**Minnesota Department of Natural Resources**
Division of Lands and Minerals
500 Lafayette Road, Box 45
St. Paul, Minnesota 55155-4045

February 11, 2011

Mr. Dan Wolf
Northshore Mining Company
PO Box 207
Babbitt, MN 55706

**RE: Watershed Mitigation Plan**

Dear Dan:

In an August 11, 2009 letter from Steve Dewar, approval was granted to Northshore for an amendment request to extend the pit limit to the east (33.9 acres in Sec 9), and expand the footprint of the E30 surface stockpile. As a condition of this amendment Northshore was required to submit a watershed mitigation plan to address the watershed impacts from mining in the block 20 watershed divide.

Conditions and requirements are driven by both the MN Mineland Reclamation Rules section 6130.2200 Management of Runoff, and

MN rules 6115.0280 Alterations of Public Waters for Mining, specifically:

*Subpart 1.*
*Goals.*

*It is the goal of the department to ensure that alterations of public waters for mining or reclamation of mining areas will minimize adverse environmental effects, preserve water resources to the maximum extent feasible and practical, and encourage the planning of future land and water utilization while at the same time promoting the orderly development of mining and the use of sound mining practices.*

*Subpart 5.*
*Compensatory measures for detrimental aspects of mining.*

*Whenever metallic, nonmetallic, and peat mining activities in the beds of public waters will result in detrimental effects on the physical and biological character of public waters, measures to compensate for the detrimental aspects shall be required in the permit conditions.*

DNR representatives from the Divisions of Ecological and Water Resources, Lands and Minerals, Fish and Wildlife, and Parks and Trails developed and submitted to Northshore a set of guidelines aimed at post-mining aquatic enhancement and recreational opportunities for the Peter Mitchell Pit. Northshore responded with the May, 2010 (draft) **Peter Mitchell Pit concept Mitigation Plan: Aquatic Habitat Enhancement through In-Pit Disposal of Overburden and Rock.**

We deem the implementation of the in-pit aquatic enhancement plan to be acceptable mitigation for watershed alterations with emphasis on the following provision:

*In the annual report due by January 31 each year, please provide an update on the planning and progress to this end. Although it may not be possible to implement the strategic in-pit placement of materials for aquatic enhancement in the very near future, we believe that plans for the post mining pit resource can begin before then, especially in regard to what will be eventual shoreland and upland landscape.*

Based on Northshore's estimated total ore reserves and the associated waste stripping volumes, a rough estimate was made of the costs associated with implementing the plan. This estimate represents the additional cost incurred by Northshore due to the restrictions on in-pit stockpile heights and increased reclamation area. It has been appended to the final mitigation plan.

We understand that Northshore applied for an IRR Innovative Reclamation grant. We think this is an excellent idea. Such a project would actively involve Northshore staff and other professionals in developing a process and methods to use toward achieving the goals outlined in the DNR guidelines, the long range Mitigation Plan, and the spirit of the Laurentian Vision.

Sincerely,

Jennifer Engstrom
Reclamation Manager
DNR Division of Lands and Minerals

c: Anne Jagunich, LAM Hibbing
Julie Jordan, LAM Hibbing
Kate Gunderson, LAM Hibbing
John Engesser, LAM Hibbing
Michael Crotteau, EWR Grand Rapids

# *Peter Mitchell Pit Concept Mitigation Plan*

## *Aquatic Habitat Enhancement through In-Pit Disposal of Overburden and Rock*

***Prepared for***
***Northshore Mining Company***

***May 2010***

BARR

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# Peter Mitchell Pit Concept Mitigation Plan

# May 2010

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## 1.1 Executive Summary

This Concept Mitigation Plan evaluates the feasibility of using in-pit disposal of overburden and rock to create aquatic habitat in the Peter Mitchell Mine Pit (PMP) following closure and refilling of the pit. The creation of aquatic habitat is part of a preferred mitigation option for the PMP which includes five components: 1) Creation of littoral zones within the PMP, 2) Creation of wetlands within the PMP, 3) Evaluation of effects of flow increases on the Dunka River, 4) Evaluation of effects of flow decreases on the Partridge River, and 5) Public access and use of the PMP lake after mining.

The Minnesota Department of Natural Resources (MDNR) provided Northshore Mining Company (Northshore) with a set of assumptions and guidelines that should be met as part of in-pit stockpiling to adequately develop aquatic habitat in the pit. This report assesses the feasibility of Northshore Mining Company's current mine plan to develop littoral areas meeting these guidelines following closure of the PMP. At present, it cannot be determined if there is sufficient material to meet the guidelines for the creation of aquatic habitat presented by the MDNR until more detailed mine planning is completed. The amount of littoral and wetland area created will depend on the sequence of mining within the pit, the amount of material stockpiled, and other operational factors (e.g. haul distances, stripping ratios, fleet size, etc.). These elements are likely to change over the life of the mine, limiting the level of detail included in this mitigation plan.

Figure 1 presents the current estimate of ultimate topography of the PMP without in-pit stockpiling. Figure 2 presents the current (2007) pit topography. Figure 3 presents the likely areas for the development of littoral areas. It should be noted that the ultimate design of the pit lake including in-pit stockpiles and littoral zones will depend on the future operations of the PMP. The annual operating plan for 2011 will be developed with a focus on the development of littoral zones.

This report addresses items 1, 2, and 5 of the preferred mitigation option. This report does not address flow impacts to the Dunka River (item 3) or Partridge River (item 4). There is adequate time between the present and proposed pit filling date (approximately 2070) to develop and implement a monitoring plan to assess ecologic and hydrologic impacts to those rivers.

