Reference Areas
PolyMet Mining, Inc.

Scientific Name	Common Name	Native Status[1]	Invasive Status[1]	Rarity Status[1]	Physiognomy[1]	Stratum	Pit Wall Slope Foliar cover (% absolute)[2]	Stockpile Flat Foliar cover (% absolute)[2]	Stockpile Slope Foliar cover (% absolute)[2]	Tailings Basin Flat Foliar cover (% absolute)[2]	Tailings Basin Slope Foliar cover (% absolute)[2]
Achillea millefolium	common yarrow	Undetermined	None	None	Forb	Herbaceous			2		
Artemisia absinthium	absinthe wormwood	Introduced	None	None	Forb	Herbaceous			10		
Astragalus cicer	chickpea milk-vetch	Introduced	No data	No data	Forb	Herbaceous	80	50	40	50	
Bromus inermis	smooth brome	Introduced	None	None	Graminoid	Herbaceous	10	50	25	10	10
Danthonia spicata	poverty grass	Native	None	None	Graminoid	Herbaceous				5	
Elymus repens	quackgrass	Introduced	None	None	Graminoid	Herbaceous		5			
Festuca rubra	red fescue	Introduced	None	None	Graminoid	Herbaceous		75			
Fragaria virginiana	common strawberry	Native	None	None	Forb	Herbaceous			5		
Galeopsis tetrahit	hemp nettle	Introduced	None	None	Forb	Herbaceous	70		1		
Hieracium caespitosum	meadow hawkweed	Introduced	None	None	Forb	Herbaceous		5	5		5
Leucanthemum vulgare	ox-eye daisy	Introduced	None	None	Forb	Herbaceous		2	2		1
Lotus corniculata	bird's foot trefoil	Introduced	None	None	Forb	Herbaceous		20	10	1	25
Melilotus officinale	yellow sweet clover	Introduced	None	None	Forb	Herbaceous				25	
Oenothera biennis	common evening primrose	Native	None	None	Forb	Herbaceous			1		
Poa compressa	Canada bluegrass	Introduced	None	None	Graminoid	Herbaceous		10	25	10	80
Poa pratensis	Kentucky bluegrass	Introduced	None	None	Graminoid	Herbaceous				10	
Rubus idaeus var. *strigosus*	red raspberry	Native	None	None	Broadleaf Deciduous	Herbaceous			5		
Solidago canadensis	Canada goldenrod	Native	None	None	Forb	Herbaceous			5		
Taraxacum officinale	common dandelion	Introduced	None	None	Forb	Herbaceous			2		1
Tragopogon dubius	yellow goat's beard	Introduced	None	None	Forb	Herbaceous					2
Verbascum thapsus	common mullein	Introduced	None	None	Forb	Herbaceous			1		
Vicia cracca	tufted vetch	Introduced	None	None	Forb	Herbaceous					10
						Total vegetation (absolute cover, %), including overlap from stacked plants:	160	217	139	111	134
						Species richness (count):	3	8	15	7	8
						Total litter (absolute cover, %):	90	95	80	90	90
						Total bare rock (absolute cover, %):	1	1	5	0	0
						Total bare soil (absolute cover, %):	1	0	5	5	5
						Total ground cover (absolute cover, %):	**98**	**99**	**90**	**95**	**95**
						Plot dimensions:	10m x 10m	10m x 10m	6.7m x 15m	10m x 10m	10m x 10m
						Plot slope (degrees):	22	3	40	<2	14
						Minutes surveyed:	20	20	20	20	20

(1) Plant data from current DNR plant checklist (November 18, 2013)

(2) Vegetation data collected by Barr Engineering Company on June 23, 2017

Note: Total ground cover is computed by subtracting total bare rock and total bare soil from 100%.



[1] The final Mining Area will be based on property ownership lines as determined by legal descriptions and official surveys.
[2] Mine features dataset received from the DNR Land and Mineral Divison, 2015.
[3] Only includes portion that is part of mining area.
[4] These are provisional representations of PWI watercourses found on the current paper regulatory maps. Due to previous disturbance, data sources may show watercourses that no longer exist.
[5] The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance, data sources may show watercourses that no longer exist.

