NorthMet Project

Reclamation Plan

Version 6

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This document was prepared for Poly Met Mining Inc. by Barr Engineering Co.

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Acronyms, Abbreviations and Units

Acronym, Abbreviation or Unit	Stands For
ACM	asbestos-containing materials
AOC	Areas of Potential Concern
AST	aboveground storage tank
AWMP	Adaptive Water Management Plan
Cliffs Erie	Cliffs Erie, LLC
ESA	Environmental Site Assessment
FTB	Flotation Tailings Basin
HRF	Hydrometallurgical Residue Facility
kV	kilovolt
LTVSMC	LTV Steel Mining Company
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
OSLA	Overburden Storage and Laydown Area
OSP	Ore Surge Pile
PCB	polychlorinated biphenyl
PCP	Post-Closure Plan
PGE	platinum-group elements
PolyMet	Poly Met Mining Inc.
Project	NorthMet Project
PTM	Permit to Mine
RTH	Rail Transfer Hopper
SAP	Sampling and Analysis Plan
TBD	To Be Determined
TWP	Treated Water Pipeline
VIC	Voluntary Inspection and Cleanup
WWTF	Mine Site Waste Water Treatment Facility
WWTP	Plant Site Waste Water Treatment Plant

1.0 Introduction

This document presents the Reclamation Plan, which includes the Contingency Reclamation Estimate, for the NorthMet Project (Project) Mine and Plant Sites, including legacy components. The Project is described in the Project Description (Reference (1)). The legacy components are the portions of Cliffs Erie, LLC (Cliffs Erie) property used for a former taconite operation that were acquired by Poly Met Mining Inc. (PolyMet), namely (Large Figure 1):

- All buildings, structures and associated infrastructure at the Plant Site, Area 1 Shops, Area 2 Shops, the Colby Lake Pumphouse and associated pipeline, the Main Gate, and the Administration Building (Large Figure 2)
- The Tailings Basin and Emergency Basin (Large Figure 3 and Large Figure 4)
- The Solid Waste Industrial Landfill SW-619 (Large Figure 5)
- Mine Area 5, which includes several stockpiles and pits (Large Figure 6)

Minnesota Rules, chapter 6132, Nonferrous Metallic Minerals Mineland Reclamation Rules, contains requirements for preparation of a mine Reclamation Plan for a nonferrous operation. Because the legacy components of the Project are from a ferrous operation, the requirements of Minnesota Rules, chapter 6132, do not currently apply to those features, as they are regulated under Minnesota Rules, chapter 6130. If any legacy components or portions of legacy components are used by the Project, those will be subject to Minnesota Rules, chapter 6132. Regulatory requirements for all features will be finalized during the permitting stage of this Project. This document has been developed based on Minnesota Rules, chapter 6132, when applicable.

Currently, Cliffs Erie holds the Minnesota Department of Natural Resources (MDNR) Permit to Mine (PTM) for the legacy components and is executing the MDNR-approved Closure Plan. Until PolyMet has been issued its PTM, which will include the legacy components, Cliffs Erie is the responsible party for final reclamation of the legacy components. In its application for the PTM, PolyMet will provide financial assurance for the legacy components listed above. The change of the assignment of PTM responsibilities from one party to another is discussed in the Minnesota Rules, part 6132.4700.

The Mining Area 5N (Large Figure 6) discharge and several Tailings Basin (Large Figure 3) surface seeps and discharges are currently being studied and mitigated via a Consent Decree between the Minnesota Pollution Control Agency (MPCA) and Cliffs Erie. The outcome of those studies could result in changes to this Reclamation Plan.

The Solid Waste Industrial Landfill SW-619 (Large Figure 5) currently has an operating permit issued by the MPCA under which there is a closure plan and associated cost estimate for closure

obligations. The operating landfill facility is on top of and adjacent to the previously-closed LTV Steel Mining Company (LTVSMC) Private Landfill.

When PolyMet obtains its PTM, they will assume the responsibility to complete reclamation activities associated with legacy components that the Project does not plan to reuse (e.g., the Area 5NW Mine Pit) and perform ongoing maintenance on those that will be reused (e.g., Tailings Basin reclamation maintenance). Reclamation activities associated with facilities that the Project plans to reuse (e.g., plant buildings) will be done as part of the final reclamation.

Several other Management Plans contain information related to the development and reclamation of the Mine Site and the Plant Site. Reclamation plans for new Project waste disposal facilities and water management systems are described in the Management Plans for those facilities, as listed below, and are summarized in this document:

- NorthMet Project Mine Plan (Reference (2)) discusses reclamation plans for the mine pits
- NorthMet Project Rock and Overburden Management Plan (Reference (3)) discusses reclamation plans for the stockpiles
- NorthMet Project Flotation Tailings Management Plan (Reference (4)) discusses the reclamation plans for Flotation Tailings Basin (FTB)
- NorthMet Project Residue Management Plan (Reference (5)) discusses the reclamation plans for Hydrometallurgical Residue Facility (HRF)
- NorthMet Project Water Management Plan – Mine (Reference (6)) discusses the reclamation plans for water management systems at the Mine Site
- NorthMet Project Water Management Plan – Plant (Reference (7)) discusses the reclamation plans for water management systems at the Plant Site
- NorthMet Project Adaptive Water Management Plan (AWMP, Reference (8)) discusses the reclamation plans associated with adaptive engineering controls including the Mine Site Waste Water Treatment Facility (WWTF), Plant Site Waste Water Treatment Plant (WWTP), Category 1 Waste Rock Stockpile Cover System, FTB Pond Cover System, and Non-Mechanical Treatment Systems

In this document, Flotation Tailings are the Project bulk flotation tailings, the Flotation Tailings Basin (FTB) is the newly constructed NorthMet Flotation Tailings impoundment, and the Tailings Basin is the existing former LTVSMC tailings basin as well as the combined LTVSMC tailings basin and FTB, the Emergency Basin is the existing former LTVSMC Emergency Basin, and Residue is the Project combined hydrometallurgical residue stored in the HRF.

1.1 Objectives and Overview

The objective of the Reclamation Plan is to reclaim the Project components to a safe, secure, and environmentally stable condition. In general, all environmental concerns will be evaluated, environmental hazards will be remediated, all buildings and structures will be demolished, all associated sites reclaimed and vegetated, and all reclamation and long-term closure maintenance practices will be implemented where necessary. This includes studies and mitigations associated with the Area 5NW Mine Pit discharge and Tailings Basin surface seeps required by the Consent Decree mentioned in Section 1.0.

1.2 Outline

The outline of this document is:

Section 1.0 Introduction, objective and overview, description of variances requested, and general references for legacy components

Section 2.0 Description of the activities associated with demolition of structures (buildings, Rail Transfer Hopper [RTH], WWTF, WWTP, sanitary systems, wells, power lines, pipelines, and tanks) including waste disposal

Section 3.0 Description of the activities associated with reclamation of the Mine Site – mine pit reclamation, stockpile reclamation, long-term water treatment, reclamation of water management systems, building areas, roads and parking lots, and removal of railroad tracks and culverts

Section 4.0 Description of the activities associated with reclamation of the Plant Site – FTB reclamation, HRF reclamation, long-term water treatment, reclamation of water management systems, building areas, roads and parking lots, and removal of railroad tracks and culverts

Section 5.0 Description of the activities associated with remediation including legacy Areas of Potential Concern (AOCs) and ongoing mitigation of water quality at the Mining Area 5N and the Tailings Basin as well as plans to investigate for potential releases at the conclusion of operations

Section 6.0 Description of ongoing monitoring and maintenance for the existing solid waste disposal facilities, reclaimed areas, water management systems, the FTB, the HRF, and wetlands

Section 7.0 Description of the Contingency Reclamation Plan (assumes closure in the upcoming year)

Section 8.0 Description of water treatment and preliminary plans to transition from mechanical to non-mechanical water treatment

Section 9.0 Description of financial assurance

Because this document is intended to evolve through the environmental review, permitting, operating, reclamation, and long-term closure phases of the Project, some headings are included as placeholders and are so identified. It will be reviewed and updated as necessary in conjunction with changes that occur and for future permitting needs. A Revision History is included at the end of the document.

1.3 Variances

Minnesota Rules, part 6132.4100 provide for variances from the MDNR reclamation rules if requested by the entity doing the reclamation and approved by the MDNR Commissioner. Requested variances anticipated include subsequent use, acceptable research to demonstrate that reclamation can be achieved by alternative methods, and abandonment of underground pipelines in-place. Requested variances are presented in Section 1.3.1 and Section 1.3.2 for subsequent use and acceptable research.

1.3.1 Subsequent Use

Minnesota Rules, part 6132.3200, subpart 2E(4) requires that structures be completely demolished within three years after closure or a longer period if approved by the Commissioner. The structures at the Plant Site, Area 1 Shops, and Area 2 Shops are part of a brownfield site that is planned to be reused as part of this Project after the Project has completed environmental review and permitting. PolyMet requests a variance to allow structure demolition to be deferred until it is determined that a particular structure will not be reused or until reclamation.

1.3.2 Acceptable Reclamation Research

Minnesota Rules, part 6132.0100, subpart 2 defines acceptable research as “research approved by the commissioner that is site-related and is reasonably designed for the purpose of demonstrating that reclamation can be achieved by alternative methods.” Several test projects will be undertaken by PolyMet during operations to evaluate alternative methods for reclamation. As described in Reference (8), test projects are proposed for the Flotation Tailings Basin (FTB) Pond Bottom Cover System, the Category 1 Waste Rock Stockpile Cover System, and Non-Mechanical Treatment Systems. Assuming this research is acceptable and successful, PolyMet will apply for a variance in accordance with Minnesota Rules, part 6132.4100 for use of these alternative methods of reclamation.

1.4 General References for Legacy Components

The following documents have been used as reference for legacy components:

- Phase 1 Environmental Site Assessment (ESA, Reference (9))
- AOC Documents

- Consent Decree Documents
  - Short-Term Mitigation Evaluation and Plans
  - Field Studies Plans

2.0 Structure Demolition and Disposal of Materials

2.1 Building/Structure Demolition

All buildings and structures will be removed. Foundations above existing grade will be razed, and foundations and slabs at or below grade will be left in place. These will all be covered with a minimum of two feet of surface overburden according to Minnesota Rules, part 6132.2700 and 3200. Seeding and mulching will be based on PolyMet's Reclamation Seeding and Mulching Procedure (Attachment A). If any oil- or chemical-stained concrete is identified as part of the foundation, it will require different handling, which is addressed in Section 2.3. Provisions may be made for continued subsequent use of mine facilities that will have future economic benefits to the surrounding area including buildings, pipelines, transmission lines, roads, and railroad lines.

2.1.1 Buildings

The timing of demolition for the individual buildings is shown in Table 2-1. The demolition / reclamation year as listed is the year in which reclamation begins; mining is planned to cease in Mine Year 20, so Year 1 of demolition/reclamation corresponds with Mine Year 21. All buildings listed in Table 2-1 will be demolished over a period of three years unless there is an approved subsequent use. The exceptions include the WWTF and the WWTP, which will be used through long-term closure as described in Section 3.3 for the Mine Site and Section 4.3 for the Plant Site. Appropriate controls for airborne asbestos will be in-place during demolition. Utility tunnels will be sealed and closed in-place. See Large Figure 2 for buildings at the Plant Site and Colby Lake. See Large Figure 4 in Reference (2) for buildings at the Mine Site.

Table 2-1 Building Demolition Schedule

Demolition / Reclamation Year[1]	Building[2]	Site[2]	Status
Year 1[3]	Additive Building & Heating Plant	Plant Site	Legacy
Year 1	Sewage Treatment Plant	Plant Site	Legacy
Year 1	Area 1 Shops	Plant Site	Legacy
Year 1	Area 2 Shops	Plant Site	Legacy
Year 1	Booster Pump House #1	Plant Site	Legacy
Year 2	Coarse Crusher	Plant Site	Legacy
Year 2	Drive House #1	Plant Site	Legacy
Year 2	Drive House #2	Plant Site	Legacy
Year 2	Fine Crusher	Plant Site	Legacy

Demolition / Reclamation Year[1]	Building[2]	Site[2]	Status
Year 2	Rail Transfer Hopper	Mine Site	New
Year 2	Mine Site Fueling and Maintenance Facility	Mine Site	New
Year 3	Concentrator (includes new SAG mill)	Plant Site	Legacy
Year 3	General Shops	Plant Site	Legacy
Year 3	Rebuild Shop	Plant Site	Legacy
Year 3	Rubber Shop	Plant Site	Legacy
Year 3	Lube House	Plant Site	Legacy
Year 3	A-Lab	Plant Site	Legacy
Year 3	Water Tower	Plant Site	Legacy
Year 3	Warehouse Electrical	Plant Site	Legacy
Year 3	Warehouse #2	Plant Site	Legacy
Year 3	Warehouse 49	Plant Site	Legacy
Year 3	Miscellaneous Buildings (not listed separately)	Plant Site	Legacy
Year 3	Administration Building	Plant Site	Legacy
Year 3	Flotation Building	Plant Site	New
Year 3	Reagent Building	Plant Site	New
Year 3	Oxygen Plant	Plant Site	New
Year 3	Concentrate Loadout	Plant Site	New
Year 3	Concentrate Storage	Plant Site	New
Year 3	Concentrate Dewatering	Plant Site	New
Year 3	Hydrometallurgical Plant	Plant Site	New
Year 3	Hydrometallurgical Reagents	Plant Site	New
Year 3	Limestone Preparation	Plant Site	New

Demolition / Reclamation Year[1]	Building[2]	Site[2]	Status
Year 3	Colby Lake Pumphouse	Colby Lake	Legacy
To Be Determined (TBD)[4]	Mine Site Waste Water Treatment Facility (WWTF)	Mine Site	New
TBD[4]	Plant Site Waste Water Treatment Plant (WWTP)	Plant Site	New

(1) Demolition / Reclamation Year is the year in which reclamation begins. Assuming Mine Year 20 is the last year of mining, Reclamation Year 1 corresponds to Mine Year 21.
(2) See Large Figure 2 for buildings at the Plant Site and Colby Lake. See Large Figure 4 in Reference (2) for buildings at the Mine Site.
(3) Portions of this building may be demolished prior to Demolition / Reclamation Year 1
(4) Buildings required through long-term closure; see Section 3.3 for the WWTF and Section 4.3 for the WWTP.

2.1.2 Rail Transfer Hopper (RTH)

The RTH, which consists of a constructed rock platform used to load rail cars for ore delivery to the Plant Site, will be covered with two feet of material and vegetated. If the rock platform is composed of Category 1 waste rock, it will be covered in the same manner as the Category 1 Waste Rock Stockpile (Section 7.1.1.1 of Reference (3)) or the rock will be relocated to the East Pit for subaqueous disposal.

The ore loading area in front of the RTH and the surrounding area along the railroad east to and including the Ore Surge Pile (OSP) is referred to as the Ore Handling Area and will be reclaimed as follows:

- sediment will be removed from the ditches and the RTH process water pond and placed in the East Pit
- any ore remaining in the RTH, the OSP or along the railroad tracks between the RTH and the OSP will be placed in the East Pit

The driving surface of the platform and the rail bed in the vicinity of the RTH will be tested and:

- if Category 2 waste rock criteria are met or exceeded, the material will be placed in the East Pit (Section 6.2 of Reference (3))
- if Category 2 waste rock criteria are not exceeded, the material will be covered with at least two feet of soil and vegetated according to Minnesota Rules, part 6132.2700 and part 3200

Reclamation of the equipment, machinery and structures associated the RTH will be handled as described in Section 2.1.1.

2.1.3 Mine Site Waste Water Treatment Facility (WWTF) and Plant Site Waste Water Treatment Plant (WWTP)

Because the Mine Site WWTF and Plant Site WWTP are expected to operate in long-term closure as described in Section 2.2 and Section 4.2 of Reference (8), demolition of those facilities will be deferred until the MDNR and MPCA determine that mechanical treatment is no longer needed.

2.1.4 Sanitary Systems and Wells

The septic systems will be pumped out and the tanks filled with soil or crushed rock and backfilled. Wells will be sealed by a licensed well driller in accordance with MDH rules. Sanitary systems and wells are located at (Large Figure 7 for locations):

- Area 1 Shops Septic System
- Area 2 Shops Septic System
- Area 5 Reporting Area Well (closed) and Septic System (closed)
- Administration Building Well and Septic System
- Tailings Basin Reporting Septic System
- Booster Pumphouse #1 Septic System
- Plant Site Sewage Treatment Plant (Legacy, see Table 2-1)
- Plant Site Sewage Treatment System, including the new sewage treatment system stabilization pond facility and the existing sewage treatment collection system
- Mine Site Sewage Holding Tanks or Septic Systems, depending on installation

2.1.5 Pipelines and Power Lines

Pipelines that will not remain as regional infrastructure will be removed, recycled or disposed, or abandoned in place. A few former existing LTVSMC Tailings Basin water management lines may be closed at the start of operations. Several of the remaining pipelines will be needed through reclamation and in long-term closure. Major pipeline systems planned for removal or to be abandoned in place during reclamation include (see Large Figure 8 for Plant locations and Large Figure 9 for locations at the Mine Site):

- Water reclaim line from the FTB to the Processing Plant
- Flotation Tailings Pipeline

- Hydrometallurgical Residue Pipelines
- Inter-pit pipeline from the Plant Reservoir to the Area 1 Shop and Area 2 Shop
- Mine Site water management – OSP sump to WWTF pipelines and process water ponds to WWTF pipelines
- Water supply pipeline from Colby Lake Pumphouse to the Plant Reservoir

Major pipeline systems that will be required to remain until long-term closure begins include:

- Treated Water Pipeline (TWP) from Mine Site WWTF to the FTB
- Mine Site water management – WWTF to East Pit pipelines

Major pipeline systems that will be required to remain through long-term closure include:

- Tailings water management – tailings seepage collection pipelines from the FTB seepage capture systems, Plant Site WWTP discharge pipes to the discharge points
- Natural gas line from the Town Border Station to the former Pellet Plant location
- Mine Site water management – West Pit dewatering pipelines and Category 1 Waste Rock Stockpile Groundwater Containment System sumps to WWTF pipelines

Above-ground pipelines and other facilities (e.g., pump booster station, associated controls) will be disassembled or demolished and the material recycled or disposed along the timeline described above. Underground pipelines will be abandoned in place. Manholes and aboveground pipeline supports and foundations will be demolished to ground level or below and covered with at least two feet of soil. Surface disturbances will be scarified and revegetated to achieve final reclamation.

Power lines (poles, pole hardware, and conductors) and substations that will not remain as regional infrastructure will be removed and recycled. Foundations and anchors will be removed or demolished to at least ground elevation and covered with at least two feet of soil and revegetated to achieve final reclamation. Power lines to be removed during reclamation include (see Large Figure 10 for locations):

- 13.8 kilovolt (kV) distribution system from the FTB to the Coarse Crusher
- 13.8 kV Lines from the Main Substation to Area 1 Shop and Area 2 Shop
- 7.20 kV distribution lines at the Mine Site

Power lines that will remain until long-term closure begins include:

- 13.8 kV Line from the Main Substation to Colby Lake Pumphouse

Power lines that will remain through long-term closure include:

- 13.8 kV Lines from the Minnesota Power Substation at the Mine Site to Mine Site facilities
- 4.16 kV distribution lines at the FTB
- 4.16 kV distribution lines at the Mine Site

2.1.6 Tanks

The inventory of tanks that will require demolition is included in Table 2-2 with existing tanks shown in Large Figure 11.

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 soil and vegetated. Smaller aboveground storage tanks will be cleaned and removed without disassembly.

Table 2-2 Inventory of Tanks Requiring Demolition – PLACEHOLDER (to be provided in permitting)

2.2 Demolition Waste Disposal

It is planned that the majority of the demolition waste from structure removal will be acceptable for disposal in the existing on-site industrial landfill (SW-619) located northwest of the Area 1 Shops. 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 permittable including coarse crusher basement, fine crusher basement, and concentrator basement, or placed in landfills as required. The Plant Reservoir may be used through reclamation for Colby Lake pumping; however, if it is available, it will also be used for concrete demolition disposal. See

Large Figure 5 for the location of the industrial landfill (SW-619) and Large Figure 12 for concrete demolition disposal locations.

2.3 Special Material Disposal

Special materials on-site at the time of closure may include ACM, nuclear sources, partially used paint, chemical and petroleum products, fluorescent and sodium halide bulbs, certain batteries, electronic waste, lighting ballasts, small capacitors, and oil- or chemical-stained concrete. All of these materials will be safely collected, removed, and properly recycled or disposed.

Surveys for ACMs have been completed. ACMs (i.e., pipe and electrical insulation) in utility tunnels will be sealed prior to the tunnels being sealed. ACMs (siding, hot water heating system insulation, lube system insulation, floor tile, etc.) from structure demolition will be removed, properly packaged and disposed in the on-site demolition landfill. Location of any ACMs in demolition landfills will be noted on the property deed. New Project facilities will not include any new ACMs.

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

During closure of the Cliffs Erie facility, all nuclear sources were inventoried and properly disposed. 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 permitting) will be disposed in accordance with U.S. Nuclear Regulatory Commission (NRC) regulations in closure, as regulated by the Minnesota Department of Health (MDH) pursuant to their 2006 agreement with the NRC.

Partially used paint, chemical and petroleum products will be collected and properly recycled or disposed.

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.

2.4 Product Disposal

It is expected that all product (copper concentrate, nickel concentrate, mixed hydroxide product, PGE [platinum-group elements] precipitate) will be shipped to customers. If any cannot be shipped, it will be placed in the HRF or disposed in an appropriate off-site landfill.

The reagent suppliers, which will be under contract to PolyMet, will remove any reagents remaining at closure. 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 reclamation.

3.0 Mine Site Reclamation and Long-Term Closure

3.1 Mine Pits

Reclamation of the mine pits is described in detail in Section 6 of Reference (2). Incremental reclamation of the pits that will begin during operations include backfilling of the East and Central Pits with the material from the temporary Category 2/3 and Category 4 Waste Rock Stockpiles. Tasks to begin during operations when appropriate and to be completed in final reclamation include:

- removal of select dewatering systems and in-pit power lines
- sloping and vegetation of the overburden layer of the pit walls
- installation of a pit perimeter barrier, which includes fencing, rock barricades, ditches, stockpiles, and berms
- providing access to the pit lake
- construction of an outlet control structure between the East Pit and the West Pit
- construction of a wetland in the East Pit (Section 3.0 of Reference (2))
- water management, including flooding of the West Pit and treatment of the East Pit water to remove constituent load from backfilled waste rock

Long-term closure activities include:

- reclamation monitoring and maintenance
- long-term water management, including managing the water level in the West Pit below an overflow elevation and long-term treatment of West Pit water prior to discharge to a small watercourse that flows to the Partridge River

3.2 Stockpiles

Reclamation of the stockpiles is described in detail in Section 7 of Reference (3). Incremental reclamation of the stockpiles will begin during operations, including:

- Relocation of the material from the temporary Category 2/3 and Category 4 Waste Rock Stockpiles to the East and Central Pits and reclamation of the stockpile footprints.

- Progressive reclamation of the permanent Category 1 Waste Rock Stockpile with an engineered geomembrane cover system starting in Mine Year 14 and concluding during final reclamation.

- Progressive reclamation of the process water ditch along the Category 1 Waste Rock Stockpile Groundwater Containment System as part of the stockpile reclamation. The groundwater containment system will continue to collect stockpile seepage in reclamation and long-term closure.

Other activities to be completed during final reclamation include:

- relocation of any excess material remaining in the temporary OSP to the East Pit and reclamation of the pile footprint

- sloping and vegetation of Overburden Storage and Laydown Area (OSLA) including construction of wetlands

Long-term closure activities include:

- reclamation maintenance of the Category 1 Waste Rock Stockpile Cover System

- continued pumping of the Category 1 Waste Rock Stockpile Groundwater Containment System drainage to the WWTF

- reclamation monitoring and maintenance

3.3 Water Management Systems

Reclamation of the Mine Site water management systems is described in detail in Section 7 of Reference (6). Incremental reclamation activities will begin during operations and include:

- removal of all water management systems associated with the temporary Category 2/3 and Category 4 Waste Rock Stockpiles, including pipes, pumps, sumps, and ponds

- reclamation of the haul road and haul road pond leading to the Category 2/3 Waste Rock Stockpile

- removal of select pit dewatering pumps and pipes in the East and Central Pits

Final reclamation tasks include:

- removal of select perimeter and interior dikes

- filling and rerouting of ditches
- restoration of process water and stormwater sedimentation ponds
- select pump and pipe removal, including the Central Pumping Station (CPS) and TWP once pumping has ceased from the Plant Site to the West Pit
- water management, including flooding of the West Pit and treatment of the East Pit water

Long-term closure activities include:

- long-term water management, including managing the water level in the West Pit below an overflow elevation and long-term treatment of West Pit water at the WWTF prior to discharge to a small watercourse that flows to the Partridge River
- reclamation monitoring and maintenance

The ultimate objective in long-term closure is to transition from mechanical treatment by the WWTF to a non-mechanical treatment system once the non-mechanical treatment system has been demonstrated to provide the required water treatment. Potential non-mechanical treatment systems at the Mine Site could be used for long-term treatment of water from the Category 1 Waste Rock Stockpile Groundwater Containment System and the West Pit overflow, as described in Section 6 of Reference (8).

3.4 Building Areas, Roads, and Parking Lots

After demolition of Mine Site buildings and parking areas, 2 feet of overburden material suitable for vegetation will be placed over the facility's former footprint. Mine roads that are deemed not necessary for access by the MDNR Commissioner will be scarified and vegetated.

There are approximately 118 acres of building areas, roads, and parking lots to be reclaimed at the Mine Site, including 116 acres of haul roads and 2 acres of buildings (Mine Site Fueling and Maintenance Facility) that will not be retained during long-term closure (e.g., WWTF buildings). It is estimated that approximately 30 acres of roads will be required through long-term closure for monitoring and maintenance activities. Building areas, roads, and parking lots not needed in long-term closure will be reclaimed and vegetated according to Minnesota Rules, part 6132.2700 by a qualified reclamation contractor. Seeding and mulching will be based on PolyMet's Reclamation Seeding and Mulching Procedure (Attachment A). Any roads, which include mine access roads (Minnesota Rules, part 6132.3200) that may develop into unofficial off-road vehicle trails, will require a variance to allow a 15-foot wide unpaved and unvegetated track down the centerline of the road once reclamation is completed.

3.5 Railroad Tracks

For the new rail spur at the RTH, the track and ties will be removed and recycled or 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. See Large Figure 13 for locations.

3.6 Culverts

Where roads and railroads will be abandoned, 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.

4.0 Plant Site Reclamation

4.1 Flotation Tailings Basin (FTB)

Reclamation of the FTB is described in detail in Section 7 of Reference (4). Incremental reclamation tasks to be completed during operations include progressive reclamation of exterior dam slopes. Activities that will occur during final reclamation include:

- construction of cover system including amendment of bentonite to exposed beach areas and pond bottom
- grading and vegetation of interior including construction of wetlands
- vegetation of exterior slopes
- removal of structures
- construction of emergency overflow structure

Long-term closure activities include:

- dam safety monitoring
- reclamation monitoring and maintenance

4.2 Hydrometallurgical Residue Facility (HRF)

Reclamation of the HRF is described in detail in Section 7 of Reference (5). During operations, progressive reclamation of exterior dam slopes and borrow areas will occur incrementally during construction. Activities to be completed during final reclamation include:

- dewatering of Residue and treatment of the leachate collected by the Drainage Collection System at the WWTP
- construction of cover system, including a temporary cover during dewatering and a final permanent cover
- vegetation of exterior slopes

Once the activities listed above are completed, long-term closure activities will begin and include:

- Drainage Collection System monitoring and continued treatment of leachate

- removal of pumps, pipes and power systems once collection ceases from the Drainage Collection System
- development of surface water runoff systems on the permanent cover
- dam safety monitoring
- reclamation monitoring and maintenance

4.3 Water Management Systems

Reclamation of the Plant Site water management systems is described in detail in Section 7 of Reference (7). Tasks required during final reclamation include:

- pumping of water from the FTB and the WWTP to the Mine Site to aid in West Pit flooding
- reject concentrate from the WWTP will be sent to the Mine Site WWTF
- removal of select pumps and pipes, including the TWP, once pumping has ceased from the WWTP to the West Pit
- FTB pond water and water collected in the FTB seepage capture systems will be treated at the WWTP prior to discharge

Activities during long-term closure, defined as the time after the FTB is reclaimed and hydrology has stabilized, include:

- reject concentrate from the WWTP will be dewatered and sent offsite for disposal
- FTB pond water and water collected in the FTB seepage capture systems will be treated at the WWTP prior to discharge
- reclamation monitoring and maintenance

The ultimate objective in long-term closure is to transition from mechanical treatment by the WWTP to a non-mechanical treatment system once the non-mechanical treatment system has been demonstrated to provide the required water treatment. Non-mechanical treatment systems at the Plant Site could be used for long-term treatment of water from the FTB seepage capture systems, the FTB overflow, and the HRF, as described in Section 6 of Reference (8).

4.4 Building Areas, Roads, and Parking Lots

After demolition of Plant Site buildings and parking areas, two feet of overburden material suitable for vegetation will be placed upon the facility's former footprint. Plant area roads that

are deemed not necessary for access by the MDNR Commissioner will be scarified and vegetated. Asphalt from paved surfaces will be removed and recycled. Reclamation of roads not controlled by PolyMet, such as the Dunka Road and the road from the North Gate, are not included in this plan or estimate; reclamation of these features is the responsibility of the owner of record for the roads.

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 PolyMet's Reclamation Seeding and Mulching Procedure (Attachment A). Any roads that may develop into unofficial off-road vehicle trails (Minnesota Rules, part 6132.3200) will require a variance to allow a 15-foot wide unpaved and unvegetated track down the centerline of the road once reclamation is completed.

4.5 Railroad Tracks

For the Railroad Connection Track connecting the existing Cliffs Erie Mainline track to the existing track in Area 3 to meet Plant Site material movement needs, the track and ties controlled by PolyMet will be removed and recycled or disposed and the railbed will be reclaimed or evaluated for an approved subsequent use. Reclamation of railroads not controlled by PolyMet is the responsibility of the owner of record. 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. See Large Figure 13 for locations.

PolyMet will conduct a survey along the railroad corridor between the RTH and the Plant Site to inspect for potential ore spillage along the track. If spillage is found of a quantity that could cause water quality degradation, clean up measures will be initiated. The specific details of this survey during operations, as well as in reclamation and long-term closure, will be outlined as part of the Transportation and Utility Corridor monitoring plan.

4.6 Culverts

Where roads and railroads will be abandoned, 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. Existing legacy culverts include (see Large Figure 14 for existing locations with future locations to be determined):

- Area 5 Road #107
- Area 5 Road #108
- Area 5 Road #109

5.0 Remediation and Mitigation

5.1 Historic Potential Releases

Prior to selling the processing plant to PolyMet, Cliffs Erie commissioned a Phase I ESA (Reference (9)) for the purpose of closing the taconite mining and processing operations. The work completed and reported in the ESA identified 59 AOCs for the property. With the purchase of a portion of the site, PolyMet accepted environmental liability for 29 of the AOCs.

Of the accepted AOCs, seven have already been closed or have received a No Further Action letter from the MPCA, including (see Large Figure 15 for locations):

- Mill Rejects Area (AOC-12)
- Area 5 Reporting (AOC-24)
- Area 5 Loading Pocket and Storage (AOC-25)
- Line 9 Area 5 Petroleum Contaminated Soil (AOC-37)
- Tailings Basin Reporting (AOC-47)
- Coarse Crusher Petroleum Contaminated Soil (AOC-49)
- Hornfels (AOC-53)

In addition, the following AOCs accepted by PolyMet are closed, formerly permitted solid waste disposal facilities that will each require post-closure monitoring per the Minnesota Solid Waste Landfill requirements:

- Private Landfill (AOC-8) now part of operating Solid Waste Industrial Landfill SW-619
- Coal Ash Landfill (AOC-36) – closed landfill, but still requires monitoring

The remaining AOCs accepted by PolyMet will require further investigation to determine whether or not they require any further action. PolyMet is continuing the Voluntary Inspection and Cleanup (VIC) program that Cliffs Erie started. The AOCs that will not be used by the Project will be investigated and remediated as necessary on a schedule and priority agreed to by the MPCA. AOCs that will be used by the Project will be remediated, if necessary, as part of closure. These remaining AOCs are summarized in Table 5-1.

Table 5-1 Areas of Potential Concern (AOC) for Remediation

AOC	Description	Activity	Contaminants of Potential Concern[2]	Status
1[1]	Area 1 Shops and Reporting (reuse planned)	Fueling equipment, rebuild and repair, steam cleaning, electrical shop	DRO, GRO, VOC, RCRA SVOC	Investigation at closure
6	Oily Waste Disposal Area	Oily waste from oil/water separator of the LTVSMC Plant Site Sewage Treatment Plant disposal	DRO, GRO, VOC, PAH, RCRA	Investigation pending
7	Bull Gear Disposal	One-time disposal of heavy lubricant	PAH, Pb	Investigation pending
9	RR Panel Yard	Railroad siding area, fabrication of rail panels, disposal of railroad ties, locomotive fueling	DRO, VOC, RCRA, PAH	Scrap and trash were disposed. Some items remain to be removed. Sampling and analysis plan was carried out and site report and further action plan is being generated.
10	Airport	Equipment salvage and tear-down area, materials storage	DRO, GRO, VOC, RCRA	Scrap sold and trash disposed. Some cleanup remains, and investigation pending.
11	Stoker Coal Ash Disposal	Coal ash industrial waste disposal	B, Sr	Investigation pending
13	2001 Storage Area	Equipment salvage, materials storage, transformer storage	DRO, GRO. VOC, PAH, PCB, RCRA Metals	Investigation pending
14	Large Equipment Paint Area	Sandblasting and painting	RCRA, VOC	Buildings sold. Scrap and trash to be removed. Investigation pending.