## 1.2 History of the Peter Mitchell Pit

The Peter Mitchell Pit (PMP) is currently operated by Northshore Mining Company; the pit is located 4 miles south of Babbitt. The pit straddles a major watershed divide between the Rainy

River-Hudson Bay drainage basin and the Lake Superior basin. Development of the mining pit was begun in the 1950s and has continued on a nearly continuous basis since then. During the course of mining, ridges or "pillars" of ore have been temporarily left in place; these pillars currently act to separate the eastern part of the pit draining to the Dunka River (Rainy River basin) and the western part, which drains to the Partridge River and ultimately to Lake Superior. Current PMP topography is shown in Figure 2. Northshore has reached a point in the development of the Peter Mitchell Mine where the ore that currently divides the pit needs to be removed. The mining of this ore is depicted in the Permit to Mine for the Peter Mitchell Pit and is not forbidden by the Minnesota rules under which the Permit to Mine was issued.

The hydrologic effects of the long-term development plan were calculated and described in a November 2008 report by Barr Engineering entitled *Long-Range Hydrology Study*. For about the next 70 years of mining, the effect on flows in the two rivers will not be significant because pumping from the pit can be directed appropriately to maintain stream flow. However, after mining ceases and the pits refill, the mining of the ore will have permanently diverted approximately 7 square miles of drainage area from the Partridge River to the Dunka River.

## 1.3 Mitigation Options for the Peter Mitchell Pit

Options for minimizing or mitigating the impacts of the drainage area diversion were investigated by Northshore Mining Company and submitted to the MDNR in a May 21, 2009 letter entitled *Potential Mitigation Measures for Effects of Watershed Modifications at the Peter Mitchell Mine*. That letter concluded that the preferred option is mitigating for watershed changes. This option includes five possible components: 1) Creation of littoral zones within the PMP, 2) Creation of wetlands within the PMP, 3) Evaluation of effects of flow increases on the Dunka River, 4) Evaluation of effects of flow decreases on the Partridge River, and 5) Public access and use of the PMP lake after mining.

The major advantage of that option is that it results in an end-use condition that does not require maintenance or produce a possible risk to public health and safety. In addition, it enhances the ecological and recreational value of the pit lake that will result from mining. This option also reinforces the State's mandate to promote the orderly development of mining and the use of sound mining practices.

## 1.4 In-Pit Disposal of Overburden and Rock

As a component of a plan to mitigate the loss of stream channel and watershed, it is proposed that surface overburden and rock materials be disposed in the PMP in such a fashion that aquatic habitat will be enhanced when natural water inflow into the pit reaches its ultimate stable water level following pit closure at a future unknown date (taconite ore production in the PMP is expected to continue until around year 2070). This section describes the guidelines specific developed by the MDNR for in-pit stockpiling. Prior to addressing these guidelines, however, it is necessary to understand the elements of PMP operation which may impact in-pit stockpile development.

### 1.4.1 Operational Factors Affecting In-pit Stockpiling

Several aspects of mine operation will impact the ability of Northshore to develop littoral areas meeting the MDNR's guidelines. These factors may affect the area available for in-pit stockpiling and/or the amount of material available; several of these factors are dynamic and interdependent:

- **Mining Plan** – The mining plan will establish areas of mining activity in the PMP for the rest of the life of the mine. Ore extraction is quantified and scheduled based on a grade control block model, which then establishes backfilling priorities for the reclamation plan.

- **Strip Ratios** – Volumetric calculations are made based on strip ratios within the PMP. From there, a general scheduling outline can be started which shows how the backfilling may take place.

- **Haulage Distance** – In addition to the volumetric calculations made from the mining plan and stripping ratios, the distance the material is hauled will need to be known. A mine plan with the shortest possible haulage distance is the most desirable for a mining company. The shortest haulage distance possible to stockpiles and then to a backfilling dump face is the basic engineering criteria and will require significant design work in the development of the final mitigation plan.

- **Haul Road Design** – This is a crucial design factor that will require specialized engineering, since new haul roads will need to be constructed for a pit backfilling program. The additional costs of these haul roads can be reduced with an efficiently designed haul road, through reduced fuel costs, tire costs and haul distances.

- **Future Overburden Stockpiles** - The design of a stockpile (access ramps, tip face, shape etc.) will heavily influence the haulage costs, as well as re-handle costs. Minimizing all of these costs through design will impact the mitigation plan.

- **Fleet Size and Availability** – The larger the fleet and the more available (lower downtime), the faster material will be moved and placed. The fleet size and availability at the PMP will change through the life of the PMP, impacting the design and construction of in-pit stockpiles.

- **Equipment Selection –** Through the remaining life of the PMP, the machinery that is currently being used will be replaced at some stage. The type of machinery chosen as replacement equipment will affect any backfilling plan, as slight difference in design or performance can change projected tonnages by thousands of tons over several years. Also, different machinery will mean changes in productivity (i.e. faster trucks, loading rates etc.)

- **Backfilling Material** – The type of material being loaded and hauled (i.e. topsoil through to fractured chert) will affect timing. This is due to differences in density and rock geometry.

- **Bulking Factors** – Density differences of stockpiles will need to be quantified for backfilling volume calculations and design.

- **Life of Mine –** The market for iron ore is constantly changing, which may affect what areas Northshore will mine and mining sequence. Such changes will impact the amount of material available for backfilling and the locations were backfilling is feasible.

### 1.4.2 MDNR Guidelines for Aquatic Habitat Creation

The MDNR developed 14 design guidelines for in-pit stockpiling. Those guidelines are listed in this section. A discussion of how Northshore will seek to meet these guidelines (referencing maps and/or calculations, where appropriate) follows each guideline:

1. The ultimate water level in the pit will be approximately 1500 feet above sea level (NAVD1929 datum).

The ultimate pit water level was estimated in the *Long-Range Hydrology Study* report submitted to the MDNR in November 2008. The water level is based on topographic data at the northeast

end of the pit (the location of the planned outlet). The 1,500 ft MSL elevation is shown on Figure 1.

2. The productive littoral zone could extend to a water depth of up to approximately 30 feet in mine pits on the Iron Range.