Imagery Source: 2016 St. Louis County Pictometry

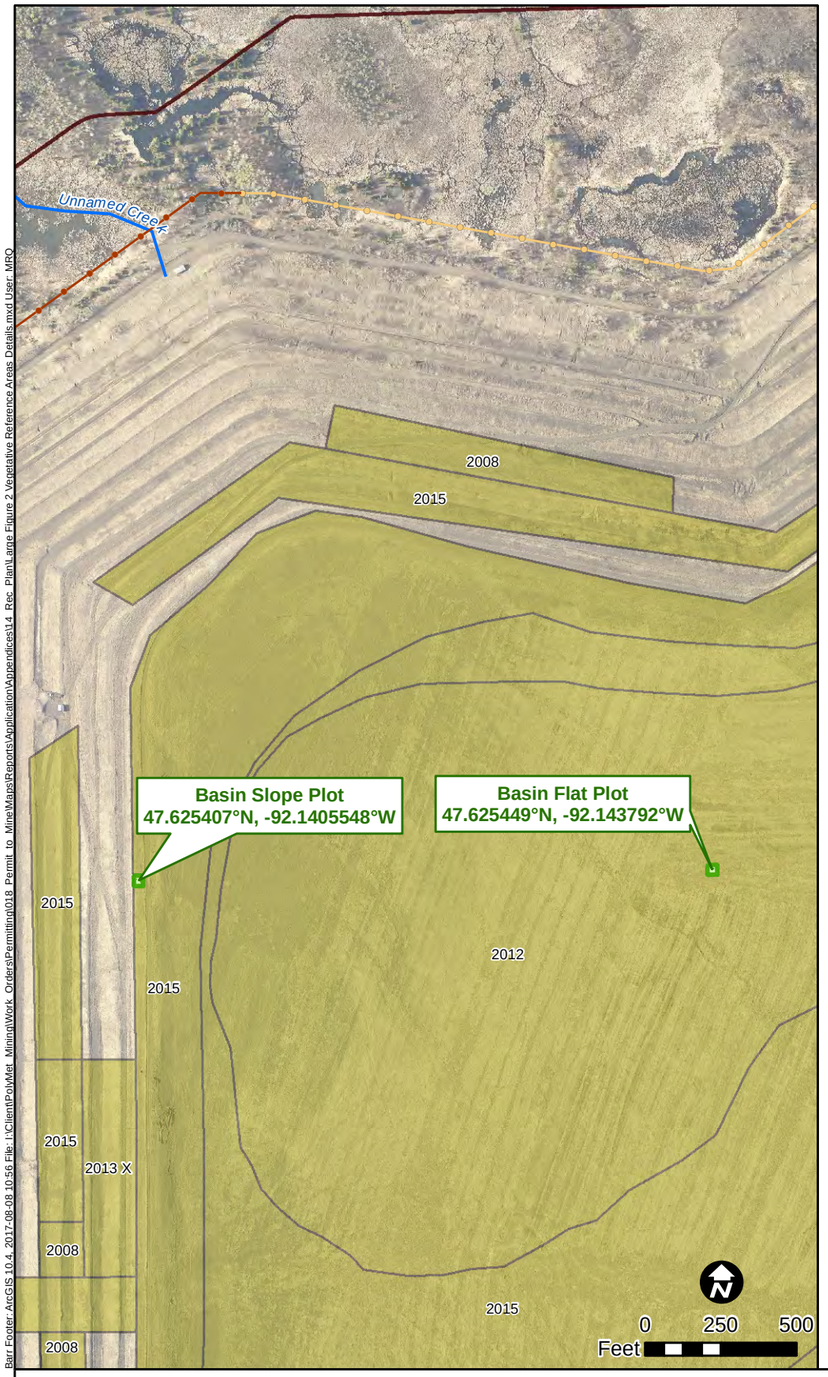
- Mining Area[1]
- Vegetative Reference Areas
- DNR Land and Minerals Mine Features (2015)[2]
- Caved Area
- Stockpile
- In-Pit Stockpile
- Taconite Pit
- Natural Ore Pit
- Reservoir or Settling Basin
- Tailings Basin
- Haul Road
- Undisturbed/Natural Ground
- Underground Mine Features (2011)
- Tailings Water Management (Underground)
- Potable Water Pipeline (Underground)
- Natural Gas Line (Underground)
- Colby Lake Pipeline
- Dunka Road[3]
- Existing Private Railroad
- PolyMet Power Distribution Lines - Existing
- Public Waters Inventory (PWI) Watercourse[4]
- National Hydrography Dataset (NHD) Rivers & Streams[5]