AOC	Description	Activity	Contaminants of Potential Concern[2]	Status
35	Dunka WTP Sludge	Stockpiling area for WTP sludge	RCRA Metals	Investigation pending
38[1]	Area 2 Shops (reuse planned)	Fueling equipment, rebuild and repair, paint shop, carpenter shop	DRO, GRO, VOC, RCRA SVOC	Site investigation complete - no solvents detected; will be handled as LUST-CAP approved[3]
40	Heavy Duty Garage	Equipment maintenance	DRO, GRO, VOC, PAH	Building removed. Investigation at closure
42	Bunker C Tank Farm	Large Aboveground Storage Tank (AST) storage of #4 to #6 fuel oil	DRO	Some excavation and removal of surface stains complete. Pump house demolished. Day tanks removed and will be scrapped. Petroleum impacted soils removed. Further work necessary to remove tanks and some fuel lines.
43[1]	Administration Building (reuse planned)	Heating oil tank	DRO, BTEX	Demolition and investigation at closure
44[1]	Main Gate Vehicle Fueling Area (reuse planned)	Two 6,000 gallon AST	GRO/DRO/VOC	Demolition and investigation at closure
46[1]	Plant Site Proper and General Shops (reuse planned)	Crushing, concentrating, pelletizing and general maintenance facilities	DRO, GRO, VOC, PAH, PCB, RCRA	Investigation at closure
48[1]	Transformers (reuse planned)	Transformers associated with pumps located within the Tailings Basin	DRO, PCB	Investigation pending

AOC	Description	Activity	Contaminants of Potential Concern(2)	Status
50[1]	Emergency Basin (reuse planned)	Drain outfall for stormwater and process waste water for the Plant Site	DRO, VOC, PAH, RCRA	Sampling and analysis plan was completed. Final report pending, recommending No Further Action to MPCA.
51	Salvage and Scrap Areas	Storage and salvaging various equipment. These are small areas scattered on the southwest side of the Tailings Basin.	DRO, PAH, PCB, RCRA Metals	Investigation pending
52	Cell 2W Salvage Area	Storage of materials and equipment	DRO, PAH, Pb	Investigation pending
59(1)	Colby Lake Pumping Station (reuse planned)	Heating oil AST transformer	DRO, BTEX	Investigation at closure

(1) Areas to be used by the Project
(2) Abbreviations include: B = boron; BTEX = benzene, toluene, ethylbenzene and xylenes; DRO = Diesel Range Organics; GRO = Gasoline Range Organics; PAH = Polycyclic aromatic hydrocarbans; Pb = lead, PCB = Polychlorinated biphenyls; RCRA = Resource Conservation and Recovery Act; RCRA SVOC = RCRA Semi-Volatile Organic Compounds; Sr = strontium; VOC = Volatile Organic Compounds
(3) LUST-CAP = leaking underground storage tank corrective action plan

The MPCA VIC program will be used to oversee the remediation activity for potential historical releases. The process to clear an AOC beyond the Phase I ESA is documented in the Quality Assurance Project Plan (QAPP) that has been prepared for the property. Within the QAPP, a process for preparing a Sampling and Analysis Plan (SAP) is included. Record searches to confirm the presence of a recognized environmental condition (REC) are completed during preparation of a SAP for each AOC. If a REC is identified, a SAP will also be used to detail the scope of the Phase II ESA investigation work that will help determine if a release to the environment has occurred. A Phase II ESA investigation is also intended to define the nature, magnitude, and extent of the release (if found). The results of the Phase II ESA will be used to perform an MPCA VIC Program Risk Based Site Evaluation (RBSE) based on intended land use, to determine if remediation is necessary to mitigate risk.

5.2 Assessment and Remediation of Operational Releases

Because of the design of the fuel and reagent handling facilities and the planned operating and maintenance procedures, no new releases are anticipated. However, upon closure, a Phase I

Environmental Site Assessment (ESA) of the Project facilities where petroleum products and reagents were received, stored or used will be performed by a qualified consultant.

5.3 Remediation Deferred Until Reclamation

Some of the items in Table 5-1 are associated with facilities that will be reused by the Project, as stated in the table, and remediation of those AOCs will be deferred until final reclamation.

AOCs identified in the ESA discussed in Section 5.2 will be handled in the same manner described in Section 5.1.

5.4 Mining Area 5N Discharge

The Consent Decree discussed in Section 1.0 required execution of field studies and mitigation options with the objective of determining the likely source of water quality non-compliance at the discharge point of the Mining Area 5N, the technical and economic feasibility of potential mitigations and the applicability of site-specific standards. If this work determines that mitigation be implemented, that mitigation will be included in this document.

5.5 Tailings Basin Surface Seeps

The Consent Decree discussed in Section 1.0 requires execution of field studies and mitigation options with the objective of determining the technical and economic feasibility of potential mitigations and the applicability of site-specific standards for three specific surface seeps at the Tailings Basin. If this work determines that mitigation be implemented, that mitigation will be included in this document.

6.0 Monitoring and Maintenance

6.1 Existing Solid Waste Disposal Facilities

A coal ash landfill and solid waste landfill currently exist within the PolyMet surface ownership boundary. See Large Figure 5 for locations of these existing solid waste disposal facilities.

6.1.1 Coal Ash Landfill

Coal ash from LTVSMC's Taconite Harbor facility was disposed at the Hoyt Lakes' Coal Ash Landfill located southeast of the Tailing Basin (Large Figure 5). As part of a Compliance Agreement with the MPCA, LTVSMC agreed to close the Coal Ash Landfill. A Closure Plan and Post-Closure Plan (Attachment B) were subsequently submitted to the MPCA during May 2000. That plan indicated that LTVSMC would stop accepting coal ash at the disposal area by approximately August 1, 2000. The Closure Plan was prepared in accordance with Minnesota Rules, part 7035.2815, subpart 5, items D and E, subpart 6 and subpart 16 and specified that closure activities be completed by September 2000. Closure activities included site preparation and grading, and installation of a final cover system and surface water control system. A groundwater monitoring system was not specified or installed as part of the closure process.

Post-closure care of the disposal site is defined in the Post-Closure Plan (PCP) portion of the May 2000 document. Minnesota Rules, part 7035.2645 and part 7035.2655 were used to determine post-closure requirements presented in the PCP. The PCP indicates that the post-closure care period will continue for 30 years from the final closure certification which certifies that the Coal Ash Landfill has been closed in accordance with approved plans and specifications as required by Minnesota Rules, part 7035.2610. Final closure was approximately 2000, so approximately 18 years remain in the post-closure care period during which inspections of the final cover system and surface water control system will be performed three times a year (spring, summer and fall), and maintenance will be performed as necessary. A report describing the inspection(s), conditions observed, corrective actions, maintenance activities, and monitoring activities is required to be submitted to MPCA annually.

The Coal Ash Landfill will be inundated by the FTB in approximately Mine Year 7, therefore the contents of the landfill will be relocated to the HRF prior to that time, or disposed of off-site in accordance with all federal and state regulations.

6.1.2 Industrial Landfill SW-619

In December 2006, PolyMet purchased Cliffs Erie's Industrial Landfill, which operates under MPCA Solid Waste Management Permit 619 (SW-619). The MPCA issued SW-619 on October 14, 2004, in accordance with Minnesota Statutes chapters 115, 115A, and 116 and Minnesota Rules, chapters 7000, 7001, and 7035. A Solid Waste License was obtained from St. Louis County by Cliffs Erie in order to operate Industrial Landfill SW-619 so as to accept waste from entities demolishing or refurbishing former LTVSMC facilities for reuse or closure. Industrial Landfill SW-619 was permitted for disposal of demolition debris, ACM (i.e., industrial waste)

and construction debris generated at the former LTVSMC properties as part of closure and economic development activities.

In order to keep waste consolidated within one area at the Hoyt Lakes facility, Industrial Landfill SW-619 is located at the closed LTVSMC industrial waste landfill site. A groundwater monitoring system and a methane ventilation system were already present at the closed LTVSMC industrial waste landfill and are used to monitor conditions at Industrial Landfill SW-619. Industrial Landfill SW-619 includes an Industrial Waste Disposal Area (IL001) and a Solid Waste Storage Area (ST001). ST001 was permitted to allow accumulation of up to 1,500 cubic yards (for up to 30 days) of demolition and construction debris, recyclable materials and waste not acceptable for disposal at Industrial Landfill SW-619. Asbestos-containing material cannot be stored at ST001 but must be directly placed in SW-619.

Groundwater and methane monitoring is performed annually during October each year. An Annual Facility Report is completed and submitted by February 1 each year that includes the following required reports:

- IL001 Annual Waste Activity Report
- ST001 Annual Waste Activity Report
- Annual Gas Monitoring Evaluation Report
- Annual Water Monitoring Evaluation Report

A Closure Plan was prepared and was approved in accordance with Minnesota Rules, part 7035.2625, including closure procedures that ensure performance of closure in accordance with Minnesota Rules, part 7035.2635. A PCP was prepared and approved in accordance with Minnesota Rules, part 7035.2645 including post-closure care procedures that ensure performance of post-closure care in accordance with Minnesota Rules, part 7035.2655, subpart 1. Post-closure care and use of the property must be in accordance with Minnesota Rules, part 7035.2655, subpart 2. The post-closure care period will continue for 30 years from the final closure certification, which certifies that the disposal area has been closed in accordance with approved plans and specifications as required by Minnesota Rules, part 7035.2610.

6.1.3 Land Treatment Facility SW-625

On September 29, 2005, the MPCA issued in accordance with Minnesota Statute Chapters 115, 115A and 116 and Minnesota Rules, chapters 7000, 7001, 7035, and 7037, a permit to Cliffs Erie to construct and operate Land Treatment Facility SW-625. The facility consists of a 90-acre land treatment site located in Cell 2W of the FTB. The permit authorized a solid waste composting area (MC001). The activities authorized included the land treatment of petroleum contaminated soil from the cleanup of former LTVSMC facilities. Petroleum contaminated soils that were

treated were from the Knox Train Fueling Station and the Area 2 Fueling Station. No other wastes were managed at this facility.

The facility was divided into two individual land treatment sites for the separate management of the Knox and Area 2 soils. A buffer strip was required between the sites. Petroleum contaminated soils were applied on a one time basis at a depth no greater than 4 inches. The native soil was supplemented with organic matter to achieve a minimum of 2% organic matter content in the upper eight inches of native soil. The petroleum contaminated soil was not land applied until a minimum organic matter content of 2% was achieved.

The petroleum contaminated soil was spread at a thickness that assured lead levels in the mixture of petroleum-contaminated soil and native soil after incorporation was below 300 parts per million (ppm).

An annual facility report is submitted to the MPCA. This report includes, among other items, soil testing analytical results from all follow-up monitoring for that year, a written description of all complaints, management problems, or other difficulties encountered during the year resulting from operation of the Facility, and a plan for addressing these problems should they occur in the future.

The Facility shall not be considered closed until the Agency issues a closure certification to Cliffs Erie. Cliffs Erie may request closure of the Facility by the Agency after the following can be demonstrated:

- all soil monitoring results (including any subsurface samples) are less than 10 ppm Total Petroleum Hydrocarbons
- all status reports, annual reports, and any other reports pertaining to the Facility were submitted to the Agency
- any other information specifically requested by the Commissioner has been provided

6.2 Reclamation Maintenance

Monitoring and maintenance of all reclaimed areas, including mine slopes, Mine Site stockpiles, Area 5 stockpiles, Plant Site Building Areas, the FTB, and the HRF, will be inspected at least twice per year, 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 and plans to make repairs or reseed will be developed and implemented. Inspection and repair will continue until the MDNR determines that the reclamation is stable and self-sustaining and issues a release of the permittee as outlined in Minnesota Rules, part 6132.1400 and 6132.4800. See Large Figure 2 for Plant Site Building Areas and Large Figure 16 for locations of reclaimed areas at Area 5. Figures for reclamation for the following facilities are included in the indicated document:

- Mine Site reclamation is shown on Large Figure 18 and Large Figure 19 of Reference (2)
- FTB reclamation is shown on Drawing FTB-024 of Attachment A in Reference (4)
- HRF reclamation is shown on Drawing HRF-020 through Drawing HRF-023 of Attachment A in Reference (5)

6.3 Water Management

Monitoring, reporting, and adaptive management of water management systems at the Mine Site are described in Sections 5 and 6 of Reference (6) and Section 2.1.1 of Reference (8).

Monitoring, reporting, and adaptive management of water management systems at the Plant Site are described in Sections 5 and 6 of Reference (7) and Section 4.1.1 of Reference (8).

6.4 Flotation Tailings Basin (FTB) (including dam safety)

Monitoring, reporting, and adaptive management are described in Sections 5 and 6 of Reference (4).

6.5 Hydrometallurgical Residue Facility (HRF) (including dam safety)

Monitoring, reporting, and adaptive management are described in Sections 5 and 6 of Reference (5).

6.6 Wetlands

Monitoring and reporting of wetlands at the Project sites and mitigation sites are described in Sections 4 and 5 of Reference (10).

7.0 Contingency Reclamation Estimates

The following section provides an overview of the contingency reclamation plan for Mine Year 0 and Mine Year 1. For more specific details on reclamation and the associated cost estimates and contingency percentages, see the permit-level version of this Reclamation Plan with the contingency reclamation estimates that will be part of the Permit to Mine application.

7.1 Contingency Reclamation Plan (Mine Year 0 and 1)

As described in Section 1.0, detailed reclamation estimates for the following facilities are developed in the indicated document:

- Pit walls and pit perimeter barrier in Reference (2)
- Waste rock stockpiles, Category 1 Waste Rock Stockpile Cover System and Groundwater Containment System, OSP, and OSLA (including wetlands) in Reference (3)
- FTB overflow, cover, and vegetation (including constructed wetlands) in Reference (4)
- HRF Residue dewatering, cover, and vegetation in Reference (5)
- Mine Site water management including long-term closure water treatment in Reference (6)
- Plant Site water management including long-term closure water treatment in Reference (7)

7.1.1 Mine Year 0 (end of construction/development)

If closure were to occur at the end of Mine Year 0, the activities described in Sections 2.0, 3.0, 4.0, 5.0, and 6.0 of this document will be implemented. No waste rock will have been placed in stockpiles with the exception of small amounts of waste rock associated with construction activities. No Flotation Tailings will have been deposited in the FTB. The Hydrometallurgical Plant, Oxygen Plant, and HRF will not have been constructed. The WWTF and WWTP will not have been operated with the exception of the construction water pond at the Mine Site WWTF.

This plan will be used to develop the contingency reclamation estimate that will be the basis for financial assurance required by Minnesota Rules, part 6132.1200 required before a PTM can be granted. For more specific details on reclamation and the associated cost estimates and contingency percentages, see the permit-level version of this Reclamation Plan with the contingency reclamation estimates that will be part of the Permit to Mine application.

7.1.2 Mine Year 1 (end of first year of operations)

If closure were to occur at the end of Mine Year 1, the activities described in Sections 2.0, 3.0, 4.0, 5.0, and 6.0 of this document will be implemented. The Hydrometallurgical Plant, Oxygen Plant, and HRF will not have been constructed.

Mine Site and Plant Site water treatment are expected to continue until discharges meet water quality standards. The treatment plants will be maintained operable until the MDNR releases PolyMet from doing so under the PTM and the MPCA releases PolyMet from doing so under the NPDES/SDS permit. For the purposes of the contingency reclamation estimates, mechanical treatment will be funded for as long as necessary.

This plan will be used to develop the contingency reclamation estimate that will be the basis for financial assurance required by Minnesota Rules, part 6132.1200 the first or second calendar year (depending on construction progress) after the issuance of the PTM. This plan will be updated annually to include contingency reclamation for the site conditions representative of the end of the upcoming year of operation.

7.2 Estimate Methodology – PLACEHOLDER

The Permit to Mine application will include a description of the methodology used to develop the contingency cost estimate.

7.3 Contingency Reclamation Estimate (Mine Year 0 and 1) – PLACEHOLDER

The Permit to Mine application will include a breakdown of the contingency reclamation estimate for Mine Years 0 and 1.

7.3.1 Mine Year 0 (end of construction/development) – PLACEHOLDER

7.3.2 Mine Year 1 (end of first year of operations) – PLACEHOLDER

7.4 Forecast of Annual Contingency Reclamation Estimates (Mine Years 2 to 20) – PLACEHOLDER

The Permit to Mine application will include a forecast of the annual contingency reclamation estimate for the life of the mine (Mine Years 2 to 20).

8.0 Duration of Water Treatment, and Preliminary Plans to Transition from Mechanical to Non-Mechanical Water Treatment

This section has been developed to provide PolyMet's conceptual plan for the transition from mechanical water treatment to the use of non-mechanical treatment technologies. This section does not reflect the Project as presented in other documents or modeled, but provides a transition approach that PolyMet would evaluate during operations. PolyMet will include funds in its contingency reclamation estimate and financial assurance package to operate mechanical water treatment for as long as necessary. However, the Permit to Mine will also require PolyMet to present a plan for eventual transition from mechanical water treatment to non-mechanical water treatment; that plan is presented here in concept.

PolyMet plans to transition from mechanical to non-mechanical water treatment as soon as the company can demonstrate that non-mechanical water treatment technologies will effectively treat water to the required water quality standards, and as soon as formal approval is received from the agencies. Preliminary conceptual plans for making this transition are outlined below.

Non-mechanical water treatment technologies are proven methods of water treatment, but they need to be designed for site-specific conditions, mainly actual site water quality. PolyMet accordingly plans to test non-mechanical water treatment technologies for several years during mine operations and reclamation, until an acceptable treatment performance can be achieved.

Non-mechanical water treatment technologies can be thoroughly evaluated in four steps: (1) collecting additional local site information (i.e., hydrology and influent water quality), (2) laboratory testing, (3) pilot scale testing, and (4) designing a system for full scale implementation. At the Tailings Basin, additional site-specific hydrologic information can be collected when the containment system is being constructed and throughout operations. Also, the quality of the water expected at the Tailings Basin in the long term due to PolyMet's operation could start to be realized at the toe of the basin during operations. Thus, the four steps for evaluating non-mechanical water treatment at the Tailings Basin are planned to be accomplished during operations, allowing the non-mechanical water treatment system at the Tailings Basin to be in place shortly after operations are complete and the FTB Pond Cover is in place. If the transition to non-mechanical treatment is undertaken prior to the completion of West Pit flooding, Colby Lake water could be used to aid in the flooding of the West Pit (with or without treatment at the WWTP). Alternatively, West Pit flooding could be extended, depending on Project priorities and anticipated water quality results.

At the Mine Site, the four steps for evaluating non-mechanical treatment technologies could be completed in less than the time estimated for the West Pit to flood (e.g., before the end of Mine Year 55, or 35 years after the mine stops operating). However, additional time is included in the plan because the water quality in the pit may take a few years to reach equilibrium after the West Pit has flooded. Therefore, the four steps will be undertaken during reclamation. As a result, non-mechanical water treatment technology could be implemented at the Mine Site a few years after the West Pit has been flooded.

The conceptual design for a non-mechanical treatment system is to treat each flow expected in the long-term. The Adaptive Water Management Plan (Reference (8)) outlines the purpose, design, degree of industry use, up front preparation, timing, and duration of implementation and potential indirect impacts of these systems.

PolyMet has already initiated testing of non-mechanical water treatment technologies on-site (in collaboration with Cliffs Erie) and will continue testing these systems and evaluating other non-mechanical water treatment technologies until they can be established and demonstrated to the adequacy of the MDNR and MPCA to provide the required water treatment. Provisions will be included in the NorthMet financial assurance package to ensure this test work and implementation of the non-mechanical water treatment technologies can be completed, in order to achieve the long-term closure goals and eventual release from the Permit to Mine.

9.0 Financial Assurance

Minnesota Rules, part 6132.1200, require that before a Permit to Mine can be issued, financial assurance instruments covering the estimated cost of reclamation, should the mine be required to close for any reason at any time, must be submitted and approved by the MDNR.

Although NEPA and MEPA regulations do not require a discussion of financial assurance, PolyMet has provided an initial estimate of expected financial assurance needs that could be included in environmental review process (Reference (11)). The level of engineering design and planning required to calculate detailed financial assurance amounts is not currently available, but will be evaluated in detail during the permitting process and included as part of the Permit to Mine application.

Revision History

Date	Version	Description
09/13/2010	1	Initial release – Legacy Only
11/30/2011	2	Added NorthMet Project
1/22/2013	3	Changes made to incorporate project changes related to the decisions made in the AWMP Version 4 and 5, respectively. These project changes include the extension of the groundwater containment system along the south side of the Category 1 Waste Rock Stockpile, the use of a geomembrane cover on the Category 1 Waste Rock Stockpile, the construction and operation of the FTB containment system, the use of long-term mechanical water treatment and the potential for non-mechanical water treatment in long-term closure.
12/12/2014	4	Changes were to add the five main changes that have been incorporated into the Project since publishing of the SDEIS: 1) addition of the SAG mill, 2) Coal Ash Landfill relocation, 3) the addition of the east side of the FTB Containment System, 4) adjustments made to the stream augmentation plan and West Pit flooding, and 5) changes made for the sewage treatment system. Additional changes were made for clarification, to add language for the timing of transition to non-mechanical treatment and financial assurance, and to address agency comments.
1/23/2015	5	Changes were made to address agency comments in Sections 4.5, 6.2, 8.0, and 9.0.
2/10/2015	6	Changes were made to address agency comments in Sections 6.6, 7.2, 7.3, 7.4, 8.0, and 9.0.

References

1. **Poly Met Mining Inc.** NorthMet Project Project Description (v9). February 2015.

2. —. NorthMet Project Mine Plan (v4). December 2014.

3. —. NorthMet Project Rock and Overburden Management Plan (v7). January 2015.

4. —. NorthMet Project Flotation Tailings Management Plan (v5). February 2015.

5. —. NorthMet Project Residue Management Plan (v4). December 2014.

6. —. NorthMet Project Water Management Plan - Mine Site (v4). February 2015.

7. —. NorthMet Project Water Management Plan - Plant (v4). February 2015.

8. —. NorthMet Project Adaptive Water Management Plan (v7). February 2015.

9. **Northeast Technical Services, Inc.** Phase I Environmental Site Assessment: Cliffs Erie Properties Including the Hoyt Lakes Facility, Dunka Property, Taconite Harbor and Railroad Corridors. Prepared for Cliffs Erie, L.L.C. September 2002.

10. **Poly Met Mining Inc.** NorthMet Project Wetland Management Plan (v7). January 2015.

11. **Foth Infrastructure & Environment, LLC.** PolyMet – Proposed SDEIS Financial Assurance Language Memorandum. March 11, 2013.

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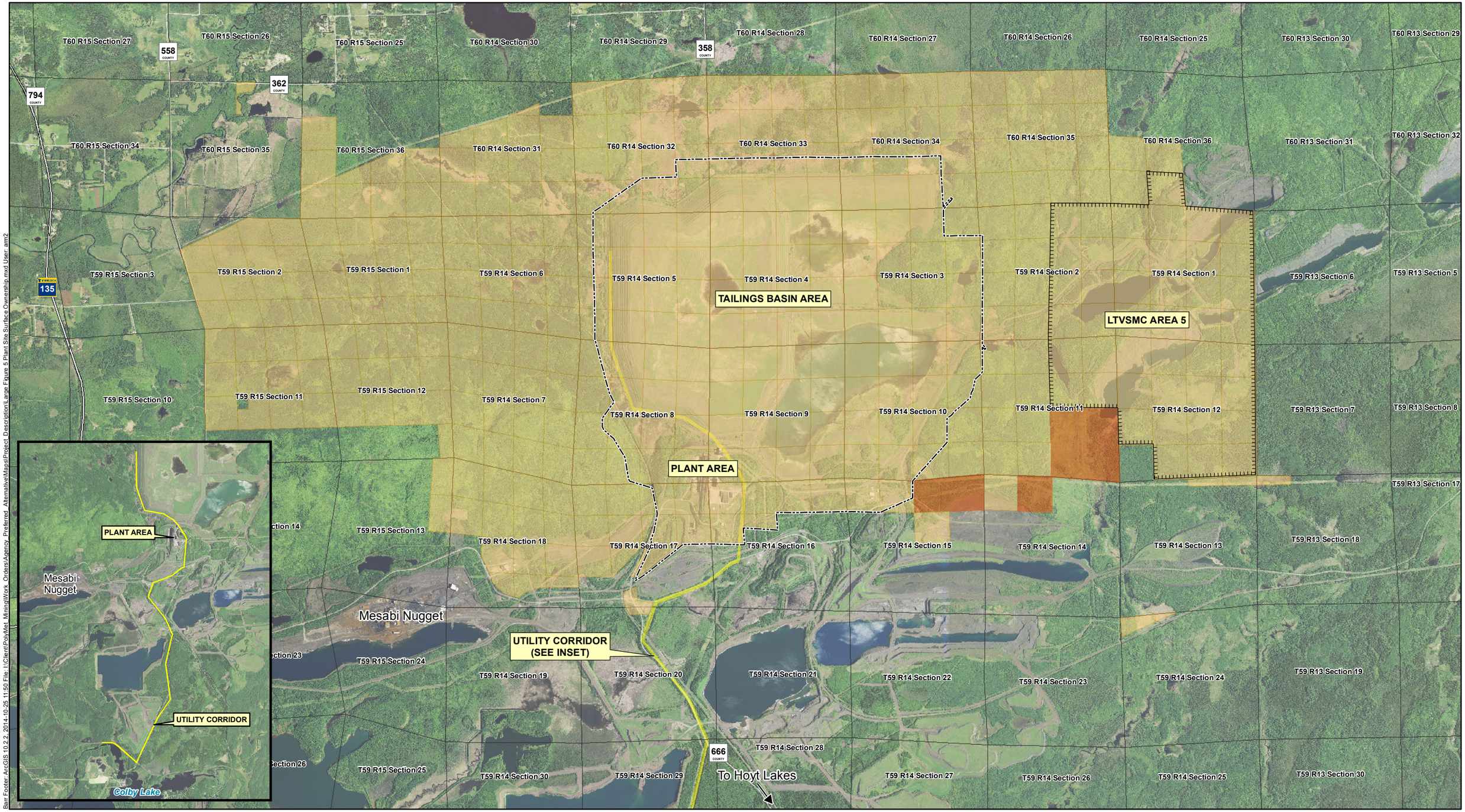


Bar Footer: ArcGIS 10.2.2, 2014-10-25 11:50 File: I:\Client\PolyMet Mining\Work Orders\Agency Preferred Alternative\Maps\Project Description\Large Figure 5 Plant Site Surface Ownership.mxd User: amm2

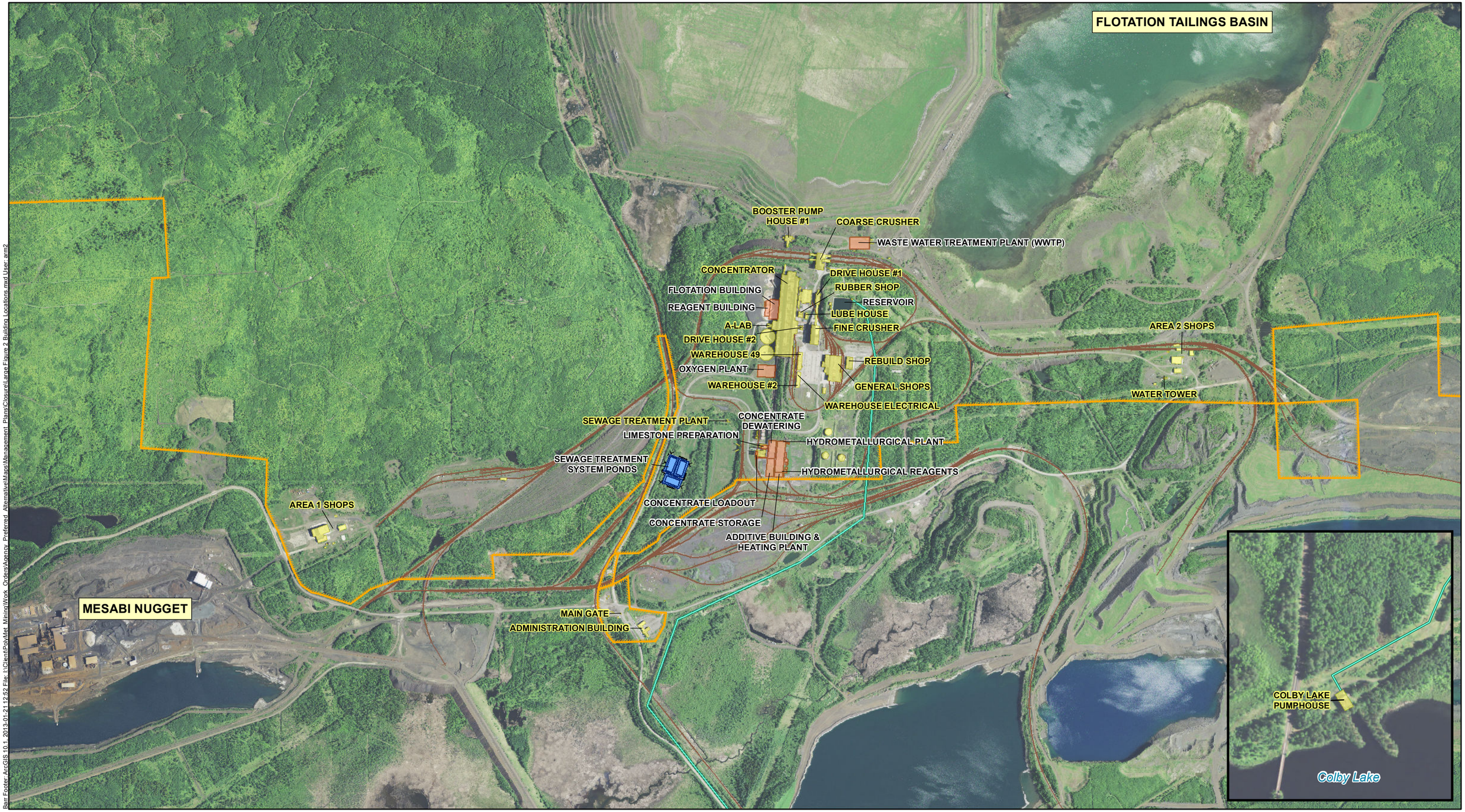
Project Area
Surface Ownership
PolyMet Owned Area
Area Leased by PolyMet
LTVSMC Area 5
Section Lines
Utility Corridor [1]

[1] PolyMet has the right (by ownership, lease or easement, depending on the section of the corridor) to use the utility corridor.