Northshore will place rock stockpiles in an effort to maximize the area between 1,470 ft MSL and 1,500 ft MSL as is feasible according to their mine plan. Likely areas for in-pit stockpiles are presented in Figure 3. The area where in-pit stockpiling may create productive littoral zones and the amount of material necessary to create those zones depends on several factors (see Section 1.4.1). Figure 4 presents limited demonstration of how in-pit stockpiling may create littoral areas.

3. The productive shallow marsh wetland zone will extend to a water depth of no greater than 6 feet.

In areas where in-pit stockpiles are between 1,470 ft MSL and 1,500 ft MSL, a smaller area will be created with elevations between 1,494 ft MSL and 1,500 ft MSL. Likely areas for littoral zones (which include some shallow marsh zones) are shown in Figure 3. A small area of shallow marsh is presented in Figure 4.

4. The desirable elevation range of the top of the stockpiles will be between 1515 and 1470 above mean sea level or between 30 feet below and 15 feet above the ultimate pit water level.

Northshore will seek to limit the top of rock stockpiles to elevations between 1,470 ft MSL and 1,515 ft MSL as is feasible according to their mine plan. Rock that cannot be developed into littoral areas will be backfilled into the pit where possible to limit the amount of rock volume above 1,515 ft MSL. A significant amount of rock will need to be stockpiled above elevation 1,515 ft MSL because in-pit areas will not always be available for stockpiling.

5. The desirable slope range of the stockpiles for creation of littoral zone will be between 3 percent and 7 percent.

Northshore will grade the surface of in-pit stockpiles with elevations between 1,470 ft MSL and 1,500 ft MSL to create slopes between 3 percent and 7 percent.

6. The desirable slope range of stockpiles for creation of shallow marsh wetlands is between 0 percent and 2 percent.

Northshore will grade the surface of in-pit stockpiles with elevations between 1,494 ft MSL and 1,500 ft MSL (shallow marsh wetland zones) to create slopes between 0 percent and 2 percent.

7. The minimum littoral zone in a productive lake is approximately 20 percent of the lake surface area. A sampling of littoral zone area of large lakes in St. Louis and Lake counties in northeastern Minnesota have been found to average 32 percent of the lake surface area (with a range of 20 to 51 percent). The final PMP area will encompass approximately 5350 acres. Estimated future water surface will be approximately 3200 acres. Therefore, target acreage of littoral zone and adjacent/connected wetland areas within the PMP should encompass a minimum of 640 acres (20 percent) (habitat inventory) and maximized to the extent practicable.

The littoral area of the PMP has been subdivided into three zones. The first zone, referred to as the marsh/wetland zone, includes areas where the depth is 0 to 6 feet and the slope is less than 2 percent. The second zone, called the shallow littoral zone, is any area where the depth is 0 to 6 feet and the slope is between 3 and 7 percent. The third and final zone, considered the deep littoral zone, includes areas where the depth is between 6 and 30 feet and slopes are between 3 and 7 percent. The sum of these areas is the productive littoral zone.

The future pit lake water surface is currently estimated to be approximately 2,800 acres at an elevation of 1,500 ft MSL, although the final pit lake area may vary according to stockpile location (Note: this is a correction to the data presented in Figure 8 of the *Long-Range Hydrology Study*, which presents a pit-lake surface area of 1,320 acres at an elevation of 1,500 ft MSL). Northshore will place rock and overburden while seeking to achieve a productive littoral area up to 20 percent of the pit lake area while working in a manner that is feasible for long-term mining operations (see Section 1.4.1). Those areas that are most likely to be developed for littoral areas (based on the current mine plan) are shown conceptually in Figure 3.

8. Shoreline irregularity, complete with bays and inlets, is highly recommended to enhance aquatic habitat and general aesthetics.

While placing rock for the development of littoral areas, Northshore will seek to provide shoreline irregularity in the form of bays and inlets. These areas may occur on either the north side of the pit or the south side of the pit, depending upon the location of rock stockpiles. The specific locations and dimensions of shoreline irregularity will be the result of Northshore's planned mining sequence.

9. The creation of islands is encouraged and will be included in the habitat inventory. Some small islands (less than 2 acres in size) containing bare course rock is encouraged for nesting opportunities for ground nesting birds.

While placing rock for the development of littoral areas, Northshore will seek to develop islands of rock and overburden to the extent that it is compatible with Northshore's long-term mine plan. These areas may occur on either the north side of the pit or the south side of the pit, depending upon the location of rock stockpiles.

10. In-pit stockpiling within the above stated ranges of elevations and slopes is generally feasible along much of the future north shore of the PMP based on material availability and fee ownership distribution. Upon closure, the entire PMP will contain approximately 130,000 feet (25 miles) of shoreline. This would constitute approximately 53,000 feet (10 miles) of potential enhanced shoreline along the north shore of the PMP. The in-pit area north of the north shore (above elevation 1515 mean sea level) will be upland and, therefore, will not be considered as areas where creation of littoral zone and/or wetlands is feasible. Upland areas, containing various stages of plant succession, will assist in providing a constant source of nutrients for the PMP lake. The south shore of the PMP (those areas along the headwall of the pit) may not be suitable for creation of littoral zone due to the depth of the pit and potential future access to minerals. However, in these areas of potential excessive depth in the pit, the company will be encouraged, where possible and after consultation with MDNR, to fill with excess pit material to achieve a less deep area. This activity should not encumber future mining potential and may be considered a form of mitigation.

Shoreline irregularity will be added to enhance littoral areas where feasible. The length of enhanced shoreline will depend on the availability of rock for littoral zone development and the details of Northshore's mining operations. Shoreline enhancement will likely occur in those areas where littoral zone development is likely (see Figure 3). It is likely that the future in-pit stockpiling to develop littoral areas will not utilize all available rock. To the extent that the practice is compatible with Northshore's long-term mine plan, additional rock not used in the development of littoral areas will be backfilled into the deeper parts of the pit lake.