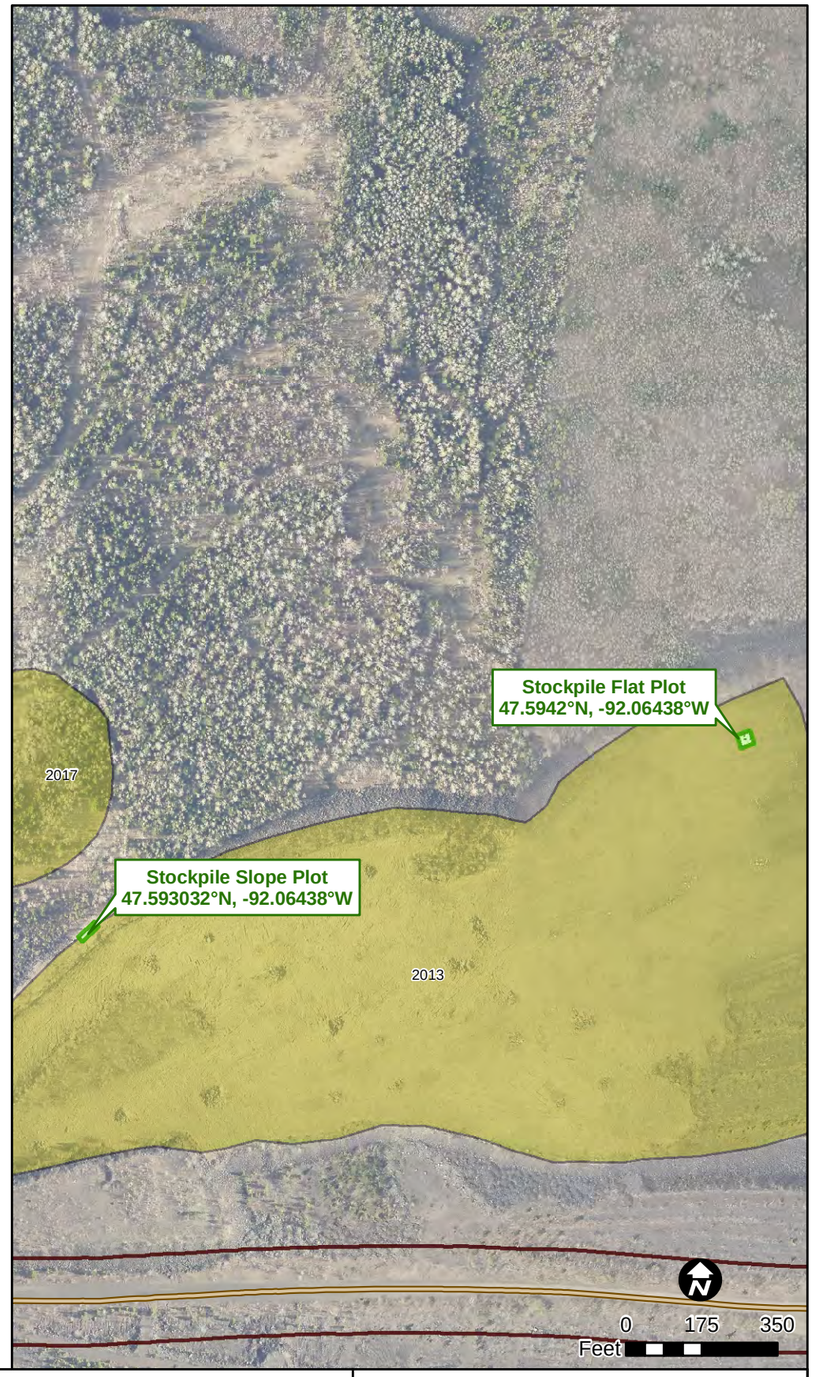
N

0 2,500 5,000
Feet

VEGETATIVE REFERENCE AREA LOCATIONS
NorthMet Project
Poly Met Mining, Inc.

Large Figure 1
Reclamation, Closure, and Postclosure Maintenance Plan





Barr Footer: ArcGIS 10.4, 2017-08-08 10:56 File: i:\Client\PolyMet_Mining\Work_Orders\Permitting\018_Permit_to_Mine\Maps\Reports\Application\Appendices\14_Res_Plan\Large Figure 2 Vegetative Reference Areas Details.mxd User: MRO

- Mining Area[1]
- Dunka Road[2]
- PolyMet Power Distribution Lines - Existing
- PolyMet Power Distribution Lines - Proposed
- Minnesota Power Transmission Lines
- Vegetative Reference Areas
- Reclaimed Reference Site[3]
- National Hydrography Dataset (NHD) Rivers & Streams[4]
- 2015 Year in which 10 year inspection was passed.