N

0 1,750 3,500 7,000
Feet

Large Figure 1
PLANT SITE SURFACE OWNERSHIP
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



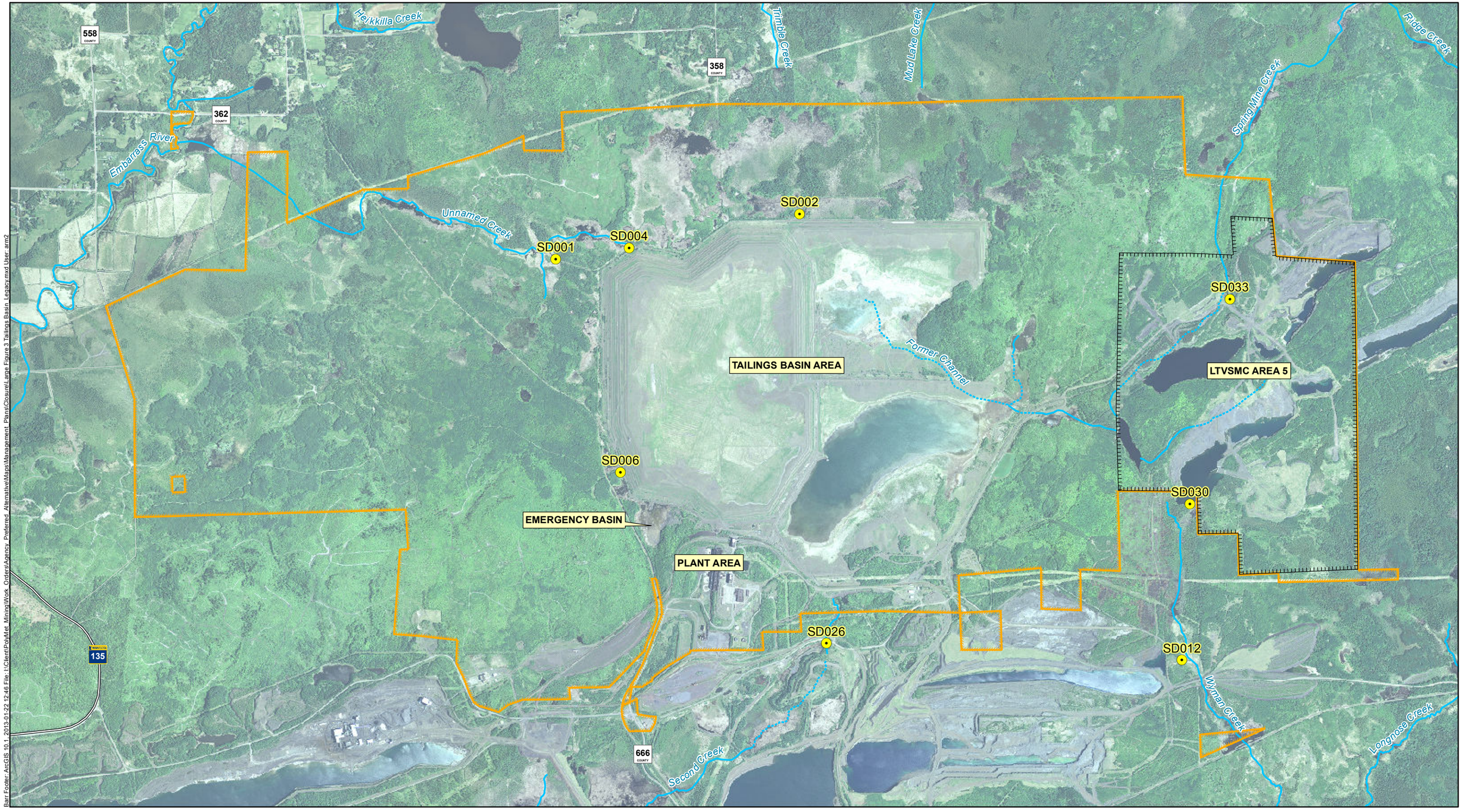
Barr Footer: ArcGIS 10.1, 2013-01-21 12:52 File: k:\Client\PolyMet_Mining\Work_Orders\Agency_Preferred_Alternative\Maps\Management_Plans\Closure\Large Figure 2 Building Locations.mxd User: amn2

PolyMet Ownership Boundary
New Project Buildings
Existing Legacy Buildings
Colby Lake Water Supply Pipeline
Existing Railroad

N

0 750 1,500 3,000
Feet

Large Figure 2
BUILDING LOCATIONS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, Minnesota



Existing Surface Discharges - Concent Decree
Rivers and Streams
Former Channel
PolyMet Ownership Boundary
LTVSMC Area 5 Boundary

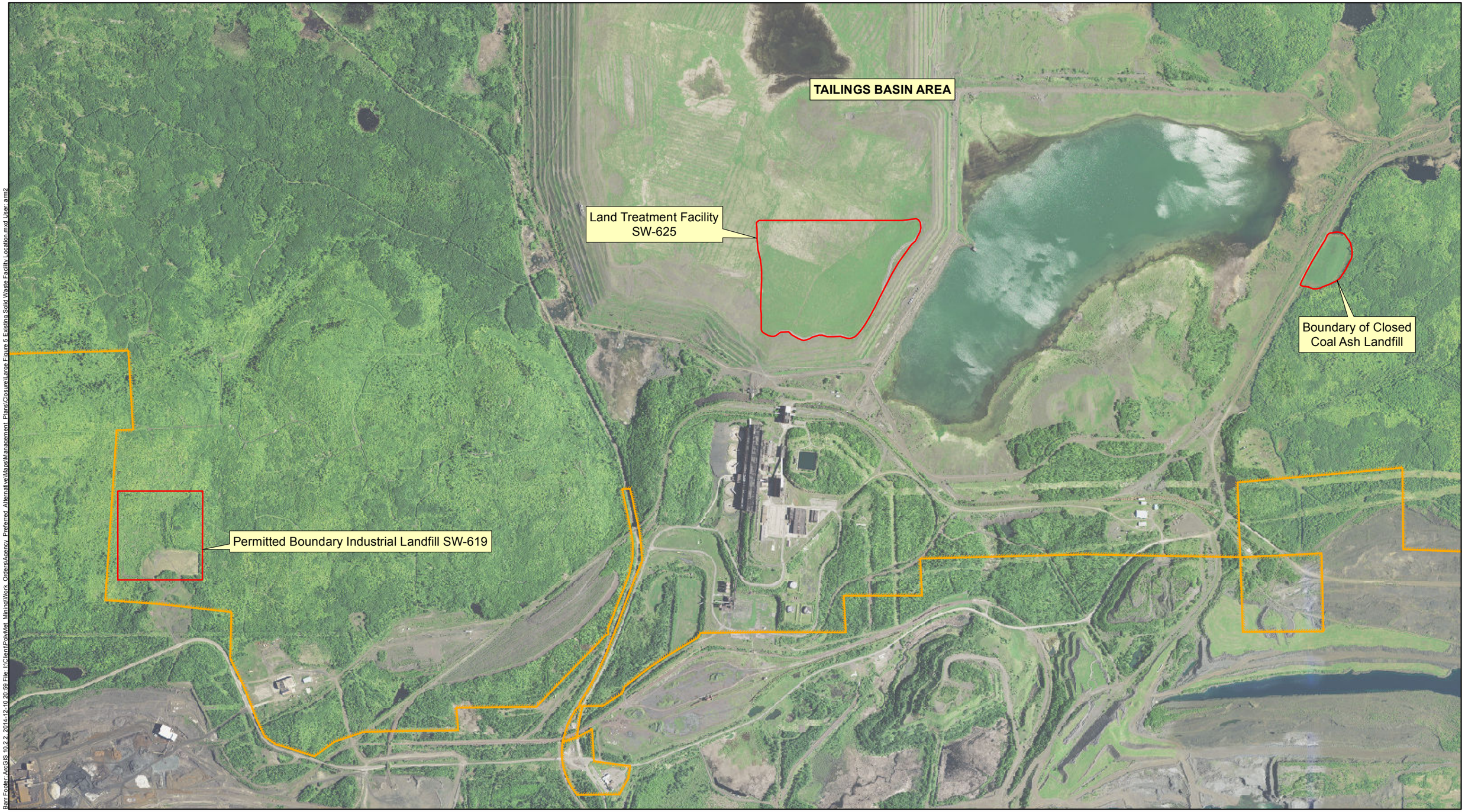
0 1,500 3,000 6,000
Feet

Large Figure 3
TAILINGS BASIN (LEGACY)
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Existing Surface Discharges - Consent Decree

0 250 500 1,000
Feet

Large Figure 4
EMERGENCY BASIN (LEGACY)
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



PolyMet Ownership Boundary

Approximate Boundaries

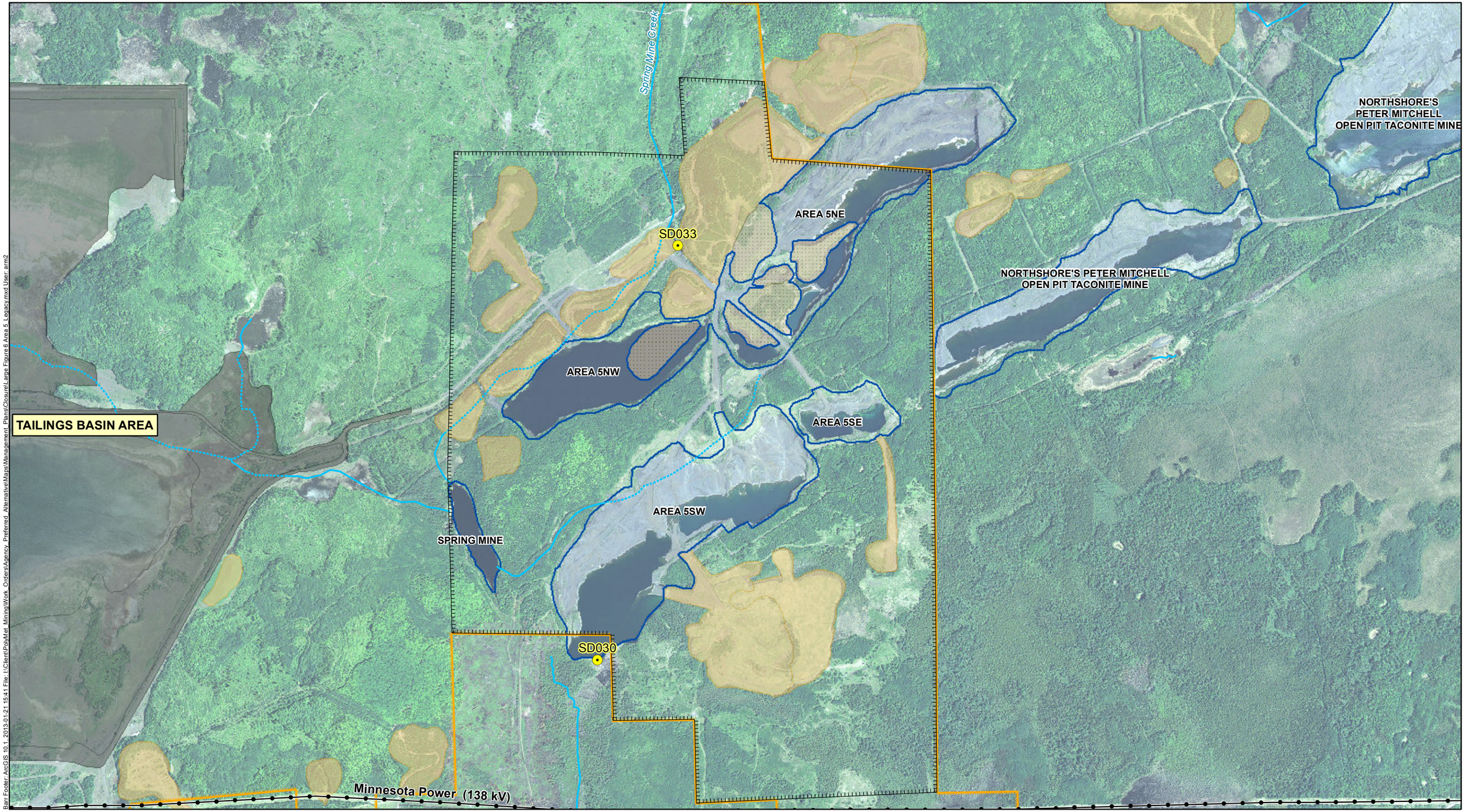
Solid Waste Facilities

N

0 750 1,500 3,000

Feet

Large Figure 5
EXISTING SOLID WASTE
FACILITY LOCATIONS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



Existing Surface Discharges - Concent Decree
Electric Transmission Lines
LTVSMC Area 5 Boundary
PolyMet Ownership Boundary
Rivers and Streams
Former Stream Channel

DNR Mine Features (2009)
Stockpiles
In-Pit Stockpiles
Tailings Basin
Mine Pits

0 750 1,500 3,000
Feet

Large Figure 6
AREA 5 (LEGACY)
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Barr Footer: ArcGIS 10.1, 2013-01-21 14:14 File: I:\Client\PolyMet_Mining\Work_Orders\Agency_Preferred_Alternative\Maps\Management_Plans\Closure\Large Figure 7 Sanitary System and Well Locations.mxd User: amr2

Existing Sanitary Systems [1]

- Septic System
- Well
- PolyMet Ownership Boundary

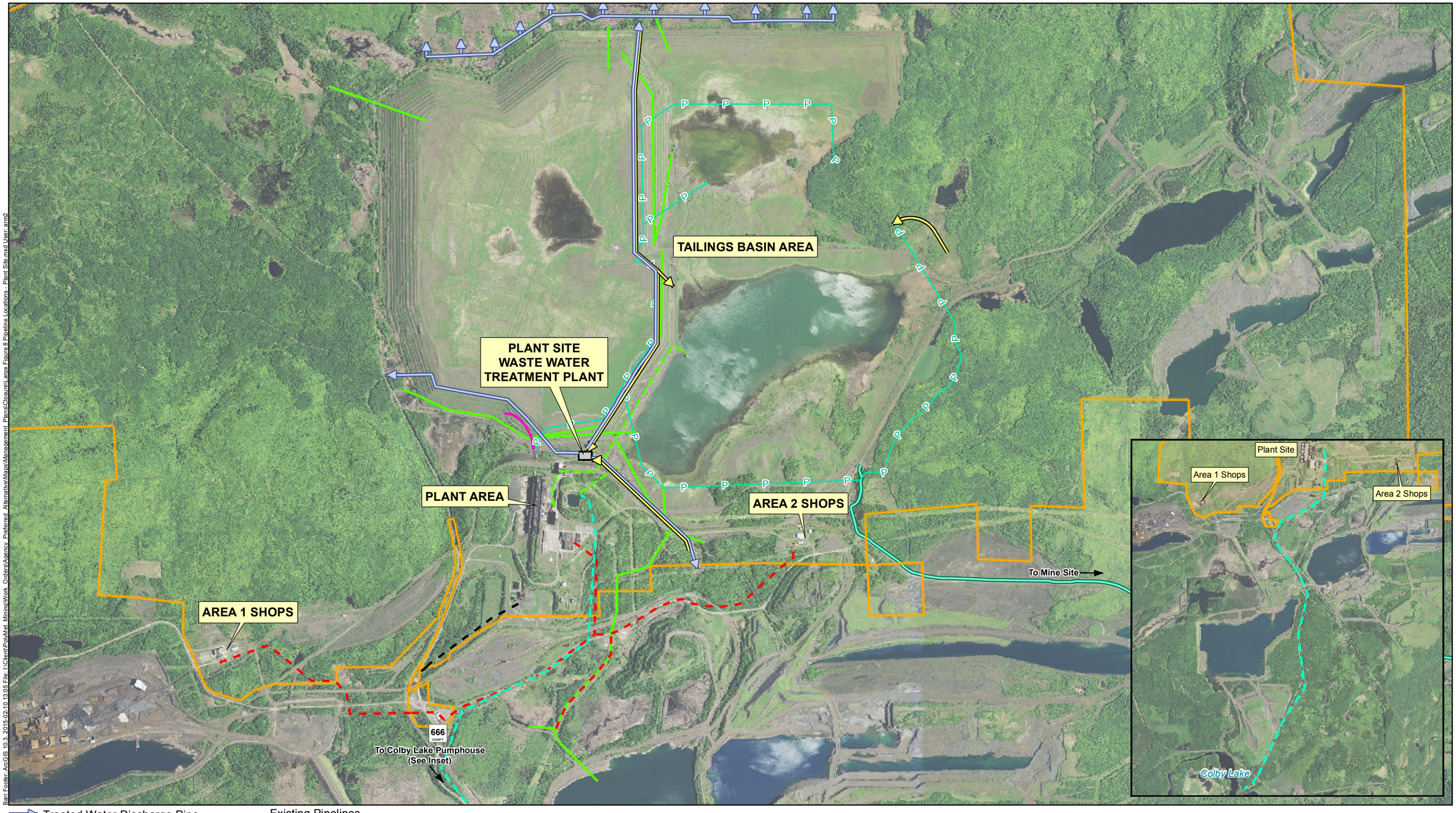
[1]There are no existing sanitary systems at the Mine Site. In closure, any sewage holding tanks or septic systems installed will also be closed, as discussed in Section 2.1.4.

N

0 2,000 4,000

Feet

Large Figure 7
SANITARY SYSTEMS AND WELL LOCATIONS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



Barr Foster-ArcGIS 10.3, 2015-02-10 13:05 File: I:\Client\PolyMet_Mining\Work_Orders\Agency_Preferred_Alternative\Maps\Management_Plans\ClosureLarge Figure 8 Pipeline Locations - Plant Site.mxd User: arm2

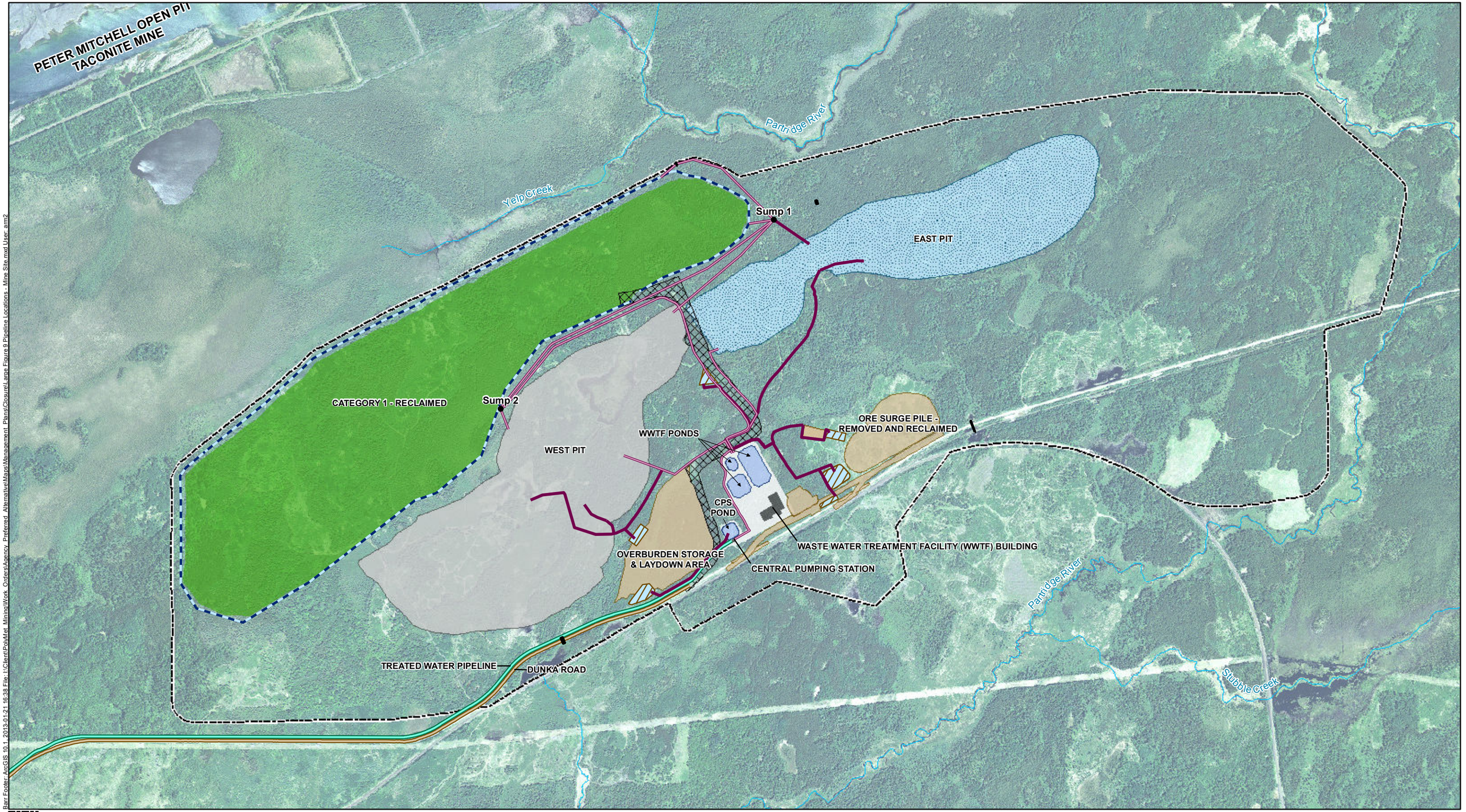
- Treated Water Discharge Pipe
- Seepage Water Pipe
- Flotation Tailings Pipeline
- Hydrometallurgical Residue Pipeline
- Treated Water Pipeline (from Mine Site)

Existing Pipelines

- Tailings Water Managment (Suface)
- Tailings Water Management (Underground)
- Inter-Pit Pipeline for Shop Water Supply (Underground)
- Natural Gas Line (Underground)
- Water Supply Pipeline (Underground)
- PolyMet Ownership Boundary

0 2,200 4,400
Feet

Large Figure 8
PIPELINE LOCATIONS PLANT SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



Mine Site

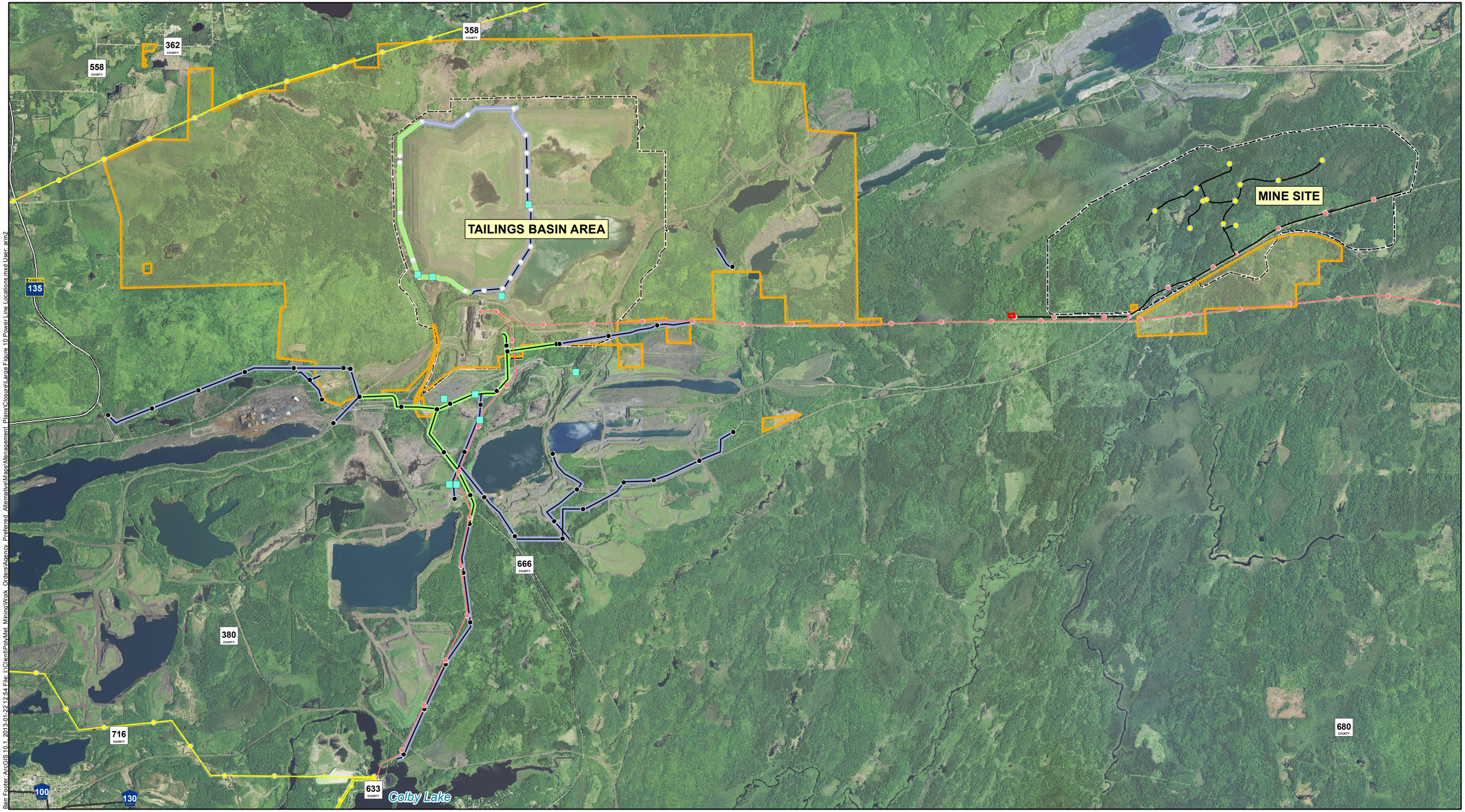
Mine Plan at Reclamation

- Covered Stockpile
- West Pit
- Mitigation Wetland
- Removed and Reclaimed Features
- Haul Roads
- Treated Water Pipeline
- Groundwater Containment System
- Process Water Pipes to Remain
- Process Water Pipes to be Removed
- Process Water Ponds and Sumps - Reclaimed
- Culverts

0 750 1,500 3,000

Feet

Large Figure 9
PIPELINE LOCATIONS MINE SITE
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



Power Lines
- 13.8 kV
- 4.16 kV
- 13.8 & 4.16 kV
- Power Lines In Use
- Power Lines Not In Use

Minnesota Power Power Lines
- 138 kV
- 115 kV
- PolyMet Ownership Boundary
- Project Areas

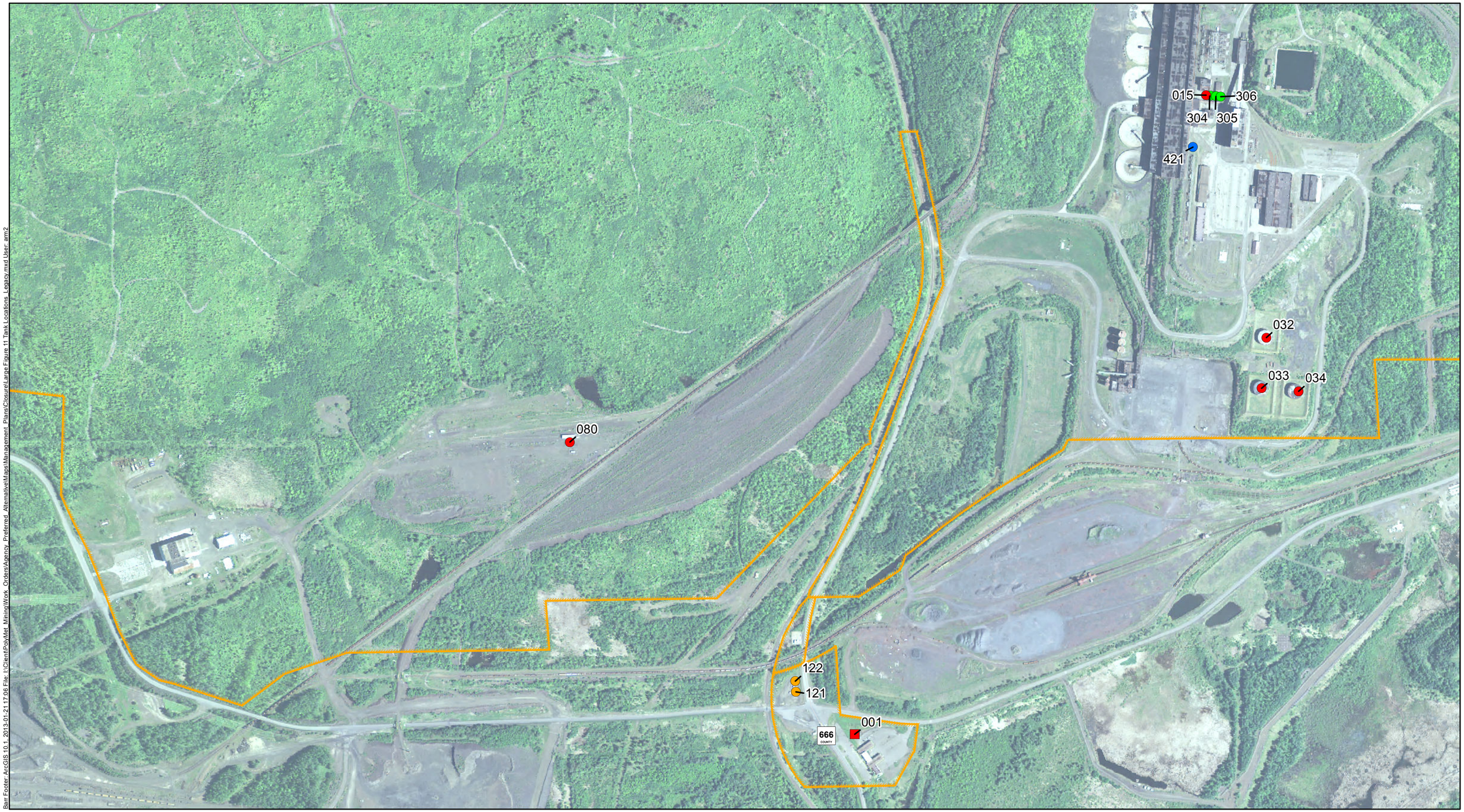
- Substations

Proposed Mine Site Features
- Mine Site 13.8 kV Power Line
- Mine Site 4.16 and/or 7.20 kV Power Line
- Substation

0 5,000 10,000
Feet

Large Figure 10
POWER LINE LOCATIONS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Barr Foster ArcGIS 10.1, 2013-01-22 12:54 File: N:\Client\PolyMet Mining\Work Orders\Agency Preferred Alternative\Maps\Management Plans\Closure\Large Figure 10 Power Line Locations.mxd User: arm2



Barr Footer: ArcGIS 10.1, 2013-01-21 17:06 File: I:\Client\PolyMet_Mining\Work_Orders\Agency_Preferred_Alternative\Maps\Management_Plans\Closure\Large Figure 11 Tank Locations_Legacy.mxd User: amr2

PolyMet Ownership Boundary

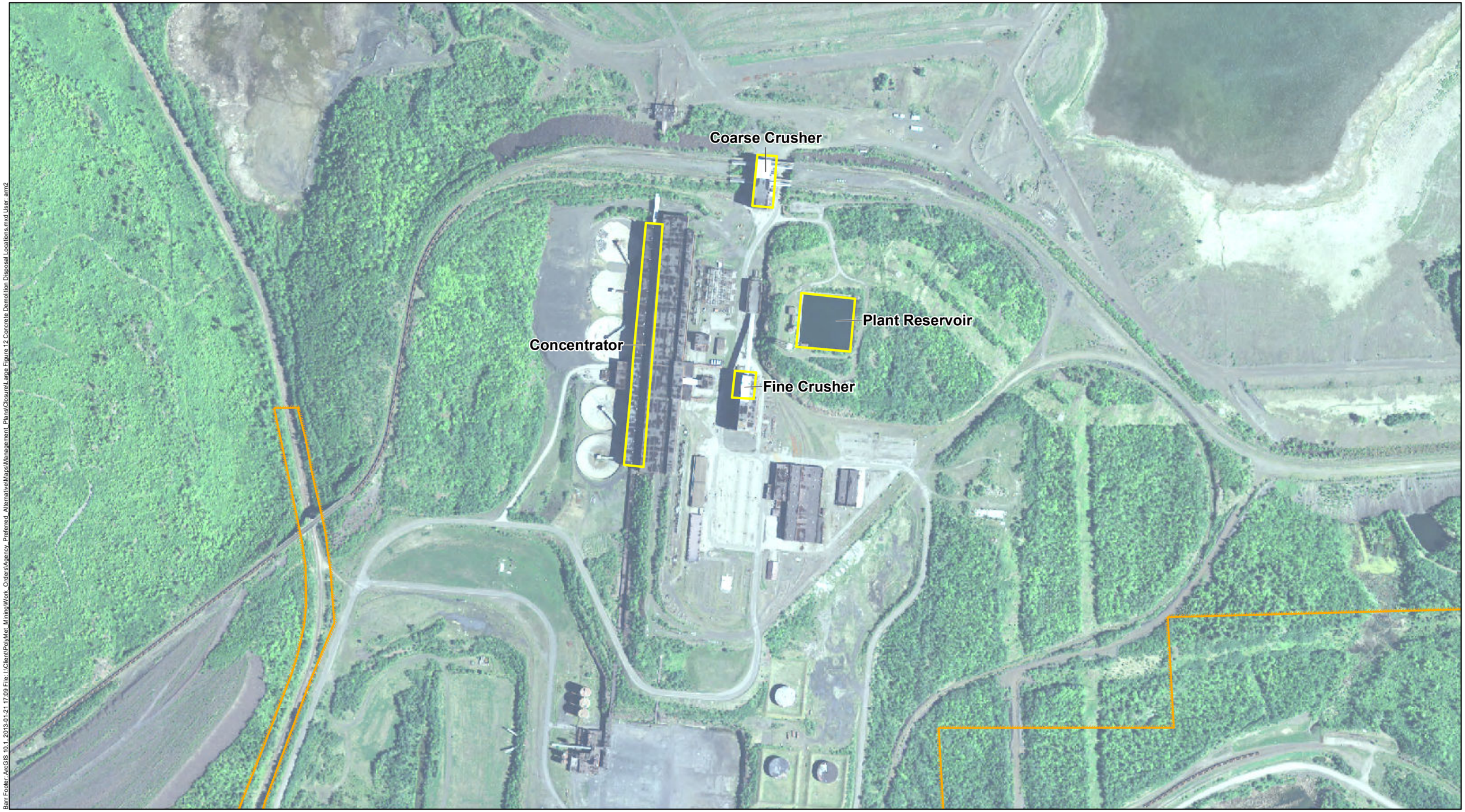
Underground Tanks
- Fuel Oil

Aboveground Tanks
- Fuel Oil
- Gasoline
- Mineral Oil
- Waste Oil

Note: There are no existing tanks at the Mine Site. In closure, tanks at the Plant Site and Mine Site will be disassembled and/or removed, as discussed in Section 2.1.6.