11. The south final pitwall slopes consisting of glacial overburden shall be designed and constructed consistent with MN Rules 6130.2900 and 6130.3600. These may include certain pitwall areas that would normally be exempt due to pre-MN Rules 6130 establishment or non-Northshore

impact. Due to the potential of future PMP lake recreation, pitwalls should be safe, stable and aesthetically pleasing. Laying pitwalls back (beyond what will be required by MN Rule) may be a form of mitigation.

Shoreline irregularity will be added to enhance littoral areas where feasible, most likely in the areas of littoral zone development. On the south side of the pit, the final pit water level will be below the level of bedrock in most locations. Northshore will modify the south shoreline of the PMP only to the extent that it is structurally sound. The elevation of the pit rim above the water level will appear similar to rocky cliffs and should be aesthetically pleasing in its final state.

12. Flooded timber and existing organic debris has been found to have great potential at jump-starting abandoned mine pit biological productivity and enhance subaqueous habitat. Herbaceous vegetation and tree growth will be encouraged for stockpile areas that will eventually be below water surface (1500 – 1470 mean sea level), in addition to those in future upland areas. This condition (for vegetating stockpiles/slopes that will eventually be below final pit water surface) is above and beyond what is required per MN Rules 6130.3600, subpart 1, item K.

Northshore will seek to cover in-pit stockpiles with elevations between 1,470 ft MSL and 1,515 ft MSL will be covered with overburden and vegetated. Vegetation in these areas will result in the accumulation of organic material. The areas between 1,470 ft MSL and 1,500 ft MSL will eventually be inundated (after approximately 10 to 12 years of pit filling).

13. Since the aquatic enhancements proposed for the PMP lake is intended to increase biological productivity and public value, it is likely that this enhanced resource will attract public use in the future. Therefore, adequate public access to the PMP lake should be part of the development plans and design. These access points should be in accordance with local preferences and consistent with the public access standards of the time.

Public access to the PMP will be provided. The most likely location for public access is the crossing of County Road 623 over the unnamed tributary which will become the outlet channel from the PMP when it begins to overflow. This location is shown on Figure 1. Construction of the public access may be coordinated with the design and construction of the pit lake outlet structure and channel (see *Long-Range Hydrology Study*).

14. The final reclamation plan could consist of modifications to include areas for spawning habitat specific for target species as well as introduction of native aquatic plant species based on the lake management plan goals.

Northshore will seek to create an ultimate pit design that meets the guidelines established by the MDNR. The inlets, bays, and islands included in that design may be modified to promote particular species or communities based on the guidance of the MDNR. The outlet channel designed to convey water from the PMP to the Dunka River, although only a few hundred feet long, may also be constructed to include favorable habitat (e.g. pool and riffle sequences). The junction of the outlet channel and Dunka River will be constructed so as not to inhibit fish passage between the PMP and Dunka River.

## 1.5 Future Monitoring and Mitigation

The analysis presented in this mitigation plan describes how Northshore will seek to meet the guidelines proposed by the MDNR for the creation of littoral zones. It should be noted that the ultimate design of the pit lake including in-pit stockpiles and littoral zones will depend on the future operations of the PMP. Changes in the Peter Mitchell Pit mine plan may impact the amount of rock available or future topography of the pit. Such changes will need to be evaluated with respect to meeting the guidelines specified by the MDNR.

Four to six years prior to closure, Northshore will initiate a monitoring plan that will aid more accurate estimates of pit filling time and eventual pit lake overflow rates (see *Long Range Hydrology Study*). This monitoring will include:

- Accurate post-mining bathymetric maps of the pit
- Pit filling records for each cell, including continuous records of pit filling rates
- On-site collection of precipitation data

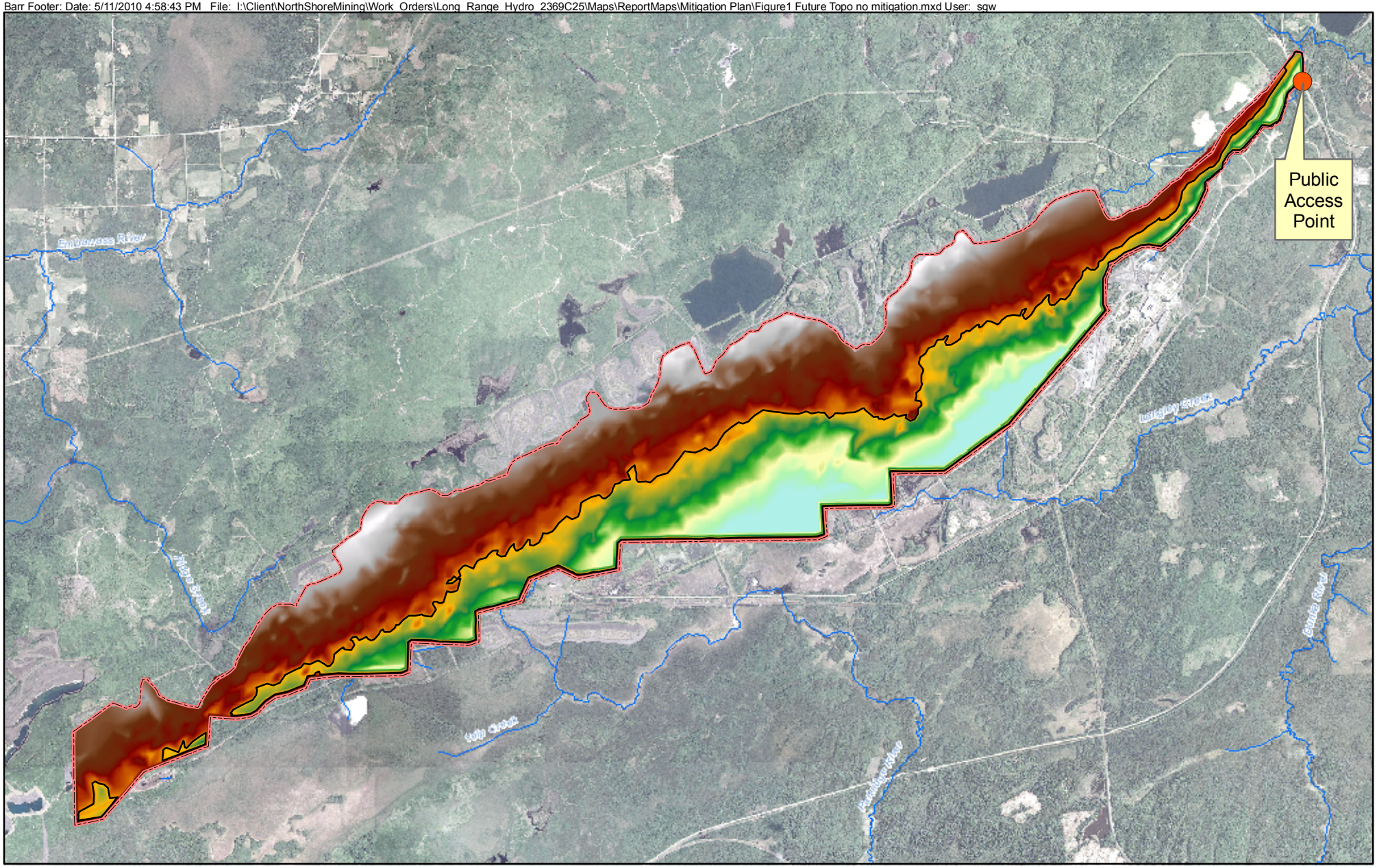
Accurate knowledge of pit filling and outflow rates will result in a clearer understand of the pit lake's response to climate conditions, including seasonal fluctuations in water level.