[1] The final Mining Area will be based on property ownership lines as determined by legal descriptions and official surveys.
[2] Only includes portion that is part of mining area.
[3] Collection of Ferrous Mining Operation's reclamation areas required by the Taconite and Iron Ore Mineland Reclamation Rules Chapter 6130. Features in this dataset were gathered from the 2016-2017 AROP, on going, and historic archives from the DNR.
[4] The NHD is a feature-based database that interconnects and uniquely identifies the stream segments or reaches that make up the nation's surface water drainage system. NHD features are created from DNR 24K Streams and 1:24,000 USGS quadrangle maps. Due to previous disturbance, data sources may show watercourses that no longer exist.

Imagery Source: 2016 St. Louis County Pictometry

VEGETATIVE REFERENCE AREA DETAIL
NorthMet Project
Poly Met Mining, Inc.

Large Figure 2
Reclamation, Closure, and Postclosure Maintenance Plan

Exhibit A

Sampling Plan for Vegetative Reference Areas

Exhibit A
Sampling Plan for Vegetative Reference Areas

This sampling plan describes the method for collecting vegetation data at PolyMet's vegetative reference areas. This plan has been adapted from the Minnesota Department of Natural Resources' (DNR) *Handbook for Collecting Vegetation Plot Data in Minnesota: the Relevé method (2nd Edition)* and is a comprehensive approach to thoroughly document existing site vegetation.

Plot Placement and Dimensions

Plots shall be established in the identified vegetative reference areas for stockpiles, pit walls, and the tailings basin. A minimum of one plot shall be placed in each vegetative reference area. For vegetative reference areas that consist of multiple habitats (varying by slope, substrate, management, etc.), a plot shall be established in each habitat (e.g., tailings basin flat and tailings basin slope).

Plots shall be placed sufficiently deep within a homogeneous community to capture a representative portion of the area that does not include or cross transitional areas. Plots shall be 100 square meters in size, with dimensions of 10 meters by 10 meters, if possible. If the target plant communities are too narrow to allow the establishment of a 10 meter by 10 meter plot, the dimensions of the plot can be modified, but an area of 100 square meters must be sampled. Plots will be aligned so that the upslope and downslope edges of the plots are parallel with elevation contours. Plots will be established by field measurements along the ground surface, and stakes will be placed at the center and at each corner.

Plot Sampling

Schedule

Plots shall be sampled between mid-June and mid-August, so that most species are flowering and distinguishing characteristics are readily identifiable.

Vegetation

Vegetation in the plot will be surveyed with a timed meander through the plot. The botanist will survey for an initial time of 15 minutes, documenting each plant to species level. After the first 15 minutes of the survey, the timer will be reset for 5 minutes, and the survey will resume. If more than 2 species are observed during the 5-minute window, then another 5-minute window will be added to the survey (bringing the survey time to 25 minutes). If more than two species are observed during 20 to 25 minute time frame, the survey time shall be extended another five minutes for a maximum of 30 minutes. The survey timer will be paused to allow the surveyor to properly identify any taxa that are not readily identifiable. For any vascular plant that cannot be identified to species-level in the field, a few representative specimens should be collected for immediate identification in the office. After the timed meander is complete, the botanist will estimate the foliar cover of each species observed within each plot. It is possible for total herbaceous cover in a plot to exceed 100 percent, due to superposition of foliar cover (stacking).

Litter

Vegetative litter consists of leaves, stems, twigs, and other identifiable organic material from preceding growing seasons. Percent cover of litter across the entire plot shall be noted. Composition of litter shall be identified, if possible.

Photographs

Photographs shall be taken from the center of each plot as follows: upslope, downslope, each of the two sideslopes, and downward. Preferably five downward photos should be collected: one at the center, and one centered in each of the four quadrants. Photographs of other pertinent features shall be collected as necessary.

Slope

Slope amount and aspect shall be recorded (in degrees) at the center of the plot, using a compass with an integrated inclinometer.

Remarks

Site modifications (historic and recent), weather or climate conditions, recent management activities, erosion, etc.

Reporting

The following information shall be presented for each plot:

- Observed vascular plant species, including scientific name, common name, native status, invasive status, rarity status, physiognomy, stratum, and foliar cover. Data on plant characteristics will be sources from the current version of the DNR Plant Checklist.
- Summary data
    - Vegetation (total percent cover), including overlap from stacked plants
    - Species richness (count)
    - Litter (total percent cover)
    - Bare substrate, separated into bare rock and bare soil (total percent cover)
    - Ground cover (total percent), computed by subtracting bare substrate from 100 percent.
    - Plot dimensions (meters)
    - Plot slope (degrees)
    - Total plot survey time (minutes)
- Summary of remarks
- Photographic log

Exhibit B

Photographs

Photograph 1 (#R0014353): Typical ground cover in Pit Wall plot on June 23, 2017.