0 350 700 1,400
Feet

Large Figure 11
TANK LOCATIONS (LEGACY)
North Met Project
Poly Met Mining Inc.
Hoyt Lakes, MN



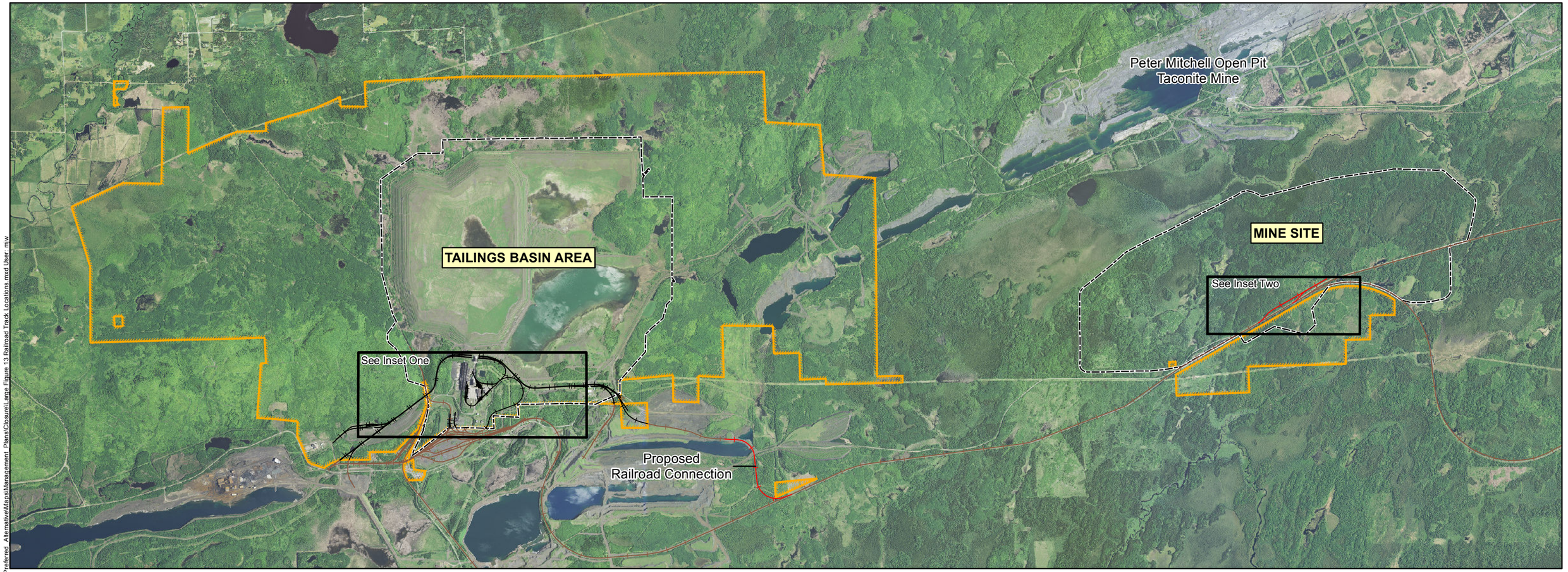
Barr Footer: ArcGIS 10.1, 2013-01-21 17:09 File: I:\Client\PolyMet Mining\Work Orders\Agency Preferred Alternative\Maps\Management Plans\Closure\Large Figure 12 Concrete Demolition Disposal Locations.mxd User: arm2

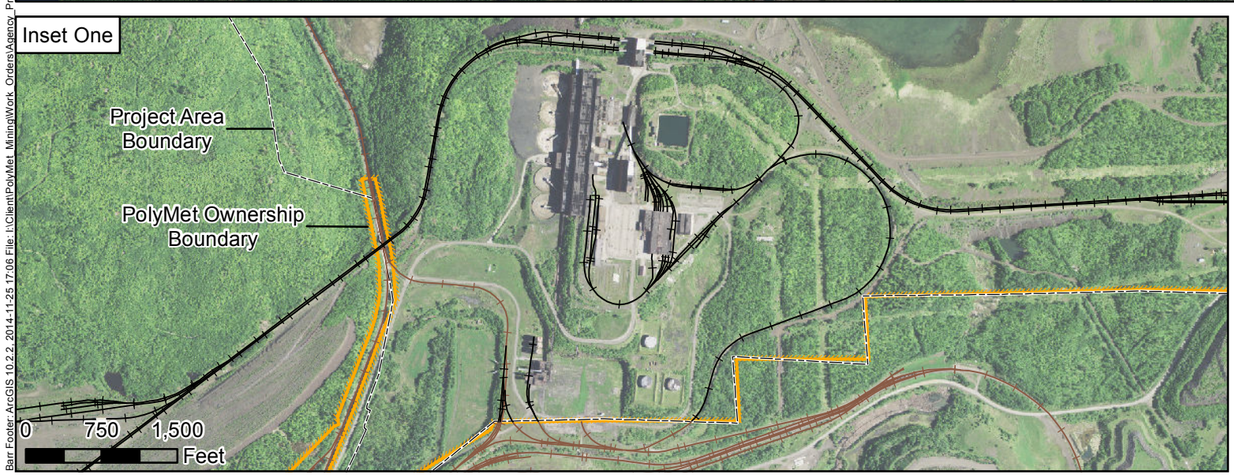
Concrete Demolition Disposal
PolyMet Ownership Boundary

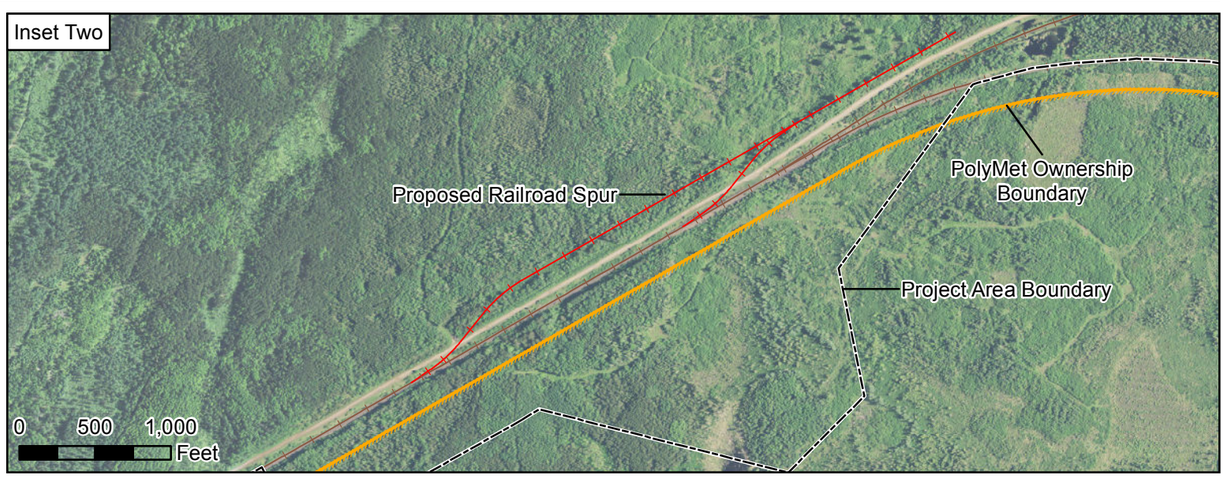
N

0 500 1,000
Feet

Large Figure 12
CONCRETE DEMOLITION DISPOSAL LOCATIONS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN







Proposed Railroad
PolyMet Railroad
Other Railroad
PolyMet Owned Area
Project Areas

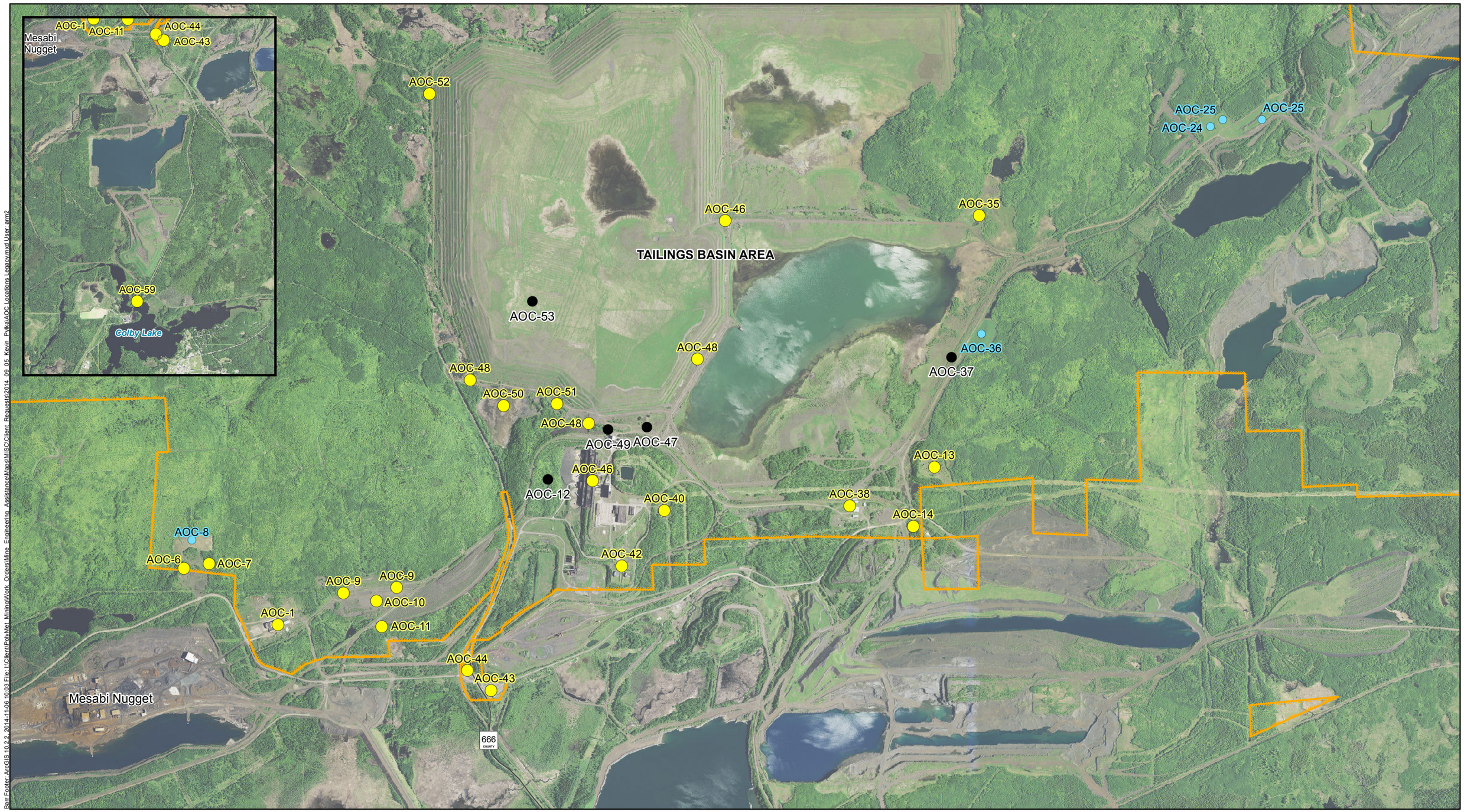
0 2,500 5,000 10,000
Feet

Large Figure 13
RAILROAD TRACK LOCATIONS
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Culvert Location
LTVSMC Area 5 Boundary
PolyMet Ownership Boundary

0 450 900 1,800
Feet

Large Figure 14
CULVERT LOCATIONS (LEGACY)
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



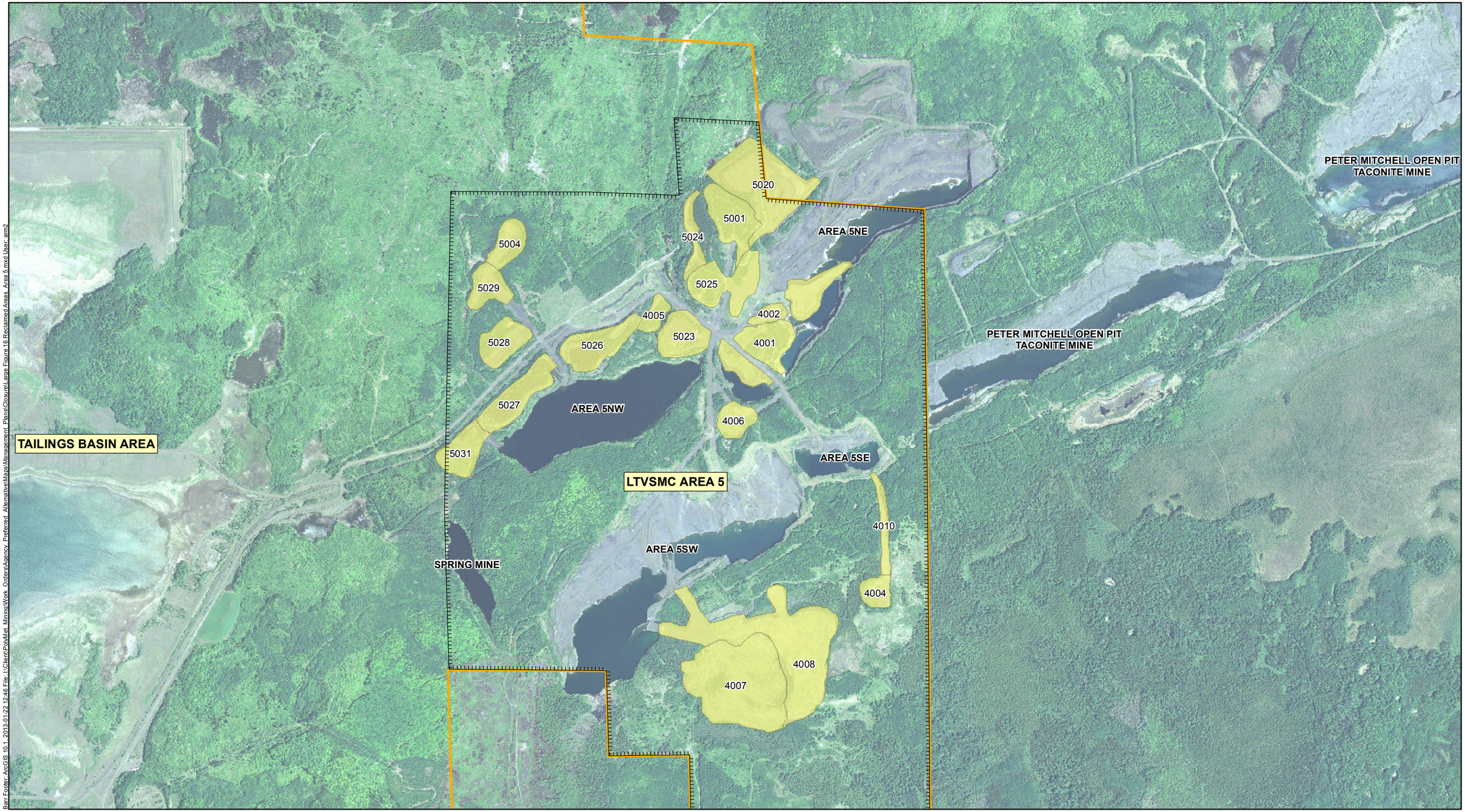
Areas of Potential Concern (AOC)

- AOC - Active
- AOC - Monitoring Only (Landfill)
- AOC - Closed
- PolyMet Ownership Boundary

0 1,000 2,000 4,000

Feet

Large Figure 15
AOC LOCATIONS (LEGACY)
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN



Barr Footer: ArcGIS 10.1, 2013-01-22 12:46 File: i:\Client\PolyMet Mining\Work Orders\Agency Preferred Alternative\Maps\Management Plans\ClosureLarge Figure 16 Reclaimed Areas Area 5.mxd User: am2

LTVSMC Area 5 Boundary

PolyMet Ownership Boundary

Area 5 Reclaimed Stockpiles (by Others)

N

0 750 1,500 3,000

Feet

Large Figure 16
RECLAIMED AREAS - AREA 5
NorthMet Project
Poly Met Mining Inc.
Hoyt Lakes, MN

Attachments

Attachment A

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	SP Number ER15
History: 2/14/12 – ER15 - initial version 9/10/13 – Edited to support Plant Site Fugitive Emission Control Plan submittal		

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 and 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 10th.

Summer: Approximately August 15 - September 15

Fall: October

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.) and asphalt emulsion mulch 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 asphalt emulsion 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 asphalt 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 glacial till overburden at a uniform rate of 400 pounds of 20-20-0 per acre (or equivalent) and on tailings at a uniform rate of 600 pounds of 11-55-0 per acre and 100 pounds of 0-46-0 per acre (or equivalent), or other rate designated by the *Operations Contact*.

3. After application, the fertilizer will be worked and thoroughly mixed with the tailing or glacial till 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
	Sweet Clover (*Trifolium repens*)		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 Milvetch (*Astragalus cicer*)	10
	Birdsfoot Trefoil (*Lotus corniculatus*)	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.
[2] Adapted from "Guidelines for Reclamation Plantings on Taconite Tailings Basins and Stockpiles". MDNR Lands and Minerals. January 2012.
[3] Used by LTVSMC for permanent taconite tailings reclamation.

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**

Mixture Number	Species	Rate (lbs/acre)
	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 glacial till overburden at a uniform rate of 400 pounds of 20-20-0 per acre (or equivalent) and on tailings at a uniform rate of 600 pounds of 11-55-0 per acre and 100 pounds of 0-46-0 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**
	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**

Mixture Number	Species	Rate (lbs/acre)
	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
D3[3]	Smooth Brome (*Bromus inermis*)	10
	Red Fescue (*Festuca rubra*)	10
	Perennial Ryegrass (*Lolium perene*)	10
	Cicer Milvetch (*Astragalus cicer*)	10
	Birdsfoot Trefoil (*Lotus corniculatus*)	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.
[3] Used by LTVSMC for permanent taconite tailings reclamation

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.*

Attachment B

Closed Coal Ash Landfill Closure Plan

Closure Plan for the Tailings Basin Coal Ash Disposal Area

LTV Steel Mining Company

Hoyt Lakes Plant

Wenck File #0435-06

Prepared for:

LTV STEEL MINING COMPANY
County Road 666
P.O. Box 847
Hoyt Lakes, Minnesota 55750

Prepared by:

WENCK ASSOCIATES, INC.
1800 Pioneer Creek Center
P.O. Box 249
Maple Plain, Minnesota 55359-0249
(763) 479-4200

May 2000

Wenck

Table of Contents

1.0 Introduction

This report consists of a Closure Plan and Post-Closure Plan for the existing coal ash disposal area in the tailings basin at the LTV Steel Mining Company's (LTV) Hoyt Lakes Plant. This report has been prepared as part of a compliance agreement with LTV and the Minnesota Pollution Control Agency (MPCA) and has been prepared in accordance with Minn. Rule 7035.2815 subp. 5 (D) (E), subp. 6, and subp. 16. The objective of the Closure and Post-Closure Plan is to establish procedures to be followed during each of the activities.

Section 2.0 of this document presents the Closure Plan that includes MPCA notification requirements, schedules, procedures and certifications, as well as the Plan Drawings and Technical Specifications for the closure project which are provided in Appendices A and B, respectively. Section 3.0 of this document defines a Post-Closure Care Plan and evaluates maintenance, inspections, corrective actions, and reporting requirements for these activities for the post-closure period.

2.0 Closure Plan

2.1 GENERAL

As part of the Compliance Agreement between LTV and the MPCA, LTV has agreed to close the existing coal ash disposal area in the tailings basin at the Hoyt Lakes Plant and will cease accepting coal ash for land disposal on approximately August 1, 2000. Final closure activities described below will then take place and are to be completed by September 22, 2000. In addition, coal-contaminated soil from the abandoned coal yard will be excavated and placed in the existing coal ash disposal area by July 21, 2000, prior to beginning closure activities.

Contact after closure is:

LTV Steel Mining Company
County Road 666
P.O. Box 847
Hoyt Lakes, MN 55750

A copy of the approved closure plan and all revisions to the plan will be kept at the plant until final closure is completed and certified.

2.2 NOTIFICATION OF FINAL CLOSURE AND SCHEDULE

Final closure at the site will be completed in accordance with the schedule presented in the compliance agreement. The MPCA will be notified (per the compliance agreement) and kept updated on all landfill closure activities. Construction plan drawings and specifications are included as part of this submittal in Appendices A and B, respectively, for MPCA review prior to closure construction activities.

2.3 CLOSURE PROCEDURES

2.3.1 General

Closure procedures for final cover construction at LTV are detailed in the Closure Plan Drawings provided in 11"x 17" format in Appendix A, with full size 22" x 34" drawings attached, as well as in the Technical Specifications provided in Appendix B. The Drawings include:

1. Index Sheet
2. Existing Site Conditions
3. Final Cover Grading and Surface Water Control Plan
4. Cross-Sections and Details

A discussion of closure procedures is provided below and a summary of closure procedures is as follows:

1. Excavate, relocate, and recompact coal ash from outside the existing coal ash pile limits (i.e., near railroad tracks and north of the ash pile). This also includes the remaining coal-contaminated soil from an abandoned coal yard that will be relocated to the ash pile by July 21, 2000 to be graded with slopes between 3 and 20 percent. This includes placing a 6-inch buffer layer over the coal ash pile following regrading. The buffer layer is to consist of tailings from the plant operations.

2. Install minimum 40-mil linear low-density polyethylene (LLDPE) synthetic flexible membrane liner.

3. Install minimum of 6 inches of granular drainage material (tailings) ($1x10^{-3}$ cm/sec minimum permeability).

4. Grading and placement of 12 inches of soil fill.

5. Placement of 6 inches of vegetation of supporting topsoil.

6. Construct sedimentation pond.

7. Seed and mulch the final covered area and sedimentation pond.

The Construction Quality Assurance/Quality Control (QA/QC) Plan included as an attachment to the project specifications (Appendix B); details the soil tests to be performed on the final cover materials. Any test results that do not meet the standards established will be discussed with MPCA staff prior to placement of the next soil cover layer.

2.3.2 Site Preparation and Grading

To begin, the site will be graded with slopes between 3 and 20 percent. This will require excavating, relocating, and recompacting ash and cover soils from the following areas:

1) Remaining coal-contaminated soil from the abandoned coal yard (estimated 7,000 cubic yards).
2) Area along railroad tracks to the west of the current disposal area (estimated 500 cubic yards).
3) Area north of the existing pile (estimated 350 cubic yards).

The ash will be relocated and regarded as shown on Plan Drawing No. 3 (2 feet below the proposed final cover system contours shown on Plan Drawing No. 3). An appropriate 6-inch buffer soil layer will be placed over the entire ash pile, as well as the regarded ash areas prior to installing the 40-mil liner. The buffer layer will consist of tailings from mining operations. To ensure suitability, the construction specifications require the contractor to inspect the buffer soil layer for rocks larger than 2 inches in diameter, or sharp rocks or other material deleterious to the geomembrane liner.

2.3.3 Final Cover System

Following site preparation and grading, the following final cover system will be placed over the ash pile:

Top to Bottom

- 6 inches topsoil
- 12 inches common borrow
- 6-inch drainage layer (tailings)
- 40-mil linear low density polyethylene liner (LLDPE)
- 6 inches buffer soil (tailings)
- Coal ash

It is proposed that tailings from mining operations be used for both the buffer layer and drainage layer. Upon examination, the tailings appear to be very much like a fine-grained sand and very suitable for use as drainage layer material. In addition, LTV submitted samples of the tailings to Braun Intertec for laboratory permeability testing, as well as load testing of the tailings on 40-mil LLDPE. The permeability results are provided in Appendix C. With regards to the load testing, tailings from LTV's mining operations were placed both above and below a sample of 40-mil LLDPE and a load was applied for approximately 15 minutes. Two tests were completed with loads of 250 pounds per square foot and 750 pounds per square foot and the liner removed and examined. The loads applied in the laboratory are greater than would be the load of the cover soils following completion of the closure, which is estimated to be 240 pounds per square foot. There were no visual signs of stress to the liner following the tests, and in fact, the tailings will improve the stability of the cover system due to its high friction angle.

The final cover is designed to promote moderate sheet flow drainage of surface water run-off and minimize any erosion potential. The final grades of the site are shown on Plan Drawing No. 4. Access roads will be provided on both the north and south end of the ash pile. Surface water is

directed to the north via drainage ditches to a sedimentation pond and ultimately the tailings basin.

HELP model calculations, provided in Appendix D, show this final cover system is designed to contain or reject approximately 99.9 percent of the precipitation falling on the system, which greatly exceeds the 90 percent required by Minn. Rule 7035.2815 subp. 6 item D.12.

Turf establishment work will generally comply with MN/DOT 2575. The grass seed mixture and application rates (pounds of pure live seed) will be as follows:

Plant Species Common Name	Lb/acre	% Weight Pure Live Seed	% Germination
Kentucky Bluegrass	25	35	85
Park Kentucky Bluegrass	11	15	85
Creeping Red Fescue	28	40	95
Perennial Rye Grass	7	10	95
Winter Wheat or Winter Rye	60	--	--

The construction specifications do require the Contractor to apply mulch with the seed and fertilizer.

2.3.4 Surface Water Control System

Construction of a stormwater collection pond (north of the closure area), along with drainage ditches and access road, will be completed as part of final cover activities. The pond will be constructed by building a northern dike with a riprap outlet structure in an existing lowland area where surface water currently ponds (Plan Drawing No. 3). A majority of the run-off from the ash pile will be directed to the sedimentation pond through the drainage ditches. Surface water from the sedimentation pond ultimately outlets to culverts located farther north into the tailings basin. Closure slopes vary from approximately 125 to 200 feet in length. Once final cover vegetation is established, and with slopes less than or equal to 20 percent, erosion should not be a concern. The ditches will be maintained and inspected as detailed in the Post-Closure Plan. The surface water control system is designed to handle a 25-year, 24-hour storm event and the appropriate surface

water calculations are provided in Appendix E. It should be noted that all surface water generated within the tailings basin area is ultimately directed to the tailings basin as part of a closed loop system.

It is also proposed that a drainage collection pipe will be incorporated into the granular drainage layer and be placed around the perimeter of the cover. Outlet pipes will be placed every 100 feet (see Detail on Plan Drawing No. 4).

2.4 CERTIFICATION OF CELL/FINAL CLOSURE

Upon completion of activities for final closure of any phase, a closure documentation report, signed by the owner and a professional engineer registered in the State of Minnesota, stating that the landfill has been closed in accordance with approved plans and specifications, will be submitted to the MPCA as required by the MPCA Solid Waste Rules Part 7035.2610.

Testing of the various components of the cap will be conducted and documented in accordance with all applicable rules and with the Construction Quality Assurance/Quality Control Plan provided in Appendix B as part of the Specifications for Final Cover Construction. The closure and construction documentation will be submitted to the MPCA no later than 60 days following completion of final closure. The documentation will contain record drawings, testing data, description of the construction process and photographs of the major aspects of the construction phase.

In addition, a description of what the facility was used for, waste types, a survey plat of the site certified by a land surveyor registered in Minnesota, and a copy of record drawings will be submitted to the St. Louis County Recorder and the MPCA, upon final closure.

2.5 DEED NOTATION

LTV will record a notation on the deed to the property, or on some other instrument normally examined during a title search. The notation will, in perpetuity, notify any potential purchasers of the property of the types and quantities of waste received and the depth to which they were disposed, and any special conditions or limitations for use of the site. The notation will include record drawings for the facility. A copy of the notation carrying the County Recorder's seal will be included with the final closure certification.

3.0 Post-Closure Plan

3.1 GENERAL

As required by the Compliance Agreement, LTV and any successor in interest will be responsible for the post-closure care of the site. Minnesota Rules Parts 7035.2645 and 7035.2655 for Municipal Solid Waste and Solid Waste Facilities are used as a guide to determine post-closure requirements. The post-closure period begins after final closure certification and continues for a period of at 30 years. A summary of the post-closure care program is provided in the following text.

3.2 INSPECTION AND MAINTENANCE

Three times a year (spring, summer, and fall) routine inspection of the site will occur. These inspections will include observations for cap integrity, erosion of the final cap and vegetation quality; evaluation of settlement and surface water drainage.

If a site inspection reveals any problems with the final cap system, appropriate corrective measures will be taken as outlined in Section 3.8 of this Plan. If erosion occurs, additional soil will be placed and compacted and measures taken to prevent further occurrence of the problem. If there are any areas where the cover vegetation is poorly established or stressed, reseeding and/or growth and development measures will be instituted and an adequate vegetative cover established. In addition, routine maintenance to prevent tree growth and maintaining drainageway flow capacity will be performed. Any equipment found to need repair or maintenance will be properly repaired and maintained.

3.3 SURFACE WATER RUN-OFF CONTROL FACILITIES

The sedimentation ponds and drainage ditches will be inspected three times annually for need of maintenance. Maintenance associated with sediment accumulations or erosion problems will be performed as needed within 30 working days of the date of the inspection, weather permitting.

3.4 LAND SURFACE

The landfill surface will be inspected three times annually and after major storm events for erosion and settlement. Land surface repairs will be performed as needed. Supplemental cover soil will be placed when needed due to erosion and settlement. Seeding, fertilizing, and mulching of bare soil will be provided where required. All surface repairs will be performed within 30 working days of the inspection, when appropriate, and weather permitting.

Any and all areas that have been seeded, fertilized and mulched will be inspected periodically to check for erosion to make sure that sustained vegetative growth has been established and continues to survive. All erosion ruts or gullies and general settlement areas of the completed landfill area will be refilled with suitable earth, graded and reseeded accordingly within 30 working days, as appropriate.

Inspections will occur on scheduled occasions and as needed due to severe weather including peak rainfalls and periods of drought.

3.5 REPORTING

A report describing the inspection, conditions observed, corrective actions, maintenance activities and monitoring activities and results will be prepared and transmitted to the MPCA annually. The contact for the facility during the post-closure period will be LTV. The contact after closure is:

LTV Steel Mining Company
County Road 666
P.O. Box 847
Hoyt Lakes, MN 55750

3.6 ULTIMATE LAND USE

LTV will control uses of the site so there will not be disturbance to the final cap system unless approval is obtained from the MPCA.

3.7 AMENDMENT OF POST-CLOSURE PLAN

A modified post-closure plan will be prepared and submitted to the MPCA for approval within 60 days of any change or event that affects the post-closure plan. This applies to, but is not limited to, any change in the monitoring system or procedures.

3.8 CORRECTIVE ACTIONS

3.8.1 General

Occurrences such as natural disasters, vandalism, etc. may lead to the need for corrective action response. Such responses typically need to be implemented immediately and may involve equipment and personnel beyond those routinely involved with facility operations. Responses will be governed by LTV's Emergency Response Plan for the Hoyt Lakes Plant. In the event of emergencies at the site, LTV personnel must be contacted.

3.8.2 Corrective Actions Requiring Emergency Action

3.8.2.1 Severe Rainfall

As soon as weather permits, inspect the site to determine any damage to the vegetation, berms, cap, and surface water controls. Place temporary erosion controls such as hay bales, soil fill or mulch to minimize further erosion. Place sand bags or riprap to stabilize facility features. Place sandbags and temporary piping to make surface water controls temporarily functional. Sediment may require removal from ditches and outlets.

3.8.2.2 Flood

The disposal area is not within the floodplain.

3.8.2.3 Grass Fire

LTV does have its own Fire Department at the plant. If necessary, LTV will contact the City of Hoyt Lakes Fire Department for assistance. Clear all access roads of equipment to facilitate emergency vehicle access. Attempt to extinguish fire using water, fire extinguisher, or soil.

3.8.2.4 Vandalism

For acts of vandalism that create hazards to human health and the environment, appropriate temporary repairs should be performed as soon as possible to make the damaged system temporarily functional.

Within two weeks after an emergency, a written report describing the emergency and the procedures followed to minimize potential hazards will be submitted to the MPCA.

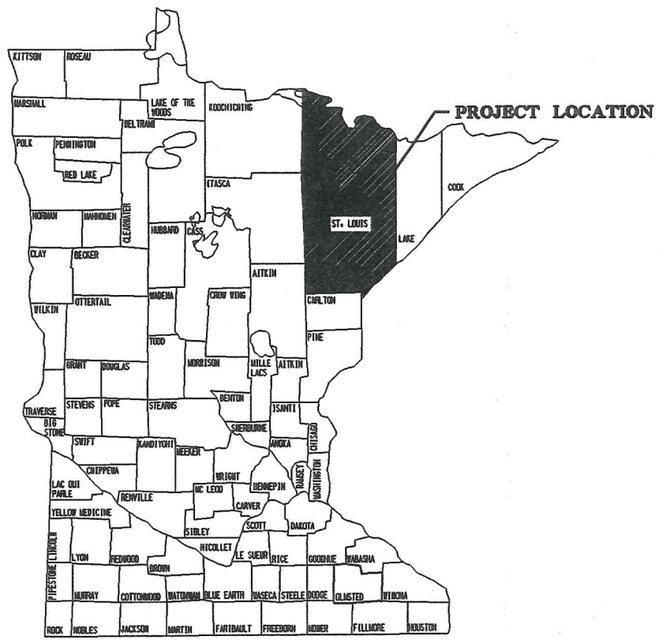
3.8.3 Events Not Requiring Emergency Action

Occurrences such as small cracks in embankments or the cap, a gradual embankment or cap movement trend, minor erosion, stressed vegetation, surface drainage problems will not require an emergency response. These contingencies may require interim response actions.