The mitigation plan proposed for the Peter Mitchell Pit includes the evaluation of impacts to the Partridge and Dunka Rivers. The *Long Range Hydrology Study* (Barr, 2008) includes predicted hydrologic impacts to those rivers. A detailed monitoring plan to evaluate the hydrologic and

ecologic impacts to the Partridge River and Dunka River, if required, will be developed before pit filling occurs (in approximately 2070).

# Figures

Barr Footer: Date: 5/11/2010 4:58:43 PM File: I:\Client\NorthShoreMining\Work_Orders\Long_Range_Hydro_2369C25\Maps\ReportMaps\Mitigation Plan\Figure1 Future Topo no mitigation.mxd User: sgw




1500 ft contour

Mine Site Boundary

Streams

Future Topography (no mitigation)

**Elevation (feet)**

High : 1785.95

Low : 1195.2

N

Kilometers

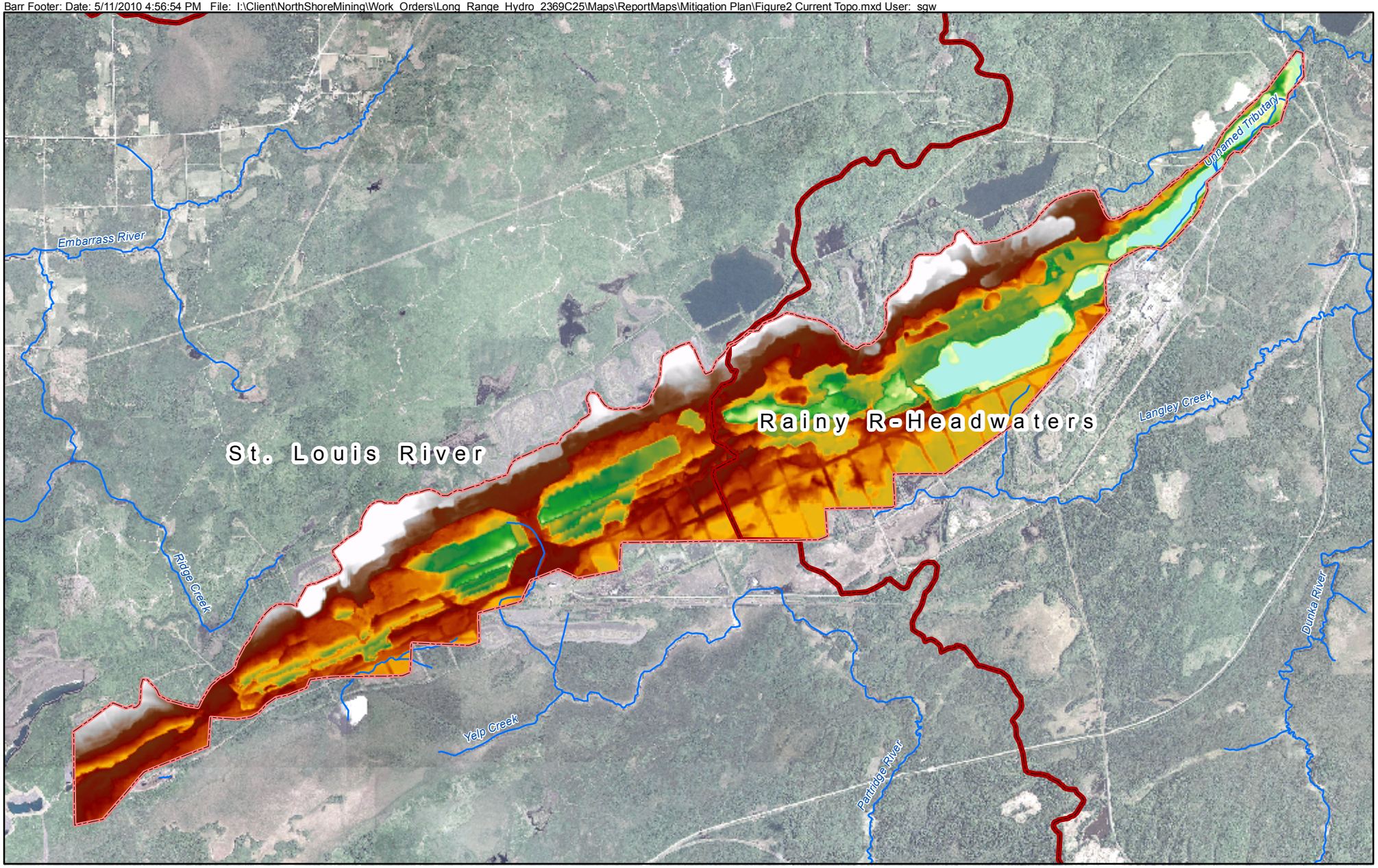
1 0 1 2 3

Miles

1 0 1 2

Figure 1

Ultimate Topography of the PMP (without Mitigation)
Peter Mitchell Pit Mitigation Plan
North Shore Mining
Babbitt, Minnesota




Mine Site Boundary

Streams

Major Watersheds

Current (2007) Topography

**Elevation (feet)**

High : 1858.95

Low : 1373.77

N

Kilometers

1 0 1 2 3

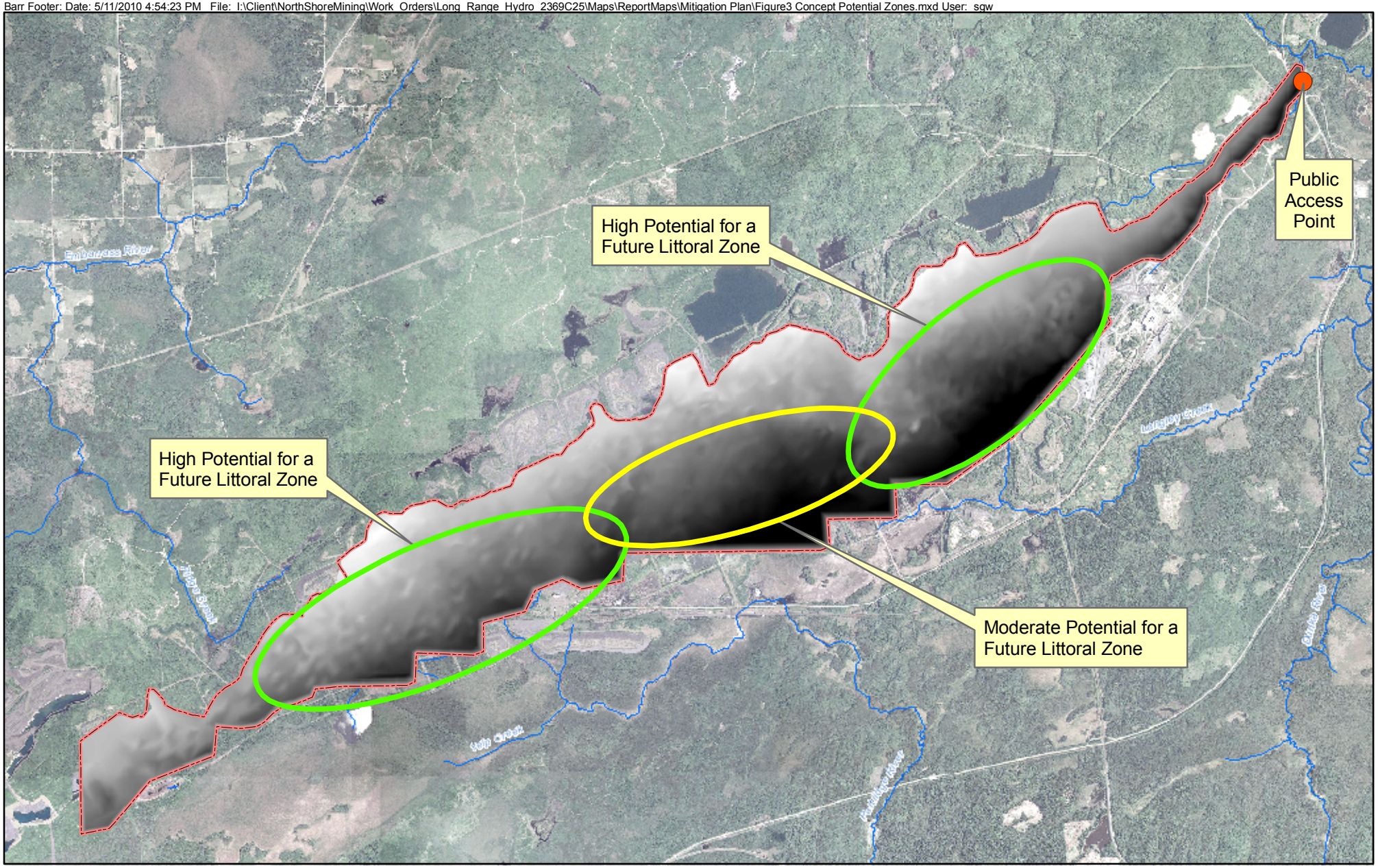
Miles

1 0 1 2

Figure 2

BARR

Current (2007) Topography of the PMP
Peter Mitchell Pit Mitigation Plan
North Shore Mining
Babbitt, Minnesota




Mine Site Boundary

Streams

Future Topography (no mitigation)