Photograph 2 (#R0014354): Typical ground cover in Pit Wall plot on June 23, 2017.

Photograph 3 (#R0014355): Typical ground cover in Pit Wall plot on June 23, 2017.

Photograph 4 (#R0014356): Typical ground cover in Pit Wall plot on June 23, 2017.

Photograph 5 (#R0014357): Typical ground cover in Pit Wall plot on June 23, 2017.

Photograph 6 (#R0014358): View northwest from center of Pit Wall plot on June 23, 2017.

Photograph 7 (#R0014359): View southeast from the center of Pit Wall plot on June 23, 2017.

Photograph 8 (#R0014360): View northeast from center of Pit Wall plot on June 23, 2017.

Photograph 9 (#R0014361): View southwest from center of Pit Wall plot on June 23, 2017.

Photograph 10 (#R0014370): View south from center of Stockpile Flat plot on June 23, 2017.

Photograph 11 (#R0014371): View north from center of Stockpile Flat plot on June 23, 2017.

Photograph 12 (#R0014372): View west from center of Stockpile Flat plot on June 23, 2017.

Photograph 13 (#R0014373): View east from center of Stockpile Flat plot on June 23, 2017.

Photograph 14 (#R0014374): Typical ground cover in Stockpile Flat plot on June 23, 2017.

Photograph 15 (#R0014375): Typical ground cover in Stockpile Flat plot on June 23, 2017.

Photograph 16 (#R0014376): Typical ground cover in Stockpile Flat plot on June 23, 2017.

Photograph 17 (#R0014377): Typical ground cover in Stockpile Flat plot on June 23, 2017.

Photograph 18 (#R0014378): Typical ground cover in Stockpile Flat plot on June 23, 2017.

Photograph 19 (#R0014362): View south from center of Stockpile Slope plot on June 23, 2017.

Photograph 20 (#R0014363): View north from center of Stockpile Slope plot on June 23, 2017.

Photograph 21 (#R0014364): View east from center of Stockpile Slope plot on June 23, 2017.

Photograph 22 (#R0014365): View west from center of Stockpile Slope plot on June 23, 2017.

Photograph 23 (#R0014366): Typical ground cover in Stockpile Slope plot on June 23, 2017.

Photograph 24 (#R0014367): Typical ground cover in Stockpile Slope plot on June 23, 2017.

Photograph 25 (#R0014368): Typical ground cover in Stockpile Slope plot on June 23, 2017.

Photograph 26 (#R0014369): Typical ground cover in Stockpile Slope plot on June 23, 2017.

Photograph 27 (#R0014379): View north from center of Tailings Basin Flat plot on June 23, 2017.

Photograph 28 (#R0014380): View east from center of Tailings Basin Flat plot on June 23, 2017.

Photograph 29 (#R0014381): View south from center of Tailings Basin Flat plot on June 23, 2017.

Photograph 30 (#R0014382): View west from center of Tailings Basin Flat plot on June 23, 2017.

Photograph 31 (#R0014383): Typical ground cover in Tailings Basin Flat plot on June 23, 2017.

Photograph 32 (#R0014384): Typical ground cover in Tailings Basin Flat plot on June 23, 2017.

Photograph 33 (#R0014385): Typical ground cover in Tailings Basin Flat plot on June 23, 2017.

Photograph 34 (#R0014386): Typical ground cover in Tailings Basin Flat plot on June 23, 2017.

Photograph 35 (#R0014387): Typical ground cover in Tailings Basin Flat plot on June 23, 2017.

Photograph 36 (#R0014388): View east from center of Tailings Basin Slope plot on June 23, 2017.

Photograph 37 (#R0014389): View west from center of Tailings Basin Slope plot on June 23, 2017.

Photograph 38 (#R0014390): View north from center of Tailings Basin Slope plot on June 23, 2017.

Photograph 39 (#R0014391): View south from center of Tailings Basin Slope plot on June 23, 2017.

Photograph 40 (#R0014392): Typical ground cover in Tailings Basin Slope plot on June 23, 2017.

Photograph 41 (#R0014393): Typical ground cover in Tailings Basin Slope plot on June 23, 2017.

Photograph 42 (#R0014394): Typical ground cover in Tailings Basin Slope plot on June 23, 2017.

Photograph 43 (#R0014395): Typical ground cover in Tailings Basin Slope plot on June 23, 2017.

Photograph 44 (#R0014396): Typical ground cover in Tailings Basin Slope plot on June 23, 2017.