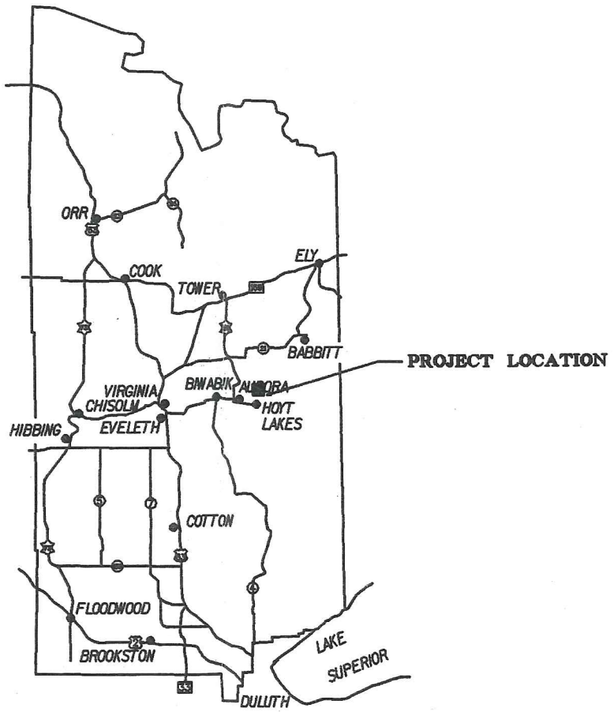
Appendix A

Plan Drawings

CLOSURE PLAN FOR THE TAILINGS BASIN
COAL ASH DISPOSAL AREA - HOYT LAKES PLANT
LTV STEEL MINING COMPANY

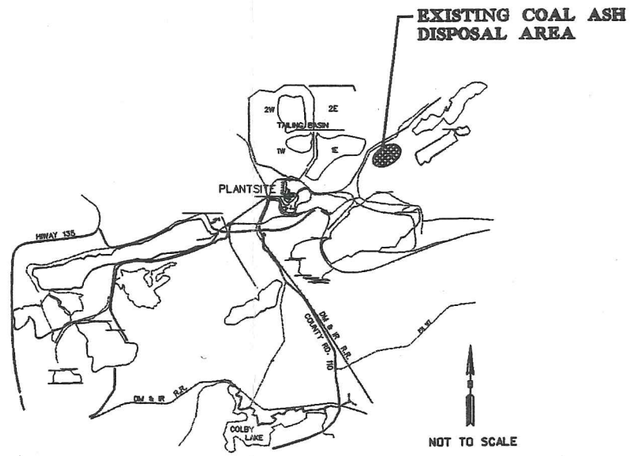


MINNESOTA
STATE MAP



ST. LOUIS
COUNTY MAP

INDEX



LTV STEEL
MINING COMPANY
SITE MAP

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

DATE _____ REG. NO. _____

REVISIONS DATE

DWN JWT DSGN JWT APPD TJS

SHEET TITLE: INDEX SHEET

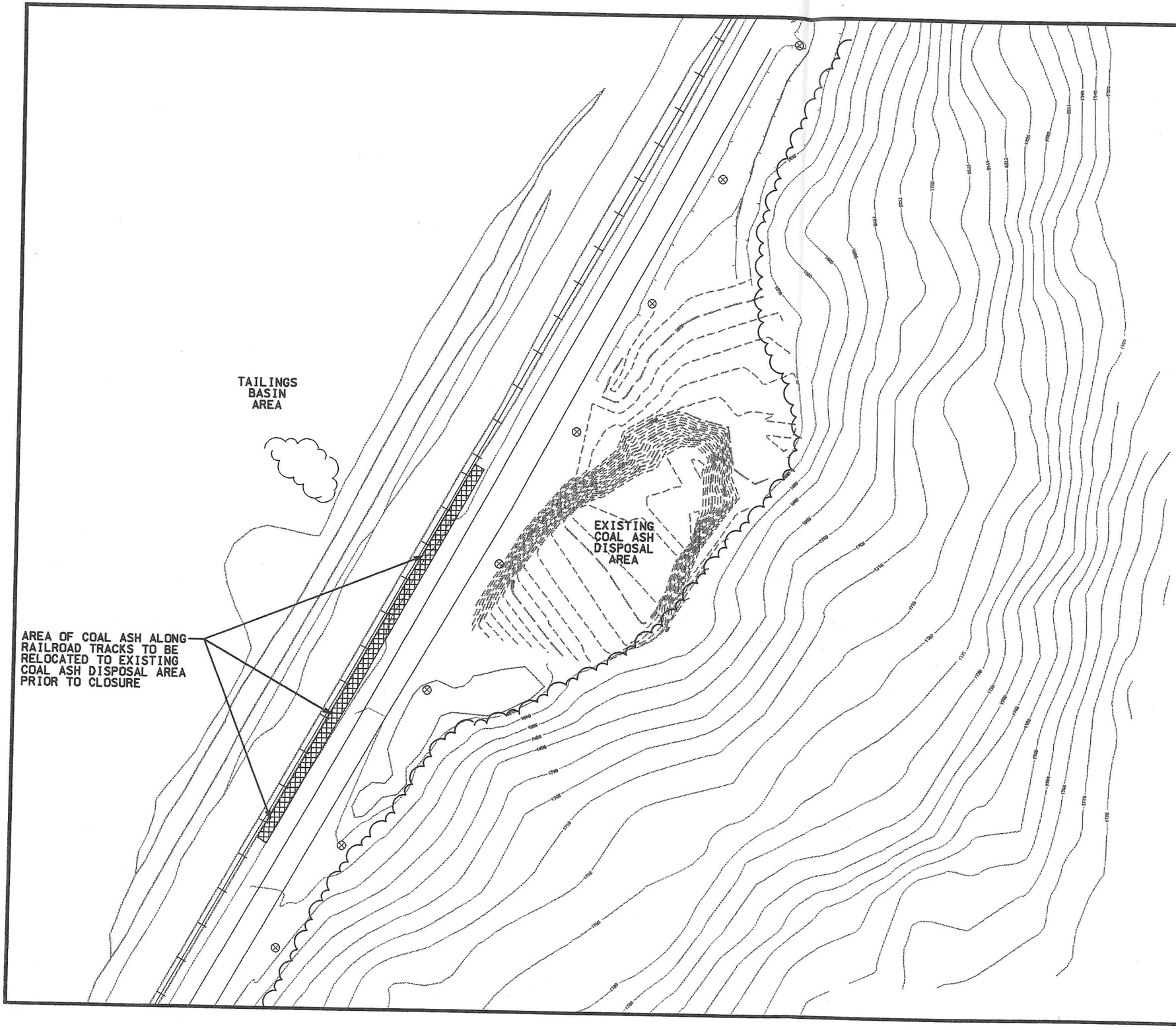
DATE: MAY, 2000

PROJECT: CLOSURE PLAN
LTV STEEL MINING COMPANY
HOYT LAKES PLANT
HOYT LAKES, MINNESOTA

Wenck Associates, Inc.
Environmental Engineers
1800 Pioneer Creek Center
Maple Plain, MN 55359
(612) 479-4200
Fax# (612) 479-4242

FILE NAME: LTVASHOLDGN REFERENCE FILES:

SHEET NO. 1



SCALE IN FEET
0 100 200

LEGEND
- EXISTING CONTOURS
- RAILROAD
- POWER POLE
- APPROXIMATE TREELINE

NOTE:
BASE MAP PROVIDED BY LTV STEEL MINING COMPANY SURVEY DEPARTMENT, APRIL, 2000.

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

DATE _____ REG. NO. _____

FILE NAME:LTVASH02.DGN REFERENCE FILES: *FLYASH_2, FLYASH_1.DGN

REVISIONS DATE

DWN JWT DSGN JWT APPD TJS

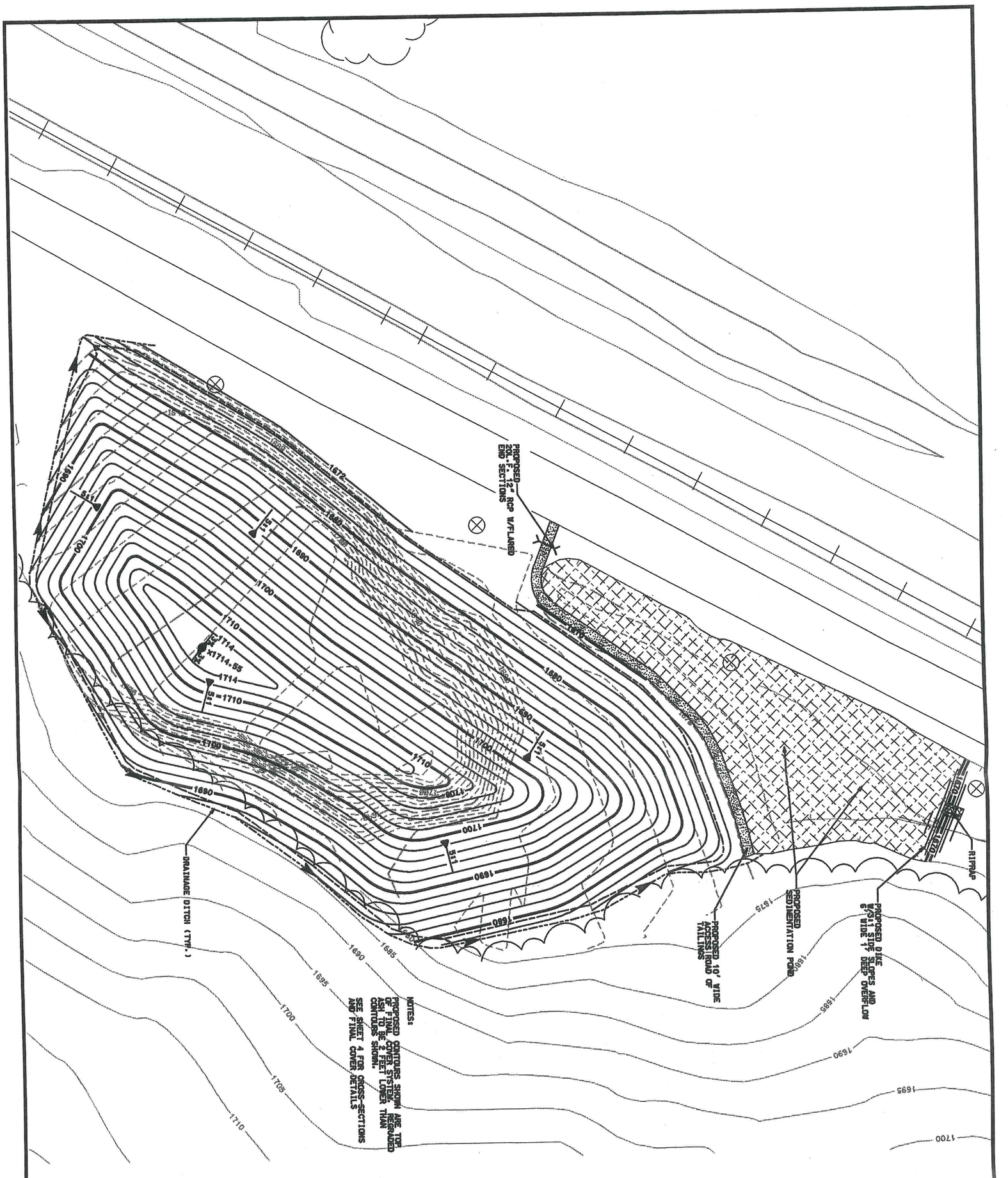
SHEET TITLE
EXISTING CONDITIONS

DATE: MAY, 2000

PROJECT
CLOSURE PLAN
LTV STEEL MINING COMPANY
HOYT LAKES PLANT
HOYT LAKES, MINNESOTA

Wenck
Wenck Associates, Inc.
Environmental Engineers
1800 Pioneer Creek Center
Maple Plain, MN 55359
(612) 479-4200
Fax (612) 479-4242

SHEET NO.
2



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DATE: _____ REG. NO. _____

FILE NAME: LTVASH03.DGN REFERENCE FILES: FLYASH_2, FLYASH_1, ASHOPT*8.DGN

SHEET NO. 3

Wenck
Wenck Associates, Inc.
Environmental Engineers
1800 Pioneer Creek Center
Maple Plain, MN 55359
(612) 479-4200
Fax: (612) 479-4242

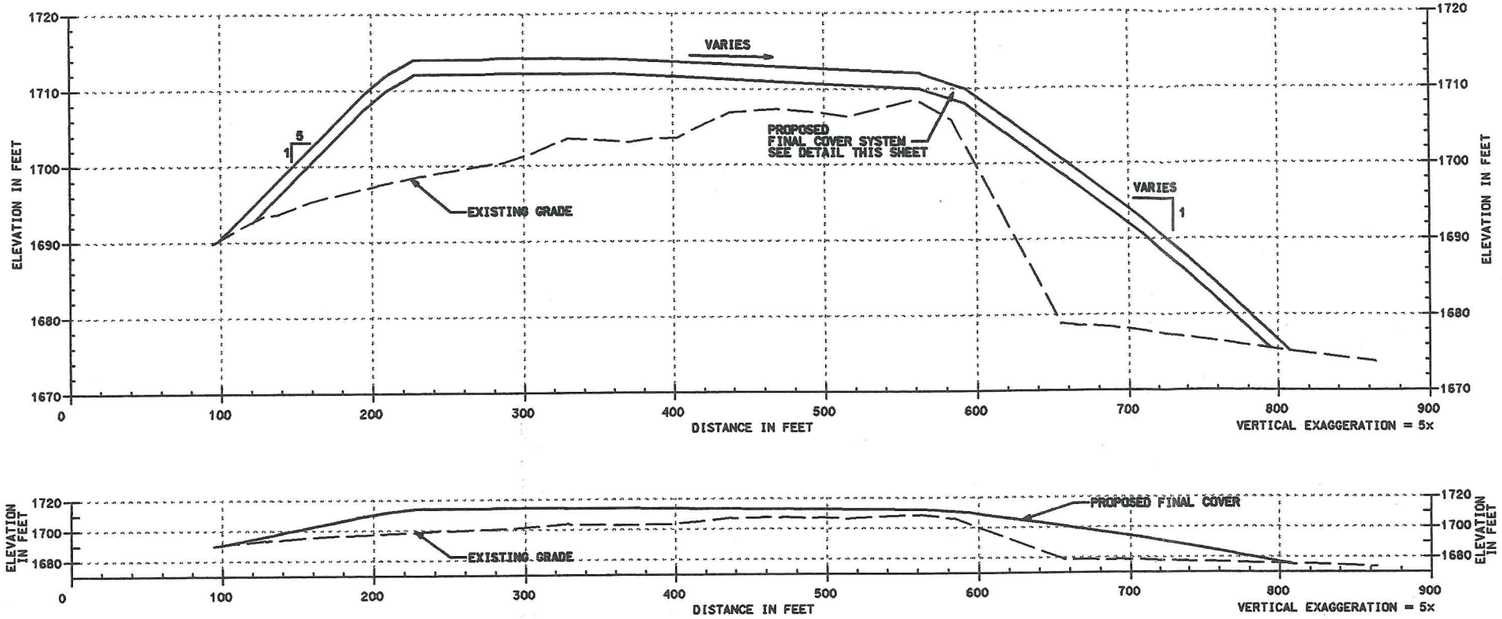
PROJECT
CLOSURE PLAN
LTV STEEL MINING COMPANY
HOYT LAKES PLANT
HOYT LAKES, MINNESOTA

SHEET TITLE
FINAL COVER GRADING PLAN & SURFACE WATER CONTROL

DATE: MAY, 2000

REVISIONS DATE

DWN JWT DSGN JWT APP'D TJS



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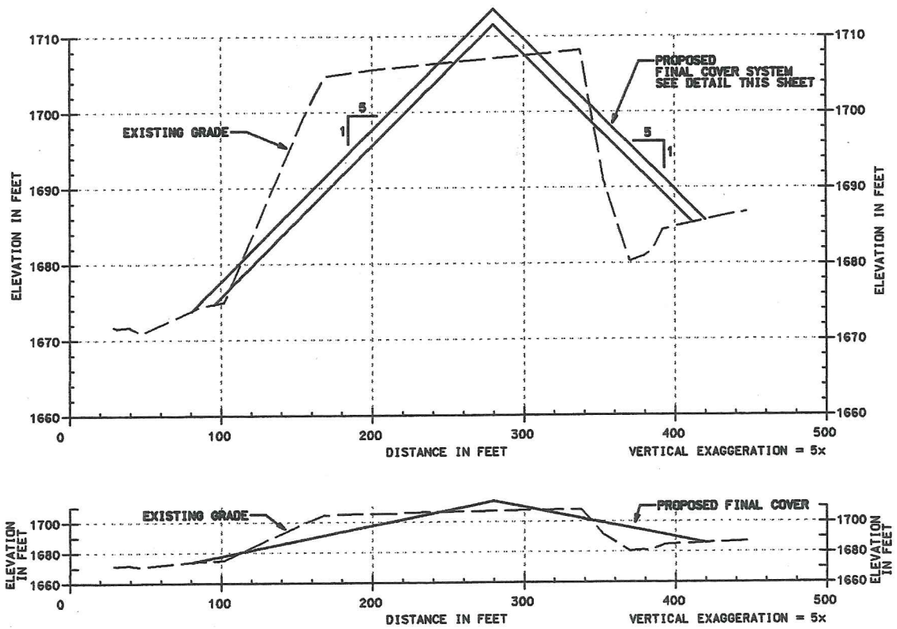

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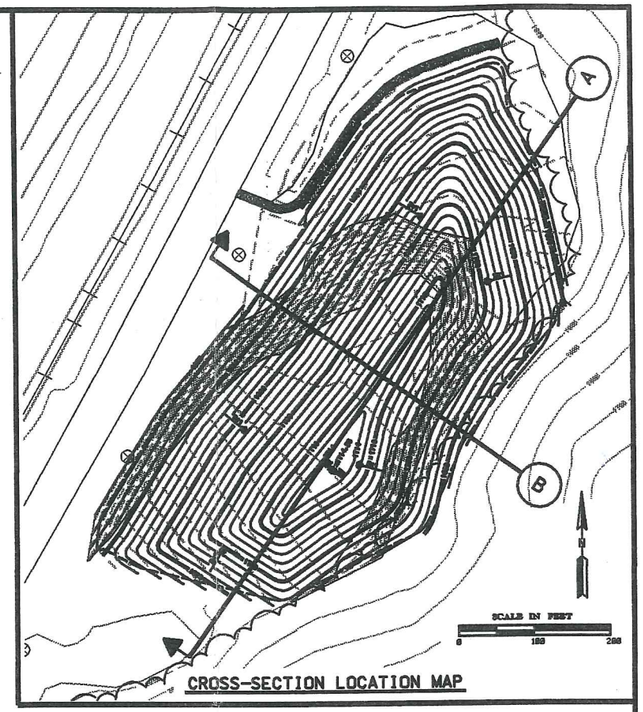
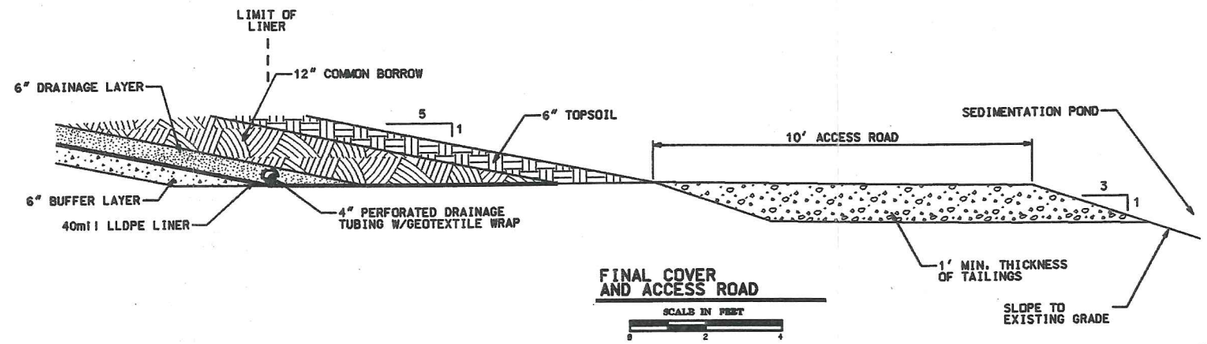
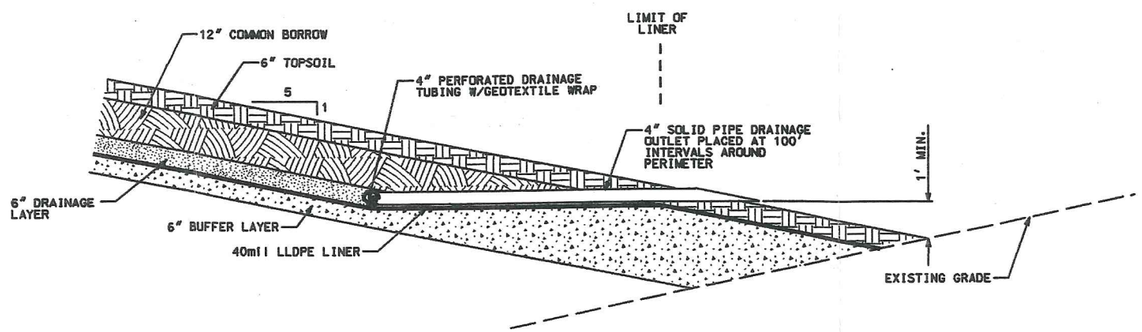


CROSS-SECTION LOCATION MAP



FINAL COVER
AND ACCESS ROAD

SCALE IN FEET
0
2
4



FINAL COVER AND
DRAINAGE LAYER OUTLET

SCALE IN FEET
0
2
4

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

DATE _____ REG. NO. _____

FILE NAME: LTV/VSHD4.DGN REFERENCE FILES: FLYASH_2, ASHOPT#5, FLYASH_1.DGN

DATE

REVISIONS

DWN JWT DSGN JWT APPD TJS

SHEET TITLE
CROSS-SECTIONS

DATE: MAY, 2000

PROJECT
CLOSURE PLAN
LTV STEEL MINING COMPANY
HOYT LAKES PLANT
HOYT LAKES, MINNESOTA

Wenck
(612) 479-4200
1800 Pioneer Creek Center
Maple Plain, MN 55359
Fax# (612) 479-4242
Wenck Associates, Inc.
Environmental Engineers

SHEET NO.
4

Appendix B

Technical Specifications and Construction Quality Assurance Program

Technical Specifications

DIVISION 1 - GENERAL

DIVISION 2 - SITE WORK

ATTACHMENT

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 CONTRACT DOCUMENTS

A. The Contract Documents are as defined in the Proposal Form. The terms of the contract documents apply to these Specifications as fully as though repeated herein.

B. The format of these Specifications is based upon the CSI MASTERFORMAT. However differences in format and subject matter location do exist. It is the Contractor's sole responsibility to thoroughly read and understand these Specifications and request written clarification of those portions, which are unclear.

C. Division of the Work as made in these Contract Documents is for the purpose of specifying and describing work, which is to be completed. There has been no attempt to make a classification according to trade or agreements, which may exist between Contractor, Subcontractors, or trade unions or other organizations. Such division and classification of the Work shall be the Contractor's sole responsibility.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Work of this Contract comprises general construction of the final cover system for the tailings basin coal ash disposal area at LTV Steel Mining Company's Hoyt Lakes Plant, located approximately 7 miles from the City of Hoyt Lakes, Minnesota on County Road 666.

B. Work specifically included in this contract includes, but is not limited to, the following:

1. Waste (coal ash) excavation and regrading conforming to the general slopes and elevations shown on the Plan Drawings.
2. Install, and in some cases, provide cover soils to include buffer soil, common borrow, granular drainage layer, and topsoil
3. Provide 40-mil linear low density polyethylene (LLDPE) geomembrane.
4. Provide surface water control features.
5. Seed, mulch, and fertilize closed landfill area and other areas disturbed by construction.

C. It is the intent of the Contract Documents to cover all aspects of the Project. Should there be some item or items not shown on the Drawings or not described in these Specifications, which are required for the Work, those items and the furnishing of all labor, materials, and equipment shall be considered incidental to the Work and no additional compensation will be provided.

D. The Work includes the furnishing of all labor, equipment, tools, machinery, materials and other items required for the construction of a complete Project as specified. Equipment furnished shall be in safe operating condition and of adequate size, capacity, and condition for the performance of the Work. Contractor shall obtain all measurements necessary for the Work and shall be responsible for establishing all dimensions, levels, and layout of the Work.

E. Contractor shall be solely responsible for the coordination of its activities with regard to the Project and the activities of Subcontractors and Owner.

1.03 FORM OF SPECIFICATIONS

A. Some Work described in these specifications use systems approach to identify systems of structure or facility.

1. System components either specified in system specifications or by reference to another section.

B. Term "provide" or "provided" shall mean, "furnish and install in-place."

1.04 WORK BY OWNER

A. Owner will provide benchmark and site coordinate information necessary for construction of the Work. Once provided, it is Contractor's responsibility to protect the information. Contractor shall request such information from Owner a minimum of five days prior to the time when such information is needed.

B. Contractor shall obtain a Minnesota Pollution Control Agency General Construction Stormwater Permit and any other construction permits, as necessary. Contractor shall obtain other permits that may be required.

1.05 OWNER-FURNISHED PRODUCTS

A. Owner will not furnish any products for this Project.

1.06 CONTRACTOR USE OF PREMISES

A. Definition of Site: The Site is defined s the area within ~~the~~ property lines and construction limits shown on the Drawings. Contractor shall limit operations, including material and equipment storage, to within those boundaries.

B. Hours of Operation:

1. Contractor's operations shall be limited to the hours of 7:00 a.m. to 7:00 p.m. (Central Standard Time), Monday through Saturday, unless prior arrangements are made with Owner 48 hours in advance of proposed change.

2. Contractor shall reimburse the Owner for additional engineering and/or inspection costs incurred as a result of overtime work in excess of the regular working hours stipulated herein. At Owner's option, overtime costs may either be deducted from the Contractor's monthly payment request or deducted from the Contractor's retention prior to release of final payment. Overtime costs for the Owner's personnel shall be based on the individual's current overtime wage rate. Overtime costs for personnel employed by the Engineer or Owner's independent testing laboratory shall be calculated in accordance with the terms of their respective contracts with the Owner.

C. Protection and Repair of Existing Facilities and Utilities: Contractor shall perform operations carefully and in such a manner as to protect existing facilities and utilities. Obstructions not shown on the Drawings may exist and shall be exposed by Contractor without damage. Contractor shall be responsible for damage to existing facilities and utilities resulting from Contractor's operations, and shall repair or replace damaged items to Owner's satisfaction.

D. Unfavorable Construction Conditions:

1. When unfavorable weather, soil, drainage, or other unsuitable construction conditions exist, Contractor shall confine operations to work, which will not be adversely affected by such conditions. No portion of the Work shall be constructed under conditions, which would adversely affect the quality of the Work, unless special means or precautions are taken to perform the Work in a proper and satisfactory manner.
2. Contractor shall be responsible for controlling blowing litter and immediately picking and properly disposing of blown litter. Owner has the right to shut down Project in the event of Contractor's failure to control blowing litter to satisfaction of Owner and/or Owner's Representative. Project shall remain shut down until startup is authorized by Owner. No additional compensation shall be made to Contractor as a result of such shut down.

1.07 SEQUENCE OF WORK

A. Contractor shall determine the sequence of Work to meet the requirement of the Contract Documents.

END OF SECTION

SECTION 01050

FIELD ENGINEERING

PART 1 - GENERAL

1.01 PRIMARY CONTROL MONUMENT

A. Benchmarks will be provided by OWNER to establish primary vertical control.

B. Monuments or references for primary horizontal control will be provided by OWNER for construction of Work.

C. CONTRACTOR shall preserve and maintain primary control monuments.

1.02 PRIMARY LINE AND GRADE

A. Primary line and grade will be provided and established by CONTRACTOR as listed above.

B. **CONTRACTOR** to provide primary line and grade. For all work including but not limited to:

1. Establish primary line and grade of:
   a. Final cover system.
   b. Waste excavation, relocation, and regrading limits.
   c. Ditching, sedimentation pond, etc.
   d. Piping, culverts, etc.
   e. Other as requested by **OWNER'S** REPRESENTATIVE.
2. Arrange operations to avoid interference with primary lines and grades.
3. Check accuracy of line and grade by visual inspection, checks between stakes, and periodic checks (with surveying equipment) between primary control monuments and stakes.
4. Responsible for protection and preservation of stakes.

1.03 CONSTRUCTION LINE AND GRADE

A. CONTRACTOR shall bear sole responsibility for correct transfer of construction lines and grades from primary line and grade points and for correct alignment and grade of completed Work based upon lines and grades shown on Drawings.

B. CONTRACTOR shall transfer line and grade for open cut construction of utilities from primary line and grade stakes to Work by means of grade boards, laser beam or other approved methods.

1.04 DOCUMENTATION SURVEY

A. Provide documentation survey in accordance with Section 02205 - Final Cover Materials.

1.05 SUBMITTALS

A. When requested by ENGINEER and/or OWNER, CONRACTOR shall submit a statement certifying that elevations and locations of work are in conformance with Contract Documents, explain all deviations.

1.06 QUALIFICATIONS

A. Surveyor to be land-surveyor licensed in Minnesota acceptable to ENGINEER and OWNER.

END OF SECTION

SECTION 01155

ON-SITE HEALTH AND SAFETY REQUIREMENTS

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Construction activities at landfills or at other waste disposal sites may place CONTRACTOR'S personnel, personnel of other CONTRACTORS hired by OWNER to perform Work at the site, and public in potentially hazardous situations.

B. CONTRACTOR shall be responsible for implementation and enforcement of safe Work practices, including, but not limited to personnel monitoring, personnel exposure to industrial waste (coal ash), use of trenching, sheeting, and shoring, scaffolding; materials handling and drilling; operation of equipment; and safety of public during progress of Work.

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:

1. CONTRACTOR shall plan for and ensure personnel comply with basic provisions of the Mine Safety and Health Administration Standards (telephone: 218-720-5448) and LTVSMC General Mine Safety Standards.
2. CONTRACTOR shall comply with all applicable Laws and Regulations of any public body having jurisdiction for safety of persons or property.

1.03 OPERATIONS AND EQUIPMENT SAFETY

A. CONTRACTOR shall be responsible for initiating, maintaining, and supervising safety precautions and programs in connection with Work. CONTRACTOR shall take necessary precautions for safety of employees on project site and other persons and organizations who may be affected by the project. CONTRACTOR to provide construction warning signs on Area 5 access roads.

B. CONTRACTOR'S duties and responsibilities for safety in connection with Work shall continue until such time as all Work is completed and ENGINEER has issued notice to CONTRACTOR that Work is complete.

1.04 HEALTH SAFETY

A. CONTRACTOR is responsible for implementation and enforcement of health safety requirements and shall take necessary precautions and provide protection for:

1. All personnel working on or visiting project site, irrespective of employer.
2. Work and materials or equipment to be incorporated in Work area whether on- or off-site.
3. Other property at or adjacent to project site.
4. Public exposed to job-related operations or potential release of toxic of hazardous materials.

B. CONTRACTOR shall prepare a site-specific health and safety plan (HASP). If CONTRACTOR does not have the capability to prepare HASP, CONTRACTOR shall employ consultants with appropriate capability. CONTRACTOR is solely responsible for the adequacy of the HASP's preparation, monitoring, management, and enforcement. At a minimum, CONTRACTOR'S HASP shall address the following:

1. Site description and history.
2. Project activities and coordination with other CONTRACTORS.
3. Hazard evaluation.
4. On-site safety responsibilities.
5. Work zones.
6. Personnel training.
7. Atmospheric monitoring.
8. Personal protection, cloth and equipment.
9. Emergency procedures.

C. If OWNER contracts with other for Work on the site, CONTRACTOR shall amend the HASP to include provisions for Work of others. CONTRACTOR shall also manage, enforce, and monitor the health and safety activities and other CONTRACTORS during duration of other CONTRACTORS' Work.

1.05 SUBMITTALS

A. Submit copies of HASP to OWNER and ENGINEER.

1. Submit HASP to OWNER and ENGINEER within 10 days after Notice to Proceed. Work on-site shall not proceed until the HASP has been submitted to ENGINEER.
   a. Submittal of CONTRACTOR'S Health and Safety Plan to ENGINEER is to inform ENGINEER and OWNER so they can comply with HASP during performance of their on-site responsibilities as described in Contract Documents.
   b. Submittal of CONTRACTOR'S Health and Safety Plan shall neither impose on ENGINEER'S responsibility for adequacy of HASP nor relieve CONTRACTOR from full responsibility therefore.

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 SUMMARY

A. OWNER will schedule and conduct preconstruction conference in accordance with Agreement.

B. ENGINEER shall schedule and administer construction progress meetings, and specially called meetings throughout progress of Work. ENGINEER'S responsibilities include:

1. Prepare agenda for meetings.
2. Distribute written notice of specially called meetings minimum of four (4) days in advance of meeting date.
3. Make physical arrangements for meetings.
4. Preside at meetings.
5. Record minutes; include significant proceedings and decisions.
6. Prepare formal minutes and distribute within three (3) days after each meeting.
   a. To participants in meeting.
   b. To parties affected by decisions made at meeting.

C. Representatives of CONTRACTOR, subcontractors, and suppliers attending meetings shall be qualified and authorized to act on behalf of entity each represents.

1.02 PRECONSTRUCTION AND PREWORK CONFERENCE

A. After OWNER issues Notice to Proceed, CONTRACTOR shall meet with OWNER for preconstruction conference.

B. Location will be selected by OWNER.

C. Purpose of Conference:

1. Make additional appropriate modifications to the C~~QA~~ Plan if needed.
2. Safety programs.
3. Review submittals.
4. Review the responsibilities of each party.
5. Address CONTRACTORS' questions.
6. Review lines of authority and communication.
7. Review principal features of Work.
8. Review methods for documenting and reporting, and for distributing documents and reports.
9. Establish protocols for testing.
10. Establish protocols for handling deficiencies, repairs, and retesting.
11. Review the time schedule for construction.

12. Review progress schedules.
13. Payrolls and labor relations.
14. Environmental protection.
15. Payment and procurement of materials.
16. Establish soil-stockpiling locations (if any).

D. Attendance:

1. CONTRACTOR'S superintendent.
2. Quality control supervisor.
3. Safety personnel.
4. Major subcontractors' job superintendents.
5. Owner
6. Contractor's Health and Safety Manager
7. ENGINEER

E. Specifics of CONTRACTOR'S health, safety, and emergency plan shall be discussed so emergency procedures and safety requirements are understood by those directly related to site Work.