**Elevation (feet)**

High : 1785.95

Low : 1195.2

N

Kilometers

1 0 1 2 3

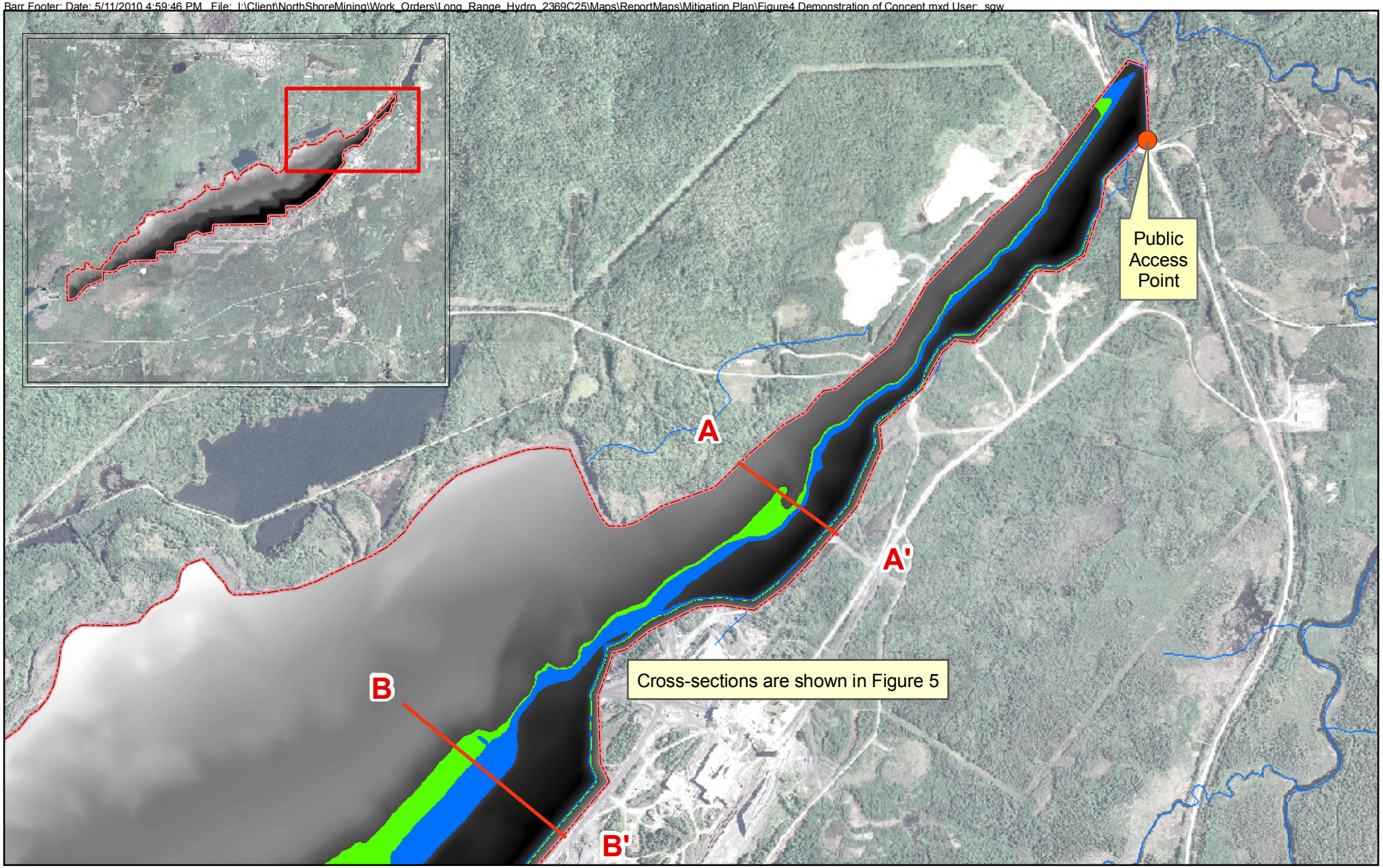
Miles

1 0 1 2

Figure 3

BARR

Concept Level Littoral Zone Locations
Peter Mitchell Pit Mitigation Plan
North Shore Mining
Babbitt, Minnesota