1.04 PROGRESS MEETINGS

A. ENGINEER shall schedule and administer progress meetings at a minimum of once per week and such additional meetings as required, or as requested by OWNER.

B. Attendance:

1. OWNER or OWNER'S representative.
2. CONTRACTOR'S superintendent.
3. CONTRACTOR'S quality control supervisory ENGINEER.
4. CONTRACTOR'S safety and emergency coordinator.
5. Subcontractors as appropriate to agenda.
6. Suppliers as appropriate to agenda.

C. General Meeting Requirements:

1. ENGINEER shall administer following general requirements for progress meetings.
   a. Prepare agenda for meetings.
   b. Make physical arrangements for meetings.
   c. Preside at meetings.
   d. Record significant proceedings and decisions of meeting.
2. The ENGINEER will reproduce and distribute copies of meeting record within three (3) days after each meeting to participants in meeting and to parties affected by decisions made at meeting. Furnish three copies of minutes to OWNER, two (2) copies to OWNER'S site representative, and two (2) copies to ENGINEER.

D. Suggested Agenda:

1. Review and approval of record of previous meeting.
2. Review of Work progress since previous meeting.
3. Field observations, problems, and conflicts.
4. Problems impeding Work schedule.
5. Review of off-site delivery schedules.
6. Corrective measures and procedures to regain projected schedule.
7. Revisions to project schedule.
8. Planned progress during Work period.
9. Coordination of schedule.
10. Review submittal schedules; expedite as required.
11. Maintenance of quality and safety standards.
12. Pending changes and substitutions.
13. Review proposed changes for effect on construction schedule and completion date, and on other contracts of project.
14. Other business.

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section contains requirements for submittals of construction progress schedules, shop Drawings, test results, operation and maintenance data, construction photographs, and other submittals required by Contract Documents.

B. Submittal for Review:

1. Submit required materials for ENGINEER'S review in accordance with requirements of Contract Documents.

C. Submittal for Record:

1. Submit required materials for inclusion into OWNER'S records. Submittal materials may or may not be reviewed by ENGINEER or OWNER.

1.02 CONSTRUCTION PROGRESS SCHEDULES

A. Prepare and submit construction progress schedule in accordance with requirements of General Conditions.

B. No Work shall be done between 7:00 p.m. and 7:00 a.m., or on Sundays or legal holidays without written permission of OWNER. However, emergency Work may be none without prior permission.

C. Night Work may be established by CONTRACTOR as regular procedure with written permission of OWNER. Such permission, however, may be revoked at any time by OWNER.

D. Prepare schedules in form of horizontal bar chart.

1. Provide separate horizontal bar for each operation.
2. Horizontal Time Scale: Identify first work day of each week.
3. Scale and spacings to allow space for notations and future revisions.
4. Arrange listings in order of start of each item of Work.

E. Construction Progress Schedule:

1. Show complete sequence of construction by activity.
2. Show dates for beginning and completion of each major element of construction and installation dates for major items. Elements shall include, but not be limited to, the following:
   a. Site preparation.
   b. Shop Drawing receipt from supplier/manufacturer, submittal to ENGINEER, review and return to supplier/manufacturer.
   c. Material and equipment order, manufacturer, delivery.
   d. Performance tests and supervisory services activity.
   e. Construction of various facilities.
   f. Grading, gas vent construction, drainage layer placement, seeding, landscaping, and sediment pond construction.
   g. Subcontractor's items of Work.
   h. Final cleanup
   i. Allowance for inclement weather.
   j. Miscellaneous items.
3. Show projected percentage of completion for each item as of first day of each month.

F. Schedule Revisions:

1. Every 30 days to reflect changes in progress of Work.
2. Indicate progress of each activity at date of submittal.
3. Show changes occurring since previous submittal of schedule.
   a. Major changes in scope.
   b. Activities modified since previous submittals.
   c. Revised projections of progress and completion.
   d. Other identifiable changes.
4. Provide narrative report as needed to define:
   a. Problem areas, anticipated delays, and impact on schedule.
   b. Corrective action recommended and its effect.
   c. Effect of changes on schedule of other CONTRACTORS.

1.03 SHOP DRAWINGS AND SAMPLES

A. Submit shop Drawings and samples required in individual specification sections.

B. CONTRACTOR'S responsibilities shall include:

1. Review shop Drawings and samples prior to submittal.
2. Determine and verify:
   a. Field measurements.
   b. Field construction criteria.
   c. Catalog numbers and similar data.
   d. Conformance with specifications
3. Coordinate each submittal with requirements of Work and of Contract Documents.

4. Notify ENGINEER in writing, at time of submittal, of deviations in submittals from requirements of Contract Documents.
5. Begin no fabrication or Work that requires submittals until return of submittals with ENGINEER approval.
6. Designate in construction progress schedule, dates for submittal and receipt of reviewed shop Drawings and samples.

C. Submittals shall contain:

1. Date of submittal and dates of previous submittals.
2. Project title and number.
3. Contract identification.
4. Names of:
   a. CONTRACTOR.
   b. Supplier.
   c. Manufacturer.
5. Identification of product, with identification numbers, and Drawings and specification section numbers.
6. Field dimensions, clearly identified.
7. Identify details required on Drawings and in specifications.
8. Show manufacturer and model number, give dimensions, and provide clearances.
9. Relation to adjacent or critical features of Work or materials.
10. Applicable standards, such as ASTM or Federal Specification numbers. Identification of deviations from Contract Documents.
11. Identification of revisions on resubmittals.
12. 8-inch by 3-inch blank space for CONTRACTOR or ENGINEER stamps.
13. CONTRACTOR'S stamp, signed, certifying to review of submittal, verification of products, field measurement, field construction criteria, and coordination of information within submittal with requirements of Work and Contract Documents.

D. Resubmittal requirements shall include:

1. Corrections or changes in submittals required by ENGINEER. Resubmittals are required until approved.
2. Shop Drawings and product data:
   a. Revise initial Drawings or data and resubmit as specified for initial submittal.
   b. Indicate changes that have been made other than those requested by ENGINEER.
3. Submit new samples as required for initial submittal.

E. Distribute reproductions of shop Drawings and copies of product data that carry ENGINEER'S stamp approval to:

1. Record documents file.
2. Subcontractors.
3. Supplier or fabricator.

F. ENGINEER'S duties include:

1. Review submittals with reasonable promptness and in accordance with schedule.
2. Affix stamp and signature, and indicate requirements for resubmittal or approval of submittal.
3. Return submittals to CONTRACTOR for distribution or for resubmittal.

1.04 OPERATION AND MAINTENANCE (O&M) DATA

A. Compile product data and related information appropriate for OWNER'S maintenance and operation of products furnished under Contract. Prepare O&M data as specified in this section and as referenced in other pertinent sections of specifications.

B. Manual Format: Prepare data in form of instruction manual for use by OWNER'S personnel.

1. Size: 8½-inch by 11-inch or 11-inch by 17-inch folded, with standard three-hole punching.
2. Text: Manufacturer's printed data, or neatly typewritten.
3. Drawings:
   a. Provide reinforced punched binder tab; bind in with text.
   b. Fold larger Drawings to size of text pages and place in envelopes that are to be bound into manual. Suitable identification shall be placed on outside of each envelope.
4. Preliminary Cover: Identify each submittal with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS."
   a. List:
      1) Title of project.
      2) Identity of CONTRACTOR.
      3) Identity of general subject matter covered in manual.
      4) Identity of section number as set forth in Contract Documents.
      5) Data of installation.
5. Final Binders:
   a. Commercial quality binders with durable and cleanable plastic covers.

C. Product Data:

1. Include only those sheets that are pertinent to specific product.
2. Annotate each sheet to:
   a. Clearly identify specific product or part installed.
   b. Clearly identify data applicable to installation.
   c. Delete references to inapplicable information.
3. Provide table of contents.
4. Project installation schedule listing dates and locations of products installed.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.01 SUBMITTAL REQUIREMENTS

A. Provide complete copies of required submittals as follows:

1. Construction progress schedule:
   a. Two copies of initial schedule.
   b. Two copies of each revision.
2. Shop Drawings: Six (6) copies.
3. Test results: Three (3) copies.
4. Other required submittals:
   a. Six (6) copies if required for review.
   b. Three (3) copies if required for record.

B. Deliver required copies of submittals to ENGINEER.

END OF SECTION

SECTION 01410

TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. OWNER will employ and pay for services of an independent testing laboratory to perform specified in-place testing as described in respective sections of specifications.

1. CONTRACTOR shall cooperate with laboratory to facilitate execution of its required services.
2. Employment of laboratory shall in no way relieve CONTRACTOR'S obligation to perform Work of Contract.

B. CONTRACTOR shall employ and pay for services on an independent testing laboratory to perform specified source testing as described in respective sections.

C. Related requirements in other parts of project Manual:

1. Inspections and testing required by laws, ordinances, rules, regulations, orders or approvals of public authorities: Conditions of Contract.

1.02 LABORATORY DUTIES

A. Cooperate with ENGINEER and CONTRACTOR. Provide qualified personnel to perform Work after due notice to proceed.

B. Perform specified inspections, secure samples, and test materials.

1. Comply with specified standards.
2. Ascertain compliance of materials with Contract Documents.

C. Promptly notify ENGINEER and CONTRACTOR of observed irregularities or deficiencies of Work, equipment, or material.

D. Promptly submit written report of each test and inspection: one copy each to ENGINEER, OWNER, material supplier, and CONTRACTOR, and one copy to record document file. Each report shall include:

1. Date issued.
2. Project title and number.
3. Testing laboratory name, address, and telephone number.
4. Name and signature of laboratory inspector.
5. Date and time of sampling or inspection.
6. Record of temperature and weather conditions if test is performed in field.
7. Date of test.
8. Identification of product and specification section.

9. Location of sample or test in project.
10. Type of inspection or test.
11. Results of tests and compliance with Contract Documents.
12. Interpretation of test results, when requested by ENGINEER.

E. Perform additional tests as required by ENGINEER.

1.04 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of Work.
3. Perform any duties of CONTRACTOR.

1.05 CONTRACTOR RESPONSIBILITIES

A. Cooperate with laboratory personnel and provide access to Work.

B. Provide to laboratory preliminary design mix proposed to be used for concrete and other material mixes that require control by testing laboratory.

C. Furnish copies of product test reports.

D. Furnish Identical Labor and Facilities:

1. To provide access to Work to be tested.
2. To obtain and handle samples at project site or at source of product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

E. Notify laboratory and ENGINEER sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed after such notice, reimburse OWNER for laboratory personnel and travel expenses incurred due to CONTRACTOR'S negligence.

F. Make arrangements with laboratory and pay for additional samples and tests required for CONTRACTOR'S convenience.

G. Employ and pay for services of testing laboratory to perform additional inspections, sampling, and testing required when initial tests indicate Work does not comply with Contract Documents.

END OF SECTION

SECTION 01500

TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes information on temporary utilities (power, sanitary sewer, and water) for use during the Project.

1.02 CONTRACTOR REQUIREMENTS

A. Electrical

1. Provide temporary power supply for construction activities, field office and appurtenances.

B. Water

1. No water supply at site available for CONTRACTOR'S use.
2. Obtain and supply water for usage at site.
3. Supply potable water for personnel use at site.

C. Sanitary facilities

1. Provide sanitary sewer facilities for personnel at the site.

D. Telephone

1. CONTRACTOR to provide service.

1.03 COORDINATION

A. Coordinate utilities connections within OWNER and utilities companies.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

3.01 Examine and verify site acceptability to receive and construct temporary utilities.

3.02 Provide power required for project Work.

3.03 Provide telephone service.

3.04 Provide water required for project Work.

3.05 Provide required sanitary sewer facilities for personnel use.

3.06 Disconnect temporary power, telephone, and water supply upon project completion.

3.07 Remove personnel sanitary sewer facilities upon project completion.

END OF SECTION

SECTION 01560

PROTECTION OF ENVIRONMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. CONTRACTOR, in executing Work, shall maintain Work areas on- and off-site free from environmental pollution that would be in violation of any federal, state or local regulations.

1.02 SUBMITTALS

A. Submit erosion control plan in accordance with Section 01300 - Submittals.

1.02 PROTECTION OF WATERWAYS

A. Observe rules and regulations of State of Minnesota and agencies of U.S. government prohibiting pollution of any lake, stream, river or wetland by dumping of refuse, rubbish, dredge material or debris therein.

B. CONTRACTOR(S) are specifically cautioned that disposal of materials into any waters of state must conform to requirements of U.S. Army Corps of Engineers. Permits, if needed, shall be obtained by CONTRACTOR at CONTRACTOR'S cost.

C. Provide holding ponds or approved method which will divert flows, including storm flows and flows created by construction activity, so as to prevent excessive silting of waterways or flooding damage to property.

D. Comply with procedures outlined in U.S. EPA manuals entitled, "Guidelines for Erosion and Sedimentation Control Planning and Implementation," Manual EPA-72-015 and "Processes, Procedures, and Methods to Control Pollution Resulting from All Construction Activity," manual EPA 43019-73-007.

1.03 STORMWATER DISCHARGE

A. CONTRACTOR shall submit application for and comply with NPDES Construction Permit as defined in Contract Documents.

1. ENGINEER will inspect construction site and CONTRACTOR shall make corrections or repairs required.
2. CONTRACTOR shall keep plan and records on-site during the contract time, available for review by MPCA.
3. CONTRACTOR shall keep log of weather and response actions as required by NPDES Construction Permit.

1.04 EROSION AND SEDIMENT CONTROL

A. Apply appropriate soil conservation measures to protect project area and adjacent lands. These measures may include, but not be limited to, mulching, rapid growth vegetation, fabric mat, hay bales, filter barriers, sediment traps, and basins.

B. Select methods of erosion and sediment in field to meet conditions encountered.

C. Prepare and submit erosion control plan to ENGINEER. Plan shall include:

1. Limits of disturbance.
2. Type(s) of stabilization to be used.
3. Existing and proposed culverts, storm drains, and outfalls.
4. Location of stabilized construction entrance.
5. Location of proposed sediment control measures.
6. Details of sediment traps and basins and other sediment control measures.
7. Sequence of construction as it relates to installation, phasing, and removal of sediment control measures.

D. Provide erosion control measures, in-place, before commencing work on project site.

1. Maintain erosion control measure during course of construction.
2. Remove erosion control measures upon establishment of permanent, surface stabilization.

E. Complete temporary or permanent stabilization of surface of perimeter controls, dikes, swales, ditches, perimeter slopes, and slopes greater than 3:1 within 7 calendar days following initial soil disturbance. Stabilize other disturbed or graded areas within 14 calendar days.

1.05 DISPOSAL OF EXCESS EXCAVATED AND OTHER WASTE MATERIALS

A. Dumping of waste oil or fuel at this site will be unacceptable. Accidental fuel or oil spills will require excavation of contaminated soils and disposal at an authorized facility. CONTRACTOR shall be responsible for cleanup.

1.06 PROTECTION OF AIR QUALITY

A. Minimize air pollution by requiring use of properly operating combustion emission control devices on construction vehicles and equipment used by CONTRACTORS, and encouraging shutdown of motorized equipment not actually in use.

B. Trash burning will not be permitted on construction site.

C. If temporary heating devices are necessary for protection of Work, they shall be of type that will not cause air pollution.

1.07 USE OF CHEMICALS

A. Chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either U.S. EPA or U.S. Department of Agriculture or any other applicable regulatory agency.

B. Use of such chemicals and disposal of residues shall be in conformance with manufacturer's instructions.

1.08 NOISE AND DUST CONTROL

A. Conduct operations to cause least annoyance to residents in vicinity of Work, and comply with applicable local ordinances.

B. Equip compressors, hoists, and other apparatus with such mechanical devices as may be necessary to minimize noise and dust. Equip compressors with silencers on intake lines.

C. Equip gasoline or oil-operated equipment with silencers or mufflers on intake and exhaust lines.

D. Line storage bins and hoppers with material that will deaden sounds.

E. Conduct operation of dumping rock and of carrying rock away in trucks so as to cause minimum of noise and dust.

F. Route vehicles carrying rock, concrete, or other material over such streets as will cause least annoyance to public and do not operate on public streets between hours of 7:00 p.m. and 7:00 a.m., or on Saturdays, Sundays, or legal holidays unless approved by ENGINEER.

G. Provide approved dust preventative or water treatment periodically on unpaved streets, roads, detours or haul roads to minimize dust. Applicable environmental regulations for dust prevention will be enforced. No chemicals will be allowed for dust control. Water used for dust control will be potable water.

H. Streets near site entrance/exit will need to be swept or cleaned regularly. ENGINEER may direct CONTRACTOR to perform additional cleaning measures if excessive buildup of soil on public roads is noticed.

1.09 METHOD OF PAYMENT

A. Work specified in and performed under this section is incidental to the cost of the project, and is borne entirely by the CONTRACTOR.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.01 DUST CONTROL

A. Apply water to roads used by CONTRACTOR'S equipment as directed by OWNER or ENGINEER to control dust generated by wind or by CONTRACTOR'S vehicle traffic.

B. Apply water to ground surfaces, site roads, and other areas as directed by OWNER or ENGINEER to control dust generated by CONTRACTOR'S activities at the site.

C. Sweep blacktopped roadway near site access as directed by OWNER or ENGINEER to control dust generated by wind and vehicle traffic.

D. Water final cover area as directed by OWNER or ENGINEER to control dust migration.

3.02 EROSION CONTROL

A. Install erosion control devices as directed by OWNER or ENGINEER where soil erosion and sediment transport from the site may occur due to CONTRACTOR'S activities.

B. Install temporary erosion control devices during the progress of the work and maintain them until permanent erosion control (turf establishment, aggregate surfacing, etc.) has been established.

C. Following construction, repair any eroded areas, remove sediment as necessary, replace eroded soils, and establish turf in accordance with these Contract Documents.

D. Silt fences shall be installed at the perimeter location indicated on the Drawings and other locations, if necessary, to prevent sediment from leaving the site and entering waters of the state.

E. Horizontal slope grading and slope roughening practices shall be performed to reduce the amount of erosion on the slopes. These practices include using bulldozers or other equipment to make tracks perpendicular to the direction of surface water runoff. Temporary cover materials may also be used along the ~~slope~~s and along the ditch channels if excess erosion is expected to occur.

3.03 STORM WATER CONTROL PLAN

A. A Minnesota Pollution Control Agency (MPCA) General Construction Storm Water Permit (Permit) is required for construction areas that disturb five or more acres of land. The CONTRACTOR is responsible for obtaining this Permit. The CONTRACTOR must sign this Permit and is responsible for meeting all requirements outlined in the Permit. The following sections give only a brief summary of the Permit requirements and the Permit should be referred to for compliance.

B. The requirements of the Permit include a Temporary Erosion and Sediment Control Plan to be developed to keep sediment from entering "waters of the state" during construction and Permanent Erosion and Sediment Control Plan to prevent erosion and keep sediment from entering "waters of the state" after construction is completed. All activities except for surface water diversion berms, if specified, shall be completed before construction begins.

C. These Specifications and the Drawings incorporate by reference the requirements of the Temporary and Permanent Erosion and Sediment Control Plans and must be available at the construction site. They must also be available to federal, state, and local officials for inspection for the duration of the Permit. Records of all inspections and rainfall events must also be available at the construction site. The inspection records shall include the following:

1. Date and time of inspections,
2. Findings of inspections,
3. Corrective actions taken (including dates and times),
4. Documentation of changes to the plans made during construction, and
5. Date of all rainfall events.

D. The Work covered by this section consists of furnishing all labor and materials and performing all operations necessary to implement temporary erosion and sediment control procedures on the site during construction activities. These procedures include, but are not limited to site grading, slope roughening, and perimeter sediment control such as silt fences or straw bales.

E. The CONTRACTOR shall be responsible for conducting the required inspections and maintenance requirements. The construction site shall be inspected once every seven (7) days and within 24 hours after every rain event which results in runoff leaving the construction site or entering waters of the state. All erosion and sediment control features shall be inspected and repaired if any damage has occurred or the structure is otherwise ineffective.

F. The OWNER and CONTRACTOR are responsible for complying with their respective portions of this Permit until construction is complete, all maintenance activities are complete, the site has undergone final stabilization, and a Notice of Termination is submitted to the MPCA.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Material and Equipment Incorporated into Work:

1. Conform to applicable specifications and standards.
2. Comply with size, make, type, and quality specified or as specifically approved by Shop Drawing, ENGINEER, or other submittal.

B. Manufactured and Fabricated Materials and Equipment:

1. Design, fabricate, and assemble in accordance with engineering and shop practices standard with industry.
2. Manufacture like parts of duplicate units to standard sizes and gauges, to be interchangeable.
3. Two or more items of same kind shall be identical, by same manufacturer.
4. Material and equipment shall be suitable for service conditions.
5. Equipment capabilities, sizes, and dimensions shown or specified shall be adhered to, unless variations are specifically approved, in writing, in accordance with General Conditions.
6. Equipment shall be adapted to best economy in power consumption and maintenance. Parts and components shall be proportioned for stresses occurring during continuous or intermittent operation, and for any additional stresses occurring during fabrication or installation.
7. Design shall be such that working parts readily accessible for inspection and repair, easily duplicated and replaced.

C. Do not use material or equipment for any purpose other than for which it is designed or specified.

1.02 SUBSTITUTIONS

A. Substitutions:

1. CONTRACTOR'S requests for changes in equipment and materials from those required by Contract Documents are considered "requests for substitutions" and subject to CONTRACTOR'S representations and review provisions of Contract Documents when one of following conditions are satisfied:

a. Where request directly related to "or equal" clause or other language of same effect in Specifications.
b. Where required equipment or material cannot be provided within Contract Time, but not as result of CONTRACTOR'S failure to pursue Work promptly or coordinate various activities properly.
c. Where required equipment or material cannot be provided in manner compatible with other materials of Work, or cannot be properly coordinated therewith.

2. CONTRACTOR'S Options:
   a. Compatibility of Options: Where more than one choice available as options for CONTRACTOR'S selection of equipment or material, select option compatible with other equipment and materials already selected.
   b. Standards, Codes, and Regulations: Where compliance with imposed standard, code or regulation required, select from among products which comply with requirements of those standards, codes, and regulations.
   c. "Or Equal": For material or equipment specified by naming one or more equipment manufacturer and "or equal", CONTRACTOR shall submit request for substitution for any equipment or manufacturer not specifically named. Submit in accordance with Article 6 of General Conditions and these General Requirements.
   d. Two or More Manufacturers: For equipment or material specified by naming several manufacturers, select any one of manufacturers named. Do not provide or offer to provide unnamed manufacturer or equipment.
   e. Single Manufacturer or Material: For equipment or material specified by naming only one manufacturer or material and followed by words indicating no substitution, there is no option.

B. Conditions which are not substitutions:

1. Requirements for substitutions do not apply to CONTRACTOR options on materials and equipment provided for in Specifications.
2. Revisions to Contract Documents, where requested by OWNER or ENGINEER, are "changes" not "substitutions."
3. CONTRACTOR'S determination of and compliance with governing regulations and orders issued by governing authorities do not constitute substitutions or basis for Change Orders, except as provided for in Contract Documents.

1.03 MANUFACTURER'S INSTRUCTIONS

A. Installation of equipment and materials shall comply with manufacturer's instructions. Obtain and distribute printed copies of such instructions to parties involved in installation, including two copies to ENGINEER.

1. Maintain one set of complete instructions at job site during installation and until completion of Work.

B. Handle, install, connect, clean, condition, and adjust materials and equipment in accordance with manufacturer's written instructions and in conformity with Specifications.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult ENGINEER for further instructions.
2. Do not proceed with Work without written instructions.

1.04 TRANSPORTATION AND HANDLING

A. CONTRACTOR shall arrange deliveries of materials and equipment in accordance with Construction Progress Schedule, coordinate to avoid conflict with Work and conditions at site.

1. Deliver materials and equipment in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
2. Protect bright-machined surfaces, such as shafts and valve faces, with heavy coat of grease prior to shipment.
3. Immediately upon delivery, inspect shipments to ensure compliance with Contract Documents and approved submittals, and products have been protected and are undamaged.

B. Provide equipment and personnel to handle materials and equipment by methods recommended by manufacturer to prevent soiling or damage to materials or equipment, or packaging.

1.05 STORAGE, PROTECTION, AND MAINTENANCE

A. On-site storage areas and buildings shall conform to requirements of Section 01500 - Temporary Utilities.

B. OWNER assumes no responsibility for materials and equipment stored in buildings or on-site or at another location approved in writing. CONTRACTOR assumes full responsibility for damage due to storage of materials and equipment.

C. Interior Storage:

1. Store materials and equipment in accordance with manufacturer's instructions, with seals and labels intact and legible.
2. Store materials and equipment subject to damage by elements in weathertight enclosures.
3. Maintain temperature and humidity within ranges required by manufacturer's instructions.

D. Exterior Storage:

1. Store fabricated materials and equipment above ground, on blocking or skids, to prevent soiling or staining. Cover materials and equipment subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.
2. Store loose granular materials in well-drained area on solid surfaces to prevent mixing with foreign matter.
3. Materials such as pipe, reinforcing and structural steel, and equipment shall be stored on pallets or racks, off ground.

E. Inspection and Maintenance:

1. Arrange storage in manner providing easy access for inspection, maintenance, and inventory.
2. Make periodic inspections of stored materials and equipment to ensure materials and equipment maintained under specified conditions and free from damage or deterioration, and coverings in place and in condition to provide required protection.
3. Perform maintenance on stored material and equipment in accordance with manufacturer's written instructions and in presence of OWNER or ENGINEER.
   a. Notify ENGINEER 24 hrs before performance of maintenance.
   b. Submit report of completed maintenance and condition of coverings to ENGINEER with each Application for Payment.
   c. Failure to perform maintenance, to notify ENGINEER of intent to perform maintenance or to submit maintenance report may result in rejection of material or equipment.

F. CONTRACTOR shall assume responsibility for protection of completed construction and repair and restore damage to completed Work equal to original condition.

END OF SECTION

SECTION 02205

FINAL COVER MATERIALS

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this includes placement of the final cover soils, including buffer soils, granular drainage layer, common borrow layer, topsoil layer, and drainage layer (as part of the perimeter drainage system).

1.02 UNIT PRICE MEASUREMENT AND PAYMENT

A. Granular Drainage Layer

1. Basis of Measurement: Placement of the drainage layer actually performed and within the limits specified will be measured in square feet based on Record Drawings. The area will be measured planimetrically to the limits shown on the Record Drawings to the thickness of 6 inches with no additional allowances for placement of material on slopes.
2. Basis of Payment: The unit price per square foot for this item shall be payment in full for hauling, placing, and grading the granular drainage layer in accordance with the Specifications and in conformance with the lines, grades, and cross-sections shown on the Drawings. OWNER shall supply on-site granular drainage layer material.

B. Common Borrow Layer (cover soils)

1. Basis of Measurement: Placement of the cover soils actually performed and within the limits specified will be measured in square feet based on Record Drawings. The area will be measured planimetrically to the limits shown on the Drawings to the thickness of 12 inches with no additional allowances for placement of material on slopes.
2. Basis of Payment: The unit price per square foot for this item shall be payment in full for providing, transporting, placing, and grading in accordance with the Specifications and in conformance with the lines and grades shown on the Drawings.

C. Topsoil Layer

1. Basis of measurement: By the cubic yard in-place to limits shown on Drawings.
2. Basis of payment: According to the unit price as bid. Includes supplying materials, placement, and grading of finished surface.

D. Buffer Soils

1. Basis of measurement: There will be no measurement of this item.
2. Basis of payment: There will be no separate payment for this material. Costs associated with use shall be merged with costs of Section 02280 – Ash Waste Regrading and Relocation.

1.03 RELATED SECTIONS

Section 01050 - FIELD ENGINEERING
Section 02210 - SITE PREPARATION AND GRADING
Section 02922 - LINEAR LOW DENSITY POLYETHYLENE GEOMEMBRANE

1.04 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D422-63 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D1140-54 - Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 um) Sieve.
3. ASTM D1556 -82 - Standard Test Method for Density of Soil in-Place by the and Cone Method.
4. ASTM D698 - Standard Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb (2.49 kg) Rammer and 12-in. (305 mm) Drop.
5. ASTM D1587-83 - Standard Practice for Thin-Walled Tube Sampling of Soils.
6. ASTM D2167-84 - Standard Test Method for Density and Unit Weight of Soil in-Place by the Rubber Balloon Method.
7. ASTM D2216-80 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
8. ASTM D2487-85 - Standard Test Method for Classification of Soils for Engineering Purposes.
9. ASTM D2922-81 - Standard Test methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow-Depth).
10. ASTM D3017-88 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).
11. ASTM D4318-84 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.05 QUALITY ASSURANCE

A. OWNER will perform quality control and quality assurance in accordance with the approved Quality Assurance Manual for this project and included as an attachment to these specifications. It is important to note, however, that CONTRACTOR shall be responsible for borrow source testing as defined in part 1.07 below.

B. CONTRACTOR shall comply with the ENGINEER in conducting tests as required in the Quality Assurance Manual.

1.06 SUBMITTALS

A. CONTRACTOR to provide required borrow test results on granular drainage layer at least 21 days prior to installation for approval.

B. Documentation survey information as outlined in 3.07D of this Section.

C. Submit in accordance with Section 01300 - Submittals.

1.07 SOIL MATERIAL SOURCE QUALITY ASSURANCE

A. Independent soils laboratory to be approved by OWNER.

B. Source testing to be performed by CONTRACTOR at no cost to the OWNER.

C. Granular Drainage Material test requirements, three (3) of each of the following:

1. Constant head permeability (at 95% of Standard Proctor dry density).
2. Grain size analysis.

D. Common borrow cover soils, three (3) of each of the following:

1. Grain size analysis.
2. Standard Proctor.

E. Topsoil, three (3) of each of the following:

1. USCS soil classification.
2. Nutrient content for conformance with MNDOT Specification 3877.2.

PART 2 - PRODUCTS

2.01 SOURCE OF MATERIAL

A. Provide all soils required for final cover construction in accordance with the requirements of Section 02205 - Final Cover Materials.

2.02 SOIL MATERIALS

A. Granular Drainage Material and Buffer Soil

Material to be provided by OWNER. Granular drainage material and buffer soil will be tailings generated from on-site plant operations.

B. Landfill Cover Soils (Common Borrow Soils)

Fertile friable soil; either excessively acid or excessively alkaline, suitable for establishment of rooting system of grass and plants. Free from gravel, cinders, stone over 1 inch in any dimension and other undesirable material.

C. Topsoil

Natural loam, sandy loam, silt loam, or humus bearing soils meeting the minimum and maximum requirements of MNDOT Specification 3877.2B "Select Topsoil Borrow."

PART 3 - EXECUTION

3.01 FILL USAGE

A. Buffer soils: Directly on top of regraded ash waste.

B. Granular Drainage Material: Directly on top of LLDPE geomembrane.

C. Common Borrow Soils: Directly on top of granular drainage layer.

D. Topsoils: Directly on top of common borrow soils.

3.02 PREPARATION

A. Surface Water Control:

1. CONTRACTOR responsible for surface water within construction limits.
2. Keep construction and borrow areas well drained and minimize surface water pooling.

B. Subsurface dewatering not permitted without OWNER'S permission.

C. Do not excavate within influence zone of existing footings or foundations, or similar structures such as monitoring wells without prior approval of ENGINEER.

3.03 PLACING GRANULAR DRAINAGE LAYER

A. Placement of granular materials on geomembrane shall not proceed at ambient temperatures below 5°C (40°F).

B. Spread with one pass of low-ground pressure-tracked equipment maximum ground pressure of 5 psi (720 PSF). Do not allow rubber-tired vehicles on granular blanket after placement. Operation of hauling equipment will be allowed only on areas with a 3-foot minimum thickness. Spread upslope; spreading downslope will not be allowed.

C. Protect buried pipes, geotextiles, and similar installations.

D. CONTRACTOR shall brake, accelerate, and change directions of spreading equipment in a manner that will minimize stress in the geomembrane.

E. CONTRACTOR shall place granular material by such method as to prevent wrinkling and possible damage to the LLDPE liner.

3.04 PLACEMENT OF COMMON BORROW COVER SOILS

A. Construct to limits shown on Drawings and to thickness of 12 inches.

B. Spread with one pass using tracked equipment.

3.05 PLACEMENT OF TOPSOILS

A. Construct to limits shown on Drawings to a thickness of 6 inches.

B. Spread with one pass using tracked equipment.

3.06 FIELD QUALITY CONTROL

A. Comply with approved Quality Assurance Manual. Cooperate with quality control program.

B. Specified soil layers shall be graded to the minimum thicknesses as shown on drawings and specified herein. Thickness tolerance of the soil layers must be between -0.0 and +0.2 feet.

C. Testing:

1. Tests performed and frequency of tests specified in the Quality Assurance Manual.
2. CONTRACTOR is responsible for all costs related to retests of materials not meeting specifications.

D. Survey Requirements;

1. CONTRACTOR shall be responsible for providing documentation survey performed by a qualified land surveyor in accordance with Section 01050 - Field Engineering, the approved Quality Assurance Manual, included as Appendix A, and as follows:
2. The major components of the survey shall include the following:
   a. Top of subgrade (buffer soils following ash waste regarding).
   b. Top of drainage layer
   c. Top of cover soil
   d. Top of topsoil

3. Survey shall be conducted on a 50 ft. x 50 ft. grid with survey points at all major breaks in slope (i.e., top and toe of slope) as indicated in the Quality Assurance Manual. The grid will be extended vertically to enable calculation of vertical thicknesses of the liner or cover component. Probing of the various final cover soil layers on a 50 + 50-foot grid shall be acceptable for verifying proper thickness, although the survey to verify proper slope shall still be required.