Cross-section Locations

Mine Site Boundary

1500 - 1494 ft MSL

1494 - 1470 ft MSL

Streams

Future Topography

**Elevation (feet)**

High : 1784.07

Low : 1197.1

N

Meters

500 0 500

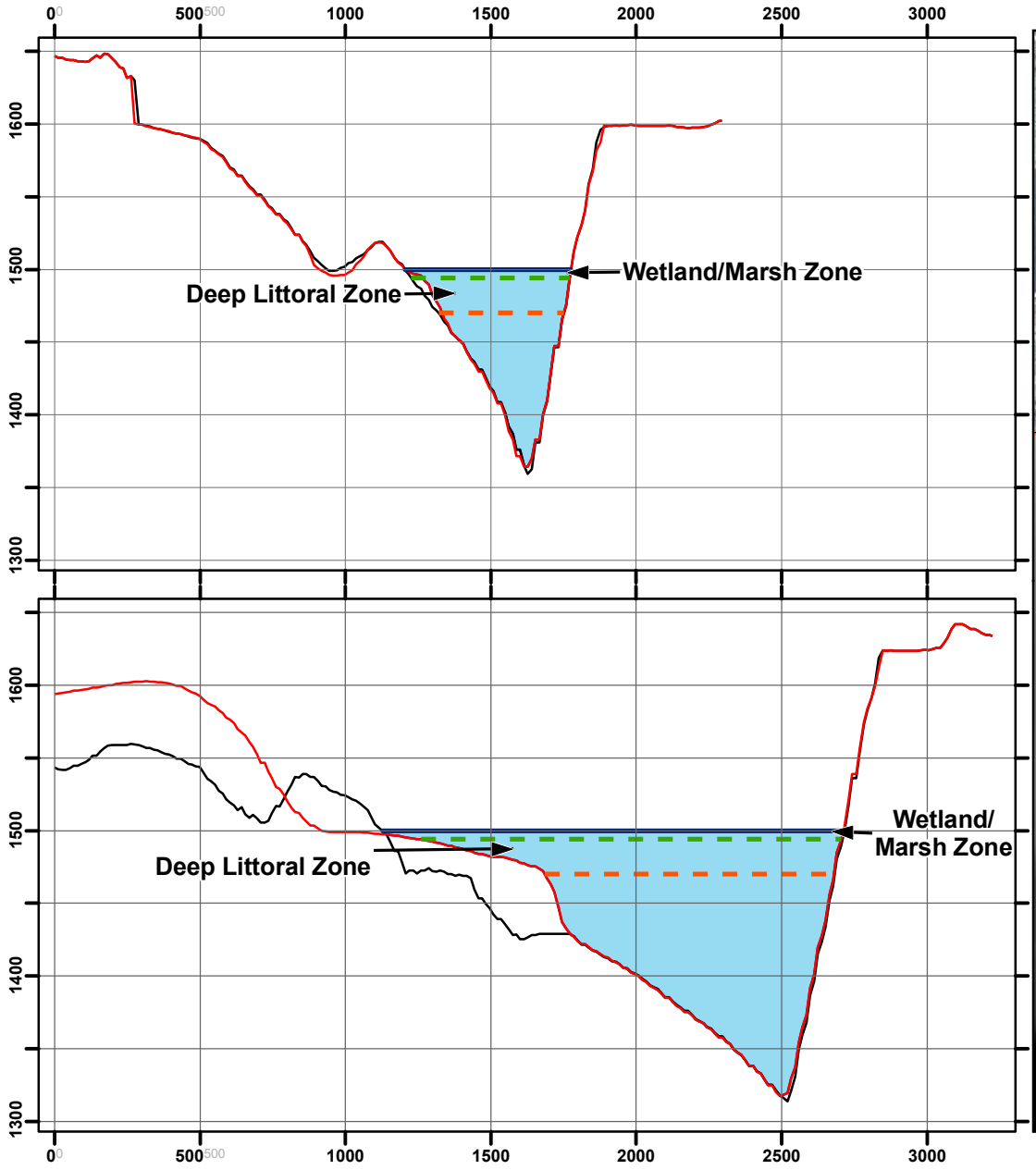
Feet

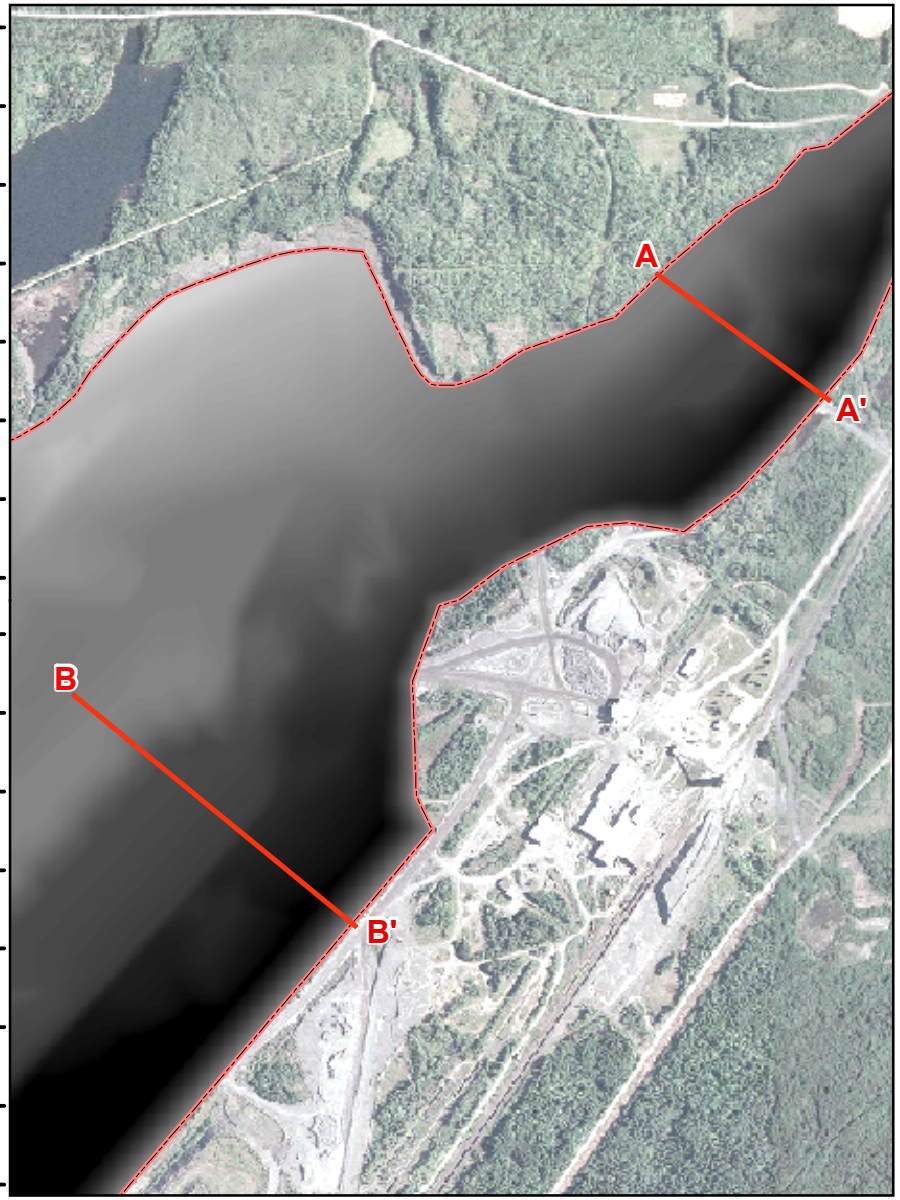
1,000 0 1,000 2,000 3,000

Figure 4

BARR

Demonstration of Potential Littoral Zone Development
Peter Mitchell Pit Mitigation Plan
North Shore Mining
Babbitt, Minnesota




Future Surface With Mitigation

Future Surface Without Mitigation

Pit Lake

Future Topography

Elevation (feet)

High : 1784.07

Low : 1197.1

Figure 5

Example Cross Sections of
Potential Littoral Zone Development
Peter Mitchell Pit Mitigation Plan
North Shore Mining
Babbitt, Minnesota