3.07 ADJUSTMENT AND CLEANING

A. Remove excess material not suitable for use from the site.

END OF SECTION

SECTION 02210

SITE PREPARATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Summary

1. The Work in this section includes all general site preparation.

1.02 QUALITY ASSURANCE

A. In-place testing: Testing shall be provided by OWNER in accordance with Section 01410 - Testing Laboratory Services and Appendix A (CQA Plan) of this Specification.

B. Source testing: CONTRACTOR shall provide source testing at borrow sources if needed (see Section 02205).

C. Grading Tolerances:

1. Grade subgrade surface for geomembrane placement to within ± 0.2 foot of design elevation.
2. Grade soil layers to the minimum thicknesses as shown on plans. CONTRACTOR will not be compensated for any additional material over designated thickness.

D. Reference Standards:

1. American Society for Testing and Materials (ASTM):
   a. ASTM D422-63 - Test Method for Particle-Size Analysis of Soils.
   b. ASTM D1557-78 - Test Method for Moisture Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. (4.5 Kg) Rammer and 18-inc. (457-mm) drop.
   c. ASTM D1587-83 - Thin Wall Tube Sampling of Soils.
   d. ASTM D2216-80 - Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock and Soil-Aggregate Mixtures.
   e. ASTM D2487-85 - Test Method for Classification of Soils for Engineering Purposes.
   f. ASTM 2922-81 - Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   g. ASTM D3017-78 - Test Method for Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
   h. ASTM D4318-84 - Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

1.03 UNIT PRICE MEASUREMENT AND PAYMENT

A. There is no separate measurement and payment for work specified in this section.

PART 2 - PRODUCTS

Refer to Section 02205 - FINAL COVER MATERIALS

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive fill to determine existence of areas loosened by frost action, softened by flooding or weather or of unsuitable materials.

B. Locate all existing structures, surface features, and utilities prior to beginning work.

C. Provide protection and support during construction for existing utilities, structures, and surface features adjacent to and within construction site.

D. Remove obstructions such as mounds of dirt, stone or debris located within working limits. Obstructions such as street signs, culverts, end walls, signs, and guard posts located within construction area may be removed if promptly replaced to original condition unless otherwise directed by OWNER.

3.02 PREPARATION

A. Fill settled areas where excavations or trenches were backfilled and holes made by demolition, tree removal, and site preparation work.

B. Native soils or compacted fill softened by frost, flooding or weather shall be removed and replaced or compacted, as required by ENGINEER.

C. Proof roll areas to receive fill material to detect soft or loose zones prior to placing fill. Remove and replace soft or loose zones.

D. Keep construction site free draining.

E. Surface of liner must be approved by the LLDPE installer prior to installation of liner. Surface rutting will not be acceptable. Surface must be smooth and free of debris, roots, and angular or sharp rocks larger than 3/8 inches in diameter to a depth of 4 inches below surface to be lined.

3.03 FIELD QUALITY CONTROL

A. Rough Grading Tolerances:

1. Grade to 6 inches below finished grade in areas to receive topsoil, unless new grade is less than 6 inches above existing grade. Grade to bottom of base course in areas to receive gravel or riprap. Maximum allowable variation from design elevations is 1 inch in 10 feet. Degree of finish shall be ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified.
2. Rough grading areas, including excavated and filled sections and adjacent transition areas shall be reasonable smooth, compacted, and free from irregular surface changes.

3.04 STOCKPILES

A. Strip area of vegetation to bottom of root zone prior to stockpiling.

B. Grade stockpile area for proper drainage.

3.05 RESTORATION

A. Restore existing utilities, surface features, and structures to condition equal to or exceeding existing condition prior to construction.

END OF SECTION

SECTION 02225

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 SUMMARY

A. Work described in this section includes excavation, backfilling and compacting for sedimentation pond, drainage ditching, access roads, and piping installation. Compaction requirements for relocated ash waste are detailed in a later section.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D422-63 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D1140-54 - Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 um) Sieve.
3. ASTM D1556-82 - Standard Test Method for Density of Soil in-Place by the Sand Cone Method.
4. ASTM D698 - Standard Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb (2.49 kg) Rammer and 12-inch (305 mm) Drop.
5. ASTM D2167-84 - Standard Test Method for Density and Unit Weight of Soil in-Place by the Rubber Balloon Method.
6. ASTM D2487-85 - Standard Test Method for Classification of Soils for Engineering Purposes.
7. ASTM D2922-81 - Standard Test Methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow-Depth).
8. ASTM D3017-88 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).

B. Minnesota Department of Transportation (MNDOT) Standard specifications for Construction, 1988 edition with revisions and supplements.

1.03 FIELD MEASUREMENTS

A. Verify intended elevations for Work as shown on Drawings once survey control established.

1.04 COORDINATION

A. Coordinate work with others performing work at project site

B. Gopher State One call to check for utilities prior to beginning Work.

1.05 UNIT PRICE MEASUREMENT AND PAYMENT

A. There will be no measurement or separate payment of the items discussed within. Costs associated with excavating, backfilling, and compacting shall be merged with costs of the appropriate items such as ash waste regrading, CPEP drain pipe, and sedimentation pond grading.

PART 2 - PRODUCTS

2.01 FINAL COVER MATERIALS

A. Refer to Section 02205- Final Cover Materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine and verify acceptability and condition of surfaces to perform Work.

3.02 PREPARATION

A. Identify required lines, grades, levels, contours, and datum.

B. Protect benchmarks, structures, equipment, and partially completed Work.

C. Notify corporations, companies, individuals, or authorities owning above- or belowground conduits, wires, pipes, or other utilities running to property or encountered during excavating operations.

D. Cap or remove and relocate services in accordance with instructions by OWNERS of services.

E. Protect, support, and maintain conduits, wires, pipes, and other remaining utilities in accordance with requirements of OWNERS of said services.

3.03 BACKFILLING AND COMPACTION

A. Do not use frozen material or place on frozen subgrade.

B. Place fill simultaneously on both sides of free-standing structures.

C. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials. When approved by ENGINEER, jetting, flooding, puddling, or vibroflotation methods may be used for compacting if CONTRACTOR furnishes test results to confirm required degree of compaction being obtained uniformly throughout entire mass.

D. Where pipes leave structures, protect by backfilling pipe or duct influence zone down to undisturbed soil with controlled fill.

E. Lift Thickness and Compaction: Place and compact fill material in accordance with MNDOT Specification 2105.3 using the ordinary compaction method herein modified, maximum lift thickness and minimum densities listed below.

Type of Fill		Maximum Compacted Lift Thickness (inches)	Standard Proctor (%)
	Buffer Soils	6	95
Final Cover	Common Borrow Soils	12	No compaction requirement

3.04 FIELD QUALITY CONTROL

A. Comply with approved Quality Assurance Manual. Cooperate with quality control program.

B. Pipe invert elevations, pipe locations, and other elevations specifically identified on the plans must be verified. Actual lengths of piping installed must be documented.

END OF SECTION

SECTION 02270

SURFACE WATER CONTROL FEATURES

PART 1 - GENERAL

1.01 SUMMARY

A. Work described in this section includes construction of surface water sedimentation pond and drainage ditch improvements.

1.02 RELATED SECTIONS

Section 02205 - FINAL COVER MATERIALS
Section 02210 - SITE PREPARATION
Section 02225 - TRENCHING, BACKFILLING, AND COMPACTING

1.03 UNIT PRICE MEASUREMENT AND PAYMENT

A. Sedimentation Pond

1. Basis of Measurement: By the cubic yard according to survey.
2. Basis of Payment: According to the unit price as bid. Includes construction of sedimentation pond, as shown on Drawings. Also includes constructing northern access road adjacent to sedimentation pond.

PART 2 - PRODUCTS

2.01 COVER MATERIAL

A. As required in Section 02205 - Final Cover Materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine and verify acceptability and condition of surfaces to perform work.

3.02 PREPARATION

A. Identify required lines, grades, levels, contours, and datum.

B. Perform work in accordance with related sections of this specification.

3.03 SEDIMENTATION POND

A. CONTRACTOR shall construct in accordance with conditions and practices as set forth in Section 02225 - Excavating, Backfilling, and Compacting.

B. OWNER shall provide tailings for construction of access road as shown on Plan Drawings.

END OF SECTION

SECTION 02276

EROSION CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Heavy duty silt fence and bale checks shall be installed for erosion control where required by the CONTRACTOR'S Erosion Control plans.

1.02 QUALITY ASSURANCE

A. The heavy duty silt fencing shall conform to MNDOT Specification Number 3886.

PART 2 - PRODUCT

2.01 GENERAL

A. A heavy duty silt fence shall consist of a composite of woven wire fence fabric, posts, geotextile, and fasteners to be assembled by the CONTRACTOR.

B. Woven wire fence fabric shall be a standard field fence type minimum 30 inches high, maximum mesh spacing of 6 inches and minimum 14½-gauge wire.

2.02 GEOTEXTILE PROPERTIES SHALL MEET OR EXCEED THE FOLLOWING:

A. Width - 36 inches
Grab tensile strength ASTM D4632 -100 pounds
Apparent opening size, AOS, ASTM D4751 - Range 20-70 Sieve
U.V. Stability, after 500 Xenon Weatherometer Hours - Not less than 70%

2.03 GEOTEXTILE MATERIAL

A. The net backing shall consist of an industrial polypropylene mesh that is joined to the geotextile at both top and bottom with double stitching of heavy duty cord.

2.04 POSTS

A. Posts shall be metal or wood with a minimum length of 5 feet. Metal posts shall be "studded tee" or "U" type with a minimum weight of 1.3 lbs/linear feet. Wood posts shall have a minimum diameter of 3 inches. Staple fasteners for wood posts shall be at least 1½ inches long.

PART 3 - EXECUTION

3.01 SILT FENCE INSTALLATION

A. Silt fence shall be trench in with a minimum of six inches of fabric buried.

B. Post shall be driven a minimum of 12 inches into the ground and in a straight and vertical position.

C. CONTRACTOR shall be responsible for maintenance and repair of silt fence until final acceptance of the project.

3.02 REMOVAL OF SILT FENCE

A. CONTRACTOR shall remove and dispense of silt fence around completion of project and the establishment of vegetation.

END OF SECTION

SECTION 02280

ASH WASTE GRADING AND RELOCATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes requirements for excavating and relocating ash waste and regrading of ash to grades shown on Plan Drawings.

1.02 RELATED SECTIONS

A. Section 01155 - On-Site Health and Safety Requirements

B. Section 02205 - Final Cover System

1.03 SUBMITTAL

A. Contractors work plan shall include the following construction methods:

1. Methods of excavating, loading, hauling, placement, and compaction of soils and wastes.
2. Method of run-on/run-off control and disposal of water, and means of temporary cover.

1.04 METHOD OF PAYMENT

A. Work specified in and performed under this section is included in the CONTRACTOR'S lump sum amount.

PART 2 - PRODUCTS

2.01 BUFFER SOILS

A. Natural Soils classified as CL, SM, SC, or ML in Unified Soil Classification System from on-site borrow sources.

PART 3 - EXECUTION

3.01 WASTE RELOCATION

A. CONTRACTOR shall excavate ash waste material from the areas as designated on the Drawings.

B. CONTRACTOR shall place all excavated ash waste in the ash disposal area as shown on the Drawings.

C. OWNER will determine the exact extent and depth of waste to be removed from each location.

D. CONTRACTOR will provide groundwater control during excavation.

E. CONTRACTOR to remove and stage any visible unacceptable wastes in OWNER-designated area on-site.

3.03 WASTE COMPACTION

A. Lifts of ash waste shall be placed and compacted with an 82IB sheepsfoot landfill compactor or equivalent in maximum 24-inch thicknesses and compacted with a minimum three passes.

B. Ash wastes shall be placed as shown on the Drawings.

3.04 TEMPORARY COVER

A. CONTRACTOR to temporarily cover any excavated waste material or contaminated soils left exposed overnight if requested by OWNER or ENGINEER.

3.05 FIELD QUALITY CONTROL

A. Surveying.

1. Prior to and after placing wastes in the waste fill area, the area should be cross-sectioned to determine actual volume relocated.

3.06 BUFFER SOILS

A. CONTRACTOR to place minimum 6-inch thick buffer soils layer above final waste grades.

B. Buffer soils layer above relocated and existing waste will be rolled smooth with a smooth drum roller - such that there are no visible tire marks or roller indentations.

C. The final surface will be inspected for rocks larger than 2-inch diameter or sharp rocks or other material deleterious to the geomembrane liner. CONTRACTOR to remove oversized rocks and deleterious material prior to geomembrane placement.

END OF SECTION

SECTION 02486

TURF RESTORATION

PART 1 - GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. This section contains requirements for seeding, fertilizing, and mulching.

B. Seed entire ash pile closure area, sedimentation pond area, and all areas disturbed by construction activities.

C. Reference Standards:

1. Minnesota Department of Transportation "Standard Specifications for Construction", (MNDOT SPECS), 1988 Edition.

1.02 SUBMITTALS

A. Analyses:

1. Supplier's analysis for standard products.

B. Submit in accordance with Section 01300 - Submittals.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Fertilizer:

1. Deliver to site in unopened, original containers, each bearing name and address of manufacturer's guaranteed analysis.

B. Seed:

1. Tag or label bag as required by state law. Supplier's name shall be shown on or attached to each bag with:
   a. Type of seed contained.
   b. Percentage of purity and germination.
   c. Percentage of hard seed, if any.
   d. Percentage of inert material.

C. Guarantee seeded areas for duration of one year after seeding to be alive and in and in satisfactory growth at end of guarantee period.

1. For purpose of establishing acceptable standard scattered bare spots, none larger than one square foot will be allowed up to maximum of three % of seeded area.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Topsoil:

1. Fine grade with no more than 15% of rocks or lumps between 2 in. and 1-1/2 in. in greatest dimension.

B. Fertilizer:

1. Contain minimum percentage by weight of:
   a. Prior to Seeding (6-24-24):
      Nitrogen
      Phosphorus
      Potash
   b. After Seeding (18-5-9):
      Nitrogen
      Phosphorus
      Potash

C. Grass Seed:

1. Comply with current U.S. Department of Agriculture rules and regulations.
2. Mix grass seeds in proportions by weight to meet or exceed minimum percentages of purity and germination as indicated:

Common Name	Lb/acre	% Weight Pure Live Seed	% Germination
Kentucky Bluegrass	25	35	85
Park Kentucky Bluegrass	11	15	85
Creeping Red Fescue	28	40	95
Perennial Rye Grass	7	10	95
Winter Whet or Winter Rye	60	--	--

D. Water:

1. CONTRACTOR shall be responsible for water.

E. Mulch:

1. Type 1 or Type 5 per MNDOT SPECS Section 3882.

PART 3 - EXECUTION

3.01 INSPECTION

A. Do not begin ground preparation until boulders, debris, and similar materials have been removed, depressions and ruts filled, and area to be seeded shaped, trimmed, and finished uniformly to grades and cross-sections shown on Drawings, or to match original grade.

3.02 SITE PREPARATION

A. Finish Grading:

1. Finish grades shall be approved by ENGINEER prior to seeding. Final 6 inches shall be topsoil.

B. Tilling:

1. Prepare areas to be seeded to required depth of approximately 3 in. by discing, rototilling, harrowing or other approved means.

C. Fertilizer Spreading:

1. Mechanically spread uniformly in two passes at right angles to each other.
2. 20 lbs of active ingredients/10,000 square feet (90 lbs/acre).
3. Disk, harrow or rototill fertilizer into soil to depth of 3 in., or use other acceptable method produce similar results.

D. Cleanup:

1. Remove and dispose of rock, trash or other materials brought to surface to off-site area in legal manner.

3.03 SEEDING

A. Planting Seasons for Seeded Areas in accordance with MNDOT Specification 2573.3D for the seed mixture and zone specified.

B. Seed Application:

1. Do not seed on saturated or frozen soil.
2. Seeding method may be varied at discretion of CONTRACTOR on his own responsibility to establish smooth, inform turf composed of specified grasses.
3. seed turf areas disturbed by construction operations.
4. Do not seed following rain or if surface has been compacted by rain.
5. Do not seed when wind velocity exceeds 6 mph.
6. seed all areas disturbed by construction including temporary slopes.

C. Mulching:

1. Mulch in accordance with MNDOT SPECS 2575 except following:
   a. Type 1 mulch shall be anchored with disc, clod buster, or other type equipment.
      1) On slopes, disc anchoring shall be at right angles to slope.
   b. Type 5 mulch to be added separately from fertilizer and seed.

3.04 MAINTENANCE

A. Maintain seeded area for 60-day period after seeding.

B. Maintenance consists of watering, fertilization, two mowings, reseeding, and repair.

C. Watering:

1. Water seeded areas within 24 hours after seeding. Penetrate seed bed to 2 in. depth.
2. Keep seed bed moist to depth of 6 in., but not wet, until seed germinates.
3. Apply water as spray or by dispersion to prevent run-off or damage.

D. Fertilizer Spreading:

1. Fertilize 1 week prior to final acceptance of seeded areas.
2. Apply 5 lbs of active ingredients/1,000 square feet (220 lbs/acre).

E. Protection:

1. Maintenance includes temporary protection fences and barriers, signs, and other Work incidental to proper maintenance.
2. CONTRACTOR liable for damage to seeded areas caused by fertilizers, pesticides, and pesticides, and other materials supplied by CONTRACTOR.

F. Reseeding and Repair:

1. Reseed areas that fail to show more than 75 plants/square feet and open areas or gaps larger than 6 in. in diameter.
2. Bare spots may be spot reseeded in accordance with sowing seeding specifications.
3. Where less than 50 plants/square feet, retill and reseed area in accordance with drill seeding and maintenance requirements.

3.05 ACCEPTANCE

A. Grass shall display reasonably uniform distribution of grass plants after any required reworking.

B. Grass shall display vigorous growth, be healthy in appearance, and of uniform color.

C. Notify ENGINEER when seeded area is ready for final inspection.

END OF SECTION

SECTION 02623

PERFORATED DRAIN PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install perforated corrugated polyethylene (drainage tubing) and appurtenances as shown on Drawings. Drainage tubing shall be wrapped with minimum 4-ounce geotextile.

1.02 SEQUENCING AND SCHEDULING

A. Include piping activities in the project schedule.

1.03 SUBMITTALS

A. The CONTRACTOR shall submit to the OWNER the manufacturer's literature that describes the physical characteristics of the pipe provided, the recommended installation procedures, and allowable pipe bend radius.

B. Submit in accordance with Section 01300.

1.04 MEASUREMENT AND PAYMENT

A. CPEP Drain Pipe.

1. Basis of Measurement: By the lineal foot.
2. Basis of Payment: According to the unit price as bid. Includes supply and installation of the pipe and any miscellaneous fittings. Also includes solid pipe outlets and geotextile wrap as shown on the Plans. Perimeter marker posts incidental to this item.

PART 2 - PRODUCTS

2.01 CORRUGATED POLYETHYLENE PIPE (CPEP) AND FITTINGS

A. CPEP and fittings shall meet the requirements of ASTM F 405 or AASHTO M252. The pipe shall meet the dimensional requirements indicated on the Contract Drawings and be manufactured by Prinsco, ADS, Hancor, or other approved manufacturer.

B. Perforated pipe shall be factory perforated with a minimum inlet area of 1 square inch/ft.

C. Fittings shall be from the same manufacturer as the pipe.

SECTION 02922

LINEAR LOW DENSITY POLYETHYLENE GEOMEMBRANE (LLDPE)

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work covered under this section includes providing all materials, equipment, and labor to furnish and install smooth 40-mil Linear Low Density Polyethylene (LLDPE) geomembrane as part of the ash disposal area final cover system. Installation shall be to the lines and dimensions as shown in the project Drawings.

1.02 DEFINITIONS/REFERENCES

A. American Society for Testing and Materials (ASTM) Standards specifically referenced in this Section:

1. ASTM D413-82 - Standard Test Methods for Rubber Property Adhesion to Flexible Substrate.
2. ASTM D638-89 - Standard Test Method for Tensile Properties of Plastics.
3. ASTM D746-79 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
4. ASTM D751-89 - Standard Test Methods for Coated Fabrics.
5. ASTM D792-86 - Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
6. ASTM D882-88 - Standard Test Methods for Tensile Properties of Thin Plastic Sheeting.
7. ASTM D1004-66 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
8. ASTM D1117-80 - Methods of Testing Non-woven Fabrics
9. ASTM D1204-84 - Standard Test Method for Linear Dimensional Changes of Non rigid Thermoplastic Sheeting or Film at Elevated Temperatures.
10. ASTM D1238-89 - Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
11. ASTM D1505-85 - Standard Test Method for Density of Plastics by the Density Gradient Technique.
12. ASTM D1593-89 - Standard Specification for Nonrigid Vinyl Chloride Plastic Sheeting.
13. ASTM D1603-76 - Standard Test Method for Carbon Black in Olefin Plastics.
14. ASTM D1682-64 - Standard Test Methods for Breaking Load and Elongation of Textile Fabrics.
15. ASTM D1693-70 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.

2.02 BEDDING AND COVER MATERIAL

A. Drainage layer material as required in Section 02205 - Final Cover Materials.

PART 3 - EXECUTION

3.01 CPEP AND FITTINGS

A. Install perforated CPEP and geotextile wrap of the size and in the locations and to the elevations and grades shown on the Drawings.

B. Do not install pipe with bends of smaller radius than the minimum recommended by the manufacturer.

3.02 FILL PLACEMENT AROUND PIPES

A. The CONTRACTOR shall notify OWNER before placing fill around pipes.

B. Do not use frozen fill material or place on frozen subgrade.

3.03 FIELD QUALITY CONTROL

A. Pipe and pipe installation will be subject to rejection for any of the following reasons:

1. Failure to conform to the SPECIFICATIONS, particularly compaction under and around the pipe.
2. Fractures or cracks passing through pipe wall or socket.
3. Cracks, which in the opinion of OWNER or OWNER'S On-Site Representative, may impair strength, durability, or serviceability of pipe.
4. Defects indicating improper proportioning, mixing, or molding.
5. Damaged ends where such damage would prevent making a satisfactory joint.

END OF SECTION

16. ASTM D1777-64 - Standard Method for Measuring Thickness of Textile Materials.
17. ASTM D3015-72 - Standard Practice for Microscopic Examination of Pigment Dispersion in Plastic Compounds.
18. ASTM D3083-89 - Standard Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining.
19. ASTM D4218-82 - Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

1.03 SEQUENCING AND SCHEDULING

A. Submit material delivery and installation schedule for incorporation into the Project schedule.

1.04 SUBMITTALS

A. The following submittals shall be provided to and approved by OWNER prior to delivery of geomembrane to the site or mobilization of the geomembrane INSTALLER'S crew or equipment:

1. The INSTALLER shall supply information from the resin manufacturer regarding the resin type, properties as specified herein, and production dates of the resin used for this project. The resin type identification shall include the cell classification of the resin in accordance with the requirements of the latest ASTM Designation D3350.
2. The INSTALLER shall submit from the geomembrane sheet manufacturer, test methods and results defining physical properties as specified herein, of the geomembrane to be used for this project. Test results representative of each roll of geomembrane (frequency determined by the manufacturer, unless otherwise specifically stated in this document) furnished for this project shall be submitted, and test results shall be reported with corresponding roll identification numbers.
3. The INSTALLER shall supply a statement of the geomembrane manufacturer's quality control procedures, identification of any resin admixtures, frequency of sampling, methods of material transportation and storage, and acceptance criteria for roll goods delivered to the site.
4. The INSTALLER shall provide submittals describing the geomembrane sheet manufacturer's details of any factory seaming process proposed. Roll test results that may not be available prior to construction (i.e., environmental stress crack) shall be presented as preliminary prior to construction, with final test results submitted or affected rolls within the construction time frame.
5. The INSTALLER shall submit from the extrudate weld rod manufacturer, verification that the weld rod was manufactured using the same resin as was used in the geomembrane sheets prior to using material.
6. The INSTALLER shall submit a proposed panel and seam layout diagram specifying the type and location of all field and factory seams. The layout diagram shall be to scale and used as a construction plan and shall include all necessary dimensions and details. The layout diagram shall be compatible with the panel and seam layout requirements specified in this Section.
7. The INSTALLER shall submit an installation schedule.

8. The INSTALLER shall submit a list of personnel performing field supervision, and quality control, along with experience records and resumes.
9. The INSTALLER shall submit a list of equipment types proposed to be used in panel layout, membrane seaming, and destructive and nondestructive testing.
10. The INSTALLER shall submit current calibration certification and load tables for the field tensiometer, not more than three (3) months old prior to mobilization date.

B. The INSTALLER shall remit the following during geomembrane Installation:

1. INSTALLER shall, at the end of each working day provide a detailed report of Work completed that day, including:
   1) Panel Placement
   2) Trial Welds Results
   3) Subgrade Acceptance Form
   4) Seams
   5) Seam Testing (air and vacuum tests)
   6) Destructive Tests
   7) Repair Log
2. The ENGINEER shall review with the INSTALLER and sign the above report at the end of each day. The ENGINEER shall be provided with a copy not more than 24 hours from the date of the report.

C. The INSTALLER shall update their liner layout Drawings on a daily basis. The Drawings shall include all panel locations and numbering, seam locations and numbering, and test locations and numbering. The INSTALLER shall maintain a current liner layout Drawing on the construction site at all times.

D. The INSTALLER shall submit final as-built liner layout Drawing(s) to ENGINEER within 1 week after completion of the liner Work. Drawings shall be submitted in mylar and digital form.

E. Quality control certificates indicating resin type, properties as specified herein, and production dates shall be provided with each shipment of extrudate rods delivered to the site no later than the time of delivery.

F. Prior to the installation of any geomembrane, the INSTALLER shall submit INSTALLER'S certification in writing that the surface upon which the geomembrane is to be installed is acceptable (complete form contained at end of this Section).

1.05 EXPERIENCE

A. The Geomembrane Supplier shall have at least 3 years continuous experience in manufacturing smooth and textured LLDPE or VLDPE geomembrane rolls and/or a manufacturing record totaling not less than 5 million square feet of LLDPE or VLDPE geomembrane. The Geomembrane Supplier shall have produced LLDPE or VLDPE membrane for at least 10 completed facilities similar in scope to this project.

B. The INSTALLER shall have at least 3 years continuous experience in the installation of ULDPE or LLDPE geomembranes and an installation record totaling at least 5 million square feet. INSTALLER shall have installed LLDPE or VLDPE geomembrane for at least 10 completed sites similar in scope to this project.

C. Geomembrane installation shall be performed under the direct supervision of a single field supervisor who must remain on-site throughout installation, including inspection of the surface upon which the geomembrane is to be installed, geomembrane handling and storage, panel layout and placement, seaming, seam testing, panel and seam repair, installation of appurtenances, anchorage and other geomembrane-related Work. The field supervisor shall have complete supervisory responsibility for the installation, testing, and repair of the geomembrane. The field supervisor shall have a personal LLDPE or VLDPE geomembrane installation record totaling at least 1 million square feet.

D. Field seaming of geomembrane panels shall be performed under the direction of a seaming supervisor who may or may not be the same person as the field supervisor. The seaming supervisor shall have a personal LLDPE or VLDPE geomembrane installation record (40 mil or greater geomembrane thickness) totaling at least 1 million square feet using the seaming methods proposed for this project.

1.06 PREINSTALLATION CONFERENCE

A. Representatives of the INSTALLER shall attend a meeting prior to installation of the geomembrane to discuss details of the proposed design, installation, and schedule.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Raw Materials:

1. LLDPE geomembrane and extrudate rods used for this project shall be manufactured of new, first quality resins, designed specifically for use in flexible membrane liner installations.
2. LLDPE resin used in manufacturing geomembranes used for this project shall meet the following specifications:

Property	LLDPE	Test Method
Specific Gravity	> 0.92 g/cc	ASTM D-792-86 Method A or ASTM D-1505
Melt Flow Index	<0.2 g/10 min	ASTM D-1238-88 Condition E (190□ C, 2.16 Kg)

3. Recycled polymer shall not be added to the resin. However, the resin may contain polymer reclaimed during the manufacturing process if reclaimed polymer content does not exceed 2 percent by weight.

B. Geomembrane Roll Goods:

1. LLDPE geomembrane sheets used for this project shall meet the following specifications:

Geomembrane Sheet Specifications

Property	40-mil Smooth LLDPE	Test Method
Nominal sheet thickness	40 mil ± 10%	ASTM D-1593
Tensile force at break (lb/in width)	>150	ASTM D-638
Tensile force at yield (lb/in width)	>66	ASTM D-638
Elongation at break	≥800%	ASTM D-638
Elongation at yield	>13%	ASTM D-638
Tear resistance	≥24 lbs	ASTM D-1004 Die. C
Puncture resistance	≥55 lbs	FTMS 101B/2065
Dimensional stability (max. change)	±1%	ASTM D-1204 as modified
Specific gravity g/cc	≥0.92	ASTM D792 Method A or ASTM 01505
Low temperature brittleness	<-94°F	ASTM D-746 Proc. B
Carbon black content	2-3%	ASTM D-1603
Carbon black dispersion	A-1, A-2, or B-1	ASTM D-3015
Environmental stress crack (min., hours)	>1,500 hrs	ASTM D-1693 as modified

Notes: (1) The symbols used in table are defined as follows:
≤ equals less than or equal to
≥ equals greater than or equal to

2. The geomembranes shall consist of unreinforced Linear Low Density Polyethylene containing at a maximum 3 percent by weight additives, fillers, or extenders.
3. The geomembranes shall be free of holes, blisters, striations, undispersed raw material, and contamination by foreign matter.
4. The geomembranes shall be supplied in rolls. Each roll shall be identified and labeled with the thickness of the geomembrane, length and width, manufacturer, lot number, and roll identification number. This identification number shall be used to identify roll location on the panel layout record Drawing.

C. Extrudate: Resin used in the polyethylene extrudate shall be the same as that used to manufacture the geomembrane sheets. Extrudate rods are to be delivered in original containers with the manufacturer's labeling. Extrudate rods shall be free of dirt, grease, moisture, other contaminants, and shall be free of damage.

2.02 EQUIPMENT

A. Extruding equipment shall be equipped with a temperature gauge at the barrel and nozzle.

B. Fusion equipment shall be equipped with a temperature gauge capable of continuous monitoring.

C. Provide digital or dial continuous temperature recording instruments, in satisfactory working condition, with each welding unit. Welding equipment shall not be operated without functioning temperature recording instruments.

D. A coupon cutter and a calibrated tensiometer shall be provided for field seaming prequalification testing and destructive sample testing.

E. Store, transport, and operate all equipment to avoid damage to geomembranes.

F. Glass top of each vacuum box must be clear and free of scratches for easy reading of pressure gauge. The sealing gasket shall be intact and functioning to form close seals during testing.

PART 3 - EXECUTION

3.01 SUBGRADE INSPECTION

A. INSTALLER shall certify in writing that the surface upon which the geomembrane is to be installed is acceptable (acceptance form contained at end of this Section).

B. After subsurface has been accepted by INSTALLER, it shall be INSTALLER'S responsibility to indicate to CONTRACTOR any change in subsurface conditions that may require repair Work. Damage to subsurface caused by Work involved in installing geomembrane shall be repaired at the INSTALLER'S expense. Geomembrane placement over damaged subsurface, as determined by the ENGINEER, is not acceptable.

3.02 ANCHORAGE SYSTEM

A. Anchor trench excavation will be by the earthwork CONTRACTOR prior to geomembrane placement.

Table of Contents

TABLES

1.0 Introduction

This manual describes Construction Quality Assurance (CQA) procedures for the installation of the soil and geomembrane components of composite liner system of the LTV Steel Mining Company's (LTV) coal ash disposal area at the Hoyt Lakes Plant. The term "Quality Assurance", used in its broadest sense, is based upon the concept of "Quality Control". This manual addresses survey, soil, piping, and geomembrane components of the liner and passive gas system, and is to be used as the basis of the overall CQA program.

The overall goals of this construction quality assurance program are to ensure that proper construction techniques and procedures are used and to verify that materials and installation techniques used meet the project design requirements. At completion of the work, the program will culminate in a certification report, which documents that the grading, liner, and piping systems have been constructed in accordance with design standards and specifications.

2.0 Earthwork Construction

Construction quality assurance will be performed by LTV OR THEIR REPRESENTATIVE on all components of soil construction. Criteria to be used for determination of acceptability of the construction work will be as identified in the project specifications and plans.

Construction Quality Assurance testing will consist of (1) observation of the work, (2) field and laboratory test, and (3) survey. All field and laboratory tests will be conducted on samples taken from material during the course of the work.

2.1 OBSERVATION OF THE WORK

Observation of the construction work by LTV OR THEIR REPRESENTATIVE will include the following:

- Observation of the thickness of lifts as loosely placed and as compacted.
- Observation of the action of the compaction and heavy hauling equipment on the construction surface (sheepsfoot penetration, pumping, cracking, etc.).

2.2 LABORATORY AND FIELD TESTS

Table 1 describes laboratory test methods typically utilized to develop data upon which acceptability evaluations can be based. Table 1 describes in detail the types and number of tests anticipated for the earthwork construction of the landfill cell.

Nuclear density methods will be preferred for all density testing due to the ease of testing and the relatively large number of tests, which can be run in a given period of time. Questions concerning the accuracy of any single test will be addressed by retesting in the same or nearby location.

Construction quality assurance testing will be conducted on samples taken from the material during the course of construction.

Sampling locations will be selected by LTV OR THEIR REPRESENTATIVE according to the number of required tests. Locations of all tests will be documented for report purposes.

A special testing frequency will by used at the discretion of LTV OR THEIR REPRESENTATIVE when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when:

- Lift thickness is greater than specified;
- Earthfill is at variable moisture content;
- Dirt-clogged rollers are used to compact the material;
- Rollers may not have used optimum ballast; and
- The degree of compaction is doubtful.

During construction, the frequency of testing may also be increased in the following situations:

- Adverse weather conditions;
- Breakdown of equipment;
- At the start and finish of grading;
- Material fails to meet specifications; and
- The work area is increased.

2.3 SURVEY OF EARTHWORK

The survey of specific locations will provide the basis for the record drawings and provide documentation of cover unit thicknesses. The survey will be performed by a qualified land surveyor. The major components of the survey will include the following:

1. Top of subgrade (regraded ash waste);
2. Top of drainage layer;
3. Top of cover soil;
4. Top of topsoil; and
5. As directed by THE MPCA OR THEIR REPRESENTATIVE.

The survey will be conducted on a 50' x 50' grid with survey points at all major breaks in slope (i.e., top and toe of slope). The grid will be extended vertically to enable calculation of vertical thicknesses of the cover component.

3.0 Synthetic Liner Installation

3.1 EARTHWORK

There are certain aspects of earthwork that directly affect the geomembrane liner installation. These are the subgrade surface conditions and the backfill in the anchor trench.

3.1.1 Surface Preparation

The subgrade surface for the geomembrane liner will be observed by LTV OR THEIR REPRESENTATIVE during smooth drum rolling to detect soft or loose areas.

The INSTALLER shall certify in writing that the surface on which the geomembrane will be installed is acceptable. The certificate of acceptance shall be given by the INSTALLER to LTV OR THEIR REPRESENTATIVE prior to commencement of geomembrane installation in the area under consideration. Commencement of geomembrane installation prior to receipt of Certificate of Subgrade Acceptance shall mean the installer has accepted the subgrade.

After the supporting soil has been accepted by the INSTALLER, it shall be the INSTALLER'S responsibility to indicate to LTV OR THEIR REPRESENTATIVE any change in the supporting soil condition that may require repair work.

3.1.2 Backfilling of the LLDPE

LTV OR THEIR REPRESENTATIVE will observe the backfilling operation and verify that the geomembrane is extended a minimum of 5 feet as shown on Plans.

3.2 LLDPE INSTALLATION

Construction quality assurance will be performed by LTV OR THEIR REPRESENTATIVE on all components of LLDPE geomembrane installation. Criteria to be used for determination of acceptability of the installation will be as identified in the project plans and specifications.

3.2.1 Laboratory and Field Tests

Tables 2 presents laboratory tests methods and criteria for determining acceptability of geomembrane installation.

3.2.2 Field Panel Placement

LTV OR THEIR REPRESENTATIVE and the INSTALLER will agree to renumber an "identification code" for each field panel. The number-letter system will be consistent with the proposed panel layout developed by the INSTALLER. LTV OR THEIR REPRESENTATIVE will maintain a list showing the correspondence between panel numbers and roll numbers. The panel identification shall be clearly marked on each panel immediately after it has been placed.

LTV OR THEIR REPRESENTATIVE will verify that field panels are installed at the location indicated on the INSTALLER'S proposed panel layout plan or with agreed modifications. LTV OR THEIR REPRESENTATIVE will maintain a record drawing of the installed panel layout.

3.2.3 Trial Welds

LTV OR THEIR REPRESENTATIVE shall observe and verify that all trial weld procedures and testing methods are conducted according to the specifications. The following information will be logged:

- Date and time of the trial weld completion;
- Ambient temperature;
- Apparatus identification;
- Seaming technician;
- Barrel temperature for extrusion welding;
- Preheat temperature or preheat setting for extrusion welding;
- Wedge temperature for fusion welding;
- Trial weld number; and
- Pass or fail of the trial weld.

3.2.4 Field Seaming

A seam numbering system compatible with the panel numbering system shall be agreed upon between LTV OR THEIR REPRESENTATIVE and the INSTALLER. Weather conditions such as wind and ambient temperature will be logged for each construction day. At the start of each seam, the seamer shall clearly write the following information on the panel adjacent to each seam:

- Seamer ID;
- Tool No.;
- Time started; and
- Seam No.

3.2.4.1 Seam Preparation

LTV OR THEIR REPRESENTATIVE shall verify that:

- prior to seaming, the seam area is clean and free of moisture, dust, dirt, debris of any kind, and foreign material;

- if seam overlap grinding is required, the process is completed according to the Geomembrane Manufacturer's instructions within one hour of the seaming operation and done in a way that does not damage the geomembrane; and
- seams are aligned with the fewest possible number of wrinkles and "fishmouths."

3.2.4.2 Extrusion Process

The INSTALLER shall provide LTV OR THEIR REPRESENTATIVE with certification that the extrudate meets the specifications and is comprised of the same resin type as the geomembrane sheeting. The following information for each extrusion welded seam will be logged:

- Date and time of the beginning of each seam;
- Seam number;
- Seam length;
- Seaming technician; and
- Apparatus identification.

3.2.4.3 Fusion Process

The following information will be logged:

- Date and time of the beginning of each seam;
- Seam number;
- Seam length;
- Seaming technician; and
- Apparatus identification.

3.2.5 Nondestructive Seam Testing

The INSTALLER shall nondestructively test all field seams over their full length using a vacuum test unit, air pressure test (for double fusion seams only), or other approved method. The purpose of nondestructive tests is to check the continuity of seams. It does not provide any information on seam strength. Continuity testing shall be carried out as the seaming work progresses, not at the completion of all field seaming.

The following information will be logged:

- Date and time of the beginning of each test;
- Seam number;
- Air pressure at the beginning and end of the test for double fusion welded seams;
- Length of time that the air pressure was held for double fusion welded seams; and
- Result of the test (pass or fail).

3.2.6 Destructive Seam Testing

LTV OR THEIR REPRESENTATIVE will select locations where seam samples will be cut out for laboratory testing. Those locations will be established as follows:

- A minimum frequency of one test location per 500 feet (150 m) of seam length. This minimum frequency is to be determined as an average taken throughout the entire facility.

- A maximum frequency will be agreed upon by LTV OR THEIR REPRESENTATIVE and the INSTALLER at the resolution and/or preconstruction meeting.

- Test locations will be determined during seaming at LTV OR THEIR REPRESENTATIVE'S discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of imperfect welding.

The INSTALLER will not be informed in advance of the locations where the seam samples will be taken.

Samples shall be cut by the INSTALLER as the seaming progresses in order to have laboratory test results before the geomembrane is covered by another material. LTV OR THEIR REPRESENTATIVE will observe and verify that testing and sampling procedures are conducted in accordance with the contract documents. This will include:

- observe sample cutting;
- assign a number to each sample and mark it accordingly; and
- record sample location on the panel layout record drawing.

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with approved repair procedures. The continuity of the new seams in the repaired area shall be tested by the INSTALLER as described in Section III.B.5.

LTV OR THEIR REPRESENTATIVE will witness all field tests and mark all samples and portions with the sample number.

3.2.7 Geosynthetic Testing Laboratory

The geosynthetic testing laboratory will be selected by LTV OR THEIR REPRESENTATIVE. Destructive test samples will be packaged and shipped under the responsibility of LTV OR THEIR REPRESENTATIVE in a manner, which will not damage the test sample. LTV OR

THEIR REPRESENTATIVE will be responsible for storage and archiving the remaining portion of the sample.

Testing will include shear strength and peel adhesion. At least five specimens will be tested for each test method. Specimens will be selected alternately by test from the samples (i.e., peel, shear, peel, shear...).

The geosynthetic testing laboratory will provide test results no more than 48 hours after they receive the samples. LTV OR THEIR REPRESENTATIVE will review laboratory test results as soon as they become available, and inform the INSTALLER of the results.

3.2.8 Defects and Repairs

All seams and non-seam areas of the geomembrane will be examined by LTV OR THEIR REPRESENTATIVE. Identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination of foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane shall be clean at the time of examination. The geomembrane surface shall be broomed or washed by the INSTALLER if the amount of dust or mud inhibits examination.

Any portion of the geomembrane exhibiting a flaw or failing a destructive or nondestructive test shall be repaired. Repair procedures shall follow the guidelines listed in the specifications. The final decision as to the appropriate repair procedure shall be agreed upon between LTV OR THEIR REPRESENTATIVE and the INSTALLER.

Each repair will be numbered and logged. Each repair shall be nondestructively tested using the methods as appropriate. Repairs, which pass the nondestructive test, will be taken as an indication of an adequate repair. Large repairs may be of sufficient extent to require destructive test sampling at the discretion of LTV OR THEIR REPRESENTATIVE. Failed tests indicate that the repair shall be redone and retested until a passing test results. LTV OR THEIR REPRESENTATIVE

will observe all nondestructive testing of repairs. The number of each repair, date, and test outcome will be logged.

When seaming of the geomembrane liner is completed (or when seaming of a large area of the geomembrane liner is completed) and prior to placing overlying materials, LTV OR THEIR REPRESENTATIVE will observe the geomembrane wrinkles. LTV OR THEIR REPRESENTATIVE will indicate to the INSTALLER which wrinkles should be cut and reseamed. The seam, thus produced, shall be tested as described in Section III.B.5.

3.2.9 Geomembrane Acceptance

The geosynthetic lining system shall be accepted by LTV OR THEIR REPRESENTATIVE when:

- the installation is finished;
- verification of the adequacy of all seams and repairs, including associated testing, is complete; and
- all documentation of installation is completed.

LTV OR THEIR REPRESENTATIVE will certify that the installation has proceeded in accordance with the Quality Assurance Plan and Specifications for the project except as noted in the documentation report.

4.0 Documentation Report and Record Drawings

The documentation report is the summary document of the construction activities throughout the project. The construction portion of the report will include discussion of all documented procedures. The report will include results from field and laboratory tests and summarize survey documentation. A summary of the documentation report is as follows:

A. Documentation drawings will be prepared for the site at a maximum scale of 1" = 80' showing top of final cover grade. These drawings will include the location of all piping, and other relevant construction details.

B. Documentation drawings will include the liner panel layout, repairs, sampling locations, and any modifications from the original panel layout submitted by the INSTALLER.

C. Final certification report will be prepared describing the construction sequence and QA/QC program, and will also include the results of field and laboratory testing.

The documentation report will be certified by a professional engineer registered in the state of Minnesota.

Tables

TABLE 1

Soils Quality Assurance Testing Requirements

Granular Drainage Layer Testing		
Test	**ASTM Method**	**Frequency**
Grain Size	D422 and D1140	1 per 1000 cubic yards
USCS Classification	D2487	
Permeability	D2434	1 per 2500 cubic yards

Coarse Aggregate Testing		
Test	**Method**	**Number of Tests**
Grain Size	D422	1/1000 L.F. trench (min 3)

TABLE 2

LLDPE Geomembrane Quality Assurance Testing Requirements

LLDPE Testing		
Test	**Reference**	**Frequency**
Material Properties (as defined in Specifications Section 02922)	NSF-54	By manufacturer Every roll provided
Visual Inspection	--	Entire sheet
Trial Seam Welding	--	Start of seaming process, every 4 hours minimum, each seamer
Non-Destructive Seam Testing	--	All seams/patches
Destructive Seam Strength Test	--	1 test per 500 L.F. seam minimum

Pass/Fail Criteria for 40-Mil LLDPE Destructive Samples	
Peel ASTM D413	45 PPI
Shear ASTM D3083	53 PPI

FTB Film Tear Bond

Appendix C

Laboratory Testing of Tailings

BRAUN INTERTEC

Braun Intertec Corporation
6801 Washington Avenue South
Minneapolis, Minnesota 55439
612-941-5600 Fax: 941-4151

Engineers and Scientists Serving the Built and Natural Environments

Constant Head Permeability-ASTM D2434

Date: 03-May-00 **Project Number:** BADX-00-1112

Client: Mr. Tom Shustarich
Wenck Associates
1800 Pioneer Creek Ctr., P.O. Box 428
Maple Plain, MN 55359

Project: Taconite Testing

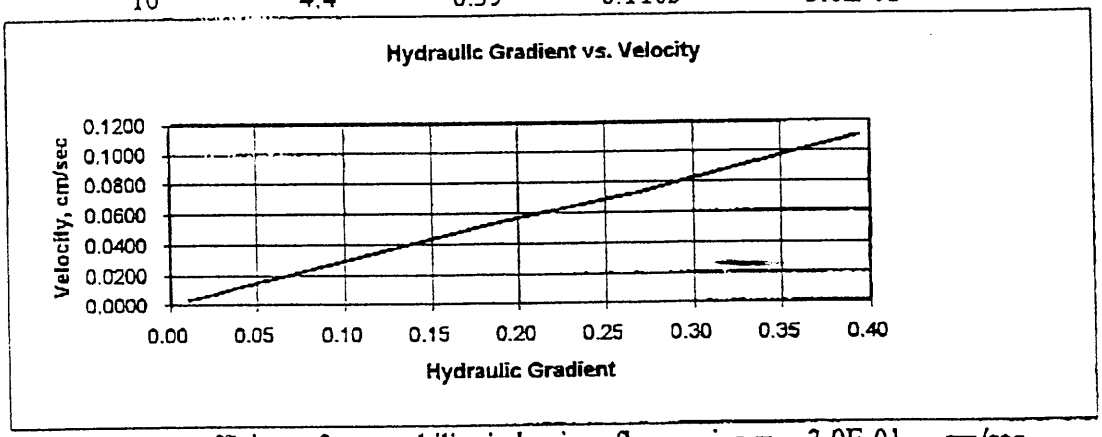
Background Information

Sample No:	1	Date Sampled:	-
Classification:	-	Date tested:	03-May-00
Sample Location:	-	Sampled by:	-
Sample type:	Remolded	Depth:	-

Test Results

Dry Density(pcf)	104.6	Maximum Density	-
Void ratio	0.58	% of Maximum	-

Trial #	Head (cm)	Hydraulic Gradient	Velocity (cm/sec)	Coefficient of Permeability(cm/sec)
1	0.1	0.01	0.0034	3.0E-01
2	0.3	0.03	0.0077	2.8E-01
3	0.4	0.04	0.0109	3.0E-01
4	0.6	0.05	0.0146	3.0E-01
5	0.7	0.06	0.0185	3.0E-01
6	0.9	0.08	0.0233	3.1E-01
7	1.3	0.12	0.0335	3.0E-01
8	2.1	0.19	0.0537	3.1E-01
9	3.0	0.27	0.0730	3.0E-01
10	4.4	0.39	0.1103	3.0E-01



Average coefficient of permeability in laminar flow region = 3.0E-01 cm/sec

Remarks:

Sincerely,
Braun Intertec Corporation

Benjamin Pomroy
Geotechnical Laboratory Supervisor

Appendix D

HELP Model Calculations

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**********
**                                                                              **
**                                                                              **
**                                                                              **
**                HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                 **
**                     HELP MODEL VERSION 3.05  (30 MARCH 1996)                 **
**                     DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                     USAE WATERWAYS EXPERIMENT STATION                        **
**                FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                              **
**********                                                                      **
**********
```

PRECIPITATION DATA FILE: T:\HELPSAM\HELP305\ltv.D4
TEMPERATURE DATA FILE: T:\HELPSAM\HELP305\ltv.D7
SOLAR RADIATION DATA FILE: T:\HELPSAM\HELP305\ltv.D13
EVAPOTRANSPIRATION DATA: T:\HELPSAM\HELP305\ltv.D11
SOIL AND DESIGN DATA FILE: T:\HELPSAM\HELP305\ltv1.D10
OUTPUT DATA FILE: T:\HELPSAM\HELP305\ltv2.OUT

TIME: 16:10 DATE: 5/ 9/2000

****

TITLE: LTV Tailings Basin Closure

****

NOTE: INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.

LAYER 1

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 8

THICKNESS	=	6.00	INCHES
POROSITY	=	0.4630	VOL/VOL
FIELD CAPACITY	=	0.2320	VOL/VOL
WILTING POINT	=	0.1160	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2731	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.369999994000E-03	CM/SEC

NOTE: SATURATED HYDRAULIC CONDUCTIVITY IS MULTIPLIED BY 3.00
FOR ROOT CHANNELS IN TOP HALF OF EVAPORATIVE ZONE.

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 9

THICKNESS	=	12.00	INCHES
POROSITY	=	0.5010	VOL/VOL
FIELD CAPACITY	=	0.2840	VOL/VOL
WILTING POINT	=	0.1350	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2180	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.190000006000E-03	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	6.00	INCHES
POROSITY	=	0.4170	VOL/VOL
FIELD CAPACITY	=	0.0450	VOL/VOL
WILTING POINT	=	0.0180	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0450	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.300000012000	CM/SEC
SLOPE	=	15.00	PERCENT
DRAINAGE LENGTH	=	175.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.04 INCHES
POROSITY	=	0.0000 VOL/VOL
FIELD CAPACITY	=	0.0000 VOL/VOL
WILTING POINT	=	0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12 CM/SEC
FML PINHOLE DENSITY	=	4.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	4.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	2 - EXCELLENT

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 30

THICKNESS	=	300.00 INCHES
POROSITY	=	0.5410 VOL/VOL
FIELD CAPACITY	=	0.1870 VOL/VOL
WILTING POINT	=	0.0470 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1870 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.499999987000E-04 CM/SEC

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS COMPUTED FROM DEFAULT SOIL DATA BASE USING SOIL TEXTURE # 8 WITH A FAIR STAND OF GRASS, A SURFACE SLOPE OF 15.% AND A SLOPE LENGTH OF 175. FEET.

SCS RUNOFF CURVE NUMBER	=	80.90	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	18.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	4.254	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	8.790	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	2.316	INCHES
INITIAL SNOW WATER	=	0.986	INCHES
INITIAL WATER IN LAYER MATERIALS	=	60.624	INCHES
TOTAL INITIAL WATER	=	61.610	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
Duluth Minnesota

STATION LATITUDE	=	46.50	DEGREES
MAXIMUM LEAF AREA INDEX	=	2.00	
START OF GROWING SEASON (JULIAN DATE)	=	144	
END OF GROWING SEASON (JULIAN DATE)	=	261	
EVAPORATIVE ZONE DEPTH	=	18.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	11.20	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	70.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	66.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	74.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	74.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DULUTH MINNESOTA

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
1.20	0.90	1.78	2.16	3.15	3.96
3.96	4.12	3.26	2.21	1.69	1.29

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DULUTH MINNESOTA

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
6.30	12.00	22.90	38.30	50.30	59.40
65.30	63.20	54.00	44.20	28.20	13.80

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR DULUTH MINNESOTA
AND STATION LATITUDE = 46.50 DEGREES

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	1.09	0.72	1.81	2.15	3.52	4.53
	3.72	3.43	3.13	1.54	1.61	1.47
STD. DEVIATIONS	0.54	0.33	0.54	1.22	1.36	2.13
	1.39	1.52	0.69	0.96	0.99	0.61
RUNOFF						
TOTALS	0.001	0.038	1.667	1.781	0.287	0.090
	0.044	0.013	0.000	0.008	0.072	0.028
STD. DEVIATIONS	0.003	0.081	1.024	0.845	0.288	0.237
	0.073	0.036	0.001	0.017	0.129	0.086

EVAPOTRANSPIRATION

TOTALS	0.421	0.480	0.505	0.406	3.347	4.140
	4.679	2.890	2.598	1.325	0.582	0.389
STD. DEVIATIONS	0.105	0.099	0.085	0.229	0.673	0.951
	1.424	1.080	0.528	0.258	0.159	0.060

LATERAL DRAINAGE COLLECTED FROM LAYER 3

TOTALS	0.0000	0.0000	0.0000	0.1087	1.3677	0.4393
	0.3657	0.0228	0.1469	0.2214	0.1921	0.0131
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.3439	0.7902	0.8898
	0.6944	0.0646	0.4581	0.4736	0.5411	0.0283

PERCOLATION/LEAKAGE THROUGH LAYER 4

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001
	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 5

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0002	0.0001
	0.0001	0.0000	0.0000	0.0000	0.0001	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 4

AVERAGES	0.0000	0.0000	0.0000	0.0025	0.0309	0.0103
	0.0083	0.0005	0.0034	0.0050	0.0045	0.0003
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0080	0.0179	0.0208
	0.0157	0.0015	0.0107	0.0107	0.0127	0.0006

****

****

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	28.72 (2.922)	104260.9	100.00
RUNOFF	4.031 (1.3496)	14631.11	14.033
EVAPOTRANSPIRATION	21.761 (1.8884)	78993.07	75.765
LATERAL DRAINAGE COLLECTED FROM LAYER 3	2.87776 (2.13469)	10446.284	10.01937
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.00025 (0.00019)	0.910	0.00087
AVERAGE HEAD ON TOP OF LAYER 4	0.005 (0.004)		
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.00025 (0.00028)	0.890	0.00085
CHANGE IN WATER STORAGE	0.018 (1.0893)	66.63	0.064

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 10

	(INCHES)	(CU. FT.)
PRECIPITATION	3.44	12487.200
RUNOFF	1.699	6167.7285
DRAINAGE COLLECTED FROM LAYER 3	1.23421	4480.19043
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.000108	0.39270
AVERAGE HEAD ON TOP OF LAYER 4	0.866	
MAXIMUM HEAD ON TOP OF LAYER 4	1.692	
LOCATION OF MAXIMUM HEAD IN LAYER 3 (DISTANCE FROM DRAIN)	0.2 FEET	
PERCOLATION/LEAKAGE THROUGH LAYER 5	0.000536	1.94421
SNOW WATER	4.48	16276.5537

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3948
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.1287

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 10

LAYER	(INCHES)	(VOL/VOL)
1	1.5091	0.2515
2	3.0686	0.2557
3	0.2700	0.0450
4	0.0000	0.0000
5	56.0998	0.1870
SNOW WATER	0.846	

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Appendix E

Surface Water Calculations

LTV Coal Ash Disposal Area, 5.8-Acre Closure
Surface Water Calculations

Peak Run-off Computations

Determine T_c in Min. Using SCS Lag Equation Below:

$$T_c = \frac{100\,L^{0.8}\left[(1000/C)-9\right]^{0.7}}{1900\,S^{0.5}}$$

Where: L = longest flow path (varies)
C = SCS run-off curve # (use average of 82)
S = Average watershed slope in % (varies)

The runoff coefficient of 0.82 was conservatively selected based upon the SCS TR-55 manual assuming that the landfill cap represents agricultural meadow occasionally mowed with grass covered exceeding 75% the coefficients range from 0.3 to 0.78 depending on the hydrologic soil group, therefore our estimate is conservative to take into account limited grass development in the period immediately following construction

T_c has two components:

A) From peak of cap to toe; L = 175', S = 20%
B) From west toe of slope to sedimentation pond; L = 20', S = 3%

$$T_{cA} = \frac{100\,(175)^{0.8}\left[(1000/82)-9\right]^{0.7}}{1900\,(20)^{0.5}} = 1.65$$

$$T_{cB} = \frac{100\,(20)^{0.8}\left[(1000/82)-9\right]^{0.7}}{1900\,(3)^{0.5}} = 0.75$$

$$T_c = T_{CA} + T_{CB} = 2.4\,\text{min}.$$

Determine rainfall intensity for 25-year return period and duration ~~appro~~ximating T_c

From "Applied Hydrology" by Chow, et. al. (Ref 1)

24 year, 15 min. precipitation = 0.7"
100 year, 15 min. precipitation = 0.9"

Interpolate for 25 year, 15 min. storm that conservatively represents peak flow during a 24-hour, 25-year storm.

P_T 25 yr = a $P_{T\ 2\,yr}$ + b $P_{100\,yr.}$ (Ref 1)

$a_{25} = 0.293$, $b_{25} = 0.669$ (Ref 1)

P_T 25 yr = .293(0.7) + 0.669 (.9) = 0.81″

Peak I for T_c = 4 x 0.81″ = 3.24″/hr

Determine peak flow Q_P

Q_P = CIA = 0.82 (3.24)(5.8) = 15.4 cfs

= peak run-off from completed landfill cap

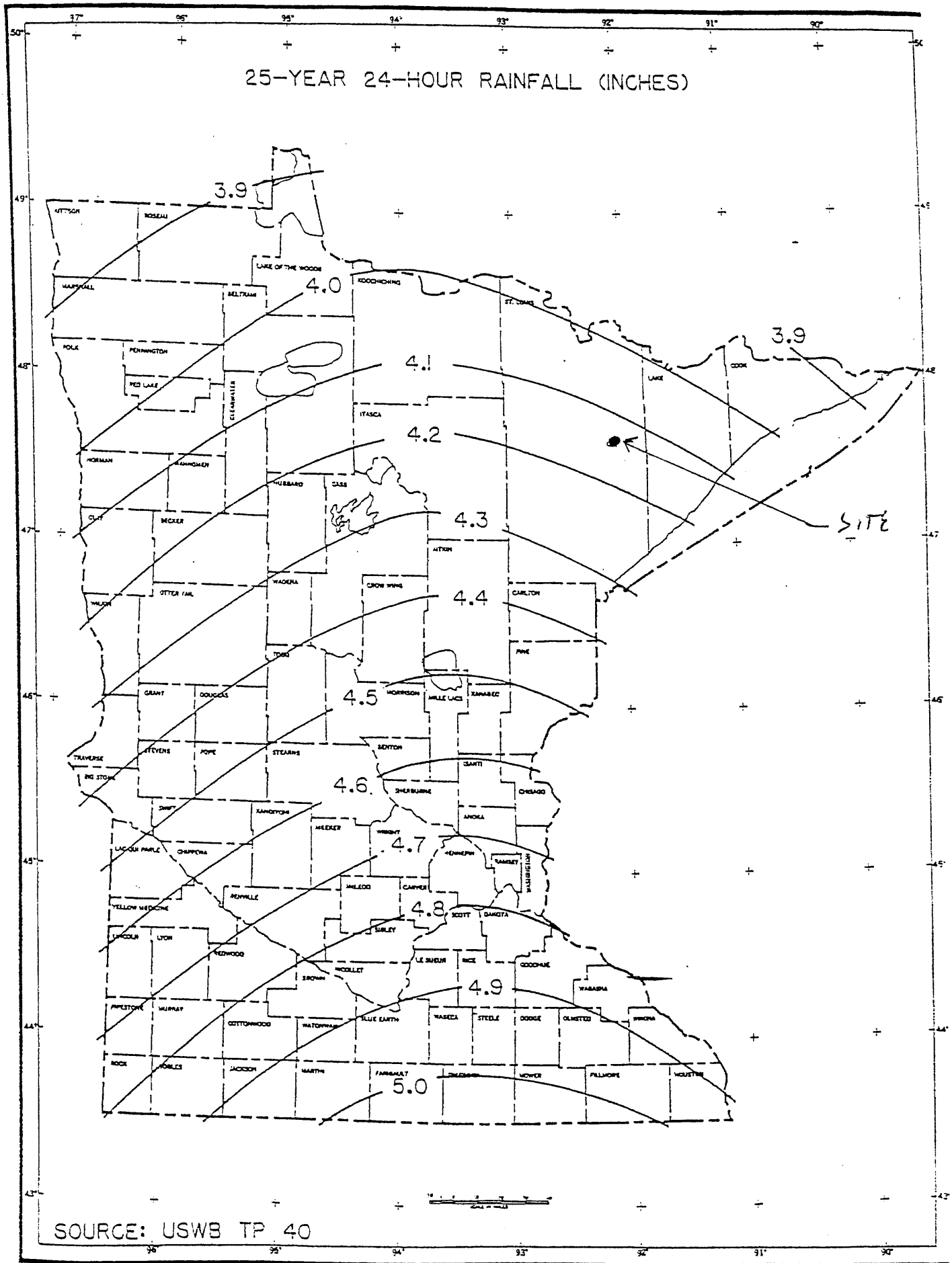
Determine storage requirements

Assume:
- 25 year, 24 hour storm = 4.1″ (see attached Figure 1-6)
- Pond has no outlet - conservative
- average SCS curve # = 82

Total run-off = 2.25″ x 1′/12″ x 5.8 AC = 1.09 ac/ft

With no outlet, ponding at the site needs to contain 1.09 ac/ft of water.

The proposed new sedimentation pond is to be located immediately north of the closed coal ash disposal area. The proposed pond will have a storage capacity of approximately 1.75 ac/ft of water. The calculations were completed assuming storage from the pond bottom (1,665 feet) to an elevation of 1,668 feet. This provides for 2 feet of freeboard due to the fact that the riprap pond outlet structure will be at elevation 1,670 feet. Based on the calculations completed, the pond far exceeds the containment requirement for a 25-year, 24-hour storm event.


25-YEAR 24-HOUR RAINFALL (INCHES)
3.9
4.0
4.1
4.2
4.3
4.4
4.5
4.6
4.7
4.8
4.9
5.0
3.9
SITE
SOURCE: USWB TP 40

texture is given in appendix A for determining the HSG classification for disturbed soils.

Cover type

Table 2-2 addresses most cover types, such as vegetation, bare soil, and impervious surfaces. There are a number of methods for determining cover type. The most common are field reconnaissance, aerial photographs, and land use maps.

Treatment

Treatment is a cover type modifier (used only in table 2-2b) to describe the management of cultivated agricultural lands. It includes mechanical practices, such as contouring and terracing, and management practices, such as crop rotations and reduced or no tillage.

Hydrologic condition

Hydrologic condition indicates the effects of cover type and treatment on infiltration and runoff and is generally estimated from density of plant and residue cover on sample areas. *Good* hydrologic condition indicates that the soil usually has a low runoff potential for that specific hydrologic soil group, cover type, and treatment. Some factors to consider in estimating the effect of cover on infiltration and runoff are (a) canopy or density of lawns, crops, or other vegetative areas; (b) amount of year-round cover; (c) amount of grass or close-seeded legumes in rotations; (d) percent of residue cover; and (e) degree of surface roughness.

Table 2-1.—Runoff depth for selected CN's and rainfall amounts[1]

Rainfall	Runoff depth for curve number of—												
	40	45	50	55	60	65	70	75	80	85	90	95	98
	inches												
1.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.08	0.17	0.32	0.56	0.79
1.2	.00	.00	.00	.00	.00	.00	.03	.07	.15	.27	.46	.74	.99
1.4	.00	.00	.00	.00	.00	.02	.06	.13	.24	.39	.61	.92	1.18
1.6	.00	.00	.00	.00	.01	.05	.11	.20	.34	.52	.76	1.11	1.38
1.8	.00	.00	.00	.00	.03	.09	.17	.29	.44	.65	.93	1.29	1.58
2.0	.00	.00	.00	.02	.06	.14	.24	.38	.56	.80	1.09	1.48	1.77
2.5	.00	.00	.02	.08	.17	.30	.46	.65	.89	1.18	1.53	1.96	2.27
3.0	.00	.02	.09	.19	.33	.51	.71	.96	1.25	1.59	1.98	2.45	2.77
3.5	.02	.08	.20	.35	.53	.75	1.01	1.30	1.64	2.02	2.45	2.94	3.27
4.0	.06	.18	.33	.53	.76	1.03	1.33	1.67	2.04	2.46	2.92	3.43	3.77
4.5	.14	.30	.50	.74	1.02	1.33	1.67	2.05	2.46	2.91	3.40	3.92	4.26
5.0	.24	.44	.69	.98	1.30	1.65	2.04	2.45	2.89	3.37	3.88	4.42	4.76
6.0	.50	.80	1.14	1.52	1.92	2.35	2.81	3.28	3.78	4.30	4.85	5.41	5.76
7.0	.84	1.24	1.68	2.12	2.60	3.10	3.62	4.15	4.69	5.25	5.82	6.41	6.76
8.0	1.25	1.74	2.25	2.78	3.33	3.89	4.46	5.04	5.63	6.21	6.81	7.40	7.76
9.0	1.71	2.29	2.88	3.49	4.10	4.72	5.33	5.95	6.57	7.18	7.79	8.40	8.76
10.0	2.23	2.89	3.56	4.23	4.90	5.56	6.22	6.88	7.52	8.16	8.78	9.40	9.76
11.0	2.78	3.52	4.26	5.00	5.72	6.43	7.13	7.81	8.48	9.13	9.77	10.39	10.76
12.0	3.38	4.19	5.00	5.79	6.56	7.32	8.05	8.76	9.45	10.11	10.76	11.39	11.76
13.0	4.00	4.89	5.76	6.61	7.42	8.21	8.98	9.71	10.42	11.10	11.76	12.39	12.76
14.0	4.65	5.62	6.55	7.44	8.30	9.12	9.91	10.67	11.39	12.08	12.75	13.39	13.76
15.0	5.33	6.36	7.35	8.29	9.19	10.04	10.85	11.63	12.37	13.07	13.74	14.39	14.76

[1]Interpolate the values shown to obtain runoff depths for CN's or rainfall amounts not shown.

Table 2-2c.—Runoff curve numbers for other agricultural lands[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing.[2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element.[3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	430	48	65	73
Woods—grass combination (orchard or tree farm).[5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods.[6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	430	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Poor:* <50% ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: >75% ground cover and lightly or only occasionally grazed.

[3]*Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.

[4]Actual curve number is less than 30; use CN = 30 for runoff computations.

[5]CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.

[6]*Